

**Specification Details:**

Specification: MIL-PRF-31032  
Title: Printed Circuit Board/Printed Wiring Board  
Federal Supply Class (FSC): 5998  
Conventional: No  
Specification contains quality assurance program: Yes  
MIL-STD-790 Established Reliability & High Reliability: No  
MIL-STD-690 Failure Rate Sampling Plans & Procedures: No  
Weibull Graded: Yes  
Specification contains space level reliability requirements: No  
Specification allows test optimization: Yes

**Contact Information:**

Office of Primary Involvement: Electronic Devices Branch, DLA Land and Maritime - VQE  
Primary Qualifying Activity Contact: 614-692-0627, e-mail: vqe.ls@dla.mil  
Secondary Qualifying Activity Contact: 614-692-0631, e-mail: vqe.bw@dla.mil

**Notes:**

If a manufacturer desires to have test data considered for qualification, it must be certified and meet all qualification test requirements of MIL-PRF-31032 and the applicable associated specification.

The listing of printed board manufacturing lines in the QML applies only to printed boards produced in the plant(s) specified herein. Therefore, only those printed boards that have been manufactured and tested on the certified/qualified lines listed herein can be supplied as QML printed boards.

The DLA Land and Maritime - VQE contacts for QML companies can be located in the file "31032 main points-of-contact" at website: [http://www.dsc.dla.mil/offices/sourcing\\_and\\_qualification/offices.asp?section=VQE](http://www.dsc.dla.mil/offices/sourcing_and_qualification/offices.asp?section=VQE)

QML is a definition of a manufacturer's verified capabilities. Manufacturers may use the add-on qualification process to qualify capabilities that are not currently listed on the QML. The user is encouraged to contact the manufacturer or Qualifying Activity to make arrangements for QML availability.

The following abbreviations are used in this listing:

Ag: Silver  
Au: Gold  
CAGE: Commercial and Government Entity (Code)  
Cu: Copper  
ENIG: Electroless Nickel Immersion Gold  
HASL: Hot Air Solder Level  
ImmAg: Immersion Silver  
IR: Infrared  
LPI: Liquid Photoimageable  
MIX: Mix of SMT and THM  
Ni: Nickel  
OSP: Organic Surface Protection  
Pb: Lead  
Pd: Palladium  
PTH: Plated Thru Hole  
SMOBC: Solder Mask Over Bare Copper  
SMT: Surface-Mount Technology  
Sn: Tin  
THM: Through-Hole Mounting

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Accurate Circuit Engineering</b><br>3019 S. Kilson Drive<br>Santa Ana, CA 92707, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0MNN9<br><br><b>Contact:</b> James Hofer<br><b>Phone:</b> 714-546-162<br><b>Fax:</b> 714-433-7418<br><b>EMail:</b> James@ace-pcb.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2                                |
| Panel Size:                   | 20" X 26"   |
| Max./Min. Board Thickness:    | .22"/Not Specified  |
| Max./Min. Base CU Thickness:  | .0056"/Not Specified  |
| Max./Min. Through Hole Size:  | .075"/.008" (after plating)                                     |
|                               | .247"/Not Specified (mounting-after plating)                    |
| Aspect Ratio:                 | 11:1 (Through Hole)   |
| Max. Number of Layers:        | 24  |
| Min. Conductor Width:         | .003"   |
| Min. Conductor Space:         | .003" (+/-10%)  |
| Part Mounting:                | MIX, SM, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant                 |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, Electrolytic Ni-Au, HASL                                  |
| Hole Preparation:             | Permanganate Desmear/Etchback, Plasma Desmear/Etchback          |
| Alternate Construction:       | Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | Characteristic, Differential 50, 75, 100 ohms +/-10%            |
| Hole Fill/Via Plug:           | Non-conductive Hole Fill/Via Plug                               |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-06-12150  
 VQE-07-12577  
 VQE-09-18384

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| <p><b>MANUFACTURER INFORMATION:</b><br/><b>American Standard Circuits</b><br/>RF Division, 475 Industrial Drive<br/>West Chicago, IL 60185, US</p> | <p><b>PLANT LOCATION:</b><br/>Same Address as Manufacturer</p> | <p>CAGE Code: 4AA34<br/><br/>Contact: Lori Ryan<br/>Phone: 603-639-5438<br/>Fax:<br/>EMail: lori@asc-i.com</p> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                | VQE-08-015934                 |
| Panel Size:  | 12" X 18"                                       |                               |
| Max./Min. Board Thickness:                                 | .062"/Not Specified                             |                               |
| Max./Min. Base CU Thickness:                               | .006"/Not Specified (1/2 oz.)                   |                               |
| Max./Min. Through Hole Size:                               | .052"/.009" (after plating)                     |                               |
| Aspect Ratio:  | 7:1 (Through Hole)                              |                               |
| Max. Number of Layers:                                     | 10  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004" (+/-10%)                                  |                               |
| Part Mounting:   | MIX, SMT, THM                                   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | HASL  |                               |
| Hole Preparation:  | Permanganate Desmear                            |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Acid Copper                                     |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                              |                               |

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Amphenol Printed Circuits</b><br>91 Northeastern Boulevard<br>Nashua, NH 03062, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 57034<br><br><b>Contact:</b> Denise Chevalier<br><b>Phone:</b> 603-879-3268<br><b>Fax:</b> 603-879-2818<br><b>E-Mail:</b> denise.chevalier@amphenol-tcs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 24" X 36", 30" X 36"  |
| Max./Min. Board Thickness:    | .322"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.008"   |
| Aspect Ratio:                 | 0.5:1 (Blind Via)<br>11:1 (Through Hole)  |
| Max. Number of Layers:        | 28  |
| Min. Conductor Width:         | .004"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | Compliant Pin, MIX, SMT, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Hybrid Built GF/Hydrocarbon Ceramic<br>Hydrocarbon Ceramic |
| Flex Base Material:           | N/A   |
| Finish System:                | Electrolytic Hard & Soft Gold, Electrolytic Nickel, Fused SnB, Nickel   |
| Hole Preparation:             | Permanganate Desmear/Etchback, Plasma Desmear   |
| Alternate Construction:       | Blind Vias Mechanicall Drilled  |
| Copper Plating:               | Acid Copper, DC Plate, Pulse Plate  |
| Solder Resist:                | Dry Film Soldermask, LPI, SMOBC, Thermal Cured Soldermask   |
| Controlled Impedance:         | 120 ohms ± 10%, 50 ohms ± 10%   |
| Hole Fill/Via Plug:           | Conductive Via Fill, Non-conductive Via Fill  |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | N/A   |

VQE-06-010054  
 VQE-09-017008  
 VQE-10-020582  
 VQE-97-000649

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Amphenol Printed Circuits</b><br>91 Northeastern Boulevard<br>Nashua, NH 03062, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 57034<br><br><b>Contact:</b> Denise Chevalier<br><b>Phone:</b> 603-879-3268<br><b>Fax:</b> 603-879-2818<br><b>E-Mail:</b> denise.chevalier@amphenol-tcs.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  |               | <b>QUALIFICATION LETTERS:</b> |
|---|---------------|-------------------------------|
| Specification: MIL-PRF-31032/1, MIL-PRF-31032/2<br>Panel Size: 21" X 24"<br>Max./Min. Board Thickness: .078"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: ".026"<br>Aspect Ratio: 3:1<br>Max. Number of Layers: 10<br>Min. Conductor Width: .004"<br>Min. Conductor Space: .004"<br>Part Mounting: Compliant Pin, MIX, SMT, THM<br>Rigid Base Material: GM (Woven E-Glass, Triazine/Bismaleimide Modified Epoxy Resin)<br>Flex Base Material: N/A<br>Finish System: ENIG, Electrolytic Hard and Soft Gold, Electrolytic Nickel, Fused SnPb, HASL<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Acid Copper: DC Plate, Pulse Plate<br>Solder Resist: N/A<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: Electroless Copper | VQE-09-018717 |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  |               | <b>QUALIFICATION LETTERS:</b> |
|---|---------------|-------------------------------|
| Specification: MIL-PRF-31032/3<br>Panel Size: 18" X 24"<br>Max./Min. Board Thickness: .125"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: ".012" ((drilled))<br>Aspect Ratio: 7.75:1 ((Through Hole))<br>Max. Number of Layers: 15<br>Min. Conductor Width: .006"<br>Min. Conductor Space: .005"<br>Part Mounting: MIX, SM, THM<br>Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: 4203/1 Acrylic Adhesive Polyimide Coverlayer<br>4204/11 Adhesiveless Polyimide<br>Finish System: HASL, Hot Oil Reflow following SnPb plate<br>Hole Preparation: Plasma Desmear/Etchback<br>Alternate Construction: N/A<br>Copper Plating: Acid Copper (DC and Pulse Plate)<br>Solder Resist: N/A<br>Controlled Impedance: Characteristic, Differential, Range 50-100 ohms (+/- 10%)<br>Hole Fill/Via Plug: N/A<br>Flex Usage: Use A (Flex to Install)<br>Hole Wall Conductive Coating: Direct Metal<br>Max. Base Cu Weight: 1 oz. | VQE-10-019533 |                               |

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| <b>MANUFACTURER INFORMATION:</b><br><b>Amphenol Printed Circuits</b><br>91 Northeastern Boulevard<br>Nashua, NH 03062, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 57034<br><br><b>Contact:</b> Denise Chevalier<br><b>Phone:</b> 603-879-3268<br><b>Fax:</b> 603-879-2818<br><b>EMail:</b> denise.chevalier@amphenol-tcs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |                                |
|---|--------------------------------|
| <b>Specification:</b> MIL-PRF-31032/3, MIL-PRF-31032/4<br><br><b>Panel Size:</b> 18" X 24" ((max))<br><b>Max./Min. Board Thickness:</b> .031"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> ".055" ((drilled))<br><b>Aspect Ratio:</b> 0.7:1 ((Through Hole))<br><b>Max. Number of Layers:</b> 4<br><b>Min. Conductor Width:</b> .005"<br><b>Min. Conductor Space:</b> .005"<br><b>Part Mounting:</b> N/A<br><b>Rigid Base Material:</b> N/A (types 1, 2 & 3 only)<br><b>Flex Base Material:</b> 4203/1 Acrylic Adhesive Polyimide Coverlayer<br>4204/1 Acrylic Adhesive<br><b>Finish System:</b> HASL, Hot Oil Reflow following SnPb plate<br><b>Hole Preparation:</b> Plasma Desmear/Etchback<br><b>Alternate Construction:</b> N/A<br><b>Copper Plating:</b> Acid Copper<br><b>Solder Resist:</b> Dru Film Soldermask<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> Use A (Flex to Install), Use B (Dynamic Flex)<br><b>Hole Wall Conductive Coating:</b> Direct Metal<br><b>Max. Base Cu Weight</b> 1 oz. | VQE-10-019533<br>VQE-10-020582 |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Calumet Electronics Corp.</b><br>25830 Depot Street<br>Calumet, MI 49913-1985, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65337<br><br><b>Contact:</b> Robert Hall<br><b>Phone:</b> 906-337-1305<br><b>Fax:</b> 906-337-5359<br><b>EMail:</b> rhall@cec-up.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |                            |
|---|----------------------------|
| <b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .125"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> .125"/.016"<br><b>Aspect Ratio:</b> 8:1 (Through Hole)<br><b>Max. Number of Layers:</b> 10<br><b>Min. Conductor Width:</b> .006"<br><b>Min. Conductor Space:</b> .003"<br><b>Part Mounting:</b> SMT, THM<br><b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br><br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> Au, HASL, Ni<br><b>Hole Preparation:</b> FR4: Chemical Etchback, Non FR4: Plasma Etchback<br><b>Alternate Construction:</b> N/A<br><b>Copper Plating:</b> Electro-deposited Acid Copper<br><b>Solder Resist:</b> N/A<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> N/A | VQE-03-4657<br>VQE-04-6280 |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Cirex International, Inc.</b><br>791 Nuttman Street<br>Santa Clara, CA 95054, | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 4MEG7<br><br><b>Contact:</b> Don Angulo<br><b>Phone:</b> 408-988-3980<br><b>Fax:</b> 408-988-4534<br><b>E-Mail:</b> dangulo@cirexxintl.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1   | VQ-08-016602                  |
| Panel Size:  | 12" X 18"   |                               |
| Max./Min. Board Thickness:                                 | .125"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.01" (Mechanical)   |                               |
| Aspect Ratio:  | 12.5:1  |                               |
| Max. Number of Layers:                                     | 22  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004"   |                               |
| Part Mounting:   | MIX, SMT, THM   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, HASL  |                               |
| Hole Preparation:  | Pemanganate Desmear, Plasma Etchback  |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | 100 ohms +/- 10%, 50 ohms +/- 10%   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/2                                 | VQE-07-014176                 |
| Panel Size:  | 12" X 18"                                       |                               |
| Max./Min. Board Thickness:                                 | .1"/Not Specified                               |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.01"                              |                               |
| Aspect Ratio:  | 10:1 (Through Hole)                             |                               |
| Max. Number of Layers:                                     | 2   |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004"   |                               |
| Part Mounting:   | MIX, SMT, THM                                   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, HASL, Ni/AU                               |                               |
| Hole Preparation:  | Plasma Desmear                                  |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Acid Copper                                     |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |



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| <b>MANUFACTURER INFORMATION:</b><br><b>Cirex International, Inc.</b><br>791 Nuttman Street<br>Santa Clara, CA 95054, | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 4MEG7<br><br><b>Contact:</b> Don Angulo<br><b>Phone:</b> 408-988-3980<br><b>Fax:</b> 408-988-4534<br><b>EMail:</b> dangulo@cirexxintl.com |
|--|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| Specification: MIL-PRF-31032/3<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .1"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: Not Specified/.01"<br>Aspect Ratio: 10:1 (Through Hole)<br>Max. Number of Layers: 2<br>Min. Conductor Width: .004"<br>Min. Conductor Space: .004"<br>Part Mounting: MIX, SMT, THM<br>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>Flex Base Material: Acrylic Adhesive Polyimide<br>Copper-Clad Adhesiveless Polyimide<br>Finish System: ENIG, HASL, Ni/Au<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Acid Copper<br>Solder Resist: Kapton Covelay<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: Class A Flex-to-Install, Class B Continuous Flex<br>Hole Wall Conductive Coating: N/A | VQE-07-014176                 |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| Specification: MIL-PRF-31032/4<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .125"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: Not Specified/.01" (Mechanical)<br>Aspect Ratio: 10:1<br>Max. Number of Layers: 16<br>Min. Conductor Width: .004"<br>Min. Conductor Space: .004"<br>Part Mounting: MIX, SMT, THM<br>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: Acrylic Adhesie<br>Copper Clad Adhesiveless Polyimide<br>Finish System: ENIG, HASL<br>Hole Preparation: Permanganate Desmear, Plasma Etchback<br>Alternate Construction: N/A<br>Copper Plating: Acid Coper<br>Solder Resist: LPI<br>Controlled Impedance: 100 ohms +/-10%, 50 ohms +/- 10%<br>Hole Fill/Via Plug: N/A<br>Flex Usage: Class A Flex-to-Install<br>Hole Wall Conductive Coating: N/A | VQ-08-016602                  |

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| <b>MANUFACTURER INFORMATION:</b><br><b>Colonial Circuits, Inc.</b><br>1026 Warrenton Road<br>Fredericksburg, VA 22406-6200, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 6T499<br><br><b>Contact:</b> Mike Hill<br><b>Phone:</b> 540-753-5511, x125<br><b>Fax:</b> 540-752-2109<br><b>E-Mail:</b> quality@colonialcircuits.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   |             | <b>QUALIFICATION LETTERS:</b> |
|--|-------------|-------------------------------|
| Specification: MIL-PRF-31032/1<br>Panel Size: 18" X 24"<br>Max./Min. Board Thickness: .088"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .052"/.021"<br>Aspect Ratio: 4.2:1 (Through Hole)<br>Max. Number of Layers: 14<br>Min. Conductor Width: .006"<br>Min. Conductor Space: .005"<br>Part Mounting: PTH, SMT<br>Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: N/A<br>Finish System: Tin/Lead HASL<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-6002 |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  |             | <b>QUALIFICATION LETTERS:</b> |
|---|-------------|-------------------------------|
| Specification: MIL-PRF-31032/1<br>Panel Size: 18" X 24"<br>Max./Min. Board Thickness: .127"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .228"/.015"<br>Aspect Ratio: 8.5:1 (Through Hole)<br>Max. Number of Layers: 12<br>Min. Conductor Width: .008"<br>Min. Conductor Space: .005"<br>Part Mounting: PTH, SMT<br>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>Flex Base Material: N/A<br>Finish System: Tin/Lead HASL<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: 55 Ohms ± 10%<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-6002 |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Colonial Circuits, Inc.</b><br>1026 Warrenton Road<br>Fredericksburg, VA 22406-6200, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 6T499<br><br><b>Contact:</b> Mike Hill<br><b>Phone:</b> 540-753-5511, x125<br><b>Fax:</b> 540-752-2109<br><b>E-Mail:</b> quality@colonialcircuits.com |
|--|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-04-6002                   |
| Panel Size:  | 12" X 18"  | VQE-06-010192                 |
| Max./Min. Board Thickness:                                 | .09"/Not Specified                                     |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | .139"/.021"  |                               |
| Aspect Ratio:  | 4.29:1 (Through Hole)                                  |                               |
| Max. Number of Layers:                                     | 8  |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | PTH, SMT   |                               |
| Rigid Base Material:                                       | Hydrocarbon Resin with Ceramic Filler<br>Woven E-Glass |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | Tin/Lead HASL, Tin/Lead Reflow                         |                               |
| Hole Preparation:  | Plasma Desmear, Plasma Etchback                        |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electrolytic Acid Copper                               |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | 55 ohms ±10%   |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | N/A  |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/3, MIL-PRF-31032/4                      | VQ-10-019425                  |
| Panel Size:  | 18" X 24"   |                               |
| Max./Min. Board Thickness:                                 | .093"/Not Specified                                   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .15"/.01"   |                               |
| Aspect Ratio:  | 8.6:1   |                               |
| Max. Number of Layers:                                     | 10  |                               |
| Min. Conductor Width:                                      | .005"   |                               |
| Min. Conductor Space:                                      | .005"   |                               |
| Part Mounting:   | PTH, SMT  |                               |
| Rigid Base Material:                                       | Rigid Flex/Kapton Adhesive                            |                               |
| Flex Base Material:  | IPC-FC-241/11 (Adhesiveless)                          |                               |
| Finish System:   | N/A   |                               |
| Hole Preparation:  | Plasma Desmear/Etchback                               |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Electrolytic Acid Copper                              |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | 0.010   |                               |
| Flex Usage:  | Class A (Flex During Installation), Class B (Dynamic) |                               |
| Hole Wall Conductive Coating:                              | Immersion Tin, Tin/Lead Reflow                        |                               |

## SECTION I

### LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <b>MANUFACTURER INFORMATION:</b><br><b>Colonial Circuits, Inc.</b><br>1026 Warrenton Road<br>Fredericksburg, VA 22406-6200, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 6T499<br><br><b>Contact:</b> Mike Hill<br><b>Phone:</b> 540-753-5511, x125<br><b>Fax:</b> 540-752-2109<br><b>EMail:</b> quality@colonialcircuits.com |
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| CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION   | QUALIFICATION LETTERS: |
|---|------------------------|
| Specification: MIL-PRF-31032/4<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .093"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .045"/.025"<br>Aspect Ratio: 3.7:1 (Through Hole)<br>Max. Number of Layers: 10<br>Min. Conductor Width: .005"<br>Min. Conductor Space: .005"<br>Part Mounting: PTH, SMT<br>Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: IPC-4204/1 Acrylic Adhesive<br>Finish System: Tin/Lead Reflow<br>Hole Preparation: Plasma Desmear/Etchback<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-6002            |

| CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION   | QUALIFICATION LETTERS: |
|---|------------------------|
| Specification: MIL-PRF-31032/Custom<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .031"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .117"/.02"<br>Aspect Ratio: 1.55:1 (Through Hole)<br>Max. Number of Layers: 2<br>Min. Conductor Width: .025"<br>Min. Conductor Space: .01"<br>Part Mounting: SMT<br>Rigid Base Material: PTFE Resin with Ceramic Filler<br>With or Without Woven E-Glass<br>Flex Base Material: N/A<br>Finish System: Tin/Lead HASL<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-6002            |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Colonial Circuits, Inc.</b><br>1026 Warrenton Road<br>Fredericksburg, VA 22406-6200, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 6T499<br><br><b>Contact:</b> Mike Hill<br><b>Phone:</b> 540-753-5511, x125<br><b>Fax:</b> 540-752-2109<br><b>EMail:</b> quality@colonialcircuits.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| Specification: MIL-PRF-31032/Custom<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .083"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .045"/.02"<br>Aspect Ratio: 4.15:1 (Through Hole)<br>Max. Number of Layers: 4<br>Min. Conductor Width: .01"<br>Min. Conductor Space: .011"<br>Part Mounting: PTH, SMT<br>Rigid Base Material: Rogers 4003<br>Flex Base Material: N/A<br>Finish System: Tin/Lead HASL<br>Hole Preparation: Plasma Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-6002                   |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Coretec Cleveland, Inc.</b><br>7 Ascot Parkway<br>Cuyahoga Falls, OH 44223, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 7Z463<br><br><b>Contact:</b> Mark Kasting<br><b>Phone:</b> 330-572-3400<br><b>Fax:</b> 330-572-3434<br><b>EMail:</b> mark_kasting/coretec@coretec-inc.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .126"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | Not Specified/.014"  |
| Aspect Ratio:                 | 5:1 (Through Hole)   |
| Max. Number of Layers:        | 16   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .004"  |
| Part Mounting:                | SMT, THM   |
| Rigid Base Material:          | AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin<br>BI: Aramid Fabric, Nonwoven, Polyimide Resin<br>GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |
| Flex Base Material:           | N/A  |
| Finish System:                | Fused Tin Lead late, HASL, Selective Solder Strip-Tin Lead Plate   |
| Hole Preparation:             | Plasma Etchback  |
| Alternate Construction:       | Sequential Lamination for Blind & Buried Vias 8 layer max  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | N/A  |
| Controlled Impedance:         | 100/50 ohm ±5%   |
| Hole Fill/Via Plug:           | N/A  |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |

VQE-00-0289  
 VQE-01-0910  
 VQE-05-008414  
 VQE-06-010963

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>Coretec Cleveland, Inc.</b><br>7 Ascot Parkway<br>Cuyahoga Falls, OH 44223, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 7Z463<br><br><b>Contact:</b> Mark Kasting<br><b>Phone:</b> 330-572-3400<br><b>Fax:</b> 330-572-3434<br><b>E-Mail:</b> mark_kasting/coretec@coretec-inc.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| <b>Specification:</b>                                      | MIL-PRF-31032/3, MIL-PRF-31032/4  | VQE-01-0909                   |
| <b>Panel Size:</b>   | 18" X 24"   | VQE-06-010963                 |
| <b>Max./Min. Board Thickness:</b>                          | .126"/Not Specified   |                               |
| <b>Max./Min. Base CU Thickness:</b>                        | N/A   |                               |
| <b>Max./Min. Through Hole Size:</b>                        | Not Specified/.017"   |                               |
| <b>Aspect Ratio:</b>                                       | 10:1 (Through Hole)   |                               |
| <b>Max. Number of Layers:</b>                              | 11  |                               |
| <b>Min. Conductor Width:</b>                               | .003"   |                               |
| <b>Min. Conductor Space:</b>                               | .003"   |                               |
| <b>Part Mounting:</b>                                      | SMT, THM  |                               |
| <b>Rigid Base Material:</b>                                | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| <b>Flex Base Material:</b>                                 | IPC-4204/1 Acrylic Adhesive<br>IPC-4204/11 Adhesiveless   |                               |
| <b>Finish System:</b>                                      | HASL  |                               |
| <b>Hole Preparation:</b>                                   | Plasma Etchback   |                               |
| <b>Alternate Construction:</b>                             | N/A   |                               |
| <b>Copper Plating:</b>                                     | Acid Copper   |                               |
| <b>Solder Resist:</b>                                      | N/A   |                               |
| <b>Controlled Impedance:</b>                               | N/A   |                               |
| <b>Hole Fill/Via Plug:</b>                                 | N/A   |                               |
| <b>Flex Usage:</b>   | Class A Flex to Install   |                               |
| <b>Hole Wall Conductive Coating:</b>                       | Electroless Copper  |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Cosmotronic, Inc.</b><br>16721 Noyes Avenue<br>Irvine, CA 92606, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 63695<br><br><b>Contact:</b> Alan Exley<br><b>Phone:</b> 949-660-0740<br><b>Fax:</b> 949-553-8371<br><b>EMail:</b> alan_exley@cosmotronic.com |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .335"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.014"   |
| Aspect Ratio:                 | 15:1 (Through Hole)   |
| Max. Number of Layers:        | 36  |
| Min. Conductor Width:         | .005"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin<br>BF: Aramid Fabric, Nonwoven, Epoxy Resin<br>BI: Aramid Fabric, Nonwoven, Polyimide Resin<br>GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, Fused SnPB, HASL, Selective Solder Strip-Tin Lead Plate   |
| Hole Preparation:             | Plasma Desmear/Etchback   |
| Alternate Construction:       | Blind Vias, Sequential Lamination   |
| Copper Plating:               | Electro-deposited Acid Copper   |
| Solder Resist:                | LPI, SMOBC  |
| Controlled Impedance:         | 50 ohms ± 10% nominal/tolerance   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | N/A   |

VQE-04-006966  
 VQE-05-009107  
 VQE-06-010085  
 VQE-06-011248



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Cosmotronic, Inc.</b><br>16721 Noyes Avenue<br>Irvine, CA 92606, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 63695<br><br><b>Contact:</b> Alan Exley<br><b>Phone:</b> 949-660-0740<br><b>Fax:</b> 949-553-8371<br><b>EMail:</b> alan_exley@cosmotronic.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .165"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | Not Specified/.012"  |
| Aspect Ratio:                 | 8:1 (Through Hole)   |
| Max. Number of Layers:        | 22   |
| Min. Conductor Width:         | .006"  |
| Min. Conductor Space:         | .008"  |
| Part Mounting:                | SMT, THM   |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>GI/GM Composite Material<br>GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant |
| Flex Base Material:           | IPC-4204/1 Acrylic Adhesive<br>IPC-4204/11 Adhesiveless  |
| Finish System:                | ENIG, Fused SnPB, HASL, Selective Solder Strip-Tin Lead Plate  |
| Hole Preparation:             | N/A  |
| Alternate Construction:       | N/A  |
| Copper Plating:               | Electro-deposited Acid Copper  |
| Solder Resist:                | LPI, SMOBC   |
| Controlled Impedance:         | N/A  |
| Hole Fill/Via Plug:           | N/A  |
| Flex Usage:                   | Class A Flex to Install, Class B Continuous Flex   |
| Hole Wall Conductive Coating: | N/A  |

VQE-04-006966  
 VQE-05-009107  
 VQE-06-010085

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Cosmotronic, Inc.</b><br>16721 Noyes Avenue<br>Irvine, CA 92606, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 63695<br><br><b>Contact:</b> Alan Exley<br><b>Phone:</b> 949-660-0740<br><b>Fax:</b> 949-553-8371<br><b>EMail:</b> alan_exley@cosmotronic.com |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |   |
|---|---|
| <b>Specification:</b> MIL-PRF-31032/Custom<br><br><b>Panel Size:</b> 12" X 18"<br><b>Max./Min. Board Thickness:</b> .225"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> Not Specified/.02"<br><b>Aspect Ratio:</b> 10:1 (Through Hole)<br><b>Max. Number of Layers:</b> 16<br><b>Min. Conductor Width:</b> .011"<br><b>Min. Conductor Space:</b> .007"<br><b>Part Mounting:</b> SMT<br><b>Rigid Base Material:</b> Rogers 4003 Ceramic-Filled Thermoset Resin<br>Rogers 4003/GI Composite<br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> ENIG, HASL<br><b>Hole Preparation:</b> Plasma Desmear/Etchback<br><b>Alternate Construction:</b> Blind Vias, Sequential Lamination<br><b>Copper Plating:</b> Electro-deposited Acid Copper<br><b>Solder Resist:</b> LPI, SMOBC<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> N/A | VQE-04-006966<br>VQE-05-009107<br>VQE-06-010085 |
|---|---|

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi Denver Corp.</b><br>10570 Bradford Road<br>Littleton, CO 80127, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 75815<br><br><b>Contact:</b> Douglas N. Berry<br><b>Phone:</b> 303-972-4105<br><b>Fax:</b> 303-933-2934<br><b>E-Mail:</b> dberry@ddiglobal.com |
|---|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |  |
|---|--|
| <b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .125"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> .001"/Not Specified<br><b>Max./Min. Through Hole Size:</b> .109"/.013"<br><b>Aspect Ratio:</b> 7:1<br><b>Max. Number of Layers:</b> 20<br><b>Min. Conductor Width:</b> .004"<br><b>Min. Conductor Space:</b> .004"<br><b>Part Mounting:</b> MIX, SMT, THM<br><b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> ENIG, HASL, IR Reflow Following SnPb Plate<br><b>Hole Preparation:</b> Plasma Desmear/Etchback<br><b>Alternate Construction:</b> N/A<br><b>Copper Plating:</b> Acid Copper<br><b>Solder Resist:</b> LPI<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> Non-conductive Epoxy Hole Fill/Via Plug<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper<br><b>Max. Base Cu Weight</b> 2 oz. | VQE-02-0317<br>VQE-05-7627<br>VQE-05-9014<br>VQE-09-18719<br>VQE-10-020224 |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi Denver Corp.</b><br>10570 Bradford Road<br>Littleton, CO 80127, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 75815<br><br><b>Contact:</b> Douglas N. Berry<br><b>Phone:</b> 303-972-4105<br><b>Fax:</b> 303-933-2934<br><b>EMail:</b> dberry@ddiglobal.com |
|---|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .092"/Not Specified   |
| Max./Min. Base CU Thickness:  | .001"/"   |
| Max./Min. Through Hole Size:  | .053"/.039"   |
| Aspect Ratio:                 | 3:1   |
| Max. Number of Layers:        | 12  |
| Min. Conductor Width:         | .004"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, HASL, IR Reflow following SnPb plate  |
| Hole Preparation:             | Plasma Desmear/Etchback   |
| Alternate Construction:       | N/A   |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | N/A   |
| Hole Fill/Via Plug:           | Non-conductive Epoxy Hole Fill/Via Plug   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |
| Max. Base Cu Weight           | 2 oz.   |

VQE-02-0317  
 VQE-05-7627  
 VQE-05-9014  
 VQE-09-18719  
 vqe-10-020224

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi Denver Corp.</b><br>10570 Bradford Road<br>Littleton, CO 80127, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 75815<br><br><b>Contact:</b> Douglas N. Berry<br><b>Phone:</b> 303-972-4105<br><b>Fax:</b> 303-933-2934<br><b>E-Mail:</b> dberry@ddiglobal.com |
|---|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-02-0217                   |
|  |  | VQE-05-7626                   |
|  |  | VQE-05-9014                   |
|  |  | VQE-09-18719                  |
|  |  | VQE-10-020224                 |
| Panel Size:  | 18" X 24"  |                               |
| Max./Min. Board Thickness:                                 | .125"/Not Specified                                    |                               |
| Max./Min. Base CU Thickness:                               | .001"/"  |                               |
| Max./Min. Through Hole Size:                               | .109"/.013"  |                               |
| Aspect Ratio:  | 10:1   |                               |
| Max. Number of Layers:                                     | 20   |                               |
| Min. Conductor Width:                                      | .004"  |                               |
| Min. Conductor Space:                                      | .004"  |                               |
| Part Mounting:   | MIX, SMT, THM  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | ENIG, HASL, IR Reflow following SnPb plate             |                               |
| Hole Preparation:  | Plasma Desmear/Etchback                                |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Acid Copper  |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | N/A  |                               |
| Hole Fill/Via Plug:  | Non-conductive Epoxy Hole Fill/Via Plug                |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                                     |                               |
| Max. Base Cu Weight  | 2 oz.  |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |  |
|--|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDI Global Corp. - Anaheim</b><br>1220 N. Simon Circle<br>Anaheim, CA 92806, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0BSG1<br><br><b>Contact:</b> Rick Sylvain<br><b>Phone:</b> 714-688-7371<br><b>Fax:</b><br><b>EMail:</b> rsylvain@ddiglobal.com |
|--|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2

Panel Size: N/A

Max./Min. Board Thickness: .1"/Not Specified

Max./Min. Base CU Thickness: N/A

Max./Min. Through Hole Size: .045"/.032" (drilled)

Aspect Ratio: 3:1

Max. Number of Layers: 10

Min. Conductor Width: .01"

Min. Conductor Space: .01"

Part Mounting: THM

Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant

Flex Base Material: N/A

Finish System: HASL ENIG

Hole Preparation: Plasma Desmear, Plasma Etchback

Alternate Construction: Foil Lamination

Copper Plating: Electrodeposited Acid Copper, Electroless Acid Copper

Solder Resist: LPI

Controlled Impedance: N/A

Hole Fill/Via Plug: N/A

Flex Usage: N/A

Hole Wall Conductive Coating: N/A

VQ-09-018147

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2

Panel Size: 18" X 24"

Max./Min. Board Thickness: .115"/Not Specified

Max./Min. Base CU Thickness: N/A

Max./Min. Through Hole Size: .009"/Not Specified (Vias)  
 ".05" (Plated Hole Size)

Aspect Ratio: 10:1

Max. Number of Layers: 22

Min. Conductor Width: .004"

Min. Conductor Space: .006"

Part Mounting: BGA, MIX, SMT, THM

Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant

Flex Base Material: N/A

Finish System: ENIG, HASL

Hole Preparation: Plasma Desmear, Plasma Etchback

Alternate Construction: Foil Lamination

Copper Plating: Electrodeposited Acid Copper, Electroless Acid Copper

Solder Resist: LPI

Controlled Impedance: Differential: 100 ohms +/-10%, Single Ended: 50 ohms +/-10%

Hole Fill/Via Plug: Blind Vias, Buried Vias with Non-conductive Fill

Flex Usage: N/A

Hole Wall Conductive Coating: N/A

VQ-09-018147

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |   |  |
|---|---|--|
| MANUFACTURER INFORMATION:<br><b>DDi Global Corp. - Sterling, VA</b><br>1200 Severn Way<br>Dulles, VA 20166-8904, US | PLANT LOCATION:<br>Same Address as Manufacturer | CAGE Code: 0K703<br><br>Contact: Tony Trnka<br>Phone: 703-652-2266<br>Fax: 703-652-2271<br>EMail: atnka@va.ddiglobal.com |
|---|---|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-03-3545                   |
| Panel Size:  | 18" X 24"   |                               |
| Max./Min. Board Thickness:                                 | .1"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .05"/.009" (nominal)<br>.15"/Not Specified (non-PTH)  |                               |
| Aspect Ratio:  | 10:1  |                               |
| Max. Number of Layers:                                     | 22  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .003"   |                               |
| Part Mounting:   | BGA, MIX, SMT, THM  |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, HASL  |                               |
| Hole Preparation:  | Plasma Desmear/Etchback   |                               |
| Alternate Construction:                                    | 0.005 Blind Vias laser, 0.006 Blind Micro Vias laser, Buried Resistors 33 ohms ± 15%                      |                               |
| Copper Plating:  | Electrolytic Acid Copper  |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | Differential 100 ohms ± 10%, Single Ended 50 ohms ± 10%   |                               |
| Hole Fill/Via Plug:  | Buried Vias with Non-conductive Via Fill  |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper  |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi North Jackson Corp.</b><br>12080 DeBartolo Drive<br>North Jackson, OH 44451, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0GN71<br><br><b>Contact:</b> Cynthia Savakis<br><b>Phone:</b> 330-538-3900, x211<br><b>Fax:</b> 330-538-3820<br><b>E-Mail:</b> quality@sovereign-circuits.com |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                                      |   |
|--------------------------------------|---|
| <b>Specification:</b>                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| <b>Panel Size:</b>                   | 18" X 24"   |
| <b>Max./Min. Board Thickness:</b>    | .25"/Not Specified  |
| <b>Max./Min. Base CU Thickness:</b>  | N/A   |
| <b>Max./Min. Through Hole Size:</b>  | .008"/Not Specified   |
| <b>Aspect Ratio:</b>                 | 15:1 (Through Hole)   |
| <b>Max. Number of Layers:</b>        | 24  |
| <b>Min. Conductor Width:</b>         | .003"   |
| <b>Min. Conductor Space:</b>         | .003"   |
| <b>Part Mounting:</b>                | MIX, Press Fit, SMT, THM  |
| <b>Rigid Base Material:</b>          | BI: Aramid Fabric, Nonwoven, Polyimide Resin<br>GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |
| <b>Flex Base Material:</b>           | N/A   |
| <b>Finish System:</b>                | ENIG, Fused SnPb, HASL, Immersion Ag, Immersion White Tin, Ni/Au,<br>Ni/Pd/Au, OSP, Reflowed Pure Tin   |
| <b>Hole Preparation:</b>             | Permanganate Desmear/Etchback, Plasma Desmear/Etchback  |
| <b>Alternate Construction:</b>       | Blind Vias, Buried Vias, Cap Lamination, Foil Lamination  |
| <b>Copper Plating:</b>               | Electroless Acid Copper, Electroplated Acid Copper  |
| <b>Solder Resist:</b>                | Dry Film, LPI   |
| <b>Controlled Impedance:</b>         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip,<br>Range 30-150 ohms ±10%  |
| <b>Hole Fill/Via Plug:</b>           | Conductive, Non-conductive  |
| <b>Flex Usage:</b>                   | N/A   |
| <b>Hole Wall Conductive Coating:</b> | Electroless   |

VQE-03-003121  
 VQE-03-003214  
 VQE-07-012925  
 VQE-10-020405



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi North Jackson Corp.</b><br>12080 DeBartolo Drive<br>North Jackson, OH 44451, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0GN71<br><br><b>Contact:</b> Cynthia Savakis<br><b>Phone:</b> 330-538-3900, x211<br><b>Fax:</b> 330-538-3820<br><b>E-Mail:</b> quality@sovereign-circuits.com |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                                      |  |
|--------------------------------------|--|
| <b>Specification:</b>                | MIL-PRF-31032/3, MIL-PRF-31032/4   |
| <b>Panel Size:</b>                   | 18" X 24"  |
| <b>Max./Min. Board Thickness:</b>    | .25"/Not Specified   |
| <b>Max./Min. Base CU Thickness:</b>  | .005"/Not Specified  |
| <b>Max./Min. Through Hole Size:</b>  | .008"/Not Specified  |
| <b>Aspect Ratio:</b>                 | 15:1 (Through Hole)  |
| <b>Max. Number of Layers:</b>        | 24   |
| <b>Min. Conductor Width:</b>         | .003"  |
| <b>Min. Conductor Space:</b>         | .003"  |
| <b>Part Mounting:</b>                | MIX, Press Fit, SMT, THM   |
| <b>Rigid Base Material:</b>          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant  |
|                                      | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant                                   |
| <b>Flex Base Material:</b>           | IPC-4204/1 Acrylic Adhesive  |
|                                      | IPC-4204/11 Adhesiveless   |
| <b>Finish System:</b>                | ENIG, Fused SnPb, HASL, Immersion Ag, Immersion White tin, Ni/Au, OSP, Reflowed Pure Tin |
| <b>Hole Preparation:</b>             | Permanganate Desmear/Etchback, Plasma Desmear/Etchback                                   |
| <b>Alternate Construction:</b>       | Blind Via, Buried Via, Cap Lamination, Foil Lamination                                   |
| <b>Copper Plating:</b>               | Electroless Acid Copper, Electroplated Acid Copper                                       |
| <b>Solder Resist:</b>                | Dry Film, LPI  |
| <b>Controlled Impedance:</b>         | 30 - 150 ohms ± 10%  |
| <b>Hole Fill/Via Plug:</b>           | Non-Conductive   |
| <b>Flex Usage:</b>                   | N/A  |
| <b>Hole Wall Conductive Coating:</b> | Electroless  |

VQE-03-003121  
 VQE-03-003214  
 VQE-07-012925  
 VQE-10-020405

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>DDi Ontario</b><br>8150 Sheppard Avenue East<br>Scarborough, Ontario, Canada M1B 5K2 | <b>PLANT LOCATIONS:</b><br>1.<br>Same Address as Manufacturer<br>2. Coretec, Inc., CAGE Code: 3AF82, 2020<br>Ellesmere Road, Scarborough, Ontario, Canada<br>M1H 2Z8 | CAGE Code: 3AF82<br>Contact: Noor Al-Shaikh<br>Phone: 416-208-2100<br>Fax: 416-439-1582<br>EMail: alshaikh@coretec-inc.com |
|---|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-04-006240                 |
| Panel Size:  | 18" X 24"  | VQE-08-015407                 |
| Max./Min. Board Thickness:                                 | .08"/Not Specified                                     |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.01" (as drilled)                        |                               |
| Aspect Ratio:  | 7:1 (Through Hole)                                     |                               |
| Max. Number of Layers:                                     | 14   |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | MIX, SMT, THM  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | ENIG, HASL   |                               |
| Hole Preparation:  | Desmear, Plasma Etchback                               |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Acid Copper  |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | Characteristics +/-10%, Differential +/-10%            |                               |
| Hole Fill/Via Plug:  | Non-conductive Via Plug                                |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                                     |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                | VQE-04-006240                 |
| Panel Size:  | 18" X 24"                                       | VQE-08-015407                 |
| Max./Min. Board Thickness:                                 | .08"/Not Specified                              |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.01" (as drilled)                 |                               |
| Aspect Ratio:  | 7:1 (Through Hole)                              |                               |
| Max. Number of Layers:                                     | 14  |                               |
| Min. Conductor Width:                                      | .005"   |                               |
| Min. Conductor Space:                                      | .005"   |                               |
| Part Mounting:   | MIX, SMT, THM                                   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, HASL                                      |                               |
| Hole Preparation:  | Chemical desmear                                |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Acid Copper                                     |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | Characteristics ± 10%, Differential ± 10%       |                               |
| Hole Fill/Via Plug:  | Non-conductive Via Plug                         |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                              |                               |

## SECTION I LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

|  |  |  |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Dynaco Corp.</b><br>1000 South Priest Drive<br>Tempe, AZ 85281-5238, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 61642<br><br><b>Contact:</b> Ted Edwards<br><b>Phone:</b> 480-736-3728<br><b>Fax:</b> 480-921-9830<br><b>E-Mail:</b> tedwards@dynacocorp.com |
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| CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION |   | QUALIFICATION LETTERS: |
|---|---|------------------------|
| Specification:                                      | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-05-9356            |
| Panel Size:   | 18" X 24"   |                        |
| Max./Min. Board Thickness:                          | .1"/Not Specified   |                        |
| Max./Min. Base CU Thickness:                        | .001"/Not Specified   |                        |
| Max./Min. Through Hole Size:                        | .045"/.032"   |                        |
| Aspect Ratio:                                       | 3:1 (Through Hole)  |                        |
| Max. Number of Layers:                              | 10  |                        |
| Min. Conductor Width:                               | .01"  |                        |
| Min. Conductor Space:                               | .01"  |                        |
| Part Mounting:                                      | THM   |                        |
| Rigid Base Material:                                | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                        |
| Flex Base Material:                                 | N/A   |                        |
| Finish System:                                      | HASL  |                        |
| Hole Preparation:                                   | Permanganate Desmear/Etchback   |                        |
| Alternate Construction:                             | N/A   |                        |
| Copper Plating:                                     | Acid Copper   |                        |
| Solder Resist:                                      | N/A   |                        |
| Controlled Impedance:                               | N/A   |                        |
| Hole Fill/Via Plug:                                 | N/A   |                        |
| Flex Usage:   | N/A   |                        |
| Hole Wall Conductive Coating:                       | N/A   |                        |

| CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION |  | QUALIFICATION LETTERS: |
|---|--|------------------------|
| Specification:                                      | MIL-PRF-31032/3, MIL-PRF-31032/4                       | VQE-05-9356            |
| Panel Size:   | 12" X 18", 18" X 24"                                   |                        |
| Max./Min. Board Thickness:                          | .1"/Not Specified                                      |                        |
| Max./Min. Base CU Thickness:                        | .001"/Not Specified                                    |                        |
| Max./Min. Through Hole Size:                        | .045"/.032"  |                        |
| Aspect Ratio:                                       | 3:1 (Through Hole)                                     |                        |
| Max. Number of Layers:                              | 10   |                        |
| Min. Conductor Width:                               | .01"   |                        |
| Min. Conductor Space:                               | .01"   |                        |
| Part Mounting:                                      | THM  |                        |
| Rigid Base Material:                                | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                        |
| Flex Base Material:                                 | IPC-241/11 Adhesiveless<br>IPC-4204/11 Adhesiveless    |                        |
| Finish System:                                      | HASL   |                        |
| Hole Preparation:                                   | Permanganate Desmear/Etchback                          |                        |
| Alternate Construction:                             | Foil Lamination  |                        |
| Copper Plating:                                     | Acid Copper  |                        |
| Solder Resist:                                      | N/A  |                        |
| Controlled Impedance:                               | N/A  |                        |
| Hole Fill/Via Plug:                                 | N/A  |                        |
| Flex Usage:   | Class A Flex to Install, Class B Continuous Flex       |                        |
| Hole Wall Conductive Coating:                       | N/A  |                        |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Dynaco Corp.</b><br>1000 South Priest Drive<br>Tempe, AZ 85281-5238, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 61642<br><br><b>Contact:</b> Ted Edwards<br><b>Phone:</b> 480-736-3728<br><b>Fax:</b> 480-921-9830<br><b>EMail:</b> tedwards@dynacocorp.com |
|--|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/3, MIL-PRF-31032/4                       | VQE-05-9356                   |
| Panel Size:  | 12" X 18", 18" X 24"                                   | VQE-06-10600                  |
| Max./Min. Board Thickness:                                 | .12"/Not Specified                                     |                               |
| Max./Min. Base CU Thickness:                               | .001"/Not Specified                                    |                               |
| Max./Min. Through Hole Size:                               | .045"/.01"   |                               |
| Aspect Ratio:  | 12:1 (Through Hole)                                    |                               |
| Max. Number of Layers:                                     | 20   |                               |
| Min. Conductor Width:                                      | .004"  |                               |
| Min. Conductor Space:                                      | .006"  |                               |
| Part Mounting:   | THM  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | IPC-4204/1 Acrylic Adhesive                            |                               |
| Finish System:   | Fused Sn/Pb, HASL                                      |                               |
| Hole Preparation:  | Permanganate Desmear/Etchback, Plasma Etchback         |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electroless Acid Copper, Electroplated Acid Copper     |                               |
| Solder Resist:   | N/A  |                               |
| Controlled Impedance:                                      | N/A  |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | N/A  |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <p>MANUFACTURER INFORMATION:<br/> <b>Dynamic &amp; Proto Circuits, Inc.</b><br/>             869 Barton Street<br/>             Stoney Creek, Ontario, Canada L8E 5G6</p> | <p>PLANT LOCATION:<br/>             Same Address as Manufacturer</p> | <p>CAGE Code: 38898<br/><br/>             Contact: Stephen Hazell<br/>             Phone: 905-643-9900<br/>             Fax: 905-643-9911<br/>             EMail: stephenhazell@dapc.com</p> |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |   |
|---|---|
| <p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2</p> <p>Panel Size: 16" X 18"</p> <p>Max./Min. Board Thickness: .125"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .039"/.018" (0.0135" Drilled)</p> <p>Aspect Ratio: 9.3:1 (Through Hole)</p> <p>Max. Number of Layers: 16</p> <p>Min. Conductor Width: .005"</p> <p>Min. Conductor Space: .005"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br/>             GI: Glass Base, Woven, Polyimide Resin, Heat Resistant</p> <p>Flex Base Material: N/A</p> <p>Finish System: HASL</p> <p>Hole Preparation: Plasma Etchback</p> <p>Alternate Construction: N/A</p> <p>Copper Plating: Acid Copper</p> <p>Solder Resist: Dry Film Solder Resist Plugs, LPI</p> <p>Controlled Impedance: N/A</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: N/A</p> <p>Hole Wall Conductive Coating: N/A</p> | <p>VQE-00-0007<br/>             VQE-01-0311<br/>             VQE-03-0818<br/>             VQE-98-1143</p> |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Electro Plate Circuitry, Inc.</b><br>1430 Century Drive<br>Carrollton, TX 75006, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 79616<br><br><b>Contact:</b> James McNeal<br><b>Phone:</b> 972-466-0818<br><b>Fax:</b> 972-466-9078<br><b>EMail:</b> jjimm@eplate.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b>                   |
|--|--|---|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                                       | VQE-06-010333<br>VQE-06-011433<br>VQE-10-020352 |
| Panel Size:  | 18" X 16", 18" X 24"   |   |
| Max./Min. Board Thickness:                                 | .17"/.03"  |   |
| Max./Min. Base CU Thickness:                               | N/A  |   |
| Max./Min. Through Hole Size:                               | ".008"   |   |
| Aspect Ratio:  | 9.3:1 ((Through Hole))   |   |
| Max. Number of Layers:                                     | 18   |   |
| Min. Conductor Width:                                      | .004"  |   |
| Min. Conductor Space:                                      | .004"  |   |
| Part Mounting:   | MIX, SMT, THM  |   |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant                        |   |
| Flex Base Material:  | N/A  |   |
| Finish System:   | ENIG, HASL, Hard Au, Reflowed SnPb                                     |   |
| Hole Preparation:  | Plasma Desmear/Etchback  |   |
| Alternate Construction:                                    | Blind/Buried Vias, Filled Vias, Foil Lamination, Sequential Lamination |   |
| Copper Plating:  | Acid Copper  |   |
| Solder Resist:   | Dry Film, LPI  |   |
| Controlled Impedance:                                      | +/- 3% Tolerance   |   |
| Hole Fill/Via Plug:  | CB100 conductive, UVP100 non-conductive                                |   |
| Flex Usage:  | N/A  |   |
| Hole Wall Conductive Coating:                              | Electroless  |   |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b>                   |
|--|--|---|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                                       | VQE-06-010333<br>VQE-06-011433<br>VQE-10-020352 |
| Panel Size:  | 18" X 24", 18" X 16"   |   |
| Max./Min. Board Thickness:                                 | .12"/.03"  |   |
| Max./Min. Base CU Thickness:                               | N/A  |   |
| Max./Min. Through Hole Size:                               | ".008"   |   |
| Aspect Ratio:  | 9.3:1 (Through Hole)   |   |
| Max. Number of Layers:                                     | 14   |   |
| Min. Conductor Width:                                      | .004"  |   |
| Min. Conductor Space:                                      | .004"  |   |
| Part Mounting:   | MIX, SMT, THM  |   |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant                 |   |
| Flex Base Material:  | N/A  |   |
| Finish System:   | ENIG, HASL, Hard Au, Reflowed SnPb                                     |   |
| Hole Preparation:  | Plasma Desmear/Etchback  |   |
| Alternate Construction:                                    | Blind/Buried Vias, Filled Vias, Foil Lamination, Sequential Lamination |   |
| Copper Plating:  | Acid Copper  |   |
| Solder Resist:   | Dry Film, LPI  |   |
| Controlled Impedance:                                      | ± 3% Tolerance   |   |
| Hole Fill/Via Plug:  | CB100 conductive, UVP100 non-conductive                                |   |
| Flex Usage:  | N/A  |   |
| Hole Wall Conductive Coating:                              | Electroless  |   |

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**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Electrotek Corp.</b><br>7745 S. 10th Street<br>Oak Creek, WI 53154, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 66030<br><br><b>Contact:</b> Tom Tikusis<br><b>Phone:</b> 414-762-1390<br><b>Fax:</b> 414-762-1510<br><b>EMail:</b> sales@boards4u.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |   |
|---|---|
| <b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .115"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> ".012"<br><b>Aspect Ratio:</b> 9:1 (Through Hole)<br><b>Max. Number of Layers:</b> 18<br><b>Min. Conductor Width:</b> .003"<br><b>Min. Conductor Space:</b> .003"<br><b>Part Mounting:</b> MIX, SMT, THM<br><b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> ENIG, Electrolytic Nickel/Gold, HASL, ImmAg<br><b>Hole Preparation:</b> Permanganate Desmear, Plasma Etchback<br><b>Alternate Construction:</b> Cap Lamination, Foil Lamination<br><b>Copper Plating:</b> Electroplated Acid Copper<br><b>Solder Resist:</b> Dry Film, LPI<br><b>Controlled Impedance:</b> GF: 100 ohms/50 ohms ± 10%, GI: 100 ohms ± 10%<br><b>Hole Fill/Via Plug:</b> Via-fill Technology, 0.016" ±25% Diameter<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper | VQ-06-011451<br>VQ-08-014513<br>VQE-09-018692 |
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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p><b>MANUFACTURER INFORMATION:</b><br/> <b>Endicott Interconnect Technologies, Inc.</b><br/>                 Dept. 0069/014-3, 1093 Clark Street<br/>                 Endicott, NY 13760, US</p> | <p><b>PLANT LOCATION:</b><br/>                 Same Address as Manufacturer</p> | <p>CAGE Code: 3ECL3<br/><br/>                 Contact: Jose Rios<br/>                 Phone: 607-755-5896<br/>                 Fax: 607-755-4649<br/>                 EMail: JoseA.Rios@eitny.com</p> |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|  |   |
|--|---|
| <p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2</p> <p>Panel Size: 24" X 28"</p> <p>Max./Min. Board Thickness: .116"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: ".01"</p> <p>Aspect Ratio: 12:1 (Through Hole)</p> <p>Max. Number of Layers: 30</p> <p>Min. Conductor Width: .003"</p> <p>Min. Conductor Space: .004"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant</p> <p>Flex Base Material: N/A</p> <p>Finish System: ENIG, HASL</p> <p>Hole Preparation: Glass Etch, Permanganate Desmear, Plasma Etchback</p> <p>Alternate Construction: Cap-Lamination, Foil-Lamination</p> <p>Copper Plating: Electroplated Acid Copper</p> <p>Solder Resist: LPI</p> <p>Controlled Impedance: N/A</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: N/A</p> <p>Hole Wall Conductive Coating: N/A</p> | <p>VQE-04-005311<br/>                 VQE-07-012236<br/>                 VQE-07-013506<br/>                 VQE-08-015922</p> |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Endicott Interconnect Technologies, Inc.</b><br>Dept. 0069/014-3, 1093 Clark Street<br>Endicott, NY 13760, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | CAGE Code: 3ECL3<br><br>Contact: Jose Rios<br>Phone: 607-755-5896<br>Fax: 607-755-4649<br>EMail: JoseA.Rios@eitny.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b>                   |
|--|--|---|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-04-005311<br>VQE-07-012236<br>VQE-07-013506 |
| Panel Size:  | 18" X 24"  |   |
| Max./Min. Board Thickness:                                 | .084"/Not Specified                                    |   |
| Max./Min. Base CU Thickness:                               | N/A  |   |
| Max./Min. Through Hole Size:                               | Not Specified/.012"                                    |   |
| Aspect Ratio:  | 7:1 (Through Hole)                                     |   |
| Max. Number of Layers:                                     | 12   |   |
| Min. Conductor Width:                                      | .004"  |   |
| Min. Conductor Space:                                      | .004"  |   |
| Part Mounting:   | MIX, SMT, THM  |   |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |   |
| Flex Base Material:  | N/A  |   |
| Finish System:   | ENIG, HASL   |   |
| Hole Preparation:  | Pemanganate Desmear, Plasma Etchback                   |   |
| Alternate Construction:                                    | Cap-Lamination, Foil-Lamination                        |   |
| Copper Plating:  | Electroplated Acid Copper                              |   |
| Solder Resist:   | LPI  |   |
| Controlled Impedance:                                      | N/A  |   |
| Hole Fill/Via Plug:  | N/A  |   |
| Flex Usage:  | N/A  |   |
| Hole Wall Conductive Coating:                              | N/A  |   |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b>                   |
|--|--|---|
| Specification:   | MIL-PRF-31032/Custom                                   | VQE-04-005311<br>VQE-07-012236<br>VQE-07-013506 |
| Panel Size:  | 19.5" X 24"  |   |
| Max./Min. Board Thickness:                                 | .153"/Not Specified                                    |   |
| Max./Min. Base CU Thickness:                               | N/A  |   |
| Max./Min. Through Hole Size:                               | Not Specified/.02"                                     |   |
| Aspect Ratio:  | 7.6:1 (Through Hole)                                   |   |
| Max. Number of Layers:                                     | 19   |   |
| Min. Conductor Width:                                      | .005"  |   |
| Min. Conductor Space:                                      | .005"  |   |
| Part Mounting:   | MIX  |   |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |   |
| Flex Base Material:  | N/A  |   |
| Finish System:   | ENIG   |   |
| Hole Preparation:  | Pemanganate Desmear, Plasma Etchback                   |   |
| Alternate Construction:                                    | Foil-Lamination, Copper Core                           |   |
| Copper Plating:  | Electroplated Acid Copper                              |   |
| Solder Resist:   | LPI  |   |
| Controlled Impedance:                                      | N/A  |   |
| Hole Fill/Via Plug:  | N/A  |   |
| Flex Usage:  | N/A  |   |
| Hole Wall Conductive Coating:                              | N/A  |   |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Firan Technology Group</b><br>250 Finchdene Square<br>Scarborough, Ontario, Canada M1X 1A5 | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> L2665<br><br><b>Contact:</b> Bryan Clark<br><b>Phone:</b> 416-299-4000<br><b>Fax:</b> 416-292-4308<br><b>E-Mail:</b> byanclark@firantechnology.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .22"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | Not Specified/.005" (Laser Control Depth)<br>Not Specified/.006" (Buried Via Mechanical Drill)<br>.025"/.008" (Mechanical Drill)   |
| Aspect Ratio:                 | 7:1 (Through Hole)   |
| Max. Number of Layers:        | 20   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .004"  |
| Part Mounting:                | MIX, SMT, THM  |
| Rigid Base Material:          | BI: Aramid Fabric, Nonwoven, Polyimide Resin<br>GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, HASL, Immersion Tin, Silver, Reflow Solder   |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback  |
| Alternate Construction:       | Sequential Lamination for Blind & Buried Vias and Micro Vias   |
| Copper Plating:               | Electroless Acid Copper, Electrolytic Acid Copper  |
| Solder Resist:                | Hole Fill, LPI   |
| Controlled Impedance:         | Characteristic $\pm$ 10%, Differential $\pm$ 10%   |
| Hole Fill/Via Plug:           | N/A  |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | N/A  |

VQE-05-009339  
 VQE-06-010764  
 VQE-06-010889

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**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Global Innovations Corp.</b><br>901 Hensley Drive<br>Wylie, TX 75098, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 04RV5<br><br><b>Contact:</b> Bob Noland<br><b>Phone:</b> 214-291-1427<br><b>Fax:</b><br><b>E-Mail:</b> bnoland@globalinnovationcorp.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

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| <b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .119"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> Not Specified/.01"<br><b>Aspect Ratio:</b> 7.5:1 (Through Hole)<br><b>Max. Number of Layers:</b> 18<br><b>Min. Conductor Width:</b> .004"<br><b>Min. Conductor Space:</b> .005"<br><b>Part Mounting:</b> MIX<br><b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> HASL<br><b>Hole Preparation:</b> Permanganate Desmear, Plasma Etchback<br><b>Alternate Construction:</b> Foil Lamination<br><b>Copper Plating:</b> Electro-deposited Acid Copper<br><b>Solder Resist:</b> Dry Film, LPI<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper | VQE-03-4341<br>VQE-04-5599<br>VQE-04-5891<br>VQE-05-7288 |
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**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Global Innovations Corp.</b><br>901 Hensley Drive<br>Wylie, TX 75098, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 04RV5<br><br><b>Contact:</b> Bob Noland<br><b>Phone:</b> 214-291-1427<br><b>Fax:</b><br><b>EMail:</b> bnoland@globalinnovationcorp.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-04-4957                   |
| Panel Size:  | 18" X 24"  | VQE-05-7288                   |
| Max./Min. Board Thickness:                                 | .074"/Not Specified                                    |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.012"                                    |                               |
| Aspect Ratio:  | 6.2:1 (Through Hole)                                   |                               |
| Max. Number of Layers:                                     | 12   |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | MIX  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | HASL   |                               |
| Hole Preparation:  | Plasma Etchback  |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electro-deposited Acid Copper                          |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | 62/37.5 ohms ±10%                                      |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                                     |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/6  | VQE-07-013270                 |
| Panel Size:  | 9" X 16"   | VQE-09-017797                 |
| Max./Min. Board Thickness:                                 | .098"/Not Specified  | VQE-10-020600                 |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.031"  |                               |
| Aspect Ratio:  | 3.2:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 2  |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | MIX  |                               |
| Rigid Base Material:                                       | GR: Glass Base, Nonwoven, Polytetrafluoroethylene Resin, Flame Resistant |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | HASL, Ni/Au  |                               |
| Hole Preparation:  | Fluoroetch   |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electro-deposited Acid Copper  |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | N/A  |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Hamby Corporation</b><br>27704 Avenue Scott<br>Valencia, CA 91355, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 07284<br><br><b>Contact:</b> Sue Sharp<br><b>Phone:</b> 661-257-1924<br><b>Fax:</b> 661-257-1213<br><b>E-Mail:</b> suesharp@hambycorp.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| Specification: MIL-PRF-31032/1, MIL-PRF-31032/2<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .035"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .05"/.02" (drilled)<br>Aspect Ratio: 2:1 (Through Hole)<br>Max. Number of Layers: 6<br>Min. Conductor Width: .009"<br>Min. Conductor Space: .009"<br>Part Mounting: MIX, SMT, THM<br>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: N/A<br>Finish System: HASL, Ni/Au<br>Hole Preparation: Plasma Etchback/Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrodeposited Acid Copper<br>Solder Resist: N/A<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: Electroless Copper | VQE-09-017349                 |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| Specification: MIL-PRF-31032/3, MIL-PRF-31032/4<br>Panel Size: 18" X 24"<br>Max./Min. Board Thickness: .085"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .035"/.018"<br>Aspect Ratio: 5:1 (Through Hole)<br>Max. Number of Layers: 11<br>Min. Conductor Width: .004"<br>Min. Conductor Space: .004"<br>Part Mounting: MIX, SMT, THM<br>Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: IPC-4204/1 Acrylic Adhesive<br>IPC-4204/11 Adhesiveless<br>Finish System: HASL, Ni/Au<br>Hole Preparation: Plasma Etchback/Desmear<br>Alternate Construction: N/A<br>Copper Plating: Electrodeposited Acid Copper<br>Solder Resist: N/A<br>Controlled Impedance: Characteristic: 35-50 ohms +/-10%, Differential: 100 ohms +/-10%<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: Electroless Copper | VQE-08-014596                 |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Hans Brockstedt GmbH</b><br>Clara-Immerwahr Strasse 7<br>24145 Kiel, Germany | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> C4831<br><br><b>Contact:</b> Hilmar Klammer<br><b>Phone:</b> 0049-431-71966-0, -30<br><b>Fax:</b> 0049-431-71966-29<br><b>E-Mail:</b> klammer@brockstedt.de |
|---|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 9" X 13", 13" X 20", 15" X 21", 18" X 24"  |
| Max./Min. Board Thickness:    | .2"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | Not Specified/.004" (Laser Drilled)  |
|                               | Not Specified/.01" (Mech. Drilled)   |
| Aspect Ratio:                 | 1:1 (Blind Vias)   |
|                               | 7:1 (Through Hole)   |
| Max. Number of Layers:        | 12   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .004"  |
| Part Mounting:                | MIX, SMT, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant  |
|                               | Gl: Glass Base, Woven, Polyimide Resin, Heat Resistant                                   |
| Flex Base Material:           | N/A  |
| Finish System:                | Electroless Nickel/Gold, Electroplated Nickel/Gold, Electroplated SnPb, Fused SnPb, HASL |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind Vias, Buried Vias, Foil Lamination, Laser Drilled Vias                             |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | LPI  |
| Controlled Impedance:         | N/A  |
| Hole Fill/Via Plug:           | N/A  |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |

VQE-03-2619  
 VQE-05-7480

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Hans Brockstedt GmbH</b><br>Clara-Immerwahr Strasse 7<br>24145 Kiel, Germany | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> C4831<br><br><b>Contact:</b> Hilmar Klammer<br><b>Phone:</b> 0049-431-71966-0, -30<br><b>Fax:</b> 0049-431-71966-29<br><b>E-Mail:</b> klammer@brockstedt.de |
|---|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4  |
| Panel Size:                   | 9" X 13", 13" X 20"   |
| Max./Min. Board Thickness:    | .2"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.004" (Laser Drilled)<br>Not Specified/.01" (Mech. Drilled)                                 |
| Aspect Ratio:                 | 1:1 (Blind Vias)<br>7:1 (Through Hole)  |
| Max. Number of Layers:        | 12  |
| Min. Conductor Width:         | .004"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>Gl: Glass Base, Woven, Polyimide Resin, Heat Resistant |
| Flex Base Material:           | IPC-4204/1 Acrylic Adhesive<br>IPC-4204/11 Adhesiveless   |
| Finish System:                | Electroless Nickel/Gold, Electroplated Nickel/Gold, Electroplated SnPb, Fused SnPb, HASL                  |
| Hole Preparation:             | Plasma Desmear/Etchback   |
| Alternate Construction:       | Blind Vias, Buried Vias, Foil Lamination, Laser Drilled Vias  |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | N/A   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | Use A (Flex to Install), Use B (Continuous Flex)  |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-03-2619  
VQE-05-7480

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Hughes Circuits</b><br>540 S. Pacific Street<br>San Marcos, CA 92078-4056, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 1KXU6<br><br><b>Contact:</b> Joe Hughes<br><b>Phone:</b> 760-744-0300<br><b>Fax:</b> 760-744-6388<br><b>EMail:</b> joe@hughescircuits.com |
|--|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| Specification: MIL-PRF-31032/1, MIL-PRF-31032/2<br>Panel Size: 18" X 24"<br>Max./Min. Board Thickness: .08"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: Not Specified/.01"<br>.012"/Not Specified<br>Aspect Ratio: 7:1 (Through Hole)<br>Max. Number of Layers: 10<br>Min. Conductor Width: .005"<br>Min. Conductor Space: .005"<br>Part Mounting: MIX<br>Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: N/A<br>Finish System: HASL<br>Hole Preparation: Plasma Desmea<br>Alternate Construction: N/A<br>Copper Plating: Electrodeposited Acid Copper<br>Solder Resist: LPI<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-07-014018                 |



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Lockheed Martin Systems Integration-Owego</b><br>1801 State Route 17C<br>Owego, NY 13827, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | CAGE Code: 03640<br><br>Contact: Melita Nagerl<br>Phone: 607-751-4665<br>Fax: 607-751-7714<br>EMail: melita.nagerl@lmco.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                              | VQE-00-0961                   |
| Panel Size:  | 18" X 24"   | VQE-99-0130                   |
| Max./Min. Board Thickness:                                 | .2"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.02"  |                               |
| Aspect Ratio:  | 8:1 (Through Hole)  |                               |
| Max. Number of Layers:                                     | 16  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | Fused SnPb, HASL, NiAu  |                               |
| Hole Preparation:  | Permanganate Desmear, Plasma Etchback                         |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Electro-deposited Acid Copper                                 |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper  |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2             | VQE-01-0539                   |
| Panel Size:  | 18" X 24"                                    |                               |
| Max./Min. Board Thickness:                                 | .095"/Not Specified                          |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.014"                          |                               |
| Aspect Ratio:  | 6.8:1 (Through Hole)                         |                               |
| Max. Number of Layers:                                     | 14   |                               |
| Min. Conductor Width:                                      | .004"  |                               |
| Min. Conductor Space:                                      | .004"  |                               |
| Part Mounting:   | SMT, THM                                     |                               |
| Rigid Base Material:                                       | BI: Aramid Fabric, Nonwoven, Polyimide Resin |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | Fused SnPb, HASL, NiAu                       |                               |
| Hole Preparation:  | Permanganate Desmear                         |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electro-deposited Acid Copper                |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | N/A  |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper                           |                               |

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Lockheed Martin Systems Integration-Owego</b><br>1801 State Route 17C<br>Owego, NY 13827, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 03640<br><br><b>Contact:</b> Melita Nagerl<br><b>Phone:</b> 607-751-4665<br><b>Fax:</b> 607-751-7714<br><b>EMail:</b> melita.nagerl@lmco.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2                |
| Panel Size:                   | 24" X 30"                                       |
| Max./Min. Board Thickness:    | .2"/Not Specified                               |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.018"                             |
| Aspect Ratio:                 | 8:1 (Through Hole)                              |
| Max. Number of Layers:        | 24  |
| Min. Conductor Width:         | .004"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | SMT, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant |
| Flex Base Material:           | N/A   |
| Finish System:                | Fused SnPb, HASL, NiAu                          |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback           |
| Alternate Construction:       | N/A   |
| Copper Plating:               | Electro-deposited Acid Copper                   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | N/A   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper                              |

|               |
|---------------|
| VQE-00-0961   |
| VQE-07-013268 |
| VQE-07-013459 |
| VQE-99-0130   |

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Lockheed Martin Systems Integration-Owego</b><br>1801 State Route 17C<br>Owego, NY 13827, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 03640<br><br><b>Contact:</b> Melita Nagerl<br><b>Phone:</b> 607-751-4665<br><b>Fax:</b> 607-751-7714<br><b>EMail:</b> melita.nagerl@lmco.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |               |
|---|---------------|
| Specification: MIL-PRF-31032/1, MIL-PRF-31032/2                             | VQE-00-0961   |
| Panel Size: 24" X 30"   | VQE-07-013459 |
| Max./Min. Board Thickness: .2"/Not Specified                                | VQE-99-0130   |
| Max./Min. Base CU Thickness: N/A  |               |
| Max./Min. Through Hole Size: Not Specified/.018"                            |               |
| Aspect Ratio: 8:1 (Through Hole)  |               |
| Max. Number of Layers: 16   |               |
| Min. Conductor Width: .004"   |               |
| Min. Conductor Space: .004"   |               |
| Part Mounting: SMT, THM   |               |
| Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |               |
| Flex Base Material: N/A   |               |
| Finish System: Fused SnPb, HASL, NiAu                                       |               |
| Hole Preparation: Permanganate Desmear, Plasma Etchback                     |               |
| Alternate Construction: N/A   |               |
| Copper Plating: Electro-deposited Acid Copper                               |               |
| Solder Resist: LPI  |               |
| Controlled Impedance: N/A   |               |
| Hole Fill/Via Plug: N/A   |               |
| Flex Usage: N/A   |               |
| Hole Wall Conductive Coating: Electroless Copper                            |               |

|               |
|---------------|
| VQE-00-0961   |
| VQE-07-013459 |
| VQE-99-0130   |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Lockheed Martin Systems Integration-Owego</b><br>1801 State Route 17C<br>Owego, NY 13827, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 03640<br><br><b>Contact:</b> Melita Nagerl<br><b>Phone:</b> 607-751-4665<br><b>Fax:</b> 607-751-7714<br><b>EMail:</b> melita.nagerl@lmco.com |
|---|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .11"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.016"   |
| Aspect Ratio:                 | 6:1 (Through Hole)  |
| Max. Number of Layers:        | 18  |
| Min. Conductor Width:         | .003"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | SMT, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |
| Flex Base Material:           | IC-4204/11 Adhesiveless<br>IPC-4204/1 Acrylic Adhesive<br>IPC-4204/2<br>IPC-4204/3<br>IPC-4204/4          |
| Finish System:                | Fused SnPb, HASL  |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback   |
| Alternate Construction:       | N/A   |
| Copper Plating:               | Electro-deposited Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | N/A   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-00-0684  
 VQE-07-013459

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>Merix Corp. (Forest Grove, OR)</b><br/> 1521 Poplar Lane<br/> Forest Grove, OR 97116, US</p> | <p>PLANT LOCATION:<br/> Same Address as Manufacturer</p> | <p>CAGE Code: 01KV9<br/> Contact: Roger Michalowski<br/> Phone: 781-639-5410<br/> Fax:<br/> EMail: Customerservice@merix.com</p> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| <p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2<br/> Panel Size: 18" X 24"<br/> Max./Min. Board Thickness: .13"/Not Specified<br/> Max./Min. Base CU Thickness: N/A<br/> Max./Min. Through Hole Size: .003"/Not Specified (Laser Via)<br/> ".008" (Mechanical)<br/> Aspect Ratio: 0.8:1 (Blind Vias)<br/> 10:1 (Through Hole)<br/> Max. Number of Layers: 26<br/> Min. Conductor Width: .004"<br/> Min. Conductor Space: .004"<br/> Part Mounting: MIX, SMT, THM<br/> Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br/> GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br/> Flex Base Material: N/A<br/> Finish System: ENIG, HASL, Immersion Ag, Ni/Hard-Au<br/> Hole Preparation: Chemical Desmear Permanganate, Plasma Desmear, Etchback<br/> Alternate Construction: Blind Vias, Laser Drilled Vias<br/> Copper Plating: Electrodeposited Acid Copper<br/> Solder Resist: LPI<br/> Controlled Impedance: Differential Methods <math>\pm 5\%</math> at 50 ohms, Microstrip, Single Ended, Single Line<br/> Hole Fill/Via Plug: N/A<br/> Flex Usage: N/A<br/> Hole Wall Conductive Coating: N/A</p> | <p>VQ-09-017325</p>           |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Merix Corp. (San Jose, CA)</b><br>355 Turtle Creek Court<br>San Jose, CA 95125-1316, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0MHG5<br><br><b>Contact:</b> Dave Williams<br><b>Phone:</b> 408-280-0422<br><b>Fax:</b> 408-280-0641<br><b>E-Mail:</b> david.williams@sj.merix.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-08-016481                 |
| Panel Size:  | 18" X 24"   | VQE-08-016632                 |
| Max./Min. Board Thickness:                                 | .13"/Not Specified  |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .004"/.008" (laser drilled)<br>.25"/.008" (mechanical)  |                               |
| Aspect Ratio:  | 0.8:1 (Blind Vias)<br>10:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 20  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004"   |                               |
| Part Mounting:   | MIX, SMT, THM   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, HASL, Hard Gold, Nickel   |                               |
| Hole Preparation:  | Chemical Desmear, Desmear, Plasma Etchback  |                               |
| Alternate Construction:                                    | Blind Vias, Buried Vias, Sequential Lamination  |                               |
| Copper Plating:  | Electrodeposited Acid Copper  |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | 25-125 ohms +/-10%  |                               |
| Hole Fill/Via Plug:  | Non-conductive Filled Vias  |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Micom Corp.</b><br>475 Old Highway 8 NW<br>New Brighton, MN 55112, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 34076<br><br><b>Contact:</b> Larry Leonard<br><b>Phone:</b> 651-604-2639<br><b>Fax:</b> 651-636-1352<br><b>EMail:</b> lleonard@micomcircuits.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-02-002780                 |
| Panel Size:  | 18" X 24"   | VQE-03-2980                   |
| Max./Min. Board Thickness:                                 | .239"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.007"   |                               |
| Aspect Ratio:  | 11:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 28  |                               |
| Min. Conductor Width:                                      | .004"   |                               |
| Min. Conductor Space:                                      | .004"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | Fuse Following SnPb Plate, HASL   |                               |
| Hole Preparation:  | Permanganate Desmear/Etchback, Plasma Desmear/Etchback  |                               |
| Alternate Construction:                                    | Blind & Buried Vias   |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | Dry Film, LPI   |                               |
| Controlled Impedance:                                      | Characteristic $\pm 10\%$ , Differential $\pm 10\%$   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Philway Products, Inc.</b><br>701 Virginia Avenue<br>Ashland, OH 44806, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 21971<br><br><b>Contact:</b> Tom School<br><b>Phone:</b> 419-281-7777<br><b>Fax:</b> 419-289-3447<br><b>EMail:</b> quality@philway.com |
|---|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:<br>Panel Size:<br>Max./Min. Board Thickness:<br>Max./Min. Base CU Thickness:<br>Max./Min. Through Hole Size:<br>Aspect Ratio:<br>Max. Number of Layers:<br>Min. Conductor Width:<br>Min. Conductor Space:<br>Part Mounting:<br>Rigid Base Material:<br><br>Flex Base Material:<br>Finish System:<br>Hole Preparation:<br>Alternate Construction:<br>Copper Plating:<br>Solder Resist:<br>Controlled Impedance:<br>Hole Fill/Via Plug:<br>Flex Usage:<br>Hole Wall Conductive Coating: | MIL-PRF-31032/1<br>18" X 21"<br>.09"/Not Specified<br>.002"/Not Specified<br>.044"/.012"<br>4:1 (Through Hole)<br>12<br>.005"<br>.005"<br>MIX, SMT, THM<br>GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin,<br>Flame Resistant<br>N/A<br>HASL, IR Reflow following SnPb Plate<br>Permanganate Desmear/Etchback<br>N/A<br>Acid Copper<br>LPI<br>N/A<br>N/A<br>N/A<br>N/A | VQE-99-1107                   |



**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/><b>Pioneer Circuits, Inc.</b><br/>3000 S. Shannon Street<br/>Santa Ana, CA 92704-6321, US</p> |  | <p>CAGE Code: 65723<br/>Contact: Elias Gabriel<br/>Phone: 714-641-3132 x234<br/>Fax: 714-641-3120<br/>EMail:</p> |
|--|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .177"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | .206"/.0135"  |
| Aspect Ratio:                 | 11:1  |
| Max. Number of Layers:        | 22  |
| Min. Conductor Width:         | .0035"  |
| Min. Conductor Space:         | .0035"  |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, Electrolytic Ni/Au Bondable, HASL, Reflowed Tin/Lead Fused, SMOBC, Selective Tin/Lead Strip |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback   |
| Alternate Construction:       | Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination                 |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | Dry Film, LPI   |
| Controlled Impedance:         | Characteristic & Differential $\pm$ 10%   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-09-017323  
VQE-09-017656

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>Pioneer Circuits, Inc.</b><br/>         3000 S. Shannon Street<br/>         Santa Ana, CA 92704-6321, US</p> |  | <p>CAGE Code: 65723<br/>         Contact: Elias Gabriel<br/>         Phone: 714-641-3132 x234<br/>         Fax: 714-641-3120<br/>         EMail:</p> |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .275"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | .252"/.012"   |
| Aspect Ratio:                 | 11:1  |
| Max. Number of Layers:        | 20  |
| Min. Conductor Width:         | .0035"  |
| Min. Conductor Space:         | .0035"  |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant   |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, Electrolytic Ni/Au Bondable, HASL, Reflowed Tin/Lead Fused, SMOBC, Selective Tin/Lead Strip |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback   |
| Alternate Construction:       | Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination                 |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | Dry Film, LPI   |
| Controlled Impedance:         | Characteristic & Differential $\pm$ 10%   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

|               |
|---------------|
| VQE-09-017323 |
| VQE-09-017656 |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>Pioneer Circuits, Inc.</b><br/>         3000 S. Shannon Street<br/>         Santa Ana, CA 92704-6321, US</p> |  | <p>CAGE Code: 65723<br/>         Contact: Elias Gabriel<br/>         Phone: 714-641-3132 x234<br/>         Fax: 714-641-3120<br/>         EMail:</p> |
|---|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b>  |
|--|--|
| <p>Specification: MIL-PRF-31032/3, MIL-PRF-31032/4</p> <p>Panel Size: 18" X 26"</p> <p>Max./Min. Board Thickness: .231"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .169"/.02"</p> <p>Aspect Ratio: 8.5:1</p> <p>Max. Number of Layers: 22</p> <p>Min. Conductor Width: .003"</p> <p>Min. Conductor Space: .003"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF (Epoxy Glass)</p> <p>Flex Base Material: Adhesiveless Epoxy</p> <p>Finish System: ENIG, Electrolytic Ni/Au (Bondable), HASL, Reflowed Tin/Lead (Fused), SMOBC, Selective Tin/Lead Strip</p> <p>Hole Preparation: Permanganate Desmear, Plasma Etchback</p> <p>Alternate Construction: Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination</p> <p>Copper Plating: Acid Copper</p> <p>Solder Resist: LPI</p> <p>Controlled Impedance: Characteristic &amp; Differential +/- 10%</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: Class A (Flex During Installation)</p> <p>Hole Wall Conductive Coating: Electroless Copper</p> | <p>VQE-09-017323<br/>         VQE-09-017656<br/>         VQE-10-020651</p> |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>Pioneer Circuits, Inc.</b><br/>         3000 S. Shannon Street<br/>         Santa Ana, CA 92704-6321, US</p> |  | <p>CAGE Code: 65723<br/>         Contact: Elias Gabriel<br/>         Phone: 714-641-3132 x234<br/>         Fax: 714-641-3120<br/>         EMail:</p> |
|---|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/3, MIL-PRF-31032/4  | VQE-09-017323                 |
|  |   | VQE-09-017656                 |
| Panel Size:  | 18" X 24"   |                               |
| Max./Min. Board Thickness:                                 | .1"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .193"/.016"   |                               |
| Aspect Ratio:  | 6:1   |                               |
| Max. Number of Layers:                                     | 10  |                               |
| Min. Conductor Width:                                      | .003"   |                               |
| Min. Conductor Space:                                      | .003"   |                               |
| Part Mounting:   | MIX, SMT, THM   |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |                               |
| Flex Base Material:  | Adhesive Polyimide  |                               |
| Finish System:   | ENIG, Electrolytic Ni/Au Bondable, HASL, Reflowed Tin/Lead Fused, SMOBC, Selective Tin/Lead Strip |                               |
| Hole Preparation:  | Permanganate Copper, Plasma Etchback  |                               |
| Alternate Construction:                                    | Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination                 |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | Characteristic & Differential $\pm$ 10%   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | Class A Flex During Installation, Class B Dynamic   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper  |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <p>MANUFACTURER INFORMATION:<br/> <b>Pioneer Circuits, Inc.</b><br/>         3000 S. Shannon Street<br/>         Santa Ana, CA 92704-6321, US</p> |  | <p>CAGE Code: 65723<br/>         Contact: Elias Gabriel<br/>         Phone: 714-641-3132 x234<br/>         Fax: 714-641-3120<br/>         EMail:</p> |
|---|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4  |
| Panel Size:                   | 24" X 36"   |
| Max./Min. Board Thickness:    | .185"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | .167"/.013"   |
| Aspect Ratio:                 | 11:1  |
| Max. Number of Layers:        | 26  |
| Min. Conductor Width:         | .003"   |
| Min. Conductor Space:         | .003"   |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |
| Flex Base Material:           | Adhesiveless Polyimide  |
| Finish System:                | ENIG, Electrolytic Ni/Au Bondable, HASL, Reflowed Tin/Lead Fused, SMOBC, Selective Tin/Lead Strip |
| Hole Preparation:             | Permanganate Desmear, Plasma Etchback   |
| Alternate Construction:       | Blind/Buried Vias, Bood Binder, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination    |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | Characteristic & Differential $\pm$ 10%   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | Class A Flex During Installation, Class B Dynamic   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-09-017323  
VQE-09-017656

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:</p> <p><b>PNC, Inc.</b><br/>         115 East Centre Street<br/>         Nutley, NJ 07110, US</p> |  | <p>CAGE Code: 66766</p> <p>Contact: Carmela Conte<br/>         Phone: 973-284-1600<br/>         Fax:<br/>         EMail: carmela@pnconline.com</p> |
|--|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| <p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2</p> <p>Panel Size: 18" X 22"</p> <p>Max./Min. Board Thickness: .093"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .12"/.014"</p> <p>Aspect Ratio: 6.6:1</p> <p>Max. Number of Layers: 10</p> <p>Min. Conductor Width: .008"</p> <p>Min. Conductor Space: .008"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant</p> <p>Flex Base Material: N/A</p> <p>Finish System: HASL</p> <p>Hole Preparation: Permanganate Desmear</p> <p>Alternate Construction: Foil Lamination</p> <p>Copper Plating: Electroplated Acid Copper</p> <p>Solder Resist: LPI</p> <p>Controlled Impedance: N/A</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: N/A</p> <p>Hole Wall Conductive Coating: Electroless Copper</p> | <p>VQE-10-19440</p>           |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Printed Circuits, Inc.</b><br>1200 West 96th Street<br>Bloomington, MN 55431, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65114<br><br><b>Contact:</b> Jim Smith<br><b>Phone:</b> 612-888-7900<br><b>Fax:</b> 612-888-2719<br><b>E-Mail:</b> jsmith@printedcircuits.com |
|---|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| Specification: MIL-PRF-31032/3, MIL-PRF-31032/4<br>Panel Size: 12" X 18", 18" X 24"<br>Max./Min. Board Thickness: .12"/Not Specified<br>Max./Min. Base CU Thickness: (1/2 oz.)<br>Max./Min. Through Hole Size: Not Specified/.01"<br>Aspect Ratio: 10:1 (Through Hole)<br>Max. Number of Layers: 16<br>Min. Conductor Width: .004"<br>Min. Conductor Space: .005" (+/- 10%)<br>Part Mounting: MIX, SMT, THM<br>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Flex Base Material: IPC-4204/1 Acrylic Adhesive<br>IPC-4204/11 Adhesiveless<br>Finish System: Electroless Ni/Au, Electrolytic Ni/Au, Fused SnPb, HASL, SMOBC<br>Hole Preparation: Plasma Desmear/Etchback<br>Alternate Construction: N/A<br>Copper Plating: Electrolytic Acid Copper<br>Solder Resist: Dry Film, LPI,<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: Class A Flex to Install, Class B Continuous Flex<br>Hole Wall Conductive Coating: Electroless Copper | VQE-01-0024                   |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Sanmina-SCI (San Jose)</b><br>2050 Bering Drive<br>San Jose, CA 95131, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 3DR67<br><br><b>Contact:</b> Darrell Myers<br><b>Phone:</b> 408-964-6515<br><b>Fax:</b> 408-964-6453<br><b>EMail:</b> darrell.myers@sanmina-sci.com |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .04"/Not Specified (for Plasma Etchback)<br>.25"/Not Specified (for Plasma Desmear)                               |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | .25"/.008"  |
| Aspect Ratio:                 | 15:1 (Through Hole)<br>1:2 (Microvias, Laser)   |
| Max. Number of Layers:        | 30  |
| Min. Conductor Width:         | .003"   |
| Min. Conductor Space:         | .003"   |
| Part Mounting:                | MIX, SMT, THM   |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant   |
| Flex Base Material:           | N/A   |
| Finish System:                | ENIG, Electrolytic Nickel Gold, HASL, Reflowed Solder   |
| Hole Preparation:             | Plasma Desmear//Etchback  |
| Alternate Construction:       | Foil Lamination, Min. Blind Via: 0.005" Laser, Min. Buried Via: 0.010"<br>Mechanical Drill, Sequential Lamination |
| Copper Plating:               | Electrolytic Acid Copper  |
| Solder Resist:                | Dry Film, LPI   |
| Controlled Impedance:         | 50-110 ohms ± 5%  |
| Hole Fill/Via Plug:           | Epoxy, Silver   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-06-011137



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Sanmina-SCI (San Jose)</b><br>2050 Bering Drive<br>San Jose, CA 95131, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 3DR67<br><br><b>Contact:</b> Darrell Myers<br><b>Phone:</b> 408-964-6515<br><b>Fax:</b> 408-964-6453<br><b>EMail:</b> darrell.myers@sanmina-sci.com |
|--|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b>  |
|---|--------------------------------|
| <b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .062"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> .25"/.01"<br><b>Aspect Ratio:</b> 6:1 (Through Hole)<br><b>Max. Number of Layers:</b> 8<br><b>Min. Conductor Width:</b> .003"<br><b>Min. Conductor Space:</b> .003"<br><b>Part Mounting:</b> SMT, THM<br><b>Rigid Base Material:</b> GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br><b>Flex Base Material:</b> N/A<br><b>Finish System:</b> ENIG, HASL, ImmAg, OSP<br><b>Hole Preparation:</b> Plasma Desmear<br><b>Alternate Construction:</b> Buried Via Mechanical Drill, Foil Lamination, Sequential Lamination<br><b>Copper Plating:</b> Acid Copper<br><b>Solder Resist:</b> Dry Film, LPI<br><b>Controlled Impedance:</b> 50-110 ohms ± 5%<br><b>Hole Fill/Via Plug:</b> Epoxy, Silver<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper | VQE-06-011137<br>VQE-10-019381 |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Speedy Circuits, Inc.</b><br>5331 McFadden Avenue<br>Huntington Beach, CA 92649-1204, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 66982<br><br><b>Contact:</b> Jan Lesky<br><b>Phone:</b> 714-766-6243<br><b>Fax:</b> 714-899-7074<br><b>EMail:</b> |
|---|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2   | VQE-08-016434                 |
| Panel Size:  | 18" X 24"  |                               |
| Max./Min. Board Thickness:                                 | .11"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | .048"/.02"   |                               |
| Aspect Ratio:  | 4:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 10   |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | SMT, THM   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | Electro-deposited Fused SnPb, Electrolytic Hard Gold, Electrolytic Nickel,<br>Electrolytic Soft Gold, HASL |                               |
| Hole Preparation:  | Etchback, Plasma Desmear   |                               |
| Alternate Construction:                                    | Foil Lamination  |                               |
| Copper Plating:  | Acid Copper  |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | 100/50 ohms +/-10% Characteristic, 100/50 ohms +/-10% Differential   |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper   |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/3, MIL-PRF-31032/4   | VQE-08-016434                 |
| Panel Size:  | 18" X 24"  |                               |
| Max./Min. Board Thickness:                                 | .11"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | .048"/.02"   |                               |
| Aspect Ratio:  | 4:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 10   |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | SMT, THM   |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant   |                               |
| Flex Base Material:  | Adhesiveless Polyimide   |                               |
| Finish System:   | Electro-deposited Fused SnPb, Electrolytic Hard Gold, Electrolytic Nickel,<br>Electrolytic Soft Gold, HASL |                               |
| Hole Preparation:  | Etchback, Plasma Desmear   |                               |
| Alternate Construction:                                    | Foil Lamination  |                               |
| Copper Plating:  | Electro-deposited Acid Copper  |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | 100/50 ohms +/-10% Characteristic, 100/50 ohms +/-10% Differential   |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | Class A Flex to Install, Class B Continuous  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
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| <p>MANUFACTURER INFORMATION:<br/> <b>Speedy Circuits, Inc.</b><br/>                     5331 McFadden Avenue<br/>                     Huntington Beach, CA 92649-1204, US</p> | <p>PLANT LOCATION:<br/>                     Same Address as Manufacturer</p> | <p>CAGE Code: 66982<br/><br/>                     Contact: Jan Lesky<br/>                     Phone: 714-766-6243<br/>                     Fax: 714-899-7074<br/>                     EMail:</p> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| <p>Specification: MIL-PRF-31032/5<br/>                     Panel Size: 12" X 18"<br/>                     Max./Min. Board Thickness: .068"/Not Specified<br/>                     Max./Min. Base CU Thickness: N/A<br/>                     Max./Min. Through Hole Size: .125"/.01"<br/>                     Aspect Ratio: 6:1<br/>                     Max. Number of Layers: 10<br/>                     Min. Conductor Width: .005"<br/>                     Min. Conductor Space: .005"<br/>                     Part Mounting: SMT, THM<br/>                     Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br/>                     GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br/>                     Flex Base Material: N/A<br/>                     Finish System: N/A<br/>                     Hole Preparation: Plasma Desmear<br/>                     Alternate Construction: Electro-deposited Fused SnPb, Electrolytic Hard and Soft Gold, Electrolytic Nickel, HASL<br/>                     Copper Plating: Acid Copper<br/>                     Solder Resist: 50, LPI<br/>                     Controlled Impedance: 50 ohms +/- 10% (Characteristic, Differential)<br/>                     Hole Fill/Via Plug: N/A<br/>                     Flex Usage: N/A<br/>                     Hole Wall Conductive Coating: Electroless Copper</p> | <p>VQE-09-018657</p>          |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Speedy Circuits, Inc.</b><br>5331 McFadden Avenue<br>Huntington Beach, CA 92649-1204, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 66982<br><br><b>Contact:</b> Jan Lesky<br><b>Phone:</b> 714-766-6243<br><b>Fax:</b> 714-899-7074<br><b>EMail:</b> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/5, MIL-PRF-31032/6  |
| Panel Size:                   | 12" X 18"   |
| Max./Min. Board Thickness:    | .1"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | .048"/.02"<br>.125"/.01"  |
| Aspect Ratio:                 | 10:1  |
| Max. Number of Layers:        | 10  |
| Min. Conductor Width:         | .005"   |
| Min. Conductor Space:         | .005"   |
| Part Mounting:                | SMT, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |
| Flex Base Material:           | N/A   |
| Finish System:                | Electro-deposited Fused SnPb, Electrolytic Hard and Soft Gold, Electrolytic Nickel, HASL                  |
| Hole Preparation:             | Plasma Desmear  |
| Alternate Construction:       | N/A   |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | LPI   |
| Controlled Impedance:         | 100/50 ohms +/-10% Characteristic, Differential   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |

VQE-09-018657

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
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| <b>MANUFACTURER INFORMATION:</b><br><b>Speedy Circuits, Inc.</b><br>5331 McFadden Avenue<br>Huntington Beach, CA 92649-1204, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 66982<br><br><b>Contact:</b> Jan Lesky<br><b>Phone:</b> 714-766-6243<br><b>Fax:</b> 714-899-7074<br><b>EMail:</b> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| Specification: MIL-PRF-31032/6<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .036"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .048"/.02"<br>Aspect Ratio: 2:1 (Through Hole)<br>Max. Number of Layers: 2<br>Min. Conductor Width: .005"<br>Min. Conductor Space: .005"<br>Part Mounting: SMT<br>Rigid Base Material: GR: Glass Base, Nonwoven, Polytetrafluoroethylene Resin, Flame Resistant<br>GY: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant, for Microwave Application<br><br>Flex Base Material: N/A<br>Finish System: Electro-deposited fused SnPb<br>Hole Preparation: N/A<br>Alternate Construction: N/A<br>Copper Plating: Acid Copper<br>Solder Resist: N/A<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: Electroless Copper | VQE-08-016434                 |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>Strataflex Corp.</b><br/>         11 Dohme Avenue<br/>         Toronto, Ontario, Canada M4B 1Y7</p> | <p>PLANT LOCATION:<br/>         Same Address as Manufacturer</p> | <p>CAGE Code: 38661<br/><br/>         Contact: Peter Pialis<br/>         Phone: 416-752-2224<br/>         Fax: 416-752-6719<br/>         EMail: ppialis@strataflex.ca</p> |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|   |   |
|---|---|
| <p>Specification: MIL-PRF-31032/3, MIL-PRF-31032/4</p> <p>Panel Size: 12" X 18"</p> <p>Max./Min. Board Thickness: .035"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .011"/Not Specified</p> <p>Aspect Ratio: 3:1 (Through Hole)</p> <p>Max. Number of Layers: 7</p> <p>Min. Conductor Width: .007"</p> <p>Min. Conductor Space: .007"</p> <p>Part Mounting: SM, THM</p> <p>Rigid Base Material: N/A</p> <p>Flex Base Material: FR4 IPC-4101/21<br/>         Flexible Polyimide Clad IPC-4204/1<br/>         Flexible Polyimide Film IPC-4202/1<br/>         Flexible Polyimide Film/Acrylic IPC-4203/1<br/>         Woven E-Glass, Polyimide Resin IPC-4101/41</p> <p>Finish System: HASL</p> <p>Hole Preparation: Plasma Etchback</p> <p>Alternate Construction: N/A</p> <p>Copper Plating: Electrodeposited Acid Copper</p> <p>Solder Resist: N/A</p> <p>Controlled Impedance: N/A</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: N/A</p> <p>Hole Wall Conductive Coating: N/A</p> | <p>VQE-04-005354<br/>         VQE-08-015729</p> |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Strataflex Corp.</b><br>11 Dohme Avenue<br>Toronto, Ontario, Canada M4B 1Y7 | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 38661<br><br><b>Contact:</b> Peter Pialis<br><b>Phone:</b> 416-752-2224<br><b>Fax:</b> 416-752-6719<br><b>EMail:</b> ppialis@strataflex.ca |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4  |
| Panel Size:                   | 12" X 18"   |
| Max./Min. Board Thickness:    | .094"/Not Specified   |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.008"   |
| Aspect Ratio:                 | 12:1 (Through Hole)   |
| Max. Number of Layers:        | 12  |
| Min. Conductor Width:         | .006"   |
| Min. Conductor Space:         | .004"   |
| Part Mounting:                | N/A   |
| Rigid Base Material:          | N/A   |
| Flex Base Material:           | Flexible Polyimide Film/Acrylic IC-4203/1<br>Flexible Polyimide IPC-4204/11<br>Woven E-Glass, Polyimide Resin IPC-4101/40<br>Woven E-Glass, Polyimide Resin IPC-4101/41<br>Woven E-Glass, Polyimide Resin IPC-4101/42 |
| Finish System:                | HASL  |
| Hole Preparation:             | Plasma Etchback   |
| Alternate Construction:       | N/A   |
| Copper Plating:               | Electrodeposited Acid Copper  |
| Solder Resist:                | TA140 PSR-4000 HG   |
| Controlled Impedance:         | N/A   |
| Hole Fill/Via Plug:           | N/A   |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Direct Metallization  |

VQE-04-005354  
 VQE-08-015729

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Strataflex Corp.</b><br>11 Dohme Avenue<br>Toronto, Ontario, Canada M4B 1Y7 | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 38661<br><br><b>Contact:</b> Peter Pialis<br><b>Phone:</b> 416-752-2224<br><b>Fax:</b> 416-752-6719<br><b>EMail:</b> ppialis@strataflex.ca |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| Specification: MIL-PRF-31032/3, MIL-PRF-31032/4<br>Panel Size: 12" X 18"<br>Max./Min. Board Thickness: .035"/Not Specified<br>Max./Min. Base CU Thickness: N/A<br>Max./Min. Through Hole Size: .011"/Not Specified<br>Aspect Ratio: 3:1 (Through Hole)<br>Max. Number of Layers: 7<br>Min. Conductor Width: .007"<br>Min. Conductor Space: .007"<br>Part Mounting: SMT, THM<br>Rigid Base Material: FR4-IPC-4101/21<br>Flexible Polyimide Clad IPC-4204/1<br>Flexible Polyimide Film IPC-4202/1<br>Flexible Polyimide Film/Acrylic IPC-4203/1<br><br>Flex Base Material: N/A<br>Finish System: HASL<br>Hole Preparation: Plasma Desmear/Etchback<br>Alternate Construction: N/A<br>Copper Plating: Acid Copper<br>Solder Resist: N/A<br>Controlled Impedance: N/A<br>Hole Fill/Via Plug: N/A<br>Flex Usage: N/A<br>Hole Wall Conductive Coating: N/A | VQE-04-5354                   |



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Titan PCB East, Inc.</b><br>2 Industrial Way<br>Amesbury, MA 01913, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0BX48<br><br><b>Contact:</b> Lance Arlander<br><b>Phone:</b> 978-388-5740<br><b>Fax:</b> 978-388-5538<br><b>EMail:</b> larlander@titaneast.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                       | VQE-04-6518                   |
|  |  | VQE-05-7439                   |
| Panel Size:  | 18" X 24"  |                               |
| Max./Min. Board Thickness:                                 | .012"/Not Specified                                    |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.012"                                    |                               |
| Aspect Ratio:  | 10:1 (Through Hole)                                    |                               |
| Max. Number of Layers:                                     | 14   |                               |
| Min. Conductor Width:                                      | .004"  |                               |
| Min. Conductor Space:                                      | .004"  |                               |
| Part Mounting:   | MIX, SMT, THM  |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant        |                               |
|  | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | ENIG, Electroplated Gold, HASL                         |                               |
| Hole Preparation:  | Plasma Etchback  |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electrolytic Acid Copper                               |                               |
| Solder Resist:   | Dry Film, LPI  |                               |
| Controlled Impedance:                                      | N/A  |                               |
| Hole Fill/Via Plug:  | N/A  |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | N/A  |                               |

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>Titan PCB East, Inc.</b><br>2 Industrial Way<br>Amesbury, MA 01913, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 0BX48<br><br><b>Contact:</b> Lance Arlander<br><b>Phone:</b> 978-388-5740<br><b>Fax:</b> 978-388-5538<br><b>EMail:</b> larlander@titaneast.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b>             |
|--|---|---|
| Specification:   | MIL-PRF-31032/3, MIL-PRF-31032/4  | VQE-01-0024<br>VQE-04-6518<br>VQE-05-7439 |
| Panel Size:  | 12" X 18", 18" X 24"  |   |
| Max./Min. Board Thickness:                                 | .012"/Not Specified   |   |
| Max./Min. Base CU Thickness:                               | N/A   |   |
| Max./Min. Through Hole Size:                               | Not Specified/.012"   |   |
| Aspect Ratio:  | 10:1 (Through Hole)   |   |
| Max. Number of Layers:                                     | 14  |   |
| Min. Conductor Width:                                      | .004"   |   |
| Min. Conductor Space:                                      | .004"   |   |
| Part Mounting:   | MIX, SMT, THM   |   |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |   |
| Flex Base Material:  | N/A   |   |
| Finish System:   | ENIG, Electroplated Gold, HASL, Immersion Ni/Au   |   |
| Hole Preparation:  | Plasma Etchback   |   |
| Alternate Construction:                                    | N/A   |   |
| Copper Plating:  | Electrodeposited Acid Copper  |   |
| Solder Resist:   | Dry Film, LPI   |   |
| Controlled Impedance:                                      | N/A   |   |
| Hole Fill/Via Plug:  | N/A   |   |
| Flex Usage:  | N/A   |   |
| Hole Wall Conductive Coating:                              | N/A   |   |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>TTM Technologies (Redmond)</b><br/>         17550 NE 67th Court<br/>         Redmond, WA 98052-4939, US</p> | <p>PLANT LOCATION:<br/>         Same Address as Manufacturer</p> | <p>CAGE Code: 3EDZ0<br/>         Contact: Margaret Schlosser<br/>         Phone: 425-883-7575<br/>         Fax:<br/>         EMail: mschlosser@ttmtech.com</p> |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-06-011027                 |
| Panel Size:  | 21.5" X 24.5"   | VQE-06-011656                 |
| Max./Min. Board Thickness:                                 | .063"/Not Specified (nominal)   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | Not Specified/.01"  |                               |
| Aspect Ratio:  | 6.3:1 (Through Hole)  |                               |
| Max. Number of Layers:                                     | 12  |                               |
| Min. Conductor Width:                                      | .005"   |                               |
| Min. Conductor Space:                                      | .003"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG  |                               |
| Hole Preparation:  | Desmear/Etchback  |                               |
| Alternate Construction:                                    | N/A   |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | N/A   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Santa Ana)</b><br>2630 South Harbor Boulevard<br>Santa Ana, CA 92704, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 1WQ42<br><br><b>Contact:</b> Terry Lichte<br><b>Phone:</b> 714-241-0303, x3127<br><b>Fax:</b> 714-241-0708<br><b>EMail:</b> tlichte@ttmtech.comca |
|---|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-05-8644                   |
|  |   | VQE-06-011211                 |
| Panel Size:  | 18" X 24"   |                               |
| Max./Min. Board Thickness:                                 | .2"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .044"/.013"   |                               |
| Aspect Ratio:  | 14:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 24  |                               |
| Min. Conductor Width:                                      | .003"   |                               |
| Min. Conductor Space:                                      | .003"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, Fused SnPb, HASL, ImmAg, OSP  |                               |
| Hole Preparation:  | Desmear Etchback  |                               |
| Alternate Construction:                                    | Aspect Ratio Microvias: 1:1, Min. Blind Via: 0.005" Laser, Min. Buried Via: 0.0135" Mechanical Drill, Sequential Lamination |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | Dry Film, LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-05-8644                   |
|  |   | VQE-06-011211                 |
| Panel Size:  | 21" X 28"   |                               |
| Max./Min. Board Thickness:                                 | .2"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .044"/.013"   |                               |
| Aspect Ratio:  | 14:1 (Through Hole)   |                               |
| Max. Number of Layers:                                     | 24  |                               |
| Min. Conductor Width:                                      | .003"   |                               |
| Min. Conductor Space:                                      | .003"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant   |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | ENIG, Fused SnPb, HASL, ImmAg, OSP  |                               |
| Hole Preparation:  | Desmear Etchback  |                               |
| Alternate Construction:                                    | Aspect Ratio Microvias: 1:1, Min. Blind Via: 0.005" Laser, Min. Buried Via: 0.0135" Mechanical Drill, Sequential Lamination |                               |
| Copper Plating:  | Acid Copper   |                               |
| Solder Resist:   | Dry Film, LPI   |                               |
| Controlled Impedance:                                      | N/A   |                               |
| Hole Fill/Via Plug:  | N/A   |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | N/A   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Santa Clara)</b><br>400 Matthew Street<br>Santa Clara, CA 95050, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65916<br><br><b>Contact:</b> Nellie Guitierrez<br><b>Phone:</b> 408-486-3184<br><b>Fax:</b> 408-727-1003<br><b>EMail:</b> nellie.guitierrez@ttmtech.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |                                  | <b>QUALIFICATION LETTERS:</b>                   |
|--|----------------------------------|---|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2 | VQE-03-003888<br>VQE-10-020500<br>VQE-10-020581 |
| Panel Size:  | 18" X 24"                        |   |
| Max./Min. Board Thickness:                                 | .12"/Not Specified               |   |
| Max./Min. Base CU Thickness:                               | N/A                              |   |
| Max./Min. Through Hole Size:                               | .191"/.012"                      |   |
| Aspect Ratio:  | 9:1 (Through Hole)               |   |
| Max. Number of Layers:                                     | 20                               |   |
| Min. Conductor Width:                                      | .004"                            |   |
| Min. Conductor Space:                                      | .004"                            |   |
| Part Mounting:   | MIX, SM, THM                     |   |
| Rigid Base Material:                                       | GF (Woven E-Glass, Epoxy Resin)  |   |
| Flex Base Material:  | N/A                              |   |
| Finish System:   | ENIG, Electrolytic Ni, HASL      |   |
| Hole Preparation:  | Plasma Desmear/Etchback          |   |
| Alternate Construction:                                    | Blind Vias                       |   |
| Copper Plating:  | Electrolytic Acid Copper         |   |
| Solder Resist:   | LPI, Screen Printed              |   |
| Controlled Impedance:                                      | +/-10% tolerance                 |   |
| Hole Fill/Via Plug:  | N/A                              |   |
| Flex Usage:  | N/A                              |   |
| Hole Wall Conductive Coating:                              | Electroless Copper               |   |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |                                     | <b>QUALIFICATION LETTERS:</b>                   |
|--|-------------------------------------|---|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2    | VQE-03-003888<br>VQE-10-020500<br>VQE-10-020581 |
| Panel Size:  | 18" X 24"                           |   |
| Max./Min. Board Thickness:                                 | .12"/Not Specified                  |   |
| Max./Min. Base CU Thickness:                               | N/A                                 |   |
| Max./Min. Through Hole Size:                               | .191"/.012"                         |   |
| Aspect Ratio:  | 9:1                                 |   |
| Max. Number of Layers:                                     | 12                                  |   |
| Min. Conductor Width:                                      | .004"                               |   |
| Min. Conductor Space:                                      | .004"                               |   |
| Part Mounting:   | MIX, SM, THM                        |   |
| Rigid Base Material:                                       | gi (Woven E-Glass, Polyimide Resin) |   |
| Flex Base Material:  | N/A                                 |   |
| Finish System:   | ENIG, Electrolytic Ni, HASL         |   |
| Hole Preparation:  | Plasma Desmear/Etchback             |   |
| Alternate Construction:                                    | Blind Vias                          |   |
| Copper Plating:  | Electrolytic Acid Copper            |   |
| Solder Resist:   | LPI, Screen Printed                 |   |
| Controlled Impedance:                                      | +/- 10% tolerance                   |   |
| Hole Fill/Via Plug:  | N/A                                 |   |
| Flex Usage:  | N/A                                 |   |
| Hole Wall Conductive Coating:                              | Electroless Copper                  |   |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Santa Clara)</b><br>400 Matthew Street<br>Santa Clara, CA 95050, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65916<br><br><b>Contact:</b> Nellie Guitierrez<br><b>Phone:</b> 408-486-3184<br><b>Fax:</b> 408-727-1003<br><b>EMail:</b> nellie.guitierrez@ttmtech.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|  |   |
|--|---|
| <b>Specification:</b> MIL-PRF-31032/3, MIL-PRF-31032/4<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .1"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> .045"/.031"<br><b>Aspect Ratio:</b> 9:1 (Through Hole)<br><b>Max. Number of Layers:</b> 10<br><b>Min. Conductor Width:</b> .004"<br><b>Min. Conductor Space:</b> .004"<br><b>Part Mounting:</b> MIX, SM, THM<br><b>Rigid Base Material:</b> GF (Woven E-Glass, Epoxy Resin)<br>GI (Woven E-Glass, Polyimide Resin)<br><b>Flex Base Material:</b> IPC-4203/1 (Acrylic Adhesive Coverlay)<br>IPC-4204/1 (Adhesive Polyimide)<br><b>Finish System:</b> ENIG, Electrolytic Ni, HASL<br><b>Hole Preparation:</b> Plasma Desmear/Etchback<br><b>Alternate Construction:</b> N/A<br><b>Copper Plating:</b> Electrolytic Acid Copper<br><b>Solder Resist:</b> N/A<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper | VQE-03-003895<br>VQE-10-020500<br>VQE-10-020581 |
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**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Santa Clara)</b><br>400 Matthew Street<br>Santa Clara, CA 95050, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65916<br><br><b>Contact:</b> Nellie Guitierrez<br><b>Phone:</b> 408-486-3184<br><b>Fax:</b> 408-727-1003<br><b>EMail:</b> nellie.guitierrez@ttmtech.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b>                   |
|---|---|
| <b>Specification:</b> MIL-PRF-31032/3, MIL-PRF-31032/4<br><br><b>Panel Size:</b> 18" X 24"<br><b>Max./Min. Board Thickness:</b> .12"/Not Specified<br><b>Max./Min. Base CU Thickness:</b> N/A<br><b>Max./Min. Through Hole Size:</b> .191"/.012"<br><b>Aspect Ratio:</b> 9:1<br><b>Max. Number of Layers:</b> 16<br><b>Min. Conductor Width:</b> .004"<br><b>Min. Conductor Space:</b> .004"<br><b>Part Mounting:</b> MIX, SM, THM<br><b>Rigid Base Material:</b> GF (Woven E-Glass, Epoxy Resin)<br>GI (Woven E-Glass, Polyimide Resin)<br><b>Flex Base Material:</b> IPC-4203/1 (Acrylic Adhesive Coverlay)<br>IPC-4204/11 (Adhesiveless Polyimide)<br><b>Finish System:</b> ENIG, Electrolytic Ni, HASL<br><b>Hole Preparation:</b> Plasma Desmear/Etchback<br><b>Alternate Construction:</b> N/A<br><b>Copper Plating:</b> Electrolytic Acid Copper<br><b>Solder Resist:</b> N/A<br><b>Controlled Impedance:</b> N/A<br><b>Hole Fill/Via Plug:</b> N/A<br><b>Flex Usage:</b> N/A<br><b>Hole Wall Conductive Coating:</b> Electroless Copper | VQE-03-003895<br>VQE-10-020500<br>VQE-10-020581 |

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Santa Clara)</b><br>400 Matthew Street<br>Santa Clara, CA 95050, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 65916<br><br><b>Contact:</b> Nellie Guitierrez<br><b>Phone:</b> 408-486-3184<br><b>Fax:</b> 408-727-1003<br><b>EMail:</b> nellie.guitierrez@ttmtech.com |
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| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>  | <b>QUALIFICATION LETTERS:</b> |
|---|-------------------------------|
| <p>Specification: MIL-PRF-31032/Custom</p> <p>Panel Size: 18" X 24"</p> <p>Max./Min. Board Thickness: .62"/.006"</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .02"/.015" (drilled)<br/>.076"/.015" (drilled)</p> <p>Aspect Ratio: 4:1 (Through Hole)</p> <p>Max. Number of Layers: 6</p> <p>Min. Conductor Width: .007"</p> <p>Min. Conductor Space: .008"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br/>IPC-4103/10 Construction</p> <p>Flex Base Material: N/A</p> <p>Finish System: ENIG</p> <p>Hole Preparation: Chemical Desmear</p> <p>Alternate Construction: Blind vias</p> <p>Copper Plating: Electroless, Electrolytic Acid Copper</p> <p>Solder Resist: LPI, SMOBC</p> <p>Controlled Impedance: 50 ohms +/-10%</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: N/A</p> <p>Hole Wall Conductive Coating: N/A</p> | <p>VQE-07-13211</p>           |



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>EMail:</b> michele.hebert@tycoelectroni<br>cs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 30" X 32"  |
| Max./Min. Board Thickness:    | .1"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | .067"/.032" (drilled)  |
| Aspect Ratio:                 | 3:1 (Through hole)   |
| Max. Number of Layers:        | 10   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | GC: Glass Base, Woven E, Reinforcement, Majority Cyanate Ester, Flame Resistant<br>SC: Glass Base, Woven S-2, Fiber, Majority Cyanate Ester, Flame Resistant |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate  |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dry-Film, LPI, Wet Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%)   |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003348  
 VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>EMail:</b> michele.hebert@tycoelectroni<br>cs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .1"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | .045"/.032" (drilled)  |
| Aspect Ratio:                 | 3:1 (Through hole)   |
| Max. Number of Layers:        | 10   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant                  |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations                                  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dry-Film, LPI, Wet Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003348  
 VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>EMail:</b> michele.hebert@tycoelectroni<br>cs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                                      |  |
|--------------------------------------|--|
| <b>Specification:</b>                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| <b>Panel Size:</b>                   | 30" X 54"  |
| <b>Max./Min. Board Thickness:</b>    | .4"/Not Specified  |
| <b>Max./Min. Base CU Thickness:</b>  | N/A  |
| <b>Max./Min. Through Hole Size:</b>  | .195"/.0079" (drilled)   |
| <b>Aspect Ratio:</b>                 | 14:1 (Through Hole)  |
| <b>Max. Number of Layers:</b>        | 50   |
| <b>Min. Conductor Width:</b>         | .004"  |
| <b>Min. Conductor Space:</b>         | .003"  |
| <b>Part Mounting:</b>                | MIX, Press Fit, SM, THM  |
| <b>Rigid Base Material:</b>          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant  |
| <b>Flex Base Material:</b>           | N/A  |
| <b>Finish System:</b>                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate, Reflowed Solder |
| <b>Hole Preparation:</b>             | Plasma Desmear/Etchback  |
| <b>Alternate Construction:</b>       | Blind and Buried Vias, Buried Resistors, Copper Invar Copper, Micro Vias, Multiple Laminations                       |
| <b>Copper Plating:</b>               | Acid Copper  |
| <b>Solder Resist:</b>                | Dry Film, LPI, Wet Mask  |
| <b>Controlled Impedance:</b>         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%)           |
| <b>Hole Fill/Via Plug:</b>           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| <b>Flex Usage:</b>                   | N/A  |
| <b>Hole Wall Conductive Coating:</b> | Electroless Copper   |
| <b>Max. Base Cu Weight</b>           | 1 oz.  |

VQE-03-3348  
 VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>EMail:</b> michele.hebert@tycoelectroni<br>cs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                                      |  |
|--------------------------------------|--|
| <b>Specification:</b>                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| <b>Panel Size:</b>                   | 18" X 24"  |
| <b>Max./Min. Board Thickness:</b>    | .13"/Not Specified   |
| <b>Max./Min. Base CU Thickness:</b>  | N/A  |
| <b>Max./Min. Through Hole Size:</b>  | .133"/.0118" (drilled)   |
| <b>Aspect Ratio:</b>                 | 11:1 (Through hole)  |
| <b>Max. Number of Layers:</b>        | 32   |
| <b>Min. Conductor Width:</b>         | .004"  |
| <b>Min. Conductor Space:</b>         | .003"  |
| <b>Part Mounting:</b>                | MIX, Press Fit, SM, THM  |
| <b>Rigid Base Material:</b>          | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant   |
| <b>Flex Base Material:</b>           | N/A  |
| <b>Finish System:</b>                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| <b>Hole Preparation:</b>             | Plasma Desmear/Etchback  |
| <b>Alternate Construction:</b>       | Blind and Buried Vias, Buried Resistors, Copper Invar Copper, Micro Vias, Multiple Laminations             |
| <b>Copper Plating:</b>               | Acid Copper  |
| <b>Solder Resist:</b>                | Dry-Film, LPI, Wet Mask  |
| <b>Controlled Impedance:</b>         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| <b>Hole Fill/Via Plug:</b>           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| <b>Flex Usage:</b>                   | N/A  |
| <b>Hole Wall Conductive Coating:</b> | Electroless Copper   |
| <b>Max. Base Cu Weight</b>           | 1 oz.  |

VQE-03-003348  
 VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
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| <p>MANUFACTURER INFORMATION:<br/> <b>TTM Technologies (Stafford)</b><br/>         4 Old Monson Road<br/>         P.O. Box 145, Stafford, CT 77497, US</p> | <p>PLANT LOCATION:<br/>         Same Address as Manufacturer</p> | <p>CAGE Code: 5L706<br/><br/>         Contact: Michelle Herbert<br/>         Phone: 860-684-5881<br/>         Fax: 860-684-7425<br/>         EMail: michele.hebert@tycoelectronics.com</p> |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 16" X 18"  |
| Max./Min. Board Thickness:    | .1"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | .045"/.0118" (drilled)   |
| Aspect Ratio:                 | 6:1 (Through hole)   |
| Max. Number of Layers:        | 10   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | BI: Aramid Fabric, Nonwoven, Polyimide Resin   |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations                                  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dry-Film, LPI, Wet Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003348  
VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION:<br/> <b>TTM Technologies (Stafford)</b><br/>         4 Old Monson Road<br/>         P.O. Box 145, Stafford, CT 77497, US</p> | <p>PLANT LOCATION:<br/>         Same Address as Manufacturer</p> | <p>CAGE Code: 5L706<br/><br/>         Contact: Michelle Herbert<br/>         Phone: 860-684-5881<br/>         Fax: 860-684-7425<br/>         EMail: michele.hebert@tycoelectroni<br/>         cs.com</p> |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .1"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | .045"/.032" (drilled)  |
| Aspect Ratio:                 | 3:1 (Through hole)   |
| Max. Number of Layers:        | 10   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin  |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations                                  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dry-Film, LPI, Wet Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003348  
VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>EMail:</b> michele.hebert@tycoelectroni<br>cs.com |
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/1, MIL-PRF-31032/2   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | N/A  |
| Max./Min. Base CU Thickness:  | .002"/"  |
| Max./Min. Through Hole Size:  | .045"/.0118" (drilled)   |
| Aspect Ratio:                 | 7:1 (Through hole)   |
| Max. Number of Layers:        | 10   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | BF: Aramid Fabric, Nonwoven, Epoxy Resin   |
| Flex Base Material:           | N/A  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations                                  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dry-Film, LPI, Wey Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | N/A  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003348  
 VQE-09-18855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>E-Mail:</b> michele.hebert@tycoelectroni<br>cs.com |
|---|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |  |
|-------------------------------|--|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4   |
| Panel Size:                   | 18" X 24"  |
| Max./Min. Board Thickness:    | .125"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A  |
| Max./Min. Through Hole Size:  | .063"/.013" (drilled)  |
| Aspect Ratio:                 | 9:1 (Through Hole)   |
| Max. Number of Layers:        | 24   |
| Min. Conductor Width:         | .004"  |
| Min. Conductor Space:         | .003"  |
| Part Mounting:                | MIX, Press Fit, SM, THM  |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  |
| Flex Base Material:           | 4201/11 Acrylic Adhesive Coverlayer<br>4204/11 Adhesive Polyimide  |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate        |
| Hole Preparation:             | Plasma Desmear/Etchback  |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations                                  |
| Copper Plating:               | Acid Copper  |
| Solder Resist:                | Dy Film, LPI, Wet Mask   |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%) |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill / Via Plug   |
| Flex Usage:                   | Class A Flex to Install, Class B Continuous  |
| Hole Wall Conductive Coating: | Electroless Copper   |
| Max. Base Cu Weight           | 1 oz.  |

VQE-03-003349  
 VQE-09-18855  
 VQE-10-19456



**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |  |
|---|--|--|
| <b>MANUFACTURER INFORMATION:</b><br><b>TTM Technologies (Stafford)</b><br>4 Old Monson Road<br>P.O. Box 145, Stafford, CT 77497, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 5L706<br><br><b>Contact:</b> Michelle Herbert<br><b>Phone:</b> 860-684-5881<br><b>Fax:</b> 860-684-7425<br><b>E-Mail:</b> michele.hebert@tycoelectroni<br>cs.com |
|---|--|--|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                               |   |
|-------------------------------|---|
| Specification:                | MIL-PRF-31032/3, MIL-PRF-31032/4, MIL-PRF-31032/Custom  |
| Panel Size:                   | 18" X 24"   |
| Max./Min. Board Thickness:    | .07"/Not Specified<br>.11"/Not Specified  |
| Max./Min. Base CU Thickness:  | N/A   |
| Max./Min. Through Hole Size:  | Not Specified/.035" (drilled)<br>.0413"/.0197" (drilled)  |
| Aspect Ratio:                 | 2:1<br>3.3:1 ((through hole))   |
| Max. Number of Layers:        | 11, 12  |
| Min. Conductor Width:         | .004"<br>.006"  |
| Min. Conductor Space:         | .003"<br>.004"  |
| Part Mounting:                | MIX, Press Fit, SM, THM   |
| Rigid Base Material:          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>GI: Glass Base, Woven, Polyimide Resin, Heat Resistant<br>Hydrocarbon with Ceramic Filler<br>PTFE Resin with Ceramic Filler, |
| Flex Base Material:           | 4204/1 Acrylic Adhesive   |
| Finish System:                | ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate   |
| Hole Preparation:             | Plasma Desmear/Etchback   |
| Alternate Construction:       | Blind and Buried Vias, Buried Resistors, Micro Vias, Multiple Laminations   |
| Copper Plating:               | Acid Copper   |
| Solder Resist:                | Dry-Film, LPI, LPI, Dry-Film, Wet Mask, Wet Mask  |
| Controlled Impedance:         | Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%)  |
| Hole Fill/Via Plug:           | Conductive & Non-conductive Epoxy Hole Fill/Via Plug  |
| Flex Usage:                   | N/A   |
| Hole Wall Conductive Coating: | Electroless Copper  |
| Max. Base Cu Weight           | 1 oz.   |

VQE-03-003348  
 VQE-03-003349  
 VQE-10-19456  
 VQE-10-19855

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|   |  |   |
|---|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Unicircuit, Inc.</b><br>8192 Southpark Lane<br>Littleton, CO 80120, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 66311<br><br><b>Contact:</b> Bob Lageman<br><b>Phone:</b> 303-730-0505, x110<br><b>Fax:</b><br><b>E-Mail:</b> blageman@unicircuit.com |
|---|--|---|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |   | <b>QUALIFICATION LETTERS:</b> |
|--|---|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2  | VQE-07-13789                  |
| Panel Size:  | 12" X 18"   | VQE-09-17422                  |
| Max./Min. Board Thickness:                                 | .12"/Not Specified  |                               |
| Max./Min. Base CU Thickness:                               | N/A   |                               |
| Max./Min. Through Hole Size:                               | .129"/.02"  |                               |
| Aspect Ratio:  | 6:1 (Through Hole)  |                               |
| Max. Number of Layers:                                     | 16  |                               |
| Min. Conductor Width:                                      | .005"   |                               |
| Min. Conductor Space:                                      | .005"   |                               |
| Part Mounting:   | SMT, THM  |                               |
| Rigid Base Material:                                       | GI: Glass Base, Woven, Polyimide Resin, Heat Resistant                                |                               |
| Flex Base Material:  | N/A   |                               |
| Finish System:   | HASL, Reflowed Tin Lead   |                               |
| Hole Preparation:  | Plasma Etchback   |                               |
| Alternate Construction:                                    | Blind Via, Bured Via, Foil Lamination, Laser-drilled Microvias, Sequential Lamination |                               |
| Copper Plating:  | Electrodeposited Acid Copper,   |                               |
| Solder Resist:   | LPI   |                               |
| Controlled Impedance:                                      | 100 ohms differential +/-10%, 53 ohms characteristic +/-7%                            |                               |
| Hole Fill/Via Plug:  | Conductive fill, Non-conductive fill  |                               |
| Flex Usage:  | N/A   |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper  |                               |
| Laser Via Hole Size  | .006 +/- .001   |                               |

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b> |  | <b>QUALIFICATION LETTERS:</b> |
|--|--|-------------------------------|
| Specification:   | MIL-PRF-31032/1, MIL-PRF-31032/2                           | VQE-09-17422                  |
| Panel Size:  | 20" X 26"  |                               |
| Max./Min. Board Thickness:                                 | .19"/Not Specified   |                               |
| Max./Min. Base CU Thickness:                               | N/A  |                               |
| Max./Min. Through Hole Size:                               | .252"/.029"  |                               |
| Aspect Ratio:  | 6.5:1 ((thru hole))  |                               |
| Max. Number of Layers:                                     | 24   |                               |
| Min. Conductor Width:                                      | .005"  |                               |
| Min. Conductor Space:                                      | .005"  |                               |
| Part Mounting:   | SMT, THM   |                               |
| Rigid Base Material:                                       | GF: Woven E-Glass, Epoxy Resin, Flame Resistant            |                               |
| Flex Base Material:  | N/A  |                               |
| Finish System:   | HASL, Reflowed Tin Lead                                    |                               |
| Hole Preparation:  | Plasma Etchback  |                               |
| Alternate Construction:                                    | N/A  |                               |
| Copper Plating:  | Electrodeposited Acid Copper                               |                               |
| Solder Resist:   | LPI  |                               |
| Controlled Impedance:                                      | 100 ohms differential +/-10%, 53 ohms characteristic +/-7% |                               |
| Hole Fill/Via Plug:  | Conductive fill, Non-conductive fill                       |                               |
| Flex Usage:  | N/A  |                               |
| Hole Wall Conductive Coating:                              | Electroless Copper   |                               |

**SECTION I**  
**LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |   |
|--|--|---|
| <b>MANUFACTURER INFORMATION:</b><br><b>Universal Circuits, Inc.</b><br>8860 Zachary Lane North<br>Maple Grove, MN 55369-4524, US | <b>PLANT LOCATION:</b><br>Same Address as Manufacturer | <b>CAGE Code:</b> 45032<br><br><b>Contact:</b><br><b>Phone:</b><br><b>Fax:</b><br><b>EMail:</b> |
|--|--|---|

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

|                                      |   |
|--------------------------------------|---|
| <b>Specification:</b>                | MIL-PRF-31032/1, MIL-PRF-31032/2  |
| <b>Panel Size:</b>                   | 18" X 24"   |
| <b>Max./Min. Board Thickness:</b>    | .125"/Not Specified<br>.18"/Not Specified   |
| <b>Max./Min. Base CU Thickness:</b>  | N/A   |
| <b>Max./Min. Through Hole Size:</b>  | ".008"<br>".021"  |
| <b>Aspect Ratio:</b>                 | 7.75:1<br>8.57:1  |
| <b>Max. Number of Layers:</b>        | 16, 18  |
| <b>Min. Conductor Width:</b>         | .0032"<br>.005"   |
| <b>Min. Conductor Space:</b>         | .0032"<br>.005"   |
| <b>Part Mounting:</b>                | MIX, SMT, THM   |
| <b>Rigid Base Material:</b>          | GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br>Hybrid GF<br>Hydrocarbon/Ceramic   |
| <b>Flex Base Material:</b>           | N/A   |
| <b>Finish System:</b>                | ENIG, HASL  |
| <b>Hole Preparation:</b>             | Chemical Desmear, Plasma Etchback   |
| <b>Alternate Construction:</b>       | Blind Vias, Foil Lamination, Sequential Lamination  |
| <b>Copper Plating:</b>               | Acid Copper   |
| <b>Solder Resist:</b>                | LPI   |
| <b>Controlled Impedance:</b>         | Differential 77.5 +/- 7.5, 90 +/- 13.5, 98 +/- 13, 100 +/- 10, 120 +/- 12, 150 +/- 7 ohms, Single-ended 50 +/- 2.5, 55 +/- 5 ohms |
| <b>Hole Fill/Via Plug:</b>           | Acid Copper   |
| <b>Flex Usage:</b>                   | N/A   |
| <b>Hole Wall Conductive Coating:</b> | Direct Metallization  |
| <b>Through Hole Metallization</b>    | Direct Metallization  |

VQE-10-019530  
 VQE-10-020323

**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

|  |  |  |
|--|--|--|
| <p>MANUFACTURER INFORMATION:<br/><b>Vermont Circuits, Inc.</b><br/>76 Technology Drive<br/>P.O. Box 1890, Brattleboro, VT 05302-1890, US</p> |  | <p>CAGE Code: 65200<br/>Contact: Bob Downing<br/>Phone: 802-257-4571<br/>Fax: 802-257-0011<br/>EMail: Bob.Downing@vtcircuits.com</p> |
|--|--|--|

| <b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>   | <b>QUALIFICATION LETTERS:</b> |
|--|-------------------------------|
| <p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2<br/>Panel Size: 18" X 24"<br/>Max./Min. Board Thickness: .1"/Not Specified<br/>Max./Min. Base CU Thickness: 1"/.5"<br/>Max./Min. Through Hole Size: .04"/.008" ((.0453/.012 Drilled))<br/>Aspect Ratio: 7.5:1<br/>Max. Number of Layers: 10<br/>Min. Conductor Width: .005"<br/>Min. Conductor Space: .005"<br/>Part Mounting: THM<br/>Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant<br/>Flex Base Material: N/A<br/>Finish System: ENIG, HASL<br/>Hole Preparation: Permanganate Desmear, Plasma Etchback/Desmear<br/>Alternate Construction: Foil Lamination<br/>Copper Plating: Acid Copper: DC Plate<br/>Solder Resist: LPI<br/>Controlled Impedance: N/A<br/>Hole Fill/Via Plug: N/A<br/>Flex Usage: N/A<br/>Hole Wall Conductive Coating: Electroless Copper</p> | <p>VQE-10-019275</p>          |

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/1**

**Accurate Circuit Engineering**

3019 S. Kilson Drive, Santa Ana, CA 92707, US

**American Standard Circuits**

RF Division, 475 Industrial Drive, West Chicago, IL 60185, US

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Calumet Electronics Corp.**

25830 Depot Street, Calumet, MI 49913-1985, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

1026 Warrenton Road, Fredericksburg, VA 22406-6200, US

**Coretec Cleveland, Inc.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Denver Corp.**

10570 Bradford Road, Littleton, CO 80127, US

**DDi Global Corp. - Anaheim**

1220 N. Simon Circle, Anaheim, CA 92806, US

**DDi Global Corp. - Sterling, VA**

1200 Severn Way, Dulles, VA 20166-8904, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**DDi Ontario**

8150 Sheppard Avenue East, Scarborough, Ontario, Canada M1B 5K2

**Dynaco Corp.**

1000 South Priest Drive, Tempe, AZ 85281-5238, US

**Dynamic & Proto Circuits, Inc.**

869 Barton Street, Stoney Creek, Ontario, Canada L8E 5G6

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Electrotek Corp.**

7745 S. 10th Street, Oak Creek, WI 53154, US

**Endicott Interconnect Technologies, Inc.**

Dept. 0069/014-3, 1093 Clark Street, Endicott, NY 13760, US

**Firan Technology Group**

250 Finchdene Square, Scarborough, Ontario, Canada M1X 1A5

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Hughes Circuits**

540 S. Pacific Street, San Marcos, CA 92078-4056, US

**Lockheed Martin Systems Integration-Owego**

1801 State Route 17C, Owego, NY 13827, US

**Merix Corp. (Forest Grove, OR)**

1521 Poplar Lane, Forest Grove, OR 97116, US

**Merix Corp. (San Jose, CA)**

355 Turtle Creek Court, San Jose, CA 95125-1316, US

**Micom Corp.**

475 Old Highway 8 NW, New Brighton, MN 55112, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/1**

**Philway Products, Inc.**

701 Virginia Avenue, Ashland, OH 44806, US

**Pioneer Circuits, Inc.**

3000 S. Shannon Street, Santa Ana, CA 92704-6321, US

**PNC, Inc.**

115 East Centre Street, Nutley, NJ 07110, US

**Sanmina-SCI (San Jose)**

2050 Bering Drive, San Jose, CA 95131, US

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**Titan PCB East, Inc.**

2 Industrial Way, Amesbury, MA 01913, US

**TTM Technologies (Redmond)**

17550 NE 67th Court, Redmond, WA 98052-4939, US

**TTM Technologies (Santa Ana)**

2630 South Harbor Boulevard, Santa Ana, CA 92704, US

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

4 Old Monson Road, P.O. Box 145, Stafford, CT 77497, US

**Unicircuit, Inc.**

8192 Southpark Lane, Littleton, CO 80120, US

**Universal Circuits, Inc.**

8860 Zachary Lane North, Maple Grove, MN 55369-4524, US

**Vermont Circuits, Inc.**

76 Technology Drive, P.O. Box 1890, Brattleboro, VT 05302-1890, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/2**

**Accurate Circuit Engineering**

3019 S. Kilson Drive, Santa Ana, CA 92707, US

**American Standard Circuits**

RF Division, 475 Industrial Drive, West Chicago, IL 60185, US

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Calumet Electronics Corp.**

25830 Depot Street, Calumet, MI 49913-1985, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

1026 Warrenton Road, Fredericksburg, VA 22406-6200, US

**Coretec Cleveland, Inc.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Denver Corp.**

10570 Bradford Road, Littleton, CO 80127, US

**DDi Global Corp. - Anaheim**

1220 N. Simon Circle, Anaheim, CA 92806, US

**DDi Global Corp. - Sterling, VA**

1200 Severn Way, Dulles, VA 20166-8904, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**DDi Ontario**

8150 Sheppard Avenue East, Scarborough, Ontario, Canada M1B 5K2

**Dynaco Corp.**

1000 South Priest Drive, Tempe, AZ 85281-5238, US

**Dynamic & Proto Circuits, Inc.**

869 Barton Street, Stoney Creek, Ontario, Canada L8E 5G6

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Electrotek Corp.**

7745 S. 10th Street, Oak Creek, WI 53154, US

**Endicott Interconnect Technologies, Inc.**

Dept. 0069/014-3, 1093 Clark Street, Endicott, NY 13760, US

**Firan Technology Group**

250 Finchdene Square, Scarborough, Ontario, Canada M1X 1A5

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Hughes Circuits**

540 S. Pacific Street, San Marcos, CA 92078-4056, US

**Lockheed Martin Systems Integration-Owego**

1801 State Route 17C, Owego, NY 13827, US

**Merix Corp. (Forest Grove, OR)**

1521 Poplar Lane, Forest Grove, OR 97116, US

**Merix Corp. (San Jose, CA)**

355 Turtle Creek Court, San Jose, CA 95125-1316, US

**Micom Corp.**

475 Old Highway 8 NW, New Brighton, MN 55112, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/2**

**Pioneer Circuits, Inc.**

3000 S. Shannon Street, Santa Ana, CA 92704-6321, US

**PNC, Inc.**

115 East Centre Street, Nutley, NJ 07110, US

**Sanmina-SCI (San Jose)**

2050 Bering Drive, San Jose, CA 95131, US

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**Titan PCB East, Inc.**

2 Industrial Way, Amesbury, MA 01913, US

**TTM Technologies (Redmond)**

17550 NE 67th Court, Redmond, WA 98052-4939, US

**TTM Technologies (Santa Ana)**

2630 South Harbor Boulevard, Santa Ana, CA 92704, US

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

4 Old Monson Road, P.O. Box 145, Stafford, CT 77497, US

**Unicircuit, Inc.**

8192 Southpark Lane, Littleton, CO 80120, US

**Universal Circuits, Inc.**

8860 Zachary Lane North, Maple Grove, MN 55369-4524, US

**Vermont Circuits, Inc.**

76 Technology Drive, P.O. Box 1890, Brattleboro, VT 05302-1890, US



**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/3**

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

1026 Warrenton Road, Fredericksburg, VA 22406-6200, US

**Coretec Cleveland, Inc.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**Dynaco Corp.**

1000 South Priest Drive, Tempe, AZ 85281-5238, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Lockheed Martin Systems Integration-Owego**

1801 State Route 17C, Owego, NY 13827, US

**Pioneer Circuits, Inc.**

3000 S. Shannon Street, Santa Ana, CA 92704-6321, US

**Printed Circuits, Inc.**

1200 West 96th Street, Bloomington, MN 55431, US

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**Strataflex Corp.**

11 Dohme Avenue, Toronto, Ontario, Canada M4B 1Y7

**Titan PCB East, Inc.**

2 Industrial Way, Amesbury, MA 01913, US

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

4 Old Monson Road, P.O. Box 145, Stafford, CT 77497, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/4**

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

1026 Warrenton Road, Fredericksburg, VA 22406-6200, US

**Coretec Cleveland, Inc.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**Dynaco Corp.**

1000 South Priest Drive, Tempe, AZ 85281-5238, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Lockheed Martin Systems Integration-Owego**

1801 State Route 17C, Owego, NY 13827, US

**Pioneer Circuits, Inc.**

3000 S. Shannon Street, Santa Ana, CA 92704-6321, US

**Printed Circuits, Inc.**

1200 West 96th Street, Bloomington, MN 55431, US

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**Strataflex Corp.**

11 Dohme Avenue, Toronto, Ontario, Canada M4B 1Y7

**Titan PCB East, Inc.**

2 Industrial Way, Amesbury, MA 01913, US

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

4 Old Monson Road, P.O. Box 145, Stafford, CT 77497, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/5**

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/6**

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Speedy Circuits, Inc.**

5331 McFadden Avenue, Huntington Beach, CA 92649-1204, US

**SECTION II**  
**LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION**

**MIL-PRF-31032/Custom**

**Colonial Circuits, Inc.**

1026 Warrenton Road, Fredericksburg, VA 22406-6200, US

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**Endicott Interconnect Technologies, Inc.**

Dept. 0069/014-3, 1093 Clark Street, Endicott, NY 13760, US

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

4 Old Monson Road, P.O. Box 145, Stafford, CT 77497, US

**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

|   |   |   |
|---|---|---|
| <p>MANUFACTURER INFORMATION:<br/><b>Accurate Circuit Engineering</b><br/>3019 S. Kilson Drive<br/>Santa Ana, CA 92707, US</p>               | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 0MNN9<br/><br/>Contact: James Hofer<br/>Phone: 714-546-162<br/>Fax: 714-433-7418<br/>EMail: James@ace-pcb.com</p>                       |
| <p>MANUFACTURER INFORMATION:<br/><b>American Standard Circuits</b><br/>RF Division, 475 Industrial Drive<br/>West Chicago, IL 60185, US</p> | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 4AA34<br/><br/>Contact: Lori Ryan<br/>Phone: 603-639-5438<br/>Fax:<br/>EMail: lori@asc-i.com</p>  |
| <p>MANUFACTURER INFORMATION:<br/><b>Amphenol Printed Circuits</b><br/>91 Northeastern Boulevard<br/>Nashua, NH 03062, US</p>                | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 57034<br/><br/>Contact: Denise Chevalier<br/>Phone: 603-879-3268<br/>Fax: 603-879-2818<br/>EMail: denise.chevalier@amphenol-tcs.com</p> |
| <p>MANUFACTURER INFORMATION:<br/><b>Calumet Electronics Corp.</b><br/>25830 Depot Street<br/>Calumet, MI 49913-1985, US</p>                 | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 65337<br/><br/>Contact: Robert Hall<br/>Phone: 906-337-1305<br/>Fax: 906-337-5359<br/>EMail: rhall@cec-up.com</p>                       |
| <p>MANUFACTURER INFORMATION:<br/><b>Cirexx International, Inc.</b><br/>791 Nuttman Street<br/>Santa Clara, CA 95054,</p>                    | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 4MEG7<br/><br/>Contact: Don Angulo<br/>Phone: 408-988-3980<br/>Fax: 408-988-4534<br/>EMail: dangulo@cirexxintl.com</p>                  |
| <p>MANUFACTURER INFORMATION:<br/><b>Colonial Circuits, Inc.</b><br/>1026 Warrenton Road<br/>Fredericksburg, VA 22406-6200, US</p>           | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 6T499<br/><br/>Contact: Mike Hill<br/>Phone: 540-753-5511, x125<br/>Fax: 540-752-2109<br/>EMail: quality@colonialcircuits.com</p>       |
| <p>MANUFACTURER INFORMATION:<br/><b>Coretec Cleveland, Inc.</b><br/>7 Ascot Parkway<br/>Cuyahoga Falls, OH 44223, US</p>                    | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 7Z463<br/><br/>Contact: Mark Kasting<br/>Phone: 330-572-3400<br/>Fax: 330-572-3434<br/>EMail: mark_kasting/coretec@coretec-inc.com</p>  |
| <p>MANUFACTURER INFORMATION:<br/><b>Cosmotronic, Inc.</b><br/>16721 Noyes Avenue<br/>Irvine, CA 92606, US</p>                               | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 63695<br/><br/>Contact: Alan Exley<br/>Phone: 949-660-0740<br/>Fax: 949-553-8371<br/>EMail: alan_exley@cosmotronic.com</p>              |

**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

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|--|---|---|
| <p>MANUFACTURER INFORMATION:<br/><b>DDi Denver Corp.</b><br/>10570 Bradford Road<br/>Littleton, CO 80127, US</p>                               | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 75815<br/><br/>Contact: Douglas N. Berry<br/>Phone: 303-972-4105<br/>Fax: 303-933-2934<br/>EMail: dberry@ddiglobal.com</p>                |
| <p>MANUFACTURER INFORMATION:<br/><b>DDI Global Corp. - Anaheim</b><br/>1220 N. Simon Circle<br/>Anaheim, CA 92806, US</p>                      | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 0BSG1<br/><br/>Contact: Rick Sylvain<br/>Phone: 714-688-7371<br/>Fax:<br/>EMail: rsylvain@ddiglobal.com</p>                               |
| <p>MANUFACTURER INFORMATION:<br/><b>DDi Global Corp. - Sterling, VA</b><br/>1200 Severn Way<br/>Dulles, VA 20166-8904, US</p>                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 0K703<br/><br/>Contact: Tony Trnka<br/>Phone: 703-652-2266<br/>Fax: 703-652-2271<br/>EMail: atrnka@va.ddiglobal.com</p>                   |
| <p>MANUFACTURER INFORMATION:<br/><b>DDi North Jackson Corp.</b><br/>12080 DeBartolo Drive<br/>North Jackson, OH 44451, US</p>                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 0GN71<br/><br/>Contact: Cynthia Savakis<br/>Phone: 330-538-3900, x211<br/>Fax: 330-538-3820<br/>EMail: quality@sovereign-circuits.com</p> |
| <p>MANUFACTURER INFORMATION:<br/><b>DDi Ontario</b><br/>8150 Sheppard Avenue East<br/>Scarborough, Ontario, Canada M1B 5K2</p>                 | <p>PLANT LOCATIONS:<br/>1. Same Address as Manufacturer<br/>2. Coretec, Inc., CAGE Code: 3AF82,<br/>2020 Ellesmere Road, Scarborough,<br/>Ontario, Canada M1H 2Z8</p> | <p>CAGE Code: 3AF82<br/><br/>Contact: Noor Al-Shaikh<br/>Phone: 416-208-2100<br/>Fax: 416-439-1582<br/>EMail: alshaikh@coretec-inc.com</p>              |
| <p>MANUFACTURER INFORMATION:<br/><b>Dynaco Corp.</b><br/>1000 South Priest Drive<br/>Tempe, AZ 85281-5238, US</p>                              | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 61642<br/><br/>Contact: Ted Edwards<br/>Phone: 480-736-3728<br/>Fax: 480-921-9830<br/>EMail: tedwards@dynacocorp.com</p>                  |
| <p>MANUFACTURER INFORMATION:<br/><b>Dynamic &amp; Proto Circuits, Inc.</b><br/>869 Barton Street<br/>Stoney Creek, Ontario, Canada L8E 5G6</p> | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 38898<br/><br/>Contact: Stephen Hazell<br/>Phone: 905-643-9900<br/>Fax: 905-643-9911<br/>EMail: stephenhazell@dapc.com</p>                |
| <p>MANUFACTURER INFORMATION:<br/><b>Electro Plate Circuitry, Inc.</b><br/>1430 Century Drive<br/>Carrollton, TX 75006, US</p>                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p>   | <p>CAGE Code: 79616<br/><br/>Contact: James McNeal<br/>Phone: 972-466-0818<br/>Fax: 972-466-9078<br/>EMail: jimmm@eplate.com</p>                        |

**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

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|---|---|---|
| <p>MANUFACTURER INFORMATION:<br/><b>Electrotek Corp.</b><br/>7745 S. 10th Street<br/>Oak Creek, WI 53154, US</p>  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 66030<br/><br/>Contact: Tom Tikusis<br/>Phone: 414-762-1390<br/>Fax: 414-762-1510<br/>EMail: sales@boards4u.com</p>                     |
| <p>MANUFACTURER INFORMATION:<br/><b>Endicott Interconnect Technologies, Inc.</b><br/>Dept. 0069/014-3, 1093 Clark Street<br/>Endicott, NY 13760, US</p> | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 3ECL3<br/><br/>Contact: Jose Rios<br/>Phone: 607-755-5896<br/>Fax: 607-755-4649<br/>EMail: JoseA.Rios@eitny.com</p>                     |
| <p>MANUFACTURER INFORMATION:<br/><b>Firan Technology Group</b><br/>250 Finchdene Square<br/>Scarborough, Ontario, Canada M1X 1A5</p>                    | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: L2665<br/><br/>Contact: Bryan Clark<br/>Phone: 416-299-4000<br/>Fax: 416-292-4308<br/>EMail: byanclark@firantechnology.com</p>          |
| <p>MANUFACTURER INFORMATION:<br/><b>Global Innovations Corp.</b><br/>901 Hensley Drive<br/>Wylie, TX 75098, US</p>                                      | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 04RV5<br/><br/>Contact: Bob Noland<br/>Phone: 214-291-1427<br/>Fax:<br/>EMail: b noland@globalinnovationcorp.com</p>                    |
| <p>MANUFACTURER INFORMATION:<br/><b>Hamby Corporation</b><br/>27704 Avenue Scott<br/>Valencia, CA 91355, US</p>   | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 07284<br/><br/>Contact: Sue Sharp<br/>Phone: 661-257-1924<br/>Fax: 661-257-1213<br/>EMail: suesharp@hambycorp.com</p>                   |
| <p>MANUFACTURER INFORMATION:<br/><b>Hans Brockstedt GmbH</b><br/>Clara-Immerwahr Strasse 7<br/>24145 Kiel, Germany</p>                                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: C4831<br/><br/>Contact: Hilmar Klammer<br/>Phone: 0049-431-71966-0, -30<br/>Fax: 0049-431-71966-29<br/>EMail: klammer@brockstedt.de</p> |
| <p>MANUFACTURER INFORMATION:<br/><b>Hughes Circuits</b><br/>540 S. Pacific Street<br/>San Marcos, CA 92078-4056, US</p>                                 | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 1KXU6<br/><br/>Contact: Joe Hughes<br/>Phone: 760-744-0300<br/>Fax: 760-744-6388<br/>EMail: joe@hughescircuits.com</p>                  |
| <p>MANUFACTURER INFORMATION:<br/><b>Lockheed Martin Systems Integration-Owego</b><br/>1801 State Route 17C<br/>Owego, NY 13827, US</p>                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 03640<br/><br/>Contact: Melita Nagerl<br/>Phone: 607-751-4665<br/>Fax: 607-751-7714<br/>EMail: melita.nagerl@lmco.com</p>               |



**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

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|---|---|---|
| <p>MANUFACTURER INFORMATION:<br/><b>Merix Corp. (Forest Grove, OR)</b><br/>1521 Poplar Lane<br/>Forest Grove, OR 97116, US</p>    | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 01KV9<br/><br/>Contact: Roger Michalowski<br/>Phone: 781-639-5410<br/>Fax:<br/>E-Mail: Customerservice@merix.com</p>              |
| <p>MANUFACTURER INFORMATION:<br/><b>Merix Corp. (San Jose, CA)</b><br/>355 Turtle Creek Court<br/>San Jose, CA 95125-1316, US</p> | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 0MHG5<br/><br/>Contact: Dave Williams<br/>Phone: 408-280-0422<br/>Fax: 408-280-0641<br/>E-Mail: david.williams@sj.merix.com</p>   |
| <p>MANUFACTURER INFORMATION:<br/><b>Micom Corp.</b><br/>475 Old Highway 8 NW<br/>New Brighton, MN 55112, US</p>                   | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 34076<br/><br/>Contact: Larry Leonard<br/>Phone: 651-604-2639<br/>Fax: 651-636-1352<br/>E-Mail: lleonard@micomcircuits.com</p>    |
| <p>MANUFACTURER INFORMATION:<br/><b>Philway Products, Inc.</b><br/>701 Virginia Avenue<br/>Ashland, OH 44806, US</p>              | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 21971<br/><br/>Contact: Tom School<br/>Phone: 419-281-7777<br/>Fax: 419-289-3447<br/>E-Mail: quality@philway.com</p>              |
| <p>MANUFACTURER INFORMATION:<br/><b>Pioneer Circuits, Inc.</b><br/>3000 S. Shannon Street<br/>Santa Ana, CA 92704-6321, US</p>    |   | <p>CAGE Code: 65723<br/><br/>Contact: Elias Gabriel<br/>Phone: 714-641-3132 x234<br/>Fax: 714-641-3120<br/>E-Mail:</p>                          |
| <p>MANUFACTURER INFORMATION:<br/><b>PNC, Inc.</b><br/>115 East Centre Street<br/>Nutley, NJ 07110, US</p>                         |   | <p>CAGE Code: 66766<br/><br/>Contact: Carmela Conte<br/>Phone: 973-284-1600<br/>Fax:<br/>E-Mail: carmela@pnconline.com</p>                      |
| <p>MANUFACTURER INFORMATION:<br/><b>Printed Circuits, Inc.</b><br/>1200 West 96th Street<br/>Bloomington, MN 55431, US</p>        | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 65114<br/><br/>Contact: Jim Smith<br/>Phone: 612-888-7900<br/>Fax: 612-888-2719<br/>E-Mail: jsmith@printedcircuits.com</p>        |
| <p>MANUFACTURER INFORMATION:<br/><b>Sanmina-SCI (San Jose)</b><br/>2050 Bering Drive<br/>San Jose, CA 95131, US</p>               | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 3DR67<br/><br/>Contact: Darrell Myers<br/>Phone: 408-964-6515<br/>Fax: 408-964-6453<br/>E-Mail: darrell.myers@sanmina-sci.com</p> |

**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

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| <p>MANUFACTURER INFORMATION:<br/><b>Speedy Circuits, Inc.</b><br/>5331 McFadden Avenue<br/>Huntington Beach, CA 92649-1204, US</p>     | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 66982<br/><br/>Contact: Jan Lesky<br/>Phone: 714-766-6243<br/>Fax: 714-899-7074<br/>EMail:</p>   |
| <p>MANUFACTURER INFORMATION:<br/><b>Strataflex Corp.</b><br/>11 Dohme Avenue<br/>Toronto, Ontario, Canada M4B 1Y7</p>                  | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 38661<br/><br/>Contact: Peter Pialis<br/>Phone: 416-752-2224<br/>Fax: 416-752-6719<br/>EMail: ppialis@strataflex.ca</p>                  |
| <p>MANUFACTURER INFORMATION:<br/><b>Titan PCB East, Inc.</b><br/>2 Industrial Way<br/>Amesbury, MA 01913, US</p>                       | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 0BX48<br/><br/>Contact: Lance Arlander<br/>Phone: 978-388-5740<br/>Fax: 978-388-5538<br/>EMail: larlander@titaneast.com</p>              |
| <p>MANUFACTURER INFORMATION:<br/><b>TTM Technologies (Redmond)</b><br/>17550 NE 67th Court<br/>Redmond, WA 98052-4939, US</p>          | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 3EDZ0<br/><br/>Contact: Margaret Schlosser<br/>Phone: 425-883-7575<br/>Fax:<br/>EMail: mschlosser@ttmtech.com</p>                        |
| <p>MANUFACTURER INFORMATION:<br/><b>TTM Technologies (Santa Ana)</b><br/>2630 South Harbor Boulevard<br/>Santa Ana, CA 92704, US</p>   | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 1WQ42<br/><br/>Contact: Terry Lichte<br/>Phone: 714-241-0303, x3127<br/>Fax: 714-241-0708<br/>EMail: tlichte@ttmtech.comca</p>           |
| <p>MANUFACTURER INFORMATION:<br/><b>TTM Technologies (Santa Clara)</b><br/>400 Matthew Street<br/>Santa Clara, CA 95050, US</p>        | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 65916<br/><br/>Contact: Nellie Guitierrez<br/>Phone: 408-486-3184<br/>Fax: 408-727-1003<br/>EMail: nellie.guitierrez@ttmtech.com</p>     |
| <p>MANUFACTURER INFORMATION:<br/><b>TTM Technologies (Stafford)</b><br/>4 Old Monson Road<br/>P.O. Box 145, Stafford, CT 77497, US</p> | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 5L706<br/><br/>Contact: Michelle Herbert<br/>Phone: 860-684-5881<br/>Fax: 860-684-7425<br/>EMail: michele.hebert@tycoelectronics.com</p> |
| <p>MANUFACTURER INFORMATION:<br/><b>Unicircuit, Inc.</b><br/>8192 Southpark Lane<br/>Littleton, CO 80120, US</p>                       | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 66311<br/><br/>Contact: Bob Lageman<br/>Phone: 303-730-0505, x110<br/>Fax:<br/>EMail: blageman@unicircuit.com</p>                        |

**SECTION III**  
**ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS**

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|--|---|---|
| <p>MANUFACTURER INFORMATION:<br/><b>Universal Circuits, Inc.</b><br/>8860 Zachary Lane North<br/>Maple Grove, MN 55369-4524, US</p>          | <p>PLANT LOCATION:<br/>Same Address as Manufacturer</p> | <p>CAGE Code: 45032<br/><br/>Contact:<br/>Phone:<br/>Fax:<br/>EMail:</p>  |
| <p>MANUFACTURER INFORMATION:<br/><b>Vermont Circuits, Inc.</b><br/>76 Technology Drive<br/>P.O. Box 1890, Brattleboro, VT 05302-1890, US</p> |   | <p>CAGE Code: 65200<br/><br/>Contact: Bob Downing<br/>Phone: 802-257-4571<br/>Fax: 802-257-0011<br/>EMail: Bob.Downing@vtcircuits.com</p> |