

**DLA Land and Maritime - VQ**  
**Supplemental Information Sheet for Electronic QML-31032**

**Date: 9/28/2016**

**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

**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.dscc.dla.mil/offices/sourcing\\_and\\_qualification/offices.asp?section=VQE](http://www.dscc.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**

<b>MANUFACTURER INFORMATION:</b> <b>AC Universal Circuits LLC</b> 8860 Zachary Lane North, Maple Grove, MN, 55369-4524 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 45032 <b>Phone:</b> 763-315-1709 <b>Fax:</b> 763-425-0999 <b>EMail:</b> MG_Quality@4pcb.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-10-019530, VQE-10-020323, VQE-12-024534  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .125"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.88:1 Through-Hole  
 Min. Conductor Width/Space: .0032"/.0032"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-10-019530, VQE-10-020323, VQE-12-024534  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .18"  
 Min. Hole Size: .021" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.57:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-021326, VQE-12-024534  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 8  
 Max. Board Thickness: .062"  
 Min. Hole Size: .0138" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 4.5:1 Through-Hole  
 Min. Conductor Width/Space: .007"/.006"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Foil Lamination

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

<p>MANUFACTURER INFORMATION:  <b>Accurate Circuit Engineering</b>          3019 S. Kilson Drive, Santa Ana, CA, 92707 US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 0MNN9          Phone: 714-546-2162          Fax: 714-433-7418          EMail: quality@ace-pcb.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-06-012150, VQE-07-012577, VQE-09-018384, VQE-10-020411, VQE-11-022279, VQE-13-026528, VQE-13-026662  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 20" x 26"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .22"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Advanced Circuits - Tempe Division</b> 229 S. Clark Drive, Tempe, AZ, 85281-3073 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 6RJS1 <b>Phone:</b> 480-966-5894 <b>Fax:</b> 480-966-5896 <b>E-Mail:</b> tempesales@4pcb.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-024291, VQE-12-024631, VQE-12-025042, VQE-13-025402, VQE-13-025881  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .125"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .8:1 Microvia, 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.0033"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-024291, VQE-12-024631, VQE-12-025042, VQE-13-025402, VQE-13-025881, VQE-15-029681  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .125"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.1:1 Microvia, 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.0033"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Airborn Flexible Circuits, Inc.</b> 11 Dohme Avenue, Toronto, M4B 1Y7, Ontario Canada	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 38661 <b>Phone:</b> 416-285-3825 <b>Fax:</b> 416-752-6719 <b>E-Mail:</b> pialisp@airbornflex.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-04-005354, VQE-08-015729  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 7  
 Max. Board Thickness: " Not Specified  
 Aspect Ratio: 3:1 Through-Hole  
 Min. Conductor Width/Space: .007"/.007"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Direct Metalization  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: HASL  
 Additional Fab Capabilities: Copper Core, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-04-005354, VQE-08-015729  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .094"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 12:1 Through-Hole  
 Min. Conductor Width/Space: .006"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Direct Metalization  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: HASL  
 Additional Fab Capabilities: Copper Core, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<b>MANUFACTURER INFORMATION:</b> <b>American Standard Circuits</b> 475 Industrial Drive, West Chicago, IL, 60185 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 4AA34 <b>Phone:</b> 603-639-5444 <b>Fax:</b> 603-293-1240 <b>EMail:</b> sales@asc-i.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-08-015934, VQE-11-021830, VQE-11-023138, VQE-13-025323, VQE-13-025791, VQE-13-025834  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .09" (for /1, Type 3 - Multilayer), .125" (for /2, Type /2 - Double-sided only)  
 Min. Hole Size: .009" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Blind Vias, Foil Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-022358, VQE-11-023138  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .125"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-16-029852  
 Composition: M - Mixed based material printed boards, S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .095"  
 Min. Hole Size: .017" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg

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

<b>MANUFACTURER INFORMATION:</b> <b>Amphenol Printed Circuits</b> 91 Northeastern Boulevard, Nashua, NH, 03062 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 57034 <b>Phone:</b> 603-879-3268 <b>Fax:</b> 603-879-2818 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE 10-020582, VQE-06-010054, VQE-09-017008, VQE-12-023765, VQE-15-029690, VQE-97-000649  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 24" x 42"  
 Max. Number of Layers: 33  
 Max. Board Thickness: .25"  
 Min. Hole Size: .007" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .6:1 Microvia, 11:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE 10-020582, VQE-06-010054, VQE-09-017008, VQE-12-023765, VQE-15-029626, VQE-97-000649  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 30" x 36"  
 Max. Number of Layers: 28  
 Max. Board Thickness: .18"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .8:1 Microvia, 11:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Amphenol Printed Circuits</b> 91 Northeastern Boulevard, Nashua, NH, 03062 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 57034 <b>Phone:</b> 603-879-3268 <b>Fax:</b> 603-879-2818 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE 10-020582, VQE-06-010054, VQE-09-017008, VQE-12-023765, VQE-15-029690  
 Composition: M - Mixed based material printed boards, S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 24" x 31"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .101"  
 Min. Hole Size: .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.2:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-10-019533, VQE-12-023765, VQE-15-029690  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 4 (types 1, 2, and 3 only)  
 Max. Board Thickness: .035"  
 Min. Hole Size: .0145"  
 Aspect Ratio: 1.75:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Palladium-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-10-019533, VQE-12-023765, VQE-15-029690  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 24" x 49"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .14"  
 Min. Hole Size: .0145" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7.75:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Foil Lamination, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)



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

<b>MANUFACTURER INFORMATION:</b> <b>Calumet Electronics Corp.</b> 25830 Depot Street, Calumet, dw, 49913-1985 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65337 <b>Phone:</b> 906-337-1305 <b>Fax:</b> 906-337-5359 <b>E-Mail:</b> quality@calumeedynectronics.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE 12 023734, VQE-03-4657, VQE-04-6280, VQE-14-027692  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .125"  
 Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL  
 Additional Fab Capabilities: Press Fit Mounting

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE 12 023734, VQE-03-4657, VQE-04-6280, VQE-13-026419  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .125"  
 Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL

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

<b>MANUFACTURER INFORMATION:</b> <b>Cirex International, Inc.</b> 791 Nuttman Street, Santa Clara, CA, 95054 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 4MEG7 <b>Phone:</b> 408-988-3980 <b>Fax:</b> 408-988-4534 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-08-016602), VQE-14-028536  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .125"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-08-016602), VQE-14-028536  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .125"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQ(VQE-07-014176), VQ(VQE-15-029356)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 5  
 Max. Board Thickness: .056"  
 Min. Hole Size: .046" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.2:1 Through-Hole  
 Min. Conductor Width/Space: .0058"/.01"  
 Hole Preparation: Permanganate Etchback, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>Cirexx International, Inc.</b>  791 Nuttman Street, Santa Clara, CA, 95054 US</p>	<p>PLANT LOCATION:  Same Address as Manufacturer</p>	<p>CAGE Code: 4MEG7  Phone: 408-988-3980  Fax: 408-988-4534  EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
Qualification Letters: VQ(VQE-08-016602), VQE-14-028536  
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
Flex Base Material: Copper Clad Adhesiveless Polyimide  
Max. Panel Size: 18" x 24"  
Max. Number of Layers: 20  
Max. Board Thickness: .125"  
Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 12.5:1 Through-Hole  
Min. Conductor Width/Space: .004"/.004"  
Hole Preparation: Permanganate Desmear, Plasma Etchback  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Direct Current Plate  
Solder Resist: Liquid Photoimageable  
Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
Additional Fab Capabilities: Foil Lamination  
Controlled Impedance: Differential, Single-Ended  
Flex Usage: Use A (Flex During Installation)

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

<b>MANUFACTURER INFORMATION:</b> <b>Coast to Coast Circuits, Inc.</b> 5331 McFadden Avenue, Huntington Beach, CA, 92649-1204 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 66982 <b>Phone:</b> 714-898-4901 <b>Fax:</b> 714-891-0607 <b>EMail:</b> sales@speedycircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-08-016434, VQE-10-021007  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .11"  
 Min. Hole Size: .015" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni (no Au), HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-08-016434, VQE-10-021007  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .11"  
 Min. Hole Size: .015" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-08-016434, VQE-10-019157, VQE-10-021007  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .13"  
 Min. Hole Size: .002" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>Coast to Coast Circuits, Inc.</b>                      5331 McFadden Avenue, Huntington Beach, CA, 92649-1204 US</p>	<p>PLANT LOCATION:                      Same Address as Manufacturer</p>	<p>CAGE Code: 66982                      Phone: 714-898-4901                      Fax: 714-891-0607                      EMail: sales@speedycircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/6  
 Qualification Letters: VQE-08-016434  
 Composition: H - Homogenous thermoplastic base material printed boards  
 Rigid Base Material: GR: Glass Base, Nonwoven, Polytetrafluoroethylene Resin, Flame Resistant; GY: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant, for Microwave Application  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 2  
 Max. Board Thickness: .036"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 2:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: Hot Oil Reflow of Plated Sn/Pb

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6  
 Qualification Letters: VQE-09-018657  
 Composition: M - Mixed based material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; With or without woven or non-woven E-glass, Polytetrafluoroethylene (PTFE) resin, ceramic filler  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10 Woven E-Glass, Hydrocarbon Resin, Ceramic Filler - Homogenous  
 Max. Board Thickness: .1"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6  
 Qualification Letters: VQE-09-018657  
 Composition: S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10 With or Without Woven or Non-woven E-Glass, PTFE Resin, Ceramic Filler and Woven E-Glass, Epoxy Resin - Mixed  
 Max. Board Thickness: .068"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Colonial Circuits, Inc.</b> 1026 Warrenton Road, Fredericksburg, VA, 22406-6200 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 6T499 <b>Phone:</b> 540-753-5511, x125 <b>Fax:</b> 540-752-2109 <b>EMail:</b> quality@colonialcircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-6002  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .088"  
 Min. Hole Size: .021" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 4.2:1 Through-Hole  
 Min. Conductor Width/Space: .006"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-6002  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .127"  
 Min. Hole Size: .015"  
 Aspect Ratio: 8.5:1 Through-Hole  
 Min. Conductor Width/Space: .008"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6  
 Qualification Letters: VQE-04-6002, VQE-06-010192  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 8  
 Max. Board Thickness: .09"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.2:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL

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

<p>MANUFACTURER INFORMATION:  <b>Colonial Circuits, Inc.</b>          1026 Warrenton Road, Fredericksburg, VA, 22406-6200          US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 6T499          Phone: 540-753-5511, x125          Fax: 540-752-2109          EMail: quality@colonialcircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQ (VQE-10-019425)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .093"  
 Min. Hole Size: .01"  
 Aspect Ratio: 8.6:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL  
 Flex Usage: Use A (Flex During Installation),

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-04-6002  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .093"  
 Min. Hole Size: .025" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3.7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL  
 Flex Usage: Use A (Flex During Installation),

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/6  
 Qualification Letters: VQE-04-6002  
 Rigid Base Material: GT: Woven E-Glass, PTFE Resin; GT: Woven E-Glass, PTFE Resin; GX: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant; With or without woven or non-woven E-glass, Polytetrafluoroethylene (PTFE) resin, ceramic filler  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 2  
 Max. Board Thickness: .031"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.55:1 Through-Hole  
 Min. Conductor Width/Space: .025"/.01"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

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

<b>MANUFACTURER INFORMATION:</b> <b>Compunetics Inc.</b> 700 Seco Rd, Monroeville, PA, 15146 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 30598 Phone: 412-858-1272 Fax: EMail: lhart@compunetics.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-13-026082), VQ(VQE-15-029422)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 32  
 Max. Board Thickness: .26"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10.8:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-15-029722  
 Composition: M - Mixed based material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .177"  
 Min. Hole Size: .017"  
 Aspect Ratio: 10.4:1 Through-Hole  
 Min. Conductor Width/Space: .0047"/.006"  
 Hole Preparation: Plasma Desmear  
 Copper Plating: Periodic Reverse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended



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

<b>MANUFACTURER INFORMATION:</b> <b>Cosmotronic, Inc.</b> 16721 Noyes Avenue, Irvine, CA, 92606-5176 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 63695 <b>Phone:</b> 949-660-0740 <b>Fax:</b> 949-553-8371 <b>EMail:</b> Patricia_Alcantar@cosmotronic.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085, VQE-06-011248  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Board Thickness: .335"  
 Min. Hole Size: .014" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085, VQE-06-011248  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Board Thickness: .335"  
 Min. Hole Size: .014" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant; GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .165"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8:1 Through-Hole  
 Min. Conductor Width/Space: .006"/.008"  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>Cosmotronic, Inc.</b>          16721 Noyes Avenue, Irvine, CA, 92606-5176 US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 63695          Phone: 949-660-0740          Fax: 949-553-8371          EMail: Patricia_Alcantar@cosmotronic.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant; GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .165"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8:1 Through-Hole  
 Min. Conductor Width/Space: .006"/.008"  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085  
 Composition: S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .225"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .011"/.007"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6  
 Qualification Letters: VQE-04-006966, VQE-05-009107, VQE-06-010085  
 Composition: S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .225"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .011"/.007"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-00-0007, VQE-01-0311, VQE-03-0818, VQE-98-1143  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 16" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .125"  
 Min. Hole Size: .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-024252  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 16" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .125"  
 Min. Hole Size: .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .025"/.025"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: HASL

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

<b>MANUFACTURER INFORMATION:</b> <b>Electro Plate Circuitry, Inc.</b> 1430 Century Drive, Carrollton, TX, 75006 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 79616 <b>Phone:</b> 972-466-0818 <b>Fax:</b> 972-466-9078 <b>E-Mail:</b> jimmm@eplate.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-06-010333), VQ(VQE-06-011433), VQ(VQE-10-020352)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 16", 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .12"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-06-010333), VQ(VQE-06-011433), VQ(VQE-10-020352)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 16", 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .17"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Electro Plate Circuitry, Inc.</b> 1430 Century Drive, Carrollton, TX, 75006 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 79616 Phone: 972-466-0818 Fax: 972-466-9078 EMail: jimmm@eplate.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6

Qualification Letters: VQ(VQE-10-021161)

Rigid Base Material: GT: Woven E-Glass, PTFE Resin; GX: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant; GY: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant, for Microwave Application; With or without woven or non-woven E-glass, Polytetrafluoroethylene (PTFE) resin, ceramic filler

Max. Panel Size: 12" x 18", 18" x 24"

Max. Number of Layers: 6

Max. Board Thickness: .18"

Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating

Aspect Ratio: 6:1 Through-Hole

Min. Conductor Width/Space: .004"/.004"

Hole Preparation: Plasma Desmear

Hole Wall Conductive Coating: Electroless Copper

Copper Plating: Direct Current Plate

Hole Fill/Via Plug: Conductive, Non-Conductive

Solder Resist: Dry Film, Liquid Photoimageable

Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb

Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination

Controlled Impedance: Differential, Single-Ended

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-06-011451), VQ(VQE-08-014513), VQ(VQE-09-018692), VQ(VQE-12-024024), VQ(VQE-12-024411)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .115"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: Carbon Ink, ENIG, Electrolytic Ni/Au, HASL, ImmAg  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-06-011451), VQ(VQE-08-014513), VQ(VQE-09-018692), VQ(VQE-12-024024), VQ(VQE-12-024411)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .115"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: Carbon Ink, ENIG, Electrolytic Ni/Au, HASL, ImmAg  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .101"  
 Min. Hole Size: .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .22"  
 Min. Hole Size: .0059" Laser Ablated Plated Hole Size Before Plating, .0096" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.01:1 Microvia, 10.2:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .13"  
 Min. Hole Size: .0059" Laser Ablated Plated Hole Size Before Plating, .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5.6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Firan Technology Group</b> 250 Finchdene Square, Scarborough, M1X 1A5, Ontario Canada	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> L2665 <b>Phone:</b> 416-299-4000 <b>Fax:</b> 416-292-4308 <b>EMail:</b> info@ftgcorp.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295  
 Rigid Base Material: GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .097"  
 Min. Hole Size: .023" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3.4:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-15-029018, VQE-16-030295  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .086"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Flex Usage: Use A (Flex During Installation)



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

<b>MANUFACTURER INFORMATION:</b> <b>FTG Circuits Inc., Hudson NH</b> 110 Lowell Road, Hudson, NH, 03051 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 22958 <b>Phone:</b> 603-889-6191 <b>Fax:</b> <b>E-Mail:</b> pctsales@teledyne.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-15-029796  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 30  
 Max. Board Thickness: .225"  
 Min. Hole Size: .0295"  
 Aspect Ratio: 7.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-15-029796  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 24" x 30"  
 Max. Number of Layers: 7  
 Max. Board Thickness: .06"  
 Min. Hole Size: .035" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.8:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

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

<b>MANUFACTURER INFORMATION:</b> <b>FTG Circuits, Inc. (Chatsworth)</b> 20750 Marilla Street, Chatsworth, CA, 91311 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 30803 <b>Phone:</b> 818-407-4024 <b>Fax:</b> 818-407-4034 <b>E-Mail:</b> info@ftgcorp.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-16-030066  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 28  
 Max. Board Thickness: .2"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.1:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.004"  
 Hole Preparation: Permanganate Etchback, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

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

MANUFACTURER INFORMATION: <b>Gorilla Circuits</b> 1445 Old Oakland Rd, San Jose, CA, 95112 US		CAGE Code: 3C7D2 Phone: 408-294-9897 Fax: 408-297-1540 EMail: info@gorillacircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: 11-022314, 14-028138  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .18"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 18:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: 11-022314, 14-028138  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .093"  
 Min. Hole Size: .01" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias  
 Controlled Impedance: Differential, Single-Ended

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

<p>MANUFACTURER INFORMATION:  <b>Graphic Plc</b>          Lords Meadow Industrial Estate, Crediton, Devon, EX17          IHN UK</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: U4538          Phone: 44-1363-774874          Fax: 44-1363-772265          EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-023205, VQE-12-025118  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .11" (2.79mm)  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.4:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-025119  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .11" (2.79mm)  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.4:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination

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

<p>MANUFACTURER INFORMATION:  <b>Hamby Corporation</b>                  27704 Avenue Scott, Valencia, CA, 91355-1218 US</p>	<p>PLANT LOCATION:                  Same Address as Manufacturer</p>	<p>CAGE Code: 07284                  Phone: 661-257-1924                  Fax: 661-257-1213                  EMail: suesharp@hambycorp.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-09-017349  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 6  
 Max. Board Thickness: .035"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 2:1 Through-Hole  
 Min. Conductor Width/Space: .009"/.009"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: Electrolytic Ni / Hard Au, HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-08-14596  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 11  
 Max. Board Thickness: .085"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: Electrolytic Ni / Hard Au, HASL  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-09-017349  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 6  
 Max. Board Thickness: .035"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 2:1 Through-Hole  
 Min. Conductor Width/Space: .009"/.009"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: Electrolytic Ni / Hard Au, HASL

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

<p>MANUFACTURER INFORMATION:  <b>Hamby Corporation</b>                  27704 Avenue Scott, Valencia, CA, 91355-1218 US</p>	<p>PLANT LOCATION:                  Same Address as Manufacturer</p>	<p>CAGE Code: 07284                  Phone: 661-257-1924                  Fax: 661-257-1213                  EMail: suesharp@hambycorp.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-08-14596  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 11  
 Max. Board Thickness: .095"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: Electrolytic Ni / Hard Au, HASL  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<b>MANUFACTURER INFORMATION:</b> <b>Hans Brockstedt GmbH</b> Clara-Immerwahr-Strabe 7, 24145 Kiel Germany	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: C4831 Phone: 0049-431-71966-0, -30 Fax: 0049-431-71966-29 EMail: klammer@brockstedt.de
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-2619, VQE-05-7480  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 9" x 13", 13" x 20", 15" x 21", 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .2"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 7:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-03-2619, VQE-05-7480,  
 Composition: S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 9" x 13", 13" x 20"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .2"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 7:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3  
 Qualification Letters: VQE-03-2619, VQE-05-7480, VQE-13-25594  
 Composition: S - Homogenous thermosetting base material printed boards  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 9" x 13", 13" x 20"  
 Max. Number of Layers: 2  
 Max. Board Thickness: .01"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>Hans Brockstedt GmbH</b>                  Clara-Immerwahr-Strabe 7, 24145 Kiel Germany</p>	<p>PLANT LOCATION:                  Same Address as Manufacturer</p>	<p>CAGE Code: C4831                  Phone: 0049-431-71966-0, -30                  Fax: 0049-431-71966-29                  EMail: klammer@brockstedt.de</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-2619, VQE-05-7480  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 9" x 13", 13" x 20", 15" x 21", 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .2"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 7:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination



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

<p>MANUFACTURER INFORMATION:  <b>Holaday Circuits, Inc.</b>  11126 Bren Road West, Minnetonka, MN, 55343 US</p>	<p>PLANT LOCATION:  Same Address as Manufacturer</p>	<p>CAGE Code: 59554  Phone: 952-988-8059  Fax:  EMail: MarwanR@Holaday.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: VQ(VQE-15-028707)  
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
Max. Panel Size: 18" x 24"  
Max. Number of Layers: 16  
Max. Board Thickness: .11"  
Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 7.8:1 Through-Hole  
Min. Conductor Width/Space: .003"/.0037"  
Hole Preparation: Permanganate Desmear, Plasma Etchback  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Direct Current Plate, Pulse Plate  
Hole Fill/Via Plug: Non-Conductive  
Solder Resist: Liquid Photoimageable  
Finish System: ENIG, HASL, ImmAg, OSP  
Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
Controlled Impedance: Differential, Single-Ended

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

<p>MANUFACTURER INFORMATION:  <b>Hughes Circuits, Inc.</b>                      540 S. Pacific Street, San Marcos, CA, 92078-4056 US</p>	<p>PLANT LOCATION:                      Same Address as Manufacturer</p>	<p>CAGE Code: 1KXU6                      Phone: 760-744-0300                      Fax: 760-744-6388                      EMail: joe@hughescircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-07-014018), VQ(VQE-14-028093), VQE-12-24783  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .08"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Graphite-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-08-015865), VQ(VQE-14-028093), VQE-12-24783  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .08"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Graphite-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL

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

<p>MANUFACTURER INFORMATION:  <b>ISU Petasys</b>          12930 Bradley St., Sylmar, CA, 91342 US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 1WFH9          Phone: 818-833-4832          Fax:          EMail: SimeonR@isupetasys.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-15-028813)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .15"  
 Min. Hole Size: .0098"  
 Aspect Ratio: 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.004"  
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg  
 Additional Fab Capabilities: Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>KCA Electronics, Inc.</b> 223 N. Crescent Way, Anaheim, CA, 92801 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 1VUH8 <b>Phone:</b> 714-239-2433 <b>Fax:</b> 714-239-2455 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-11-021796, VQE-14-027414, VQE-16-030557  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .133"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3  
 Qualification Letters: VQE-11-021796  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 1  
 Max. Board Thickness: .008"  
 Min. Conductor Width/Space: .004"/.006"  
 Finish System: HASL  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-022398, VQE-14-027414  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .092"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.75:1 Microvia, 7:1 Through-Hole  
 Min. Conductor Width/Space: .0048"/.004"  
 Hole Preparation: Permanganate Etchback, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL  
 Controlled Impedance: Differential, Single-Ended

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

<p>MANUFACTURER INFORMATION:  <b>KCA Electronics, Inc.</b>                  223 N. Crescent Way, Anaheim, CA, 92801 US</p>	<p>PLANT LOCATION:                  Same Address as Manufacturer</p>	<p>CAGE Code: 1VUH8                  Phone: 714-239-2433                  Fax: 714-239-2455                  EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-022964, VQE-14-027414, VQE-16-030045  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .117"  
 Min. Hole Size: .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.67:1 Through-Hole  
 Min. Conductor Width/Space: .0098"/.0044"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL

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

<b>MANUFACTURER INFORMATION:</b> <b>Lockheed Martin Mission Systems &amp; Training</b> 1801 State Route 17C, Owego, NY, 13827 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 03640 <b>Phone:</b> 607-751-5395 <b>Fax:</b> 607-751-7714 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-00-000961, VQE-15-029009, VQE-15-029561, VQE-16-030240, VQE-99-000130  
 Rigid Base Material: AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .075"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3.6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-00-000961, VQE-07-013268, VQE-07-013459, VQE-11-022596, VQE-15-029009, VQE-15-029561, VQE-16-030240, VQE-16-030354, VQE-99-000130  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 24" x 30"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .104"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-00-000961, VQE-07-013459, VQE-15-029009, VQE-15-029561, VQE-16-030240, VQE-99-000130  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 24" x 30"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .082"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb

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

<b>MANUFACTURER INFORMATION:</b> <b>Lockheed Martin Mission Systems &amp; Training</b> 1801 State Route 17C, Owego, NY, 13827 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 03640 <b>Phone:</b> 607-751-5395 <b>Fax:</b> 607-751-7714 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-00-000684, VQE-07-013459, VQE-15-029009  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .11"  
 Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-00-000684, VQE-07-013459, VQE-15-029009, VQE-15-029562  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 4 (types 1, 2, and 3 only)  
 Max. Board Thickness: .022"  
 Min. Hole Size: .0413"  
 Aspect Ratio: .5:1 Through-Hole  
 Min. Conductor Width/Space: .009"/.01"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation)

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

<p>MANUFACTURER INFORMATION:  <b>Lone Star Circuits</b>            901 Hensley Drive, Wylie, TX, 75098-4909 US</p>	<p>PLANT LOCATION:            Same Address as Manufacturer</p>	<p>CAGE Code: 04RV5            Phone: 214-291-1427            Fax:            EMail: sdiacont@lscpwb.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-4341, VQE-04-5599, VQE-04-5891, VQE-05-7288  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .119"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7.5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Fused Tin Lead, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-4957, VQE-05-7288  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .074"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.2:1 Through-Hole  
 Min. Conductor Width/Space: .007"/.007"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Fused Tin Lead, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/6  
 Qualification Letters: VQE-11-021947  
 Rigid Base Material: GY: Glass Base, Woven, Polytetrafluoroethylene Resin, Flame Resistant, for Microwave Application  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 2  
 Max. Board Thickness: .031"  
 Min. Hole Size: .039" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Through-Hole  
 Min. Conductor Width/Space: .19"/.9515"  
 Hole Preparation: Sodium Treatment  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Fused Tin Lead, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Controlled Impedance: Differential, Single-Ended



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

<p>MANUFACTURER INFORMATION:  <b>Midwest Printed Circuit Services</b>  1741 Circuit Drive, Round Lake Beach, IL, 60073 US</p>		<p>CAGE Code: 0YYS4  Phone: 847-740-4120  Fax: 847-740-4187  EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: VQE-12-024841, VQE-12-025070, VQE-13-025727, VQE-14-028088, VQE-16-030296  
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
Max. Panel Size: 18" x 24"  
Max. Number of Layers: 12  
Max. Board Thickness: .1"  
Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 7.92:1 Through-Hole  
Min. Conductor Width/Space: .004"/.004"  
Hole Preparation: Permanganate Desmear, Plasma Etchback  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Direct Current Plate  
Solder Resist: Dry Film, Liquid Photoimageable  
Finish System: ENIG, HASL  
Additional Fab Capabilities: Controlled Depth Mechanically Drilled Low Aspect Ratio Blind Vias, Foil Lamination  
Controlled Impedance: Differential

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: VQE-13-025705, VQE-14-028088  
Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
Max. Panel Size: 18" x 24"  
Max. Number of Layers: 10  
Max. Board Thickness: .1"  
Min. Hole Size: .038" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 2.5:1 Through-Hole  
Min. Conductor Width/Space: .01"/.01"  
Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Direct Current Plate  
Solder Resist: Liquid Photoimageable  
Finish System: ENIG, HASL

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
Qualification Letters: VQE-16-030690  
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
Flex Base Material: Copper Clad Adhesiveless Polyimide  
Max. Panel Size: 12" x 18"  
Max. Number of Layers: 10  
Max. Board Thickness: .094"  
Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 5.8:1 Through-Hole  
Min. Conductor Width/Space: .01"/.01"  
Hole Preparation: Plasma Desmear  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Direct Current Plate  
Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
Finish System: ENIG, HASL  
Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>Murrietta Circuits, Inc.</b>                      5000 E. Landon Drive, Anaheim, CA, 92807 US</p>	<p>PLANT LOCATION:                      Same Address as Manufacturer</p>	<p>CAGE Code: 0EJD7                      Phone: 714-970-2430                      Fax: 714-970-2406                      EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-15-029521  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .103"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Etchback, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Single-Ended

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

MANUFACTURER INFORMATION: <b>Pioneer Circuits, Inc.</b> 3000 S. Shannon Street, Santa Ana, CA, 92704-6321 US		CAGE Code: 65723 Phone: 714-641-3132 Fax: 714-641-3120 EMail: Quality@pioneercircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-09-017323, VQE-09-017656  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .177"  
 Min. Hole Size: .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.0035"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-09-017323, VQE-09-017656  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .275"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.0035"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

MANUFACTURER INFORMATION: <b>Pioneer Circuits, Inc.</b> 3000 S. Shannon Street, Santa Ana, CA, 92704-6321 US		CAGE Code: 65723 Phone: 714-641-3132 Fax: 714-641-3120 EMail: Quality@pioneercircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-09-017323, VQE-09-017656, VQE-10-029651  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 26"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .231"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 8.5:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-09-017323, VQE-09-017656  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.0035"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Book Binder, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:</p> <p><b>Pioneer Circuits, Inc.</b>          3000 S. Shannon Street, Santa Ana, CA, 92704-6321          US</p>		<p>CAGE Code: 65723          Phone: 714-641-3132          Fax: 714-641-3120          EMail: Quality@pioneercircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-09-017323, VQE-09-017656  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 26  
 Max. Board Thickness: .185"  
 Min. Hole Size: .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.0035"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Periodic Reverse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Book Binder, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<b>MANUFACTURER INFORMATION:</b> <b>PNC, Inc.</b> 115 East Centre Street, Nutley, NJ, 07110 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 66766 <b>Phone:</b> 973-284-1600 <b>Fax:</b> <b>E-Mail:</b> carmela@pnconline.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-10-19440, VQE-15-029233  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<p>MANUFACTURER INFORMATION:  <b>Printed Circuits, Inc.</b>                  1200 West 96th Street, Bloomington, MN, 55431-2606                  US</p>	<p>PLANT LOCATION:                  Same Address as Manufacturer</p>	<p>CAGE Code: 65114                  Phone: 952-886-9333                  Fax:                  EMail: jsmith@printedcircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-01-000024  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 12" x 18", 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Sequential Lamination  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-15-029290)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18", 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .01"  
 Aspect Ratio: 10:1  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-15-029290)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18", 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .01"  
 Aspect Ratio: 10:1  
 Min. Conductor Width/Space: .004"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au

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

<p>MANUFACTURER INFORMATION:  <b>Pro-Tech Interconnect Solutions LLC</b>          4300 Peavey Road, Chaska, MN, 55318 US</p>		<p>CAGE Code: 3CP65          Phone: 952-442-2189          Fax: 952-442-2472          EMail: hkooda@protechmn.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-021704  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .024" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 4:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg, OSP  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-021704, VQE-16-030058  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .1"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0059" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole, 1:1 Microvia  
 Min. Conductor Width/Space: .003"/.002"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Carbon-based  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended



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

MANUFACTURER INFORMATION: <b>Sanmina-SCI (Costa Mesa)</b> 2945 Airway Avenue, Costa Mesa, CA, 92626 US		CAGE Code: 3BKL5 Phone: 714-371-2800 Fax: 714-371-2833 EMail: joann.medina@sanmina-sci.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-024031  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 8  
 Max. Board Thickness: .063"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 5:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Soft Au, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-12-24471  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .093"  
 Min. Hole Size: .013" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7 : 1 Through-Hole  
 Min. Conductor Width/Space: .003"/.0035"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni / Soft Au, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-16-030438  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 14" x 14"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .07"  
 Min. Hole Size: .008"  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.0045"  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG

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

<p>MANUFACTURER INFORMATION:  <b>Sanmina-SCI (Owego)</b>          1200 Taylor Rd., Owego, NY, 13827 US</p>		<p>CAGE Code: 4GZ84          Phone: 607-689-5543          Fax:          EMail: rick.sylvain@sanmina-sci.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-21597  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .11"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .008"/.0045"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL  
 Additional Fab Capabilities: Foil Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-11-22386  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .095"  
 Min. Hole Size: .007" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .59:1 Microvia, 9.7:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.0032"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-06-11137, VQE-10-19381, VQE-11-22038  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 21" x 27"  
 Max. Number of Layers: 30  
 Max. Board Thickness: .25"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, OSP  
 Additional Fab Capabilities: Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-06-11137  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 30  
 Max. Board Thickness: .25"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole, 1:2 Microvia  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/2, MIL-PRF-31032/6  
 Qualification Letters: VQE-10-20921, VQE-10-21014  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 2  
 Max. Board Thickness: .062"  
 Min. Hole Size: .0197" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3.1:1 Through-Hole  
 Min. Conductor Width/Space: .008"/.014"  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/5  
 Qualification Letters: VQE-11-021514  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 7  
 Max. Board Thickness: .066"  
 Min. Hole Size: .01"  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .088"  
 Min. Hole Size: .0138"  
 Aspect Ratio: 5.4:1 Through-Hole  
 Min. Conductor Width/Space: .0064"/.0068"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG

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

<p>MANUFACTURER INFORMATION:  <b>Thales Nederland B.V.</b>          Haaksbergerstraat 49, 7554PA Hengelo The Netherlands</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: H0203          Phone: 31 0 742482880          Fax: 31 0 742484124          EMail: jan.bokhove@nl.thalesgroup.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-14-028079  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .025" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 4:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Permanganate Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: HASL  
 Additional Fab Capabilities: Foil Lamination

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-14-028079  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .025" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 4:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Permanganate Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: HASL  
 Additional Fab Capabilities: Foil Lamination

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Santa Ana)</b> 2630 South Harbor Boulevard, Santa Ana, CA, 92704 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 1WQ42 <b>Phone:</b> 714-241-0303 <b>Fax:</b> 714-241-0708 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-008644, VQE-06-011211, VQE-16-030524  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 26  
 Max. Board Thickness: .135"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .75:1 Microvia, 11.5:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-05-008644, VQE-06-011211, VQE-12-023569, VQE-16-030524  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 30  
 Max. Board Thickness: .135"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: .75:1 Microvia, 11.5:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Santa Clara)</b> 407 Mathew Street, Santa Clara, CA, 95050 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 65916 Phone: 408-486-3184 Fax: 408-727-1003 EMail:
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003888, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-15-029137, VQE-15-029683, VQE-16-030610  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 21.5" x 24.5"  
 Max. Number of Layers: 28  
 Max. Board Thickness: .19"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003888, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-16-030610  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 33  
 Max. Board Thickness: .19"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Santa Clara)</b> 407 Mathew Street, Santa Clara, CA, 95050 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65916 <b>Phone:</b> 408-486-3184 <b>Fax:</b> 408-727-1003 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-03-003895, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-16-030610  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-03-003895, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-16-030610  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 6  
 Max. Board Thickness: .043"  
 Min. Hole Size: .031" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)



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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Santa Clara)</b> 407 Mathew Street, Santa Clara, CA, 95050 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65916 <b>Phone:</b> 408-486-3184 <b>Fax:</b> 408-727-1003 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-07-013211, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-16-030611  
 Composition: H - Homogenous thermoplastic base material printed boards, M - Mixed based material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .109"  
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Etchback, Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003888, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-16-030610  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .12"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.45:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-13-026953, VQE-14-028262, VQE-16-030610  
 Rigid Base Material: BF: Aramid Fabric, Nonwoven, Epoxy Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .076"  
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7:1 Through-Hole  
 Min. Conductor Width/Space: .0088"/.008"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Controlled Impedance: Differential

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Stafford)</b> 4 Old Monson Road, Stafford, CT, 06075 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 5L706 <b>Phone:</b> 860-684-5881 <b>Fax:</b> 860-684-7425 <b>EMail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003348, VQE-09-018855, VQE-11-023287, VQE-12-023366  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; Woven E-Glass, Epoxy Resin, Flame Resistant, with Inorganic Filler  
 Max. Panel Size: 30" x 54"  
 Max. Number of Layers: 50  
 Max. Board Thickness: .4"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14:1 Through-Hole, 1:1 Microvia  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Copper Core, Embedded Resistors, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003348, VQE-09-018855, VQE-11-023287, VQE-12-023366, VQE-16-030095  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 32  
 Max. Board Thickness: .219"  
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Copper Core, Copper Invar Copper, Embedded Resistors, Press Fit Mounting, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003348, VQE-09-018855, VQE-11-023287, VQE-16-030095  
 Rigid Base Material: AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .0138" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Foil Lamination,  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Stafford)</b> 4 Old Monson Road, Stafford, CT, 06075 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 5L706 <b>Phone:</b> 860-684-5881 <b>Fax:</b> 860-684-7425 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003348, VQE-09-018855, VQE-11-023287, VQE-12-023366, VQE-16-030095  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .129"  
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 11:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-03-003348, VQE-09-018855, VQE-11-023287  
 Rigid Base Material: GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .1"  
 Min. Hole Size: .032" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: Custom  
 Qualification Letters: VQE-03-003348, VQE-10-019855, VQE-11-023287, VQE-16-030095  
 Rigid Base Material: With or without woven or non-woven E-glass, Polytetrafluoroethylene (PTFE) resin, ceramic filler  
 Max. Panel Size: 24" x 30"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .11"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating, .012" Laser Ablated Plated Hole Size Before Plating  
 Aspect Ratio: .5:1 Microvia, 7.6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Embedded Resistors, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Stafford)</b> 4 Old Monson Road, Stafford, CT, 06075 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 5L706 <b>Phone:</b> 860-684-5881 <b>Fax:</b> 860-684-7425 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2, Custom  
 Qualification Letters: VQE-03-003348, VQE-10-019855, VQE-11-023287, VQE-16-030095  
 Composition: M - Mixed based material printed boards  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 24" x 42"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .175"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Copper Core, Embedded Resistors, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-03-003349, VQE-09-018855, VQE-10-019456, VQE-11-023287, VQE-12-023366, VQE-16-030095  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant; Woven E-Glass, Epoxy Resin, Flame Resistant, with Inorganic Filler  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .275"  
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<p>MANUFACTURER INFORMATION:  <b>TTM Technologies (Stafford)</b>          4 Old Monson Road, Stafford, CT, 06075 US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 5L706          Phone: 860-684-5881          Fax: 860-684-7425          EMail:</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-03-003349, VQE-10-019456, VQE-11-023287  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant; Woven E-Glass, Epoxy Resin, Flame Resistant, with Inorganic Filler  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 11  
 Max. Board Thickness: .07"  
 Min. Hole Size: .035" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 2:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination,  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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

<b>MANUFACTURER INFORMATION:</b> <b>Unicircuit, Inc.</b> 8192 Southpark Lane, Littleton, CO, 80120 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 66311 Phone: 303-730-0505, x110 Fax: EMail: blageman@unicircuit.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-07-13789, VQE-09-17422, VQE-11-23044  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-09-17422, VQE-12-24296  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 20" x 26"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .12"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: HASL, Hot Oil Reflow of Plated Sn/Pb  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - Anaheim</b> 3140 East Coronado Street, Anaheim, CA, 92806 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0BSG1 <b>Phone:</b> 714-688-7296 <b>Fax:</b> <b>EMail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-09-018147), VQ(VQE-14-028542), VQE-14-028660, VQE-16-029908  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .1"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5:1 Through-Hole  
 Min. Conductor Width/Space: .01"/.01"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-09-018147)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 22  
 Max. Board Thickness: .115"  
 Min. Hole Size: .009" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.006"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - Denver</b> 10570 Bradford Road, Littleton, CO, 80127-4211 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 75815 <b>Phone:</b> 303-972-4105 <b>Fax:</b> 303-933-2934 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-02-000317, VQE-05-007627, VQE-05-009014, VQE-09-018719, VQE-10-020224, VQE-12-024984, VQE-13-026251, VQE-13-026429, VQE-15-029639  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .125"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole, 1:1 Microvia  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-02-000317, VQE-05-007627, VQE-05-009014, VQE-09-018719, VQE-10-020224, VQE-12-024984, VQE-13-026251, VQE-13-026429, VQE-15-029639  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .14"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole, 1:1 Microvia  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended



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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - North Jackson</b> 12080 DeBartolo Drive, North Jackson, OH, 44451 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0GN71 <b>Phone:</b> 330-538-3900 <b>Fax:</b> 330-538-3820 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-03-003121), VQ(VQE-03-003214), VQ(VQE-07-012925), VQ(VQE-10-020405)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .25"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, ImmAg, Ni/Pd/Au, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-03-003121), VQ(VQE-03-003214), VQ(VQE-07-012925), VQ(VQE-10-020405)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .25"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, ImmAg, Ni/Pd/Au, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - North Jackson</b> 12080 DeBartolo Drive, North Jackson, OH, 44451 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0GN71 <b>Phone:</b> 330-538-3900 <b>Fax:</b> 330-538-3820 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQ(VQE-03-003121), VQ(VQE-03-003214), VQ(VQE-07-012925), VQ(VQE-10-020405)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .25"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.003"  
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni/Au, HASL, ImmAg, OSP  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - San Jose</b> 355 Turtle Creek Court, San Jose, CA, 95125-1316 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0MHG5 <b>Phone:</b> 408-938-7219 <b>Fax:</b> 408-280-0641 <b>E-Mail:</b> arnold.amaral@viasystems.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-08-016481), VQ(VQE-08-016632)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .13"  
 Min. Hole Size: .004" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.8:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-08-016481), VQ(VQE-08-016632)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .13"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating, .008" Laser Ablated Plated Hole Size Before Plating  
 Aspect Ratio: 0.8:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Technologies Corp., LLC - Sterling</b> 1200 Severn Way, Sterling, VA, 20166-8904 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0K703 <b>Phone:</b> 703-652-2200 <b>Fax:</b> 703-652-2272 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-03-003545), VQ(VQE-09-018207), VQ(VQE-14-028500), VQ(VQE-14-028501)  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 26  
 Max. Board Thickness: .11"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .009" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: LDI, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Resistors  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-03-003545), VQ(VQE-09-018207), VQ(VQE-14-028500), VQ(VQE-14-028501)  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 26  
 Max. Board Thickness: .11"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .009" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: LDI, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Resistors  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-11-021244), VQ(VQE-14-028500), VQ(VQE-15-028809)  
 Composition: H - Homogenous thermoplastic base material printed boards  
 Rigid Base Material: Woven glass, reinforced, hydrocarbon resin, with ceramic fill  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 9  
 Max. Board Thickness: .0844"  
 Min. Hole Size: .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7.4:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Toronto Inc.</b> 8150 Sheppard Avenue East, Scarborough, M1B 5K2, Ontario Canada	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 3AF82 <b>Phone:</b> 416-208-2100 <b>Fax:</b> 416-208-2196 <b>E-Mail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-006240, VQE-08-015407, VQE-09-018857, VQE-11-022676, VQE-12-023550  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .088"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 8.4:1 Through-Hole  
 Min. Conductor Width/Space: .0037"/.0028"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper,  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, ImmAg, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-04-006240, VQE-08-015407, VQE-09-018857, VQE-11-022676, VQE-12-023550  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .093"  
 Min. Hole Size: .0091" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1:1 Microvia, 9.6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive, Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, ImmAg, Ni/Pd/Au  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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

<b>MANUFACTURER INFORMATION:</b> <b>Westak of Oregon</b> 3941 24th Avenue, Forest Grove, OR, 97116 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65745 <b>Phone:</b> 503-359-3593 <b>Fax:</b> 503-357-5332 <b>E-Mail:</b> or-qa@westak.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-13-026434, VQE-14-027108  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .11"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-13-026434, VQE-14-027109  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .11"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10.6:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Controlled Impedance: Differential, Single-Ended

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

**AC Universal Circuits LLC**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 8860 Zachary Lane North, Maple Grove, MN, 55369-4524 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 45032  MIL-PRF-31032/3  MIL-PRF-31032/6

**Accurate Circuit Engineering**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 3019 S. Kilson Drive, Santa Ana, CA, 92707 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0MNN9  MIL-PRF-31032/3  MIL-PRF-31032/6

**Advanced Circuits - Tempe Division**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 229 S. Clark Drive, Tempe, AZ, 85281-3073 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 6RJS1  MIL-PRF-31032/3  MIL-PRF-31032/6

**Airborn Flexible Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 11 Dohme Avenue, Toronto, M4B 1Y7, Ontario Canada  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 38661  MIL-PRF-31032/3  MIL-PRF-31032/6

**American Standard Circuits**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 475 Industrial Drive, West Chicago, IL, 60185 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 4AA34  MIL-PRF-31032/3  MIL-PRF-31032/6

**Amphenol Printed Circuits**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 91 Northeastern Boulevard, Nashua, NH, 03062 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 57034  MIL-PRF-31032/3  MIL-PRF-31032/6

**Calumet Electronics Corp.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 25830 Depot Street, Calumet, dw, 49913-1985 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 65337  MIL-PRF-31032/3  MIL-PRF-31032/6

**Cirexx International, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 791 Nuttman Street, Santa Clara, CA, 95054 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 4MEG7  MIL-PRF-31032/3  MIL-PRF-31032/6

**Coast to Coast Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 5331 McFadden Avenue, Huntington Beach, CA, 92649-1204 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 66982  MIL-PRF-31032/3  MIL-PRF-31032/6

**Colonial Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1026 Warrenton Road, Fredericksburg, VA, 22406-6200 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 6T499  MIL-PRF-31032/3  MIL-PRF-31032/6

**Compunetics Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 700 Seco Rd, Monroeville, PA, 15146 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 30598  MIL-PRF-31032/3  MIL-PRF-31032/6

**Cosmotronic, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 16721 Noyes Avenue, Irvine, CA, 92606-5176 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 63695  MIL-PRF-31032/3  MIL-PRF-31032/6

**Dynamic & Proto Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 869 Barton Street, Stoney Creek, L8E 5G6, Ontario Canada  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 38898  MIL-PRF-31032/3  MIL-PRF-31032/6

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

**Electro Plate Circuitry, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1430 Century Drive, Carrollton, TX, 75006 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 79616  MIL-PRF-31032/3  MIL-PRF-31032/6

**Electrotek Corp.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 7745 S. 10th Street, Oak Creek, WI, 53154 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 66030  MIL-PRF-31032/3  MIL-PRF-31032/6

**Firan Technology Group**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 250 Finchdene Square, Scarborough, M1X 1A5, Ontario Canada  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: L2665  MIL-PRF-31032/3  MIL-PRF-31032/6

**FTG Circuits Inc., Hudson NH**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 110 Lowell Road, Hudson, NH, 03051 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 22958  MIL-PRF-31032/3  MIL-PRF-31032/6

**FTG Circuits, Inc. (Chatsworth)**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 20750 Marilla Street, Chatsworth, CA, 91311 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 30803  MIL-PRF-31032/3  MIL-PRF-31032/6

**Gorilla Circuits**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1445 Old Oakland Rd, San Jose, CA, 95112 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 3C7D2  MIL-PRF-31032/3  MIL-PRF-31032/6

**Graphic Plc**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 Lords Meadow Industrial Estate, Crediton, Devon, EX17 1HN UK  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: U4538  MIL-PRF-31032/3  MIL-PRF-31032/6

**Hamby Corporation**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 27704 Avenue Scott, Valencia, CA, 91355-1218 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 07284  MIL-PRF-31032/3  MIL-PRF-31032/6

**Hans Brockstedt GmbH**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 Clara-Immerwahr-Strabe 7, 24145 Kiel Germany  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: C4831  MIL-PRF-31032/3  MIL-PRF-31032/6

**Holiday Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 11126 Bren Road West, Minnetonka, MN, 55343 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 59554  MIL-PRF-31032/3  MIL-PRF-31032/6

**Hughes Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 540 S. Pacific Street, San Marcos, CA, 92078-4056 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 1KXU6  MIL-PRF-31032/3  MIL-PRF-31032/6

**ISU Petasys**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 12930 Bradley St., Sylmar, CA, 91342 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 1WFH9  MIL-PRF-31032/3  MIL-PRF-31032/6

**KCA Electronics, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 223 N. Crescent Way, Anaheim, CA, 92801 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 1VUH8  MIL-PRF-31032/3  MIL-PRF-31032/6



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

**Lockheed Martin Mission Systems & Training**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 1801 State Route 17C, Owego, NY, 13827 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 03640       MIL-PRF-31032/3     MIL-PRF-31032/6

**Lone Star Circuits**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 901 Hensley Drive, Wylie, TX, 75098-4909 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 04RV5       MIL-PRF-31032/3     MIL-PRF-31032/6

**Midwest Printed Circuit Services**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 1741 Circuit Drive, Round Lake Beach, IL, 60073 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 0YYS4       MIL-PRF-31032/3     MIL-PRF-31032/6

**Murrietta Circuits, Inc.**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 5000 E. Landon Drive, Anaheim, CA, 92807 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 0EJD7       MIL-PRF-31032/3     MIL-PRF-31032/6

**Pioneer Circuits, Inc.**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 3000 S. Shannon Street, Santa Ana, CA, 92704-6321 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 65723       MIL-PRF-31032/3     MIL-PRF-31032/6

**PNC, Inc.**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 115 East Centre Street, Nutley, NJ, 07110 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 66766       MIL-PRF-31032/3     MIL-PRF-31032/6

**Printed Circuits, Inc.**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 1200 West 96th Street, Bloomington, MN, 55431-2606 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 65114       MIL-PRF-31032/3     MIL-PRF-31032/6

**Pro-Tech Interconnect Solutions LLC**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 4300 Peavey Road, Chaska, MN, 55318 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 3CP65       MIL-PRF-31032/3     MIL-PRF-31032/6

**Sanmina-SCI (Costa Mesa)**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 2945 Airway Avenue, Costa Mesa, CA, 92626 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 3BKL5       MIL-PRF-31032/3     MIL-PRF-31032/6

**Sanmina-SCI (Owego)**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 1200 Taylor Rd., Owego, NY, 13827 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 4GZ84       MIL-PRF-31032/3     MIL-PRF-31032/6

**Sanmina-SCI (San Jose)**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 2050 Bering Drive, San Jose, CA, 95131 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 3DR67       MIL-PRF-31032/3     MIL-PRF-31032/6

**Thales Nederland B.V.**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 Haaksbergerstraat 49, 7554PA Hengelo The Netherlands  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: H0203       MIL-PRF-31032/3     MIL-PRF-31032/6

**TTM Technologies (Santa Ana)**       MIL-PRF-31032/1     MIL-PRF-31032/4     Custom  
 2630 South Harbor Boulevard, Santa Ana, CA, 92704 US  
 MIL-PRF-31032/2     MIL-PRF-31032/5  
 CAGE Code: 1WQ42       MIL-PRF-31032/3     MIL-PRF-31032/6

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

**TTM Technologies (Santa Clara)**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 407 Mathew Street, Santa Clara, CA, 95050 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 65916  MIL-PRF-31032/3  MIL-PRF-31032/6

**TTM Technologies (Stafford)**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 4 Old Monson Road, Stafford, CT, 06075 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 5L706  MIL-PRF-31032/3  MIL-PRF-31032/6

**Unicircuit, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 8192 Southpark Lane, Littleton, CO, 80120 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 66311  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Technologies Corp., LLC - Anaheim**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 3140 East Coronado Street, Anaheim, CA, 92806 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0BSG1  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Technologies Corp., LLC - Denver**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 10570 Bradford Road, Littleton, CO, 80127-4211 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 75815  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Technologies Corp., LLC - North Jackson**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 12080 DeBartolo Drive, North Jackson, OH, 44451 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0GN71  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Technologies Corp., LLC - San Jose**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 355 Turtle Creek Court, San Jose, CA, 95125-1316 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0MHG5  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Technologies Corp., LLC - Sterling**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1200 Severn Way, Sterling, VA, 20166-8904 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0K703  MIL-PRF-31032/3  MIL-PRF-31032/6

**Viasystems Toronto Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 8150 Sheppard Avenue East, Scarborough, M1B 5K2, Ontario Canada  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 3AF82  MIL-PRF-31032/3  MIL-PRF-31032/6

**Westak of Oregon**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 3941 24th Avenue, Forest Grove, OR, 97116 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 65745  MIL-PRF-31032/3  MIL-PRF-31032/6