

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

**Date: 4/25/2018**

**Specification Details:**

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

**Contact Information:**

Office of Primary Involvement: Electronic Devices Branch, DLA Land and Maritime - VQE  
Primary Qualifying Activity Contact: 614-692-0627, e-mail: vqe.ls@dla.mil  
Secondary Qualifying Activity Contact: 614-692-0625, e-mail: vqe.rp@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.dsccl.dla.mil/offices/sourcing\\_and\\_qualification/offices.asp?section=VQE](http://www.dsccl.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>E-Mail:</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, 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-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, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Additional Fab Capabilities: Foil Lamination

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**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

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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

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**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: Foil Lamination, Metal Core, 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: Foil Lamination, Metal Core, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

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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>E-Mail:</b> sales@asc-i.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-17-031437  
 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: 14  
 Max. Board Thickness: .095"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .0033"/.006"  
 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, ImmAg  
 Additional Fab Capabilities: Foil Lamination  
 Flex Usage: Use A (Flex During Installation)

**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

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

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

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**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	CAGE Code: 57034 Phone: 603-879-3268 Fax: 603-879-2818 EMail:
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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-17-031637, VQE-97-000649  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 33  
 Max. Board Thickness: .25"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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 (no Au), 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-17-031637, 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 (no Au), 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-15-029690  
 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"/.004"  
 Hole Preparation: 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 (no Au), 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-31032/3, 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 36"  
 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, Palladium-based  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable, Silk Screen  
 Finish System: ENIG, Electrolytic Ni (no Au), 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, MI, 49913-1985 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 65337 Phone: 906-337-1305 Fax: 906-337-5359 EMail: quality@calumetelectronics.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, VQE-17-030995  
 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: Foil Lamination, 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, VQE-17-030995  
 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  
 Additional Fab Capabilities: Foil Lamination

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

<b>MANUFACTURER INFORMATION:</b> <b>Cirexx 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**

<b>MANUFACTURER INFORMATION:</b> <b>Cirexx 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>EMail:</b>
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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>E-Mail:</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**

<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>E-Mail:</b> sales@speedycircuits.com
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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>E-Mail:</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: G1: 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: ENIG, 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: ENIG, 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: ENIG, HASL

**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>E-Mail:</b> quality@colonialcircuits.com
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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: ENIG, 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: ENIG, 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: ENIG, 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: sales@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  
 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-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" Drilled Plated-Through Hole Before Plating  
 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

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQ (VQE-17-031349)  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 24" x 18"  
 Max. Number of Layers: 4  
 Max. Board Thickness: .024"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.3 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Periodic Reverse Plate  
 Finish System: HASL  
 Flex Usage: Use A (Flex During Installation)

**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

**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), VQ(VQE-17-031008  
 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: .115"  
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.7:1 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>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, VQE-17-031083, VQE-17-031084  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 14  
 Max. Board Thickness: .106"  
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5.1:1 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, Pulse Plate  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, 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-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295, VQE-17-031083  
 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: .245"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.01:1 Microvia, 15.9:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.003"  
 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: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, 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-05-009339, VQE-06-010764, VQE-06-010889, VQE-15-028987, VQE-16-030295, VQE-17-031083  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .17"  
 Min. Hole Size: .0059" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.6:1 Microvia, 9.6:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.003"  
 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: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 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>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, VQE-17-031083  
 Rigid Base Material: GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Max. Panel Size: 21" x 24"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .137"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 9.3:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.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: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg  
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination

**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. (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-18-032231  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 18  
 Max. Board Thickness: .165"  
 Min. Hole Size: .0256" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.5:1 Through-Hole  
 Min. Conductor Width/Space: .007"/.005"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Finish System: ENIG, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-17-031574  
 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: .2"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.2:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.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, 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-31032/3  
 Qualification Letters: VQE-17-031141  
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 1  
 Max. Board Thickness: .027"  
 Min. Conductor Width/Space: .012"/.008"  
 Finish System: ENIG, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au  
 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-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-17-031067  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 32  
 Max. Board Thickness: .2"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0135" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.2:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .0035"/.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, 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-31032/3, 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: 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, 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**

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: 11-022314, 14-028138, 17-031452, 17-031462  
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  
Hole Wall Conductive Coating: Electroless Copper  
Copper Plating: Pulse Plate  
Hole Fill/Via Plug: Conductive, Non-Conductive  
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: 11-022314, 14-028138, 17-031452, 17-031462  
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" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 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: Foil Lamination  
Controlled Impedance: Differential, Single-Ended



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

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

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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

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**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	<b>CAGE Code:</b> C4831 <b>Phone:</b> 0049-431-71966-0, -30 <b>Fax:</b> 0049-431-71966-29 <b>E-Mail:</b> Joerg.Kremer@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: Joerg.Kremer@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**

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-15-028707)  
 Composition: S - Homogenous thermosetting base material printed boards  
 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  
 Min. Conductor Width/Space: .003"/.0037"  
 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: Liquid Photoimageable  
 Finish System: ENIG, HASL, 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: VQ(VQE-15-028707)  
 Composition: S - Homogenous thermosetting base material printed boards  
 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: .016" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 6.66:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.0037"  
 Hole Preparation: Permanganate Desmear  
 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**

<b>MANUFACTURER INFORMATION:</b> <b>Hughes Circuits, Inc.</b> 540 S. Pacific Street, San Marcos, CA, 92078-4056 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 1KXU6 <b>Phone:</b> 760-744-0300 <b>Fax:</b> 760-744-6388 <b>E-Mail:</b> Trevor@hughescircuits.com
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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: G1: 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>IMI, Inc.</b> 140 Hilldale Avenue, Haverhill, MA, 01832</p>		<p>CAGE Code: 78256 Phone: 978-373-9190 Fax: 978-521-1846 EMail: elaine@imipcb.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-17-031308)  
 Composition: S - Homogenous thermosetting base material printed boards  
 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: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 12.5:1 Through-Hole  
 Min. Conductor Width/Space: .005"/.005"  
 Hole Preparation: Permanganate Desmear  
 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>ISU Petasys</b>          12930 Bradley St, Symar, CA, 91342 US</p>		<p>CAGE Code: 1WFH9          Phone:          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**

MANUFACTURER INFORMATION: <b>ITL Circuits</b> 90 Don Park Road, Markham, L3R 1C4, Ontario, Canada		CAGE Code: 38747 Phone: 905-475-6658 Fax: 905-475-5097 EMail: sales@itlcircuits.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: VQE-17-031450  
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: .08"  
Min. Hole Size: .0138" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 5.7:1 Through-Hole  
Min. Conductor Width/Space: .01"/.008"  
Hole Preparation: 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**

<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, VQE-16-030789  
 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  
 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, VQE-17-031406  
 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: .187"  
 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-18-032427, VQE-99-000130  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 9  
 Max. Board Thickness: .104"  
 Min. Hole Size: .018" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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, 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: 18" x 24"  
 Max. Number of Layers: 12  
 Max. Board Thickness: .082"  
 Min. Hole Size: .0256" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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, 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: 12" x 18"  
 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**

<b>MANUFACTURER INFORMATION:</b> <b>Lone Star Circuits</b> 901 Hensley Drive, Wylie, TX, 75098-4909 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 04RV5 Phone: 214-291-1427 Fax: EMail: sdiacont@lscpwb.com
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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:</p> <p><b>Metaplast Circuits Ltd.</b>          180 Hymus Road, Scarborough, M1L 2E1, Ontario,          Canada</p>		<p>CAGE Code: 3AD63          Phone: 416-285-5000          Fax:          EMail: sales@metaplast.ca</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-18-032032  
 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: .113"  
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Permanganate Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Periodic Reverse 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**

<b>MANUFACTURER INFORMATION:</b> <b>Micropack Limited</b> , Plot No. 16, Jigani Industrial Area, Anekal Taluk, Bangalore District 560105 India	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> SAL28 <b>Phone:</b> 91-80-27825223 <b>Fax:</b> 91-80-27825225 <b>E-Mail:</b> process@micropack.in
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4  
 Qualification Letters: VQE-17-031413  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .1"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Controlled Impedance: Differential, Single-Ended  
 Flex Usage: Use A (Flex During Installation)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-17-031258  
 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: .1"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination, Metal Core  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-17-031258  
 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: .1"  
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Foil Lamination, Metal Core  
 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, VQE-18-032565  
 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: .11"  
 Min. Hole Size: .011" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: 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: Liquid Photoimageable  
 Finish System: ENIG, HASL, Ni/Pd/Au  
 Additional Fab Capabilities: Foil Lamination  
 Controlled Impedance: Single-Ended

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

<p>MANUFACTURER INFORMATION:  <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-31032/1, 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

**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)

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

<p>MANUFACTURER INFORMATION:  <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 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)

**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**

<p>MANUFACTURER INFORMATION: <b>PNC, Inc.</b> 115 East Centre Street, Nutley, NJ, 07110 US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 66766 Phone: 973-284-1600 Fax: EMail: carmela@pnconline.com</p>
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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)

**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



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

MANUFACTURER INFORMATION: <b>Prototron Circuits, Inc.</b> 3760 East 43rd Place, Tucson, AZ, 58713 US		CAGE Code: 66108 Phone: 520-745-8515 Fax: 520-747-8334 EMail:
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
Qualification Letters: VQE-17-030991  
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: .112"  
Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
Aspect Ratio: 10:1 Through-Hole  
Min. Conductor Width/Space: .005"/.005"  
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

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

<p>MANUFACTURER INFORMATION: <b>Sanmina (Costa Mesa)</b> 2945 Airway Avenue, Costa Mesa, CA, 92626 US</p>		<p>CAGE Code: 3BKL5 Phone: 714-371-2800 Fax: 714-371-2833 EMail: joann.medina@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-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>E-Mail:</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: VQ(VQE-18-031913)  
 Composition: S - Homogenous thermosetting base material printed boards  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 21" x 27"  
 Max. Number of Layers: 20  
 Max. Board Thickness: .221"  
 Min. Hole Size: .0157" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14.1:1 Through-Hole  
 Min. Conductor Width/Space: .00735"/.004"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, IR Reflow of Plated Sn/Pb, ImmAg, ImmAu, OSP  
 Additional Fab Capabilities: Blind Vias  
 Controlled Impedance: Differential, Single-Ended

**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, ImmAu, 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, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, ImmAu, 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>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>E-Mail:</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-16-030024  
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin  
 Max. Panel Size: 21" x 27"  
 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, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, ImmAu, OSP  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-18-031913)  
 Composition: M - Mixed based material printed boards  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant; GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 21" x 27"  
 Max. Number of Layers: 24  
 Max. Board Thickness: .111"  
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14.1:1 Through-Hole  
 Min. Conductor Width/Space: .003"/.0025"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Carbon-based  
 Hole Fill/Via Plug: Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, ImmAu, OSP  
 Additional Fab Capabilities: Blind Vias  
 Controlled Impedance: Differential, Single-Ended

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-18-031913)  
 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: 21" x 27"  
 Max. Number of Layers: 28  
 Max. Board Thickness: .227"  
 Min. Hole Size: .0157" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14.5:1 Through-Hole  
 Min. Conductor Width/Space: .0046"/.0035"  
 Hole Preparation: Plasma Desmear  
 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, ImmAg, ImmAu, OSP  
 Additional Fab Capabilities: Blind Vias  
 Controlled Impedance: Differential, Single-Ended

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

<p>MANUFACTURER INFORMATION: <b>Sierra Circuits Inc.</b> 1108 West Evelyn Ave, Sunnyvale, CA, 94086 USA</p>		<p>CAGE Code: 0ZHS4 Phone: (408) 735-7137 Fax: EMail: ScottB@protoexpress.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQ(VQE-18-032408)  
 Composition: H - Homogenous thermoplastic base material printed boards  
 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: .1"  
 Min. Hole Size: .007" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.6:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Periodic Reverse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 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: VQ(VQE-18-032408)  
 Composition: H - Homogenous thermoplastic base material printed boards  
 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: .1"  
 Min. Hole Size: .007" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.6:1 Microvia, 10:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.004"  
 Hole Preparation: Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Periodic Reverse Plate  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: Blind Vias, Foil Lamination  
 Controlled Impedance: Differential, Single-Ended

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

<p>MANUFACTURER INFORMATION: <b>Streamline Circuits</b> 1410 Martin Ave., Santa Clara, CA, 95050</p>		<p>CAGE Code: 3WUY3 Phone: 408-727-1418 Fax: 408-727-8971 EMail: trb@streamlinecircuits.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-17-031750  
 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: .093"  
 Min. Hole Size: .024" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 3.6:1 Through-Hole  
 Min. Conductor Width/Space: .009"/.006"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG  
 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-18-031873  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Flex Base Material: Copper Clad Adhesiveless Polyimide  
 Max. Panel Size: 12" x 18"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .063"  
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 5.02:1 Through-Hole  
 Min. Conductor Width/Space: .008"/.003"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Electrolytic Ni (no Au), HASL  
 Additional Fab Capabilities: Sequential Lamination  
 Flex Usage: Use B (Dynamic Flex)

**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  
 Qualification Letters: VQE-18-031945  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 28  
 Max. Board Thickness: .16"  
 Min. Hole Size: .0225" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 7.2:1 Through-Hole  
 Min. Conductor Width/Space: .004"/.00475"  
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate, Pulse Plate  
 Solder Resist: Liquid Photoimageable  
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination  
 Controlled Impedance: Differential, Single-Ended

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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 (Denver)</b> 10570 Bradford Road, Littleton, CO, 80127-4211 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 75815 Phone: 303-972-4105 Fax: 303-933-2934 EMail:
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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, VQE-17-031662  
 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, .0091" 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, VQE-17-031662  
 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: .15"  
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0091" 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

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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	CAGE Code: 1WQ42 Phone: 714-241-0303 Fax: 714-241-0708 EMail:
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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

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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-17-030872  
 Rigid Base Material: GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant  
 Max. Panel Size: 18.5" x 24.5"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .079"  
 Min. Hole Size: .023" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 2:1 Through-Hole  
 Min. Conductor Width/Space: .02"/.007"  
 Hole Preparation: Plasma Desmear  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 Solder Resist: Liquid Photoimageable  
 Finish System: Hot Oil Reflow of Plated Sn/Pb  
 Additional Fab Capabilities: Foil Lamination

**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)

**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, VQE-17-030871  
 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, Hot Oil Reflow of Plated Sn/Pb  
 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>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-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-17-030872  
 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>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-17-031350  
 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: .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14:1 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, Embedded Resistors, Foil Lamination, Metal Core, 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, VQE-17-031350  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 24" x 36"  
 Max. Number of Layers: 33  
 Max. Board Thickness: .219"  
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 14:1 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 Invar Copper, Embedded Resistors, Foil Lamination, Metal Core, 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, VQE-17-031350  
 Rigid Base Material: AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin  
 Max. Panel Size: 18" x 24"  
 Max. Number of Layers: 12  
 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	CAGE Code: 5L706 Phone: 860-684-5881 Fax: 860-684-7425 EMail:
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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, VQE-17-031350  
 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, Embedded Resistors, Foil Lamination, Metal Core, 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, VQE-17-031350  
 Rigid Base Material: With or without woven or non-woven E-glass, Polytetrafluoroethylene (PTFE) resin, ceramic filler  
 Max. Panel Size: 30" x 36"  
 Max. Number of Layers: 16  
 Max. Board Thickness: .16"  
 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	CAGE Code: 5L706 Phone: 860-684-5881 Fax: 860-684-7425 EMail:
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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, VQE-17-031350  
 Composition: M - Mixed based material printed boards  
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill  
 Max. Panel Size: 30" x 36"  
 Max. Number of Layers: 30  
 Max. Board Thickness: .216"  
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 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, Embedded Resistors, Foil Lamination, Metal Core, 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, VQE-17-031350  
 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 48"  
 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, Embedded Resistors, 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, VQE-17-031350  
 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: 24" x 36"  
 Max. Number of Layers: 11  
 Max. Board Thickness: .082"  
 Min. Hole Size: .0225" 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, 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>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: G1: 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	CAGE Code: 0BSG1 Phone: 714-688-7296 Fax: EMail:
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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: VQE-09-018147, VQE-17-031347, VQE-18-031989  
 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: .007" Laser Ablated Plated Hole Size Before Plating, .009" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 0.6:1 Microvia, 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: Non-Conductive  
 Solder Resist: Liquid Photoimageable  
 Finish System: ENIG, HASL  
 Additional Fab Capabilities: 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-17-030811)  
 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: 4  
 Max. Board Thickness: .044"  
 Min. Hole Size: .035" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 1.08:1 Through-Hole  
 Min. Conductor Width/Space: .015"/.008"  
 Hole Preparation: Plasma Desmear, Plasma Etchback  
 Hole Wall Conductive Coating: Electroless Copper  
 Copper Plating: Direct Current Plate  
 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: 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  
 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>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>EMail:</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, 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-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, 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 - Sterling</b> 1200 Severn Way, Sterling, VA, 20166-8904 US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 0K703 Phone: 703-652-2200 Fax: 703-652-2272 EMail:
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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), VQ(VQE-17-031087)  
 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, Foil Lamination, 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), VQ(VQE-17-031087)  
 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, Foil Lamination, 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	CAGE Code: 3AF82 Phone: 416-208-2100 Fax: 416-208-2196 EMail:
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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: .0069" Laser Ablated Plated Hole Size Before Plating, .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: .0069" Laser Ablated Plated Hole Size Before Plating, .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	CAGE Code: 65745 Phone: 503-359-3593 Fax: 503-357-5332 EMail: 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, VQE-17-030915  
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  
 Max. Panel Size: 21" x 24", " x "  
 Max. Number of Layers: 18  
 Max. Board Thickness: .18"  
 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  
 Hole Fill/Via Plug: Non-Conductive  
 Solder Resist: Dry Film, Liquid Photoimageable  
 Finish System: ENIG, Electrolytic Ni (no Au), Electrolytic Ni / Hard Au, HASL  
 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-13-026434, VQE-14-027109, VQE-17-030915  
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant  
 Max. Panel Size: 21" x 26"  
 Max. Number of Layers: 10  
 Max. Board Thickness: .11"  
 Min. Hole Size: .006" Drilled Plated-Through Hole Before Plating  
 Aspect Ratio: 15:1 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, Electrolytic Ni (no Au), Electrolytic Ni / Hard Au, 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, MI, 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

**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

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

<b>FTG Circuits, Inc. (Chatsworth)</b> 20750 Marilla Street, Chatsworth, CA, 91311 US CAGE Code: 30803	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input checked="" type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input checked="" type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Gorilla Circuits</b> 1445 Old Oakland Rd, San Jose, CA, 95112 US CAGE Code: 3C7D2	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Graphic Plc</b> Lords Meadow Industrial Estate, Crediton, Devon, EX17 IHN UK CAGE Code: U4538	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Hamby Corporation</b> 27704 Avenue Scott, Valencia, CA, 91355-1218 US CAGE Code: 07284	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input checked="" type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input checked="" type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Hans Brockstedt GmbH</b> Clara-Immerwahr-Strabe 7, 24145 Kiel Germany CAGE Code: C4831	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input checked="" type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input checked="" type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Holiday Circuits, Inc.</b> 11126 Bren Road West, Minnetonka, MN, 55343 US CAGE Code: 59554	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Hughes Circuits, Inc.</b> 540 S. Pacific Street, San Marcos, CA, 92078-4056 US CAGE Code: 1KXU6	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>IMI, Inc.</b> 140 Hilldale Avenue, Haverhill, MA, 01832 CAGE Code: 78256	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>ISU Petasys</b> 12930 Bradley St, Symar, CA, 91342 US CAGE Code: 1WFH9	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>ITL Circuits</b> 90 Don Park Road, Markham, L3R 1C4, Ontario, Canada CAGE Code: 38747	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>KCA Electronics, Inc.</b> 223 N. Crescent Way, Anaheim, CA, 92801 US CAGE Code: 1VUH8	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input checked="" type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input checked="" type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Lockheed Martin Mission Systems &amp; Training</b> 1801 State Route 17C, Owego, NY, 13827 US CAGE Code: 03640	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input checked="" type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input checked="" type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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<b>Lone Star Circuits</b> 901 Hensley Drive, Wylie, TX, 75098-4909 US CAGE Code: 04RV5	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input checked="" type="checkbox"/> MIL-PRF-31032/6
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<b>Metaplast Circuits Ltd.</b> 180 Hymus Road, Scarborough, M1L 2E1, Ontario, Canada CAGE Code: 3AD63	<input checked="" type="checkbox"/> MIL-PRF-31032/1 <input type="checkbox"/> MIL-PRF-31032/4 <input type="checkbox"/> Custom <input checked="" type="checkbox"/> MIL-PRF-31032/2 <input type="checkbox"/> MIL-PRF-31032/5 <input type="checkbox"/> MIL-PRF-31032/3 <input type="checkbox"/> MIL-PRF-31032/6
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**SECTION II**  
**LIST OF MANUFACTURERS AND ASSOCIATED SPECIFICATION**

**Micropack Limited**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 , Plot No. 16, Jigani Industrial Area, Anekal Taluk, Bangalore District 560105  
 India  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: SAL28  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

**Prototron Circuits, Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 3760 East 43rd Place, Tucson, AZ, 58713 US  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 66108  MIL-PRF-31032/3  MIL-PRF-31032/6

**Sanmina (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

**Sierra Circuits Inc.**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1108 West Evelyn Ave, Sunnyvale, CA, 94086 USA  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 0ZHS4  MIL-PRF-31032/3  MIL-PRF-31032/6

**Streamline Circuits**  MIL-PRF-31032/1  MIL-PRF-31032/4  Custom  
 1410 Martin Ave., Santa Clara, CA, 95050  MIL-PRF-31032/2  MIL-PRF-31032/5  
 CAGE Code: 3WUY3  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

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

**TTM Technologies (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

**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

**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 - 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