

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

Date: 9/8/2022

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: 614-692-9508, e-mail: vqe.kp@dla.mil

Notes:

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

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

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

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

The following abbreviations are used in this listing:

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

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

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| <p>MANUFACTURER INFORMATION: Accurate Circuit Engineering 3019 S. Kilson Drive, Santa Ana, CA, 92707 USA</p> | <p>PLANT LOCATION: Same Address as Manufacturer</p> | <p>CAGE Code: 0MNN9 Phone: 714-546-2162 Fax: 714-546-8134 EMail: quality@ace-pcb.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2, Custom
 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: 18" x 24"
 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, Ni/Pd/Au
 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**

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| <p>MANUFACTURER INFORMATION: Accurate Engineering Inc.. 8710 Telfair Ave, Sun Valley, CA, 91352 USA</p> | | <p>CAGE Code: 1W538 Phone: 818-768-3919 Fax: 818-768-2771 EMail: harsh@accueng.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-20-035521)
 Composition: H - Homogenous thermoplastic base material printed boards
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 16" x 21"
 Max. Number of Layers: 20
 Max. Board Thickness: .128"
 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 Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL
 Additional Fab Capabilities: Foil Lamination
 Controlled Impedance: Differential, Single-Ended

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-20-035521)
 Composition: H - Homogenous thermoplastic base material printed boards
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
 Max. Panel Size: 16" x 21"
 Max. Number of Layers: 20
 Max. Board Thickness: .128"
 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 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

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|--|--|---|
| MANUFACTURER INFORMATION: Advanced Circuits Minnesota 886 Zachary Lane North, Maple Grove, MN, 55369-4524 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 45032 Phone: 763-315-1719 Fax: 763-425-0999 E-Mail: 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
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 21" 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, 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, 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
 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: .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: VQ (VQE-20-034383), VQE-11-021326, VQE-12-024534
 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: 8
 Max. Board Thickness: .07"
 Min. Hole Size: .0138" 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: Carbon-based
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: 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

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| | | |
|---|--|---|
| MANUFACTURER INFORMATION: Advanced Circuits, Inc. (Chandler) 6615 W. Boreon St., Chandler, AZ, 85266 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 6RJS1 Phone: 480-966-5894 Fax: 480-966-5896 E-Mail: |
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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,
 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: 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,
 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: 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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| | | |
|---|--|---|
| MANUFACTURER INFORMATION: Airborn Flexible Circuits, Inc. 11 Dohme Avenue, Toronto, M4B 1Y7, Ontario Canada | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 38661 Phone: 416-285-3825 Fax: 416-752-6719 E-Mail: 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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|---|--|--|
| MANUFACTURER INFORMATION: All Flex, Inc. 1705 Cannon Lane, Northfield, MN, 55057-3605 USA | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 0ZGB2 Phone: (800) 959-0865 Fax: (844) 274-3970 E-Mail: tbladstad@allflexinc.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQ(VQE-19-033269), VQ(VQE-19-033661)
 Flex Base Material: Copper Clad Polyimide with Acrylic Adhesive
 Max. Panel Size: 12" x 107", 18" x 24"
 Max. Number of Layers: 6
 Max. Board Thickness: .029"
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 2:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Permanganate Desmear, Plasma Desmear
 Hole Wall Conductive Coating: Graphite-based
 Copper Plating: Direct Current Plate
 Solder Resist: Dry Film, Liquid Photoimageable
 Finish System: ENIG, HASL
 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: VQ(VQE-19-033269), VQ(VQE-19-033661)
 Flex Base Material: Copper Clad Adhesiveless Polyimide
 Max. Panel Size: 12" x 54", 18" x 24"
 Max. Number of Layers: 6
 Max. Board Thickness: .029"
 Min. Hole Size: .0118" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 2:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Permanganate Desmear, Plasma Desmear
 Hole Wall Conductive Coating: Graphite-based
 Copper Plating: Direct Current Plate
 Solder Resist: Dry Film, Liquid Photoimageable
 Finish System: ENIG, HASL
 Flex Usage: Use A (Flex During Installation)

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| MANUFACTURER INFORMATION: American Standard Circuits 475 Indueaial Drive, West Chicago, IL, 60185 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 4AA34 Phone: 603-639-5444 Fax: 603-293-1240 EMail: 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: 20
 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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| <p>MANUFACTURER INFORMATION: American Standard Circuits 475 Indueaial 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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|---|--|--|
| <p>MANUFACTURER INFORMATION: Amitron Corporation 2001 Landmeier Road, Elk Grove Village, IL, 60007 USA</p> | | <p>CAGE Code: 1LHP6 Phone: 847-290-9800 Fax: 847-290-9823 EMail: kammrad@amitroncorp.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-19-033935
 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: 18
 Max. Board Thickness: .08"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Permanganate Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Graphite-based
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Liquid Photoimageable, Silk Screen
 Finish System: ENIG, HASL
 Additional Fab Capabilities: Blind Vias, Foil Lamination
 Controlled Impedance: Differential, Single-Ended

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| MANUFACTURER INFORMATION: Amphenol Printed Circuits 91 Northeastern Boulevard, Nashua, NH, 03062 US | PLANT LOCATION: 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-20-035416, 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, Ni/Pd/Au
 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-20-035416, 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, Ni/Pd/Au
 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, VQE-19-033889, VQE-20-035416
 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: .04" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 2.6:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Plasma Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Pulse Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: 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, Ni/Pd/Au
 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

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| MANUFACTURER INFORMATION: Amphenol Printed Circuits 91 Northeastern Boulevard, Nashua, NH, 03062 US | PLANT LOCATION: 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-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-10-019533, VQE-12-023765, VQE-15-029690
 Composition: S - Homogenous thermosetting base material printed boards
 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, VQE-20-035416
 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; 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: .0197" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1 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, Ni/Pd/Au
 Additional Fab Capabilities: Foil Lamination, Press Fit Mounting, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended
 Flex Usage: Use A (Flex During Installation)

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: Calumet Electronics Corp. 25830 Depot Street, Calumet, MI, 49913-1985 US | PLANT LOCATION: 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: VQ(VQE-19-033358), VQE 12 023734, VQE-03-4657, VQE-04-6280, VQE-14-027692, VQE-17-030995, VQE-18-032747, VQE-18-033030
 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: Carbon-based, 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, Electrolytic Ni / Soft Au, HASL, ImmAg
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Press Fit Mounting, Sequential Lamination

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-19-033358), VQE 12 023734, VQE-03-4657, VQE-04-6280, VQE-13-026419, VQE-17-030995, VQE-18-032747
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 21" x 24"
 Max. Number of Layers: 24
 Max. Board Thickness: .125"
 Min. Hole Size: .0079" 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
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, ImmAg
 Additional Fab Capabilities: Foil Lamination
 Controlled Impedance: Differential, Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: CIMULEC , Z.I. Les Jonquieres, 57365 ENNERY France | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: FB1Y2 Phone: (33) 3 87 73 63 19 Fax: E-Mail: sketterer@cimulecgroup.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQ (VQE-20-035497)
 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: 20
 Max. Board Thickness: .157"
 Min. Hole Size: .019" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1 Through-Hole
 Min. Conductor Width/Space: .003"/.003"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG
 Additional Fab Capabilities: Foil Lamination
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ (VQE-20-034642)
 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: 20
 Max. Board Thickness: .157"
 Min. Hole Size: .019" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1 Through-Hole
 Min. Conductor Width/Space: .003"/.003"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG
 Additional Fab Capabilities: Foil Lamination

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ (VQE 20 035170)
 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: 20
 Max. Board Thickness: .157"
 Min. Hole Size: .019" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1 Through-Hole
 Min. Conductor Width/Space: .003"/.003"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG
 Additional Fab Capabilities: Foil Lamination

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

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| <p>MANUFACTURER INFORMATION: Circuit-Tech, Inc. 399 Denison Street, Markham, ON, L3R 1B7 Canada</p> | <p>PLANT LOCATION: Same Address as Manufacturer</p> | <p>CAGE Code: L4387 Phone: 905-474-9227 Fax: 416 497-4953 EMail: sales@circuittech.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-19-033355
 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: 18
 Max. Board Thickness: .125"
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 12:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.0035"
 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: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-08-016602, VQE-14-028536, VQE-18-032748, VQE-19-034045
 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: 22
 Max. Board Thickness: .185"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 14.2:1 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 / Hard Au, 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-08-016602, VQE-14-028536, VQE-18-032748, VQE-19-034045
 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: 22
 Max. Board Thickness: .185"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 14.2:1 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 / Hard Au, 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-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-07-014176, VQE-15-029356, VQE-19-033333, VQE-19-034045
 Composition: S - Homogenous thermosetting base material printed boards
 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: .016" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 3.5:1 Through-Hole
 Min. Conductor Width/Space: .0058"/.01"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg, Ni/Pd/Au
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-08-016602, VQE-14-028536, VQE-19-033333, VQE-19-034045
 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; 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: 8.3:1 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
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg, Ni/Pd/Au
 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**

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| MANUFACTURER INFORMATION: Cirtech, Inc. 250 E. Emerson Ave., Orange, CA, 92865-3303 | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 8K616 Phone: 714-921-0860 Fax: E-Mail: dennisw@apctinc.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE 19 033331)
 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: 16
 Max. Board Thickness: .125"
 Min. Hole Size: .016"
 Aspect Ratio: 8:1 Through-Hole
 Min. Conductor Width/Space: .008"/.006"
 Hole Preparation: Plasma Desmear
 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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQ (VQE-19-033575)
 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: 12
 Max. Board Thickness: .08"
 Min. Hole Size: .0098" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8.5:1 Through-Hole
 Min. Conductor Width/Space: .005"/.006"
 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
 Flex Usage: Use A (Flex During Installation)

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ (VQE-19-033573), VQ (VQE-19-034352)
 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: 14
 Max. Board Thickness: .1"
 Min. Hole Size: .011" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 9:1 Through-Hole
 Min. Conductor Width/Space: .006"/.006"
 Hole Preparation: Plasma Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Foil Lamination

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: Compunetics Inc. 700 Seco Rd, Monroeville, PA, 15146 US | PLANT LOCATION: 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, 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-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, ImmAg
 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)

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: Electro Plate Circuitry, Inc. 1430 Century Drive, Carrollton, TX, 75006 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 79616 Phone: 972-466-0818 Fax: 972-466-9078 E-Mail: jim@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: 10
 Max. Board Thickness: .12"
 Min. Hole Size: .012" 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: 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 12"
 Max. Number of Layers: 6
 Max. Board Thickness: .18"
 Min. Hole Size: .039" 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

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| MANUFACTURER INFORMATION: Firan Technology Group 250 Finchdene Square, Scarborough, M1X 1A5, Ontario, Canada | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: L2665 Phone: 416-299-4000 Fax: 416-292-4308 E-Mail: 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**

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| MANUFACTURER INFORMATION: Firan Technology Group 250 Finchdene Square, Scarborough, M1X 1A5, Ontario, Canada | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: L2665 Phone: 416-299-4000 Fax: 416-292-4308 E-Mail: 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, VQE-21-036160
 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: .073"
 Min. Hole Size: .008" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 9:1
 Min. Conductor Width/Space: .004"/.004"
 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, Hot Oil Reflow of Plated Sn/Pb, ImmAg
 Flex Usage: Use A (Flex During Installation)

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION:</p> <p>Flexible Circuits Inc. 222 Valley Rd, Warrington, PA, 18976 US</p> | | <p>CAGE Code: 22928 Phone: 215-343-2300 Fax: EMail:</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQ(VQE-21-035706)
 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: 8
 Max. Board Thickness: .07"
 Min. Hole Size: .031" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 3:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 Hole Preparation: Plasma Etchback
 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

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| MANUFACTURER INFORMATION: FTG Circuits Fredericksburg Inc. 1026 Warrenton Road, Fredericksburg, VA, 22406-6200 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 6T499 Phone: 540-753-5511, x177 Fax: 540-752-2109 E-Mail: quality@colonialcircuits.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-21-035719), VQE-04-6002
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 14
 Max. Board Thickness: .088"
 Min. Hole Size: .021" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 4.2:1 Through-Hole
 Min. Conductor Width/Space: .006"/.005"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Carbon-based
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL, 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: VQ(VQE-21-035719), VQE-04-6002, VQE-20-034719
 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: .127"
 Min. Hole Size: .015"
 Aspect Ratio: 8.5:1 Through-Hole
 Min. Conductor Width/Space: .005"/.004"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Carbon-based
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Foil Lamination

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: Carbon-based
 Copper Plating: Direct Current Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL
 Flex Usage: Use A (Flex During Installation),

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION: FTG Circuits, Inc. - Chatsworth 20750 Marilla Street, Chatsworth,, CA, 91311 US</p> | | <p>CAGE Code: 30803 Phone: 818-407-4024 Fax: 818-407-4034 EMail: info@ftgcorp.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-19-033705
 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: 20
 Max. Board Thickness: .165"
 Min. Hole Size: .016" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8.9:1 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: 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, 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-19-033708
 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; 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: .18"
 Min. Hole Size: .0197" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 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
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni / Soft Au, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au
 Controlled Impedance: Differential, Single-Ended
 Flex Usage: Use A (Flex During Installation)

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-19-033709
 Composition: M - Mixed based material printed boards
 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)

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION: FTG Circuits, Inc. - Chatsworth 20750 Marilla Street, Chatsworth,, CA, 91311 US</p> | | <p>CAGE Code: 30803 Phone: 818-407-4024 Fax: 818-407-4034 EMail: info@ftgcorp.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-19-033706
 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: 32
 Max. Board Thickness: .201"
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 11.3:1 Through-Hole, 1:1 Microvia
 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: 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, 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-19-033707
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 16
 Max. Board Thickness: .095"
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 12:1 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: 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: Foil Lamination
 Controlled Impedance: Differential, Single-Ended

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION: Gorilla Circuits 1445 Old Oakland Rd, San Jose, CA, 95112 US</p> | <p>PLANT LOCATION: Same Address as Manufacturer</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, 18-032591
 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: 10:1 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

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

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| MANUFACTURER INFORMATION: Holiday Circuits, Inc. 11126 Bren Road West, Minnetonka, MN, 55343 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 59554 Phone: 952-988-8059 Fax: EMail: MarwanR@Holiday.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), VQ(VQE-18-032982), VQ(VQE-19-033858)
 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: .136"
 Min. Hole Size: .007" Laser Ablated Plated Hole Size Before Plating, .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 0.56:1 Microvia, 6.75:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.0045"
 Hole Preparation: Permanganate Desmear, Plasma Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Pulse Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Dry Film, Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-15-028707), VQ(VQE-18-032982), VQ(VQE-19-033858)
 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: .122"
 Min. Hole Size: .014" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 6.66:1 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, Electrolytic Ni / Hard Au, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION:</p> <p>HT Pho-tronics 8701 W Bradley Rd, Milwaukee, WI, 53224 US</p> | | <p>CAGE Code: 79243 Phone: 414-355-5300 Fax: 414-355-0593 EMail: tim.hudson@htgpcb.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-21-035563)
 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: 14
 Max. Board Thickness: .102"
 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, Permanganate 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

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-07-014018), VQ(VQE-14-028093), VQE-12-24783
 Rigid Base Material: 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

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: IMI, Inc. 140 Hilldale Avenue, Haverhill, MA, 01832 | | CAGE Code: 78259 Phone: 978-373-9190 Fax: 978-521-1846 EMail: elaine@imipcb.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
Qualification Letters: VQ(VQE-17-031308)
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
Max. Panel Size: 16" x 18"
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**

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| <p>MANUFACTURER INFORMATION: ISU Petasys 12930 Bradley St, Sylmar, 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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-19-033897)
 Rigid Base Material: AF: Aramid Fabric, Woven, Majority Polyfunctional Epoxy Resin
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 10
 Max. Board Thickness: .076"
 Min. Hole Size: .02" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 3.8:1 Through-Hole
 Min. Conductor Width/Space: .008"/.007"
 Hole Preparation: 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

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-31032/1, 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: .132"
 Min. Hole Size: .008" Laser Ablated Plated Hole Size Before Plating, .01" 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

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: KCA Electronics, Inc. 223 N. Crescent Way, Anaheim, CA, 92801 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 1VUH8 Phone: 714-239-2433 Fax: 714-239-2455 EMail: |
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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: Conductive, Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: HASL

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: Lockheed Martin Rotary Mission Systems 1801 State Route 17C, Owego, NY, 13827 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 03640 Phone: 607-751-5395 Fax: 607-751-7714 E-Mail: |
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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-18-032427, 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

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-18-032427
 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)

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

| | | |
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| <p>MANUFACTURER INFORMATION: Lockheed Martin Rotary Mission Systems 1801 State Route 17C, Owego, NY, 13827 US</p> | <p>PLANT LOCATION: Same Address as Manufacturer</p> | <p>CAGE Code: 03640 Phone: 607-751-5395 Fax: 607-751-7714 EMail:</p> |
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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, VQE-15-029562, VQE-18-032427
 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**

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

Specification: MIL-PRF-31032/6
 Qualification Letters: VQ(VQE-15-029714), VQE-11-021947
 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: 9" x 16", 18" x 24"
 Max. Number of Layers: 2, 2
 Max. Board Thickness: .031", .098"
 Min. Hole Size: .031", .039" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 1:1 Through-Hole, 3.2:1
 Min. Conductor Width/Space: .013"/.005", .19"/.005"
 Hole Preparation: Sodium Treatment, Sodium Treatment
 Hole Wall Conductive Coating: Electroless Copper, Electroless Copper
 Copper Plating: Direct Current Plate, Direct Current Plate
 Solder Resist: Liquid Photoimageable, 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-31032/1, 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: 6
 Max. Board Thickness: .074"
 Min. Hole Size: .031" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 2:1 Through-Hole
 Min. Conductor Width/Space: .01"/.014"
 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

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER INFORMATION:

Mass Design, Inc.
41 Simon St., Nashua, NH, 03060

CAGE Code: 35ZD0
Phone: (603) 886-6460
Fax: (603) 886-1208
EMail: info@massdesign.com

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
Qualification Letters: VQ(VQE-20-034397)
Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
Max. Panel Size: 18" x 24"
Max. Number of Layers: 6
Max. Board Thickness: .062"
Min. Hole Size: .015" Drilled Plated-Through Hole Before Plating
Aspect Ratio: 10:1 Through-Hole
Min. Conductor Width/Space: .008"/.007"
Hole Preparation: Permanganate Desmear
Hole Wall Conductive Coating: Palladium-based
Copper Plating: Direct Current 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

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| <p>MANUFACTURER INFORMATION:</p> <p>Metaplast Circuits Ltd. 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**

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| MANUFACTURER INFORMATION: Micropack Limited , Plot No. 16, Jigani Industrial Area, Anekal Taluk, Bangalore District 560105 India | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 0436Y Phone: 91-80-27825223 Fax: 91-80-27825225 E-Mail: 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: 21" x 24"
 Max. Number of Layers: 26
 Max. Board Thickness: .12"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 11.92:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.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
 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: 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
 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: 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

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| <p>MANUFACTURER INFORMATION: Micropack Limited , Plot No. 16, Jigani Industrial Area, Anekal Taluk, Bangalore District 560105 India</p> | <p>PLANT LOCATION: Same Address as Manufacturer</p> | <p>CAGE Code: 0436Y Phone: 91-80-27825223 Fax: 91-80-27825225 EMail: process@micropack.in</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/5
Qualification Letters: VQ (VQE-20-035093)
Composition: 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: 20
Max. Board Thickness: .1366"
Min. Hole Size: .00984" Drilled Plated-Through Hole Before Plating
Aspect Ratio: 13.9:1 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
Solder Resist: Liquid Photoimageable
Finish System: ENIG, HASL
Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination

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

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| <p>MANUFACTURER INFORMATION: Midwest Printed Circuit Services 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

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

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| <p>MANUFACTURER INFORMATION: Multicircuits Inc. 2301 Universal St, Oshkosh, WI, 54904</p> | | <p>CAGE Code: 1BQS8 Phone: 920-385-7537 Fax: EMail: cgauthier@multicircuits.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-19-033227)
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 21" x 24"
 Max. Number of Layers: 16
 Max. Board Thickness: .127"
 Min. Hole Size: .0079" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 9:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.003"
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, 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 / 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-19-033870)
 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: 16
 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: .003"/.003"
 Hole Preparation: Permanganate Desmear, Permanganate Etchback, 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 / 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

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| <p>MANUFACTURER INFORMATION:</p> <p>Multilayer Technology 3835 West Conflans Road, Irving, TX, 75061</p> | | <p>CAGE Code: 0JKV9 Phone: 972-790-0062 Fax: EMail: rick@multilayer.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE(VQ-20-034746)
 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: 16
 Max. Board Thickness: .102"
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 11.625:1 Through-Hole, 1:1 Microvia
 Min. Conductor Width/Space: .00325"/.0049"
 Hole Preparation: Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-20-034846
 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: .103"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 9.4:1 Through-Hole
 Min. Conductor Width/Space: .0045"/.0045"
 Hole Preparation: 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-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

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| <p>MANUFACTURER INFORMATION: Pioneer Circuits, Inc. 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@pioneer-circuits.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
 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: 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
 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: 20
 Max. Board Thickness: .275"
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 11:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.0035"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Periodic Reverse Plate
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Dry Film, Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

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

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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

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

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

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| <p>MANUFACTURER INFORMATION: Pioneer Circuits, Inc. 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@pioneer-circuits.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

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

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

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| <p>MANUFACTURER INFORMATION: Pioneer Circuits, Inc. 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@pioneer-circuits.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
 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: 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
 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: 20
 Max. Board Thickness: .275"
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 11:1 Through-Hole
 Min. Conductor Width/Space: .0035"/.0035"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Periodic Reverse Plate
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Dry Film, Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

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

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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

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

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

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

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION: Pro-Tech Interconnect Solutions LLC 4300 Peavey Road, Chaska, MN, 55318 US</p> | | <p>CAGE Code: 3CP65 Phone: 952-442-2189 Fax: 952-442-2472 EMail: stum@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, VQE-19-033101
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
 Max. Panel Size: 12" x 24"
 Max. Number of Layers: 16 ,
 Max. Board Thickness: .1"
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0079" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 1.8:1 Microvia, 12:1 Through-Hole
 Min. Conductor Width/Space: .005"/.003"
 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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-11-021704, VQE-16-030058, VQE-19-033101
 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: .005" Laser Ablated Plated Hole Size Before Plating, .0059" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 15:1 Through-Hole, 1:1 Microvia
 Min. Conductor Width/Space: .003"/.002"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Carbon-based
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, Electrolytic Ni / Hard Au, HASL, ImmAg, OSP
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

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

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| <p>MANUFACTURER INFORMATION: Prototron Circuits, Inc. 3760 East 43rd Place, Tucson, AZ, 58713 US</p> | | <p>CAGE Code: 66108 Phone: 520-745-8515 Fax: 520-747-8334 EMail:</p> |
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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

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| MANUFACTURER INFORMATION: Sanmina (Costa Mesa) 2945 Airway Avenue, Costa Mesa, CA, 92626 US | | CAGE Code: 3BKL5 Phone: 714-371-2800 Fax: 714-371-2833 EMail: terry.lichte@sanmina.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-19-033984)
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 6
 Max. Board Thickness: .12"
 Min. Hole Size: .0159"
 Aspect Ratio: 7.59
 Min. Conductor Width/Space: .005"/.005"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ImmAu

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: .008"/.008"
 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, 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: VQ(VQE-19-033984), 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: .008"/.008"
 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
 Additional Fab Capabilities: Foil Lamination
 Controlled Impedance: Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: Sanmina-SCI (San Jose) 2050 Bering Drive, San Jose, CA, 95131 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 3DR67 Phone: 408-964-6515 Fax: 408-964-6453 E-Mail: 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), VQ(VQE-19-033467)
 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, Ni/Pd/Au
 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: 8
 Max. Board Thickness: .062"
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 6.32:1 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, Ni/Pd/Au
 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: 21" x 27"
 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, 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**

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| MANUFACTURER INFORMATION: Sanmina-SCI (San Jose) 2050 Bering Drive, San Jose, CA, 95131 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 3DR67 Phone: 408-964-6515 Fax: 408-964-6453 EMail: 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: 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
 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, Ni/Pd/Au
 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, Ni/Pd/Au
 Additional Fab Capabilities: Blind Vias
 Controlled Impedance: Differential, Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

| | | |
|---|--|---|
| <p>MANUFACTURER INFORMATION: Sierra Circuits Inc. 1108 West Evelyn Ave, Sunnyvale, CA, 94086 USA</p> | | <p>CAGE Code: 0ZHS4 Phone: 800-763-7503 Fax: 408-735-0175 EMail: estrelitam@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: 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: 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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-22-037319
 Composition: H - Homogenous thermoplastic 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 Polyimide with Acrylic Adhesive
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 2
 Max. Board Thickness: .12"
 Min. Hole Size: .0079"
 Aspect Ratio: 12:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Pulse Plate
 Solder Resist: Dry Film
 Finish System: ENIG, HASL
 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

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|---|--|---|
| <p>MANUFACTURER INFORMATION: Sierra Circuits Inc. 1108 West Evelyn Ave, Sunnyvale, CA, 94086 USA</p> | | <p>CAGE Code: 0ZHS4 Phone: 800-763-7503 Fax: 408-735-0175 EMail: estrelitam@protoexpress.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-22-037319
 Composition: H - Homogenous thermoplastic 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: 18" x 24"
 Max. Number of Layers: 2
 Max. Board Thickness: .12"
 Min. Hole Size: .0079"
 Aspect Ratio: 12:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Pulse Plate
 Solder Resist: Dry Film
 Finish System: ENIG, HASL
 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**

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| MANUFACTURER INFORMATION: Sierra Electrotek LLC 7745 S. 10th Street, Oak Creek, WI, 53154 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 66030 Phone: 414-762-1390 Fax: 414-762-1510 EMail: 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, VQ(VQE-19-033298), VQ(VQE-19-033627)
 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: .0098" 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), VQ(VQE-19-033298)
 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

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| <p>MANUFACTURER INFORMATION: Streamline Circuits 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: 6
 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: .013"/.01"
 Hole Preparation: Permanganate Desmear, Plasma Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, 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-18-031945
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 6
 Max. Board Thickness: .062"
 Min. Hole Size: .0079" 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
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Pulse Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL
 Additional Fab Capabilities: Foil Lamination
 Controlled Impedance: Single-Ended

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| <p>MANUFACTURER INFORMATION: Summit Interconnect Toronto 90 Don Park Road, Markham, L3R 1C4, Ontario, Canada</p> | <p>PLANT LOCATION: Same Address as Manufacturer</p> | <p>CAGE Code: 38747 Phone: 905-475-6658 Fax: 905-475-5097 EMail: sales@itlcircuits.com</p> |
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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: .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 5.7:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 Hole Preparation: Permanganate 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

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-18-032695
 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: .08"
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 6.7:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-14-028079, VQE-19-034061
 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: 12
 Max. Board Thickness: .1"
 Min. Hole Size: .014" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 5.7:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Dry Film
 Finish System: HASL
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-14-028079, VQE-19-034062
 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: 12
 Max. Board Thickness: .1"
 Min. Hole Size: .014" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 5.7:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Permanganate Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Dry Film
 Finish System: HASL
 Additional Fab Capabilities: Blind Vias, Foil Lamination, Sequential Lamination

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

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| MANUFACTURER INFORMATION: TTM Technologies Toronto, Inc. 8150 Sheppard Avenue East, Scarborough, M1B 5K2, Ontario Canada | PLANT LOCATION: 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

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Anaheim) 3140 East Coronado Street, Anaheim, CA, 92806 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 0BSG1 Phone: 714-688-7382 Fax: E-Mail: |
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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: LDI, Liquid Photoimageable
 Finish System: ENIG, HASL, Ni/Pd/Au
 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: LDI, Liquid Photoimageable
 Finish System: ENIG, HASL, Ni/Pd/Au
 Additional Fab Capabilities: Buried Vias, Foil Lamination
 Controlled Impedance: Differential, Single-Ended

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LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Forest Grove) 1521 Poplar Lane, Forest Grove, OR, 97116-2033 | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 01KV9 Phone: (503) 992-4336 Fax: E-Mail: alan.preston@ttmtech.com |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE 19-033918), VQ(VQE-19-033180)
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 21" x 24"
 Max. Number of Layers: 31
 Max. Board Thickness: .156"
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 0.84:1 Microvia, 11.9:1 Through-Hole
 Min. Conductor Width/Space: .0032"/.0025"
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Pulse Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Dry Film, LDI, 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: VQ(VQE 19-033919), VQ(VQE-19-033181)
 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: 18
 Max. Board Thickness: .099"
 Min. Hole Size: .005" Laser Ablated Plated Hole Size Before Plating, .0098" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 0.84:1 Microvia, 8.4:1 Through-Hole
 Min. Conductor Width/Space: .0032"/.004"
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Pulse Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Dry Film, LDI, 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-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQ(VQE20-034650)
 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: 16
 Max. Board Thickness: .11"
 Min. Hole Size: .0138" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 8:1 Through-Hole
 Min. Conductor Width/Space: .012"/.005"
 Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Pulse Plate
 Solder Resist: LDI
 Finish System: ENIG
 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

| | | |
|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (North Jackson) 12080 DeBartolo Drive, North Jackson, OH, 44451 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 0GN71 Phone: 330-538-3900 Fax: 330-538-3820 E-Mail: |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/2
 Qualification Letters: VQE-18-032965
 Rigid Base Material: Woven Glass Reinforced, Hydrocarbon Resin with Ceramic Fill
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 2
 Max. Board Thickness: .117" (with Bonded Copper Backer)
 Min. Hole Size: .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 4.1:1 Through-Hole
 Min. Conductor Width/Space: .0152"/.009"
 Hole Preparation: Permanganate Desmear, Plasma Desmear
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG
 Additional Fab Capabilities: Metal Core

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/3, MIL-PRF-31032/4
 Qualification Letters: 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: VQE-03-003121, VQE-03-003214, VQE-07-012925, VQE-10-020405, VQE-19-033261
 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 (no Au), Electrolytic Ni/Au, HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, Ni/Pd/Au, OSP
 Additional Fab Capabilities: Blind Vias, Buried Vias, Foil Lamination, Metal Core, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

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

| | | |
|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (North Jackson) 12080 DeBartolo Drive, North Jackson, OH, 44451 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 0GN71 Phone: 330-538-3900 Fax: 330-538-3820 E-Mail: |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-03-003121, VQE-03-003214, VQE-07-012925, VQE-10-020405, VQE-19-033261
 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: .0075" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 0.53:1 Microvia, 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 (no Au), HASL, Hot Oil Reflow of Plated Sn/Pb, ImmAg, Ni/Pd/Au, 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-31032/3, MIL-PRF-31032/4
 Qualification Letters: VQE-03-003121, VQE-03-003214, VQE-07-012925, VQE-10-020405, VQE-19-033261
 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: .0075" Laser Ablated Plated Hole Size Before Plating, .008" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 0.53:1 Microvia, 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 (no Au), Electrolytic Ni/Au, 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
 Flex Usage: Use A (Flex During Installation), Use B (Dynamic Flex)

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

| | | |
|--|--|--|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Santa Ana) 2630 South Harbor Boulevard, Santa Ana, CA, 92704 US | PLANT LOCATION: 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, VQE-20-035011
 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, 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-05-008644, VQE-06-011211, VQE-12-023569, VQE-16-030524, VQE-20-035011
 Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant
 Max. Panel Size: 21" x 24"
 Max. Number of Layers: 30
 Max. Board Thickness: .125"
 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, Ni/Pd/Au
 Additional Fab Capabilities: Blind Vias, Buried Vias, Sequential Lamination
 Controlled Impedance: Differential, Single-Ended

SECTION I
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-17-030872, VQE-18-032677,
 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, VQE-18-032677
 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, VQE-18-032677
 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

| | | |
|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Santa Clara) 407 Mathew Street, Santa Clara, CA, 95050 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 65916 Phone: 408-486-3184 Fax: 408-727-1003 E-Mail: |
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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, VQE-18-032677, VQE-18-032893
 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: 18.5" x 24.5"
 Max. Number of Layers: 20
 Max. Board Thickness: .17"
 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, VQE-18-032677
 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: .0118" 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, VQE-18-032677
 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: .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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQE-03-003888, VQE-10-020500, VQE-10-020581, VQE-11-022973, VQE-14-028240, VQE-14-028262, VQE-16-030610, VQE-18-032677
 Rigid Base Material: BI: Aramid Fabric, Nonwoven, Polyimide Resin
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 14
 Max. Board Thickness: .182"
 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, VQE-18-032677
 Rigid Base Material: BF: Aramid Fabric, Nonwoven, Epoxy Resin
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 14
 Max. Board Thickness: .135"
 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

| | | |
|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Stafford) 4 Old Monson Road, Stafford, CT, 06075 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 5L706 Phone: 860-684-5881 Fax: 860-684-7425 E-Mail: |
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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

| | | |
|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Stafford) 4 Old Monson Road, Stafford, CT, 06075 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 5L706 Phone: 860-684-5881 Fax: 860-684-7425 E-Mail: |
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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**

| | | |
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| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Stafford) 4 Old Monson Road, Stafford, CT, 06075 US | PLANT LOCATION: 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

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|---|--|---|
| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Stafford) 4 Old Monson Road, Stafford, CT, 06075 US | PLANT LOCATION: Same Address as Manufacturer | CAGE Code: 5L706 Phone: 860-684-5881 Fax: 860-684-7425 E-Mail: |
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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, VQE-21-036251
 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: 24" x 36"
 Max. Number of Layers: 4
 Max. Board Thickness: .05"
 Min. Hole Size: .035" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 1.4:1 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

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| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Sterling) 1200 Severn Way, Sterling, VA, 20166-8904 US | PLANT LOCATION: 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-21-035999)
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: PPE/Woven Glass
 Max. Panel Size: 18" x 24"
 Max. Number of Layers: 12
 Max. Board Thickness: .0619"
 Min. Hole Size: .0079"
 Aspect Ratio: 7.8:1 Through-Hole
 Min. Conductor Width/Space: .004"/.0042"
 Hole Preparation: 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 (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, Foil Lamination
 Controlled Impedance: 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), VQ(VQE-20-034480)
 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: .192"
 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

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

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| MANUFACTURER INFORMATION: TTM Technologies, Inc. (Sterling) 1200 Severn Way, Sterling, VA, 20166-8904 US | PLANT LOCATION: 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-11-021244), VQ(VQE-14-028500), VQ(VQE-15-028809), VQ(VQE-20-034478), VQ(VQE-21-035999)
 Composition: H - Homogenous thermoplastic base material printed boards, H - Homogenous thermoplastic base material printed boards
 Rigid Base Material: Woven glass, reinforced, hydrocarbon resin, with ceramic fill
 Max. Panel Size: 12" x 24", 18" x 24"
 Max. Number of Layers: 12, 12
 Max. Board Thickness: .0169", .0877"
 Min. Hole Size: .0079", .01" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 7.8:1 Through-Hole, 8.2:1 Through-Hole
 Min. Conductor Width/Space: .004"/.0042", .004"/.003"
 Hole Preparation: Plasma Desmear, Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper, Electroless Copper
 Copper Plating: Direct Current Plate, Direct Current Plate, Pulse Plate
 Hole Fill/Via Plug: Non-Conductive
 Solder Resist: Liquid Photoimageable, Liquid Photoimageable
 Finish System: ENIG, ENIG, Electrolytic Ni (no Au), Electrolytic Ni / Hard Au, Electrolytic Ni / Soft Au, HASL, HASL, Hot Oil Reflow of Plated Sn/Pb, Ni/Pd/Au
 Additional Fab Capabilities: Blind Vias
 Controlled Impedance: Differential, Single-Ended, Single-Ended

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

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| MANUFACTURER INFORMATION: Unicircuit, Inc. 8192 Southpark Lane, Littleton, CO, 80120 US | PLANT LOCATION: 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, VQE-22-037175
 Composition: S - Homogenous thermosetting base material printed boards
 Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
 Max. Panel Size: 12" x 18"
 Max. Number of Layers: 16
 Max. Board Thickness: .12"
 Min. Hole Size: .006" Laser Ablated Plated Hole Size Before Plating, .02" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 6:1 Through-Hole
 Min. Conductor Width/Space: .005"/.005"
 Hole Preparation: Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper
 Copper Plating: Direct Current Plate, Pulse Plate
 Hole Fill/Via Plug: Conductive, Non-Conductive
 Solder Resist: Dry Film, 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, VQE-20-034915
 Composition: S - Homogenous thermosetting base material printed boards
 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: .063"
 Min. Hole Size: .015" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 4:1 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: Dry Film, 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

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| <p>MANUFACTURER INFORMATION: US Circuit 2071 Wineridge Place, Escondido, CA, 92029</p> | | <p>CAGE Code: 66483 Phone: 760-489-1413 Fax: EMail: jmcintosh@uscircuit.com</p> |
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CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2
 Qualification Letters: VQ(VQE-19-033743), VQE-20-035360
 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: 10
 Max. Board Thickness: .11"
 Min. Hole Size: .012" Drilled Plated-Through Hole Before Plating
 Aspect Ratio: 9.1:1 Through-Hole
 Min. Conductor Width/Space: .004"/.004"
 Hole Preparation: Plasma Etchback
 Hole Wall Conductive Coating: Electroless Copper, Graphite-based
 Copper Plating: Periodic Reverse 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-19-033744), VQE-20-035305
 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: 10
 Max. Board Thickness: .11"
 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 Etchback
 Hole Wall Conductive Coating: Electroless Copper, Graphite-based
 Copper Plating: Periodic Reverse Plate
 Solder Resist: Liquid Photoimageable
 Finish System: ENIG, HASL

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

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| MANUFACTURER INFORMATION: Westak of Oregon 3941 24th Avenue, Forest Grove, OR, 97116 US | PLANT LOCATION: 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: .008" 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
 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

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

Accurate Engineering Inc.. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 8710 Telfair Ave, Sun Valley, CA, 91352 USA MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 1W538 MIL-PRF-31032/3 MIL-PRF-31032/6

Advanced Circuits Minnesota MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 886 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

Advanced Circuits, Inc. (Chandler) MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 6615 W. Boreon St., Chandler, AZ, 85266 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

All Flex, Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 1705 Cannon Lane, Northfield, MN, 55057-3605 USA MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 0ZGB2 MIL-PRF-31032/3 MIL-PRF-31032/6

American Standard Circuits MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 475 Indueaial 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

Amitron Corporation MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 2001 Landmeier Road, Elk Grove Village, IL, 60007 USA MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 1LHP6 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

CIMULEC MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 , Z.I. Les Jonquieres, 57365 ENNERY France MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: FB1Y2 MIL-PRF-31032/3 MIL-PRF-31032/6

Circuit-Tech, Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 399 Denison Street, Markham, ON, L3R 1B7 Canada MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: L4387 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

Cirtech, Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 250 E. Emerson Ave., Orange, CA, 92865-3303 MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 8K616 MIL-PRF-31032/3 MIL-PRF-31032/6

SECTION II
LIST OF MANUFACTURERS AND ASSOCIATED SPECIFICATION

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

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

Flexible Circuits Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
222 Valley Rd, Warrington, PA, 18976 US MIL-PRF-31032/2 MIL-PRF-31032/5
CAGE Code: 22928 MIL-PRF-31032/3 MIL-PRF-31032/6

FTG Circuits Fredericksburg 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

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

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

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

HT Pho-tronics MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
8701 W Bradley Rd, Milwaukee, WI, 53224 US MIL-PRF-31032/2 MIL-PRF-31032/5
CAGE Code: 79243 MIL-PRF-31032/3 MIL-PRF-31032/6

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

IMI, Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
140 Hilldale Avenue, Haverhill, MA, 01832 MIL-PRF-31032/2 MIL-PRF-31032/5
CAGE Code: 78259 MIL-PRF-31032/3 MIL-PRF-31032/6

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

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

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

SECTION II
LIST OF MANUFACTURERS AND ASSOCIATED SPECIFICATION

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

Mass Design, Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 41 Simon St., Nashua, NH, 03060 MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 35ZD0 MIL-PRF-31032/3 MIL-PRF-31032/6

Metaplast Circuits Ltd. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 180 Hymus Road, Scarborough, M1L 2E1, Ontario, Canada MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 3AD63 MIL-PRF-31032/3 MIL-PRF-31032/6

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: 0436Y 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

Multicircuits Inc. MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 2301 Universal St, Oshkosh, WI, 54904 MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 1BQS8 MIL-PRF-31032/3 MIL-PRF-31032/6

Multilayer Technology MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 3835 West Conflans Road, Irving, TX, 75061 MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 0JKV9 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
 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

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

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 (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

SECTION II
LIST OF MANUFACTURERS AND ASSOCIATED SPECIFICATION

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

Sierra Electrotek LLC 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

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

Summit Interconnect Toronto MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 90 Don Park Road, Markham, L3R 1C4, Ontario, Canada MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 38747 MIL-PRF-31032/3 MIL-PRF-31032/6

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

TTM Technologies 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

TTM Technologies, Inc. (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

TTM Technologies, Inc. (Forest Grove) MIL-PRF-31032/1 MIL-PRF-31032/4 Custom
 1521 Poplar Lane, Forest Grove, OR, 97116-2033 MIL-PRF-31032/2 MIL-PRF-31032/5
 CAGE Code: 01KV9 MIL-PRF-31032/3 MIL-PRF-31032/6

TTM Technologies, Inc. (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

TTM Technologies, Inc. (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, Inc. (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, Inc. (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

TTM Technologies, Inc. (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

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

SECTION II
LIST OF MANUFACTURERS AND ASSOCIATED SPECIFICATION

US Circuit

2071 Wineridge Place, Escondido, CA, 92029

CAGE Code: 66483

MIL-PRF-31032/1 MIL-PRF-31032/4 Custom

MIL-PRF-31032/2 MIL-PRF-31032/5

MIL-PRF-31032/3 MIL-PRF-31032/6

Westak of Oregon

3941 24th Avenue, Forest Grove, OR, 97116 US

CAGE Code: 65745

MIL-PRF-31032/1 MIL-PRF-31032/4 Custom

MIL-PRF-31032/2 MIL-PRF-31032/5

MIL-PRF-31032/3 MIL-PRF-31032/6