

**Specification Details:**

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

**Contact Information:**

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

**Notes:**

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

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

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

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

The following abbreviations are used in this listing:

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

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

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

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

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

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

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

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

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

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

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

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/3, MIL-PRF-31032/4 Panel Size: 18" X 24" ((max)) Max./Min. Board Thickness: .031"/Not Specified Max./Min. Base CU Thickness: 1/" Max./Min. Through Hole Size: ".055" ((drilled)) Aspect Ratio: 0.7:1 ((Through Hole)) Max. Number of Layers: 4 Min. Conductor Width: .005" Min. Conductor Space: .005" Part Mounting: MIX, SM, THM Rigid Base Material: N/A (types 1, 2 & 3 only) Flex Base Material: 4203/1 Acrylic Adhesive Polyimide Coverlayer 4204/1 Acrylic Adhesive Finish System: HASL, Hot Oil Reflow following SnPb plate Hole Preparation: Plasma Desmear, Plasma Etchback Alternate Construction: N/A Copper Plating: Acid Copper Solder Resist: Dru Film Soldermask Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: Use A (Flex to Install), Use B (Dynamic Flex) Hole Wall Conductive Coating: Direct Metallization Max. Base Cu Weight: 1 oz.	VQE-10-019533

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<b>MANUFACTURER INFORMATION:</b> <b>Amphenol Printed Circuits</b> 91 Northeastern Boulevard Nashua, NH 03062, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 57034  <b>Contact:</b> Denise Chevalier <b>Phone:</b> 603-879-3268 <b>Fax:</b> 603-879-2818 <b>E-Mail:</b> denise.chevalier@amphenol-tcs.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/3, MIL-PRF-31032/4 Panel Size: 18" X 24" ((max)) Max./Min. Board Thickness: .125"/Not Specified Max./Min. Base CU Thickness: 1"/" Max./Min. Through Hole Size: ".012" ((drilled)) Aspect Ratio: 7.75:1 ((Through Hole)) Max. Number of Layers: 15 Min. Conductor Width: .006" Min. Conductor Space: .005" Part Mounting: MIX, SM, THM Rigid Base Material: GI: Glass Base, Woven, Polyimide Resin, Heat Resistant Flex Base Material: 4203/1 Acrylic Adhesive Polyimide Coverlayer 4204/11 Adhesiveless Polyimide Finish System: HASL, Hot Oil Reflow following SnPb plate Hole Preparation: Plasma Desmear, Plasma Etchback Alternate Construction: N/A Copper Plating: Acid Copper (DC and Pulse Plate) Solder Resist: N/A Controlled Impedance: Characteristic, Differential, Range 50-100 ohms (+/- 10%) Hole Fill/Via Plug: N/A Flex Usage: Use A (Flex to Install) Hole Wall Conductive Coating: Direct Metallization Max. Base Cu Weight 1 oz.	VQE-10-019533

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<b>MANUFACTURER INFORMATION:</b> <b>Calumet Electronics Corp.</b> 25830 Depot Street Calumet, MI 49913-1985, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65337  <b>Contact:</b> Robert Hall <b>Phone:</b> 906-337-1305 <b>Fax:</b> 906-337-5359 <b>EMail:</b> rhall@cec-up.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-03-4657
Panel Size:	18" X 24"	VQE-04-6280
Max./Min. Board Thickness:	.125"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.125"/.016"	
Aspect Ratio:	8:1 (Through Hole)	
Max. Number of Layers:	10	
Min. Conductor Width:	.006"	
Min. Conductor Space:	.003"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	Au, HASL, Ni	
Hole Preparation:	FR4: Chemical Etchback, Non FR4: Plasma Etchback	
Alternate Construction:	N/A	
Copper Plating:	Electro-deposited Acid Copper	
Solder Resist:	N/A	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	N/A	

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

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



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<b>MANUFACTURER INFORMATION:</b> <b>Cirex International, Inc.</b> 791 Nuttman Street Santa Clara, CA 95054,	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 4MEG7  <b>Contact:</b> Don Angulo <b>Phone:</b> 408-988-3980 <b>Fax:</b> 408-988-4534 <b>E-Mail:</b> dangulo@cirexxintl.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/3 Panel Size: 12" X 18" Max./Min. Board Thickness: .1"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: Not Specified/.01" Aspect Ratio: 10:1 (Through Hole) Max. Number of Layers: 2 Min. Conductor Width: .004" Min. Conductor Space: .004" Part Mounting: MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant Flex Base Material: Acrylic Adhesive Polyimide Copper-Clad Adhesiveless Polyimide Finish System: ENIG, HASL, Ni/Au Hole Preparation: Plasma Desmear Alternate Construction: N/A Copper Plating: Acid Copper Solder Resist: Kapton Covelay Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: Class A Flex-to-Install, Class B Continuous Flex Hole Wall Conductive Coating: N/A	VQE-07-014176	

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

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

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

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<b>MANUFACTURER INFORMATION:</b> <b>Colonial Circuits, Inc.</b> 1026 Warrenton Road Fredericksburg, VA 22406-6200, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 6T499  <b>Contact:</b> Mike Hill <b>Phone:</b> 540-753-5511, x125 <b>Fax:</b> 540-752-2109 <b>E-Mail:</b> quality@colonialcircuits.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-04-6002
Panel Size:	12" X 18"	VQE-06-010192
Max./Min. Board Thickness:	.09"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.139"/.021"	
Aspect Ratio:	4.29:1 (Through Hole)	
Max. Number of Layers:	8	
Min. Conductor Width:	.005"	
Min. Conductor Space:	.005"	
Part Mounting:	PTH, SMT	
Rigid Base Material:	Hydrocarbon Resin with Ceramic Filler Woven E-Glass	
Flex Base Material:	N/A	
Finish System:	Tin/Lead HASL, Tin/Lead Reflow	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	N/A	
Copper Plating:	Electrolytic Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	55 ohms ±10%	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	N/A	

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

<p><b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2</p> <p><b>Panel Size:</b> 18" X 24"</p> <p><b>Max./Min. Board Thickness:</b> .126"/Not Specified</p> <p><b>Max./Min. Base CU Thickness:</b> 1"/Not Specified</p> <p><b>Max./Min. Through Hole Size:</b> .021"/.015"</p> <p><b>Aspect Ratio:</b> 5:1</p> <p><b>Max. Number of Layers:</b> 10</p> <p><b>Min. Conductor Width:</b> .004"</p> <p><b>Min. Conductor Space:</b> .004"</p> <p><b>Part Mounting:</b> MIX, SM, THM</p> <p><b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant</p> <p><b>Flex Base Material:</b> N/A</p> <p><b>Finish System:</b> Fused SnPb, HASL, Selective SnPb Plate</p> <p><b>Hole Preparation:</b> Plasma Desmear, Plasma Etchback</p> <p><b>Alternate Construction:</b> Sequential Lamination for Blind &amp; Buried Vias 8 layer max</p> <p><b>Copper Plating:</b> Acid Copper</p> <p><b>Solder Resist:</b> Dry Film, LPI</p> <p><b>Controlled Impedance:</b> 100/50 ohm ±10%</p> <p><b>Hole Fill/Via Plug:</b> N/A</p> <p><b>Flex Usage:</b> N/A</p> <p><b>Hole Wall Conductive Coating:</b> Electroless Copper</p>	VQE-00-000289 VQE-01-000910 VQE-05-008414 VQE-06-010963
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**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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

<b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-00-000289
<b>Panel Size:</b> 18" X 24"	VQE-01-000910
<b>Max./Min. Board Thickness:</b> .126"/Not Specified	VQE-05-008414
<b>Max./Min. Base CU Thickness:</b> 2"/"	VQE-06-010963
<b>Max./Min. Through Hole Size:</b> .045"/.013"	
<b>Aspect Ratio:</b> 5:1	
<b>Max. Number of Layers:</b> 16	
<b>Min. Conductor Width:</b> .004"	
<b>Min. Conductor Space:</b> .004"	
<b>Part Mounting:</b> MIX, SMT, THM	
<b>Rigid Base Material:</b> GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
<b>Flex Base Material:</b> N/A	
<b>Finish System:</b> Fused SnPb, HASL, Selective SnPb Plate	
<b>Hole Preparation:</b> Plasma Desmear, Plasma Etchback	
<b>Alternate Construction:</b> Sequential Lamination for Blind & Buried Vias 8 layer max	
<b>Copper Plating:</b> Acid Copper	
<b>Solder Resist:</b> N/A	
<b>Controlled Impedance:</b> 100/50 ohms +/- 10%	
<b>Hole Fill/Via Plug:</b> N/A	
<b>Flex Usage:</b> N/A	
<b>Hole Wall Conductive Coating:</b> Electroless Copper	

VQE-00-000289  
 VQE-01-000910  
 VQE-05-008414  
 VQE-06-010963

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

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

Specification:	MIL-PRF-31032/3, MIL-PRF-31032/4
Panel Size:	18" X 24"
Max./Min. Board Thickness:	.126"/Not Specified
Max./Min. Base CU Thickness:	2"/"
Max./Min. Through Hole Size:	.039"/.013"
Aspect Ratio:	10:1
Max. Number of Layers:	11
Min. Conductor Width:	.004"
Min. Conductor Space:	.004"
Part Mounting:	MIX, SM, THM
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
Flex Base Material:	IPC-4204/11 Adhesiveless
Finish System:	HASL
Hole Preparation:	Plasma Desmear, Plasma Etchback
Alternate Construction:	N/A
Copper Plating:	Acid Copper
Solder Resist:	N/A
Controlled Impedance:	N/A
Hole Fill/Via Plug:	N/A
Flex Usage:	N/A
Hole Wall Conductive Coating:	Electroless Copper
Flex Usage	Class A Flex to Install

VQE-01-000909  
 VQE-06-010963

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

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

<b>Specification:</b>	MIL-PRF-31032/3, MIL-PRF-31032/4
<b>Panel Size:</b>	18" X 24"
<b>Max./Min. Board Thickness:</b>	.07"/Not Specified
<b>Max./Min. Base CU Thickness:</b>	1"/Not Specified
<b>Max./Min. Through Hole Size:</b>	Not Specified/.026"
<b>Aspect Ratio:</b>	2.6:1
<b>Max. Number of Layers:</b>	7
<b>Min. Conductor Width:</b>	.004"
<b>Min. Conductor Space:</b>	.004"
<b>Part Mounting:</b>	MIX, SMT, THM
<b>Rigid Base Material:</b>	GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
<b>Flex Base Material:</b>	IPC-4204/1 Acrylic Adhesive
<b>Finish System:</b>	HASL
<b>Hole Preparation:</b>	Plasma Desmear, Plasma Etchback
<b>Alternate Construction:</b>	N/A
<b>Copper Plating:</b>	Acid Copper
<b>Solder Resist:</b>	N/A
<b>Controlled Impedance:</b>	N/A
<b>Hole Fill/Via Plug:</b>	N/A
<b>Flex Usage:</b>	Class A Flex to Install
<b>Hole Wall Conductive Coating:</b>	Electroless Copper
<b>Flex Usage:</b>	Class A Flex to Install

VQE-01-000909  
 VQE-06-010963

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

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

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

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

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

<b>MANUFACTURER INFORMATION:</b> <b>DDI Global Corp. - Anaheim</b> 1220 N. Simon Circle Anaheim, CA 92806, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0BSG1  <b>Contact:</b> Rick Sylvain <b>Phone:</b> 714-688-7371 <b>Fax:</b> <b>EMail:</b> rsylvain@ddiglobal.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
<b>Specification:</b>	MIL-PRF-31032/1, MIL-PRF-31032/2	VQ-09-018147
<b>Panel Size:</b>	N/A	
<b>Max./Min. Board Thickness:</b>	.1"/Not Specified	
<b>Max./Min. Base CU Thickness:</b>	N/A	
<b>Max./Min. Through Hole Size:</b>	.045"/.032" (drilled)	
<b>Aspect Ratio:</b>	3:1	
<b>Max. Number of Layers:</b>	10	
<b>Min. Conductor Width:</b>	.01"	
<b>Min. Conductor Space:</b>	.01"	
<b>Part Mounting:</b>	THM	
<b>Rigid Base Material:</b>	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
<b>Flex Base Material:</b>	N/A	
<b>Finish System:</b>	HASL ENIG	
<b>Hole Preparation:</b>	Plasma Desmear, Plasma Etchback	
<b>Alternate Construction:</b>	Foil Lamination	
<b>Copper Plating:</b>	Electrodeposited Acid Copper, Electroless Acid Copper	
<b>Solder Resist:</b>	LPI	
<b>Controlled Impedance:</b>	N/A	
<b>Hole Fill/Via Plug:</b>	N/A	
<b>Flex Usage:</b>	N/A	
<b>Hole Wall Conductive Coating:</b>	N/A	

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
<b>Specification:</b>	MIL-PRF-31032/1, MIL-PRF-31032/2	VQ-09-018147
<b>Panel Size:</b>	18" X 24"	
<b>Max./Min. Board Thickness:</b>	.115"/Not Specified	
<b>Max./Min. Base CU Thickness:</b>	N/A	
<b>Max./Min. Through Hole Size:</b>	.009"/Not Specified (Vias) ".05" (Plated Hole Size)	
<b>Aspect Ratio:</b>	10:1	
<b>Max. Number of Layers:</b>	22	
<b>Min. Conductor Width:</b>	.004"	
<b>Min. Conductor Space:</b>	.006"	
<b>Part Mounting:</b>	BGA, MIX, SMT, THM	
<b>Rigid Base Material:</b>	GF: Woven E-Glass, Epoxy Resin, Flame Resistant	
<b>Flex Base Material:</b>	N/A	
<b>Finish System:</b>	ENIG, HASL	
<b>Hole Preparation:</b>	Plasma Desmear, Plasma Etchback	
<b>Alternate Construction:</b>	Foil Lamination	
<b>Copper Plating:</b>	Electrodeposited Acid Copper, Electroless Acid Copper	
<b>Solder Resist:</b>	LPI	
<b>Controlled Impedance:</b>	Differential: 100 ohms +/-10%, Single Ended: 50 ohms +/-10%	
<b>Hole Fill/Via Plug:</b>	Conductive, Non-conductive	
<b>Flex Usage:</b>	N/A	
<b>Hole Wall Conductive Coating:</b>	N/A	

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

<b>MANUFACTURER INFORMATION:</b> <b>DDi Global Corp. - Sterling, VA</b> 1200 Severn Way Dulles, VA 20166-8904, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0K703  <b>Contact:</b> Juan Vasquez <b>Phone:</b> 703-652-2200 <b>Fax:</b> 703-652-2272 <b>E-Mail:</b> jvasquez@ddiglobal.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/1, MIL-PRF-31032/2 Panel Size: 18" X 24" Max./Min. Board Thickness: .1"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: .05"/.009" (nominal) .15"/Not Specified (non-PTH)  Aspect Ratio: 10:1 Max. Number of Layers: 22 Min. Conductor Width: .004" Min. Conductor Space: .003" Part Mounting: BGA, MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant  Flex Base Material: N/A Finish System: ENIG, HASL Hole Preparation: Plasma Desmear, Plasma Etchback Alternate Construction: 0.005 Blind Vias laser, 0.006 Blind Micro Vias laser, Buried Resistors 33 ohms ± 15%  Copper Plating: Electrolytic Acid Copper Solder Resist: LPI Controlled Impedance: Differential 100 ohms ± 10%, Single Ended 50 ohms ± 10% Hole Fill/Via Plug: Non-conductive Flex Usage: N/A Hole Wall Conductive Coating: N/A	VQE-03-3545

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/2 Panel Size: 18" X 24" Max./Min. Board Thickness: .034"/.03" Max./Min. Base CU Thickness: 1"/" Max./Min. Through Hole Size: .142"/.02" Aspect Ratio: 1.6:1 Max. Number of Layers: 2 Min. Conductor Width: .015" Min. Conductor Space: .005" Part Mounting: MIX, SMT, THM Rigid Base Material: Woven Golass, Reinforced, Hydrocarbon Resin with Ceramic Fill Flex Base Material: N/A Finish System: ENIG Hole Preparation: Plasma Desmear Alternate Construction: Capped Thru Via With Fill Copper Plating: Panel Plate, Pattern Plate, Copper Wrap Solder Resist: LPI Controlled Impedance: N/A Hole Fill/Via Plug: Non-conductive Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper	VQE-11-021244



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

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

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

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

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

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

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

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

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

<b>MANUFACTURER INFORMATION:</b> <b>DDi Ontario</b> 8150 Sheppard Avenue East Scarborough, Ontario, Canada M1B 5K2	<b>PLANT LOCATIONS:</b> 1. Same Address as Manufacturer 2. Coretec, Inc., CAGE Code: 3AF82, 2020 Ellesmere Road, Scarborough, Ontario, Canada M1H 2Z8	CAGE Code: 3AF82 Contact: Noor Al-Shaikh Phone: 416-208-2100 Fax: 416-439-1582 EMail: alshaikh@coretec-inc.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-04-006240
Panel Size:	18" X 24"	VQE-08-015407
Max./Min. Board Thickness:	.08"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	Not Specified/.01" (as drilled)	
Aspect Ratio:	7:1 (Through Hole)	
Max. Number of Layers:	14	
Min. Conductor Width:	.005"	
Min. Conductor Space:	.005"	
Part Mounting:	MIX, SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, HASL	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	N/A	
Copper Plating:	Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	Characteristics +/-10%, Differential +/-10%	
Hole Fill/Via Plug:	Non-conductive	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

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

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

<b>MANUFACTURER INFORMATION:</b>  <b>Dynaco Corp.</b> 1000 South Priest Drive Tempe, AZ 85281-5238, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 61642  <b>Contact:</b> Ted Edwards <b>Phone:</b> 480-736-3728 <b>Fax:</b> 480-921-9830 <b>E-Mail:</b> tedwards@dynacocorp.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2 Panel Size: 18" X 24" Max./Min. Board Thickness: .1"/Not Specified Max./Min. Base CU Thickness: .001"/Not Specified Max./Min. Through Hole Size: .045"/.032" Aspect Ratio: 3:1 (Through Hole) Max. Number of Layers: 10 Min. Conductor Width: .01" Min. Conductor Space: .01" Part Mounting: THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant Flex Base Material: N/A Finish System: HASL Hole Preparation: Permanganate Desmear, Permanganate Etchback Alternate Construction: N/A Copper Plating: Acid Copper Solder Resist: N/A Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: N/A	VQE-05-9356
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

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

<p>MANUFACTURER INFORMATION:  <b>Dynaco Corp.</b>          1000 South Priest Drive          Tempe, AZ 85281-5238, US</p>	<p>PLANT LOCATION:          Same Address as Manufacturer</p>	<p>CAGE Code: 61642           Contact: Ted Edwards          Phone: 480-736-3728          Fax: 480-921-9830          EMail: tedwards@dynacocorp.com</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/3, MIL-PRF-31032/4	VQE-05-9356
Panel Size:	12" X 18", 18" X 24"	VQE-06-10600
Max./Min. Board Thickness:	.12"/Not Specified	
Max./Min. Base CU Thickness:	.001"/Not Specified	
Max./Min. Through Hole Size:	.045"/.01"	
Aspect Ratio:	12:1 (Through Hole)	
Max. Number of Layers:	20	
Min. Conductor Width:	.004"	
Min. Conductor Space:	.006"	
Part Mounting:	THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	IPC-4204/1 Acrylic Adhesive	
Finish System:	Fused Sn/Pb, HASL	
Hole Preparation:	Permanganate Desmear, Permanganate Etchback, Plasma Etchback	
Alternate Construction:	N/A	
Copper Plating:	Electroless Acid Copper, Electroplated Acid Copper	
Solder Resist:	N/A	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	N/A	

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

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

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

<b>MANUFACTURER INFORMATION:</b> <b>Electro Plate Circuitry, Inc.</b> 1430 Century Drive Carrollton, TX 75006, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 79616  <b>Contact:</b> James McNeal <b>Phone:</b> 972-466-0818 <b>Fax:</b> 972-466-9078 <b>EMail:</b> jjimm@eplate.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-06-010333 VQE-06-011433 VQE-10-020352
Panel Size:	18" X 24", 18" X 16"	
Max./Min. Board Thickness:	.12"/.03"	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	".008"	
Aspect Ratio:	9.3:1 (Through Hole)	
Max. Number of Layers:	14	
Min. Conductor Width:	.004"	
Min. Conductor Space:	.004"	
Part Mounting:	MIX, SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, HASL, Hard Au, Reflowed SnPb	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	Blind/Buried Vias, Filled Vias, Foil Lamination, Sequential Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	Dry Film, LPI	
Controlled Impedance:	± 3% Tolerance	
Hole Fill/Via Plug:	Conductive, Non-conductive	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-06-010333 VQE-06-011433 VQE-10-020352
Panel Size:	18" X 16", 18" X 24"	
Max./Min. Board Thickness:	.17"/.03"	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	".008"	
Aspect Ratio:	9.3:1 ((Through Hole))	
Max. Number of Layers:	18	
Min. Conductor Width:	.004"	
Min. Conductor Space:	.004"	
Part Mounting:	MIX, SMT, THM	
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, HASL, Hard Au, Reflowed SnPb	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	Blind/Buried Vias, Filled Vias, Foil Lamination, Sequential Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	Dry Film, LPI	
Controlled Impedance:	± 3% Tolerance	
Hole Fill/Via Plug:	Conductive, Non-conductive	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

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

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

Specification: MIL-PRF-31032/5, MIL-PRF-31032/6 Panel Size: 12" X 18", 18" X 24" Max./Min. Board Thickness: .18"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: ".008" Aspect Ratio: 6:1 Max. Number of Layers: 6 Min. Conductor Width: .004" Min. Conductor Space: .004" Part Mounting: MIX, SMT, THM Rigid Base Material: GT: Woven E-Glass, PTFE Resin GX: Glass Base, Non-Woven, PTFE Resin, Flame Resistant GY: Glass Base, Woven, PTFE Resin, Flame Resistant, for Microwave Application With or Without Woven or Non-Woven E-Glass, Polytetrafluoroethylene (PTFE) Resin, Ceramic Filler  Flex Base Material: N/A Finish System: ENIG, Electrolytic Nickel with Electrolytic Hard/Soft Gold, HASL, Hot Oil Reflow of Plated SnPb, Tin Lead Plate Hole Preparation: Plasma Desmear Alternate Construction: Blind Vias, Cavity, Exposed Inner Layer, Foil Lamination, Sequential Lamination Copper Plating: Acid Copper Solder Resist: Dry Film, LPI Controlled Impedance: ± 3% Characteristic, ± 3% Differential Hole Fill/Via Plug: Conductive, Non-conductive Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper	VQE-10-021161
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**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

<b>MANUFACTURER INFORMATION:</b> <b>Electro Plate Circuitry, Inc.</b> 1430 Century Drive Carrollton, TX 75006, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 79616  <b>Contact:</b> James McNeal <b>Phone:</b> 972-466-0818 <b>Fax:</b> 972-466-9078 <b>EMail:</b> jjimm@eplate.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: N/A Panel Size: N/A Max./Min. Board Thickness: N/A Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: N/A Aspect Ratio: N/A Max. Number of Layers: N/A Min. Conductor Width: N/A Min. Conductor Space: N/A Part Mounting: N/A Rigid Base Material: N/A Flex Base Material: N/A Finish System: N/A Hole Preparation: N/A Alternate Construction: N/A Copper Plating: N/A Solder Resist: N/A Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: N/A	N/A

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

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

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

VQ-06-011451  
 VQ-08-014513  
 VQE-09-018692

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

VQE-03-2619  
VQE-05-7480

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

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

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

VQE-03-2619  
 VQE-05-7480



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

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

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

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2  Panel Size: 24" X 30" Max./Min. Board Thickness: .2"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: Not Specified/.018" Aspect Ratio: 8:1 (Through Hole) Max. Number of Layers: 24 Min. Conductor Width: .004" Min. Conductor Space: .004" Part Mounting: SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant Flex Base Material: N/A Finish System: Fused SnPb, HASL, NiAu Hole Preparation: Permanganate Desmear, Plasma Etchback Alternate Construction: N/A Copper Plating: Electro-deposited Acid Copper Solder Resist: LPI Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper	VQE-00-0961 VQE-07-013268 VQE-07-013459 VQE-99-0130
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**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

<b>MANUFACTURER INFORMATION:</b> <b>Lockheed Martin Systems Integration</b> 1801 State Route 17C Owego, NY 13827, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	CAGE Code: 03640  Contact: Melita Nagerl Phone: 607-751-4665 Fax: 607-751-7714 EMail: melita.nagerl@lmco.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-00-0961 VQE-07-013459 VQE-99-0130
Panel Size:	24" X 30"	
Max./Min. Board Thickness:	.2"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	Not Specified/.018"	
Aspect Ratio:	8:1 (Through Hole)	
Max. Number of Layers:	16	
Min. Conductor Width:	.004"	
Min. Conductor Space:	.004"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	Fused SnPb, HASL, NiAu	
Hole Preparation:	Permanganate Desmear, Plasma Etchback	
Alternate Construction:	N/A	
Copper Plating:	Electro-deposited Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

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

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

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

VQE-00-0684  
 VQE-07-013459

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

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



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

<p><b>MANUFACTURER INFORMATION:</b> <b>Philway Products, Inc.</b> 701 Virginia Avenue Ashland, OH 44806, US</p>	<p><b>PLANT LOCATION:</b> Same Address as Manufacturer</p>	<p>CAGE Code: 21971  Contact: Tom School Phone: 419-281-7777 Fax: 419-289-3447 EMail: quality@philway.com</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
<p>Specification: Panel Size: Max./Min. Board Thickness: Max./Min. Base CU Thickness: Max./Min. Through Hole Size: Aspect Ratio: Max. Number of Layers: Min. Conductor Width: Min. Conductor Space: Part Mounting: Rigid Base Material:  Flex Base Material: Finish System: Hole Preparation: Alternate Construction: Copper Plating: Solder Resist: Controlled Impedance: Hole Fill/Via Plug: Flex Usage: Hole Wall Conductive Coating:</p>	<p>MIL-PRF-31032/1 18" X 21" .09"/Not Specified .002"/Not Specified .044"/.012" 4:1 (Through Hole) 12 .005" .005" MIX, SMT, THM GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant GM: Glass Base, Woven, Triazine and/or Bismaleimide Modified Epoxy Resin, Flame Resistant N/A HASL, IR Reflow following SnPb Plate Permanganate Desmear, Permanganate Etchback N/A Acid Copper LPI N/A N/A N/A N/A</p>	<p>VQE-99-1107</p>

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

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

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

VQE-09-017323  
VQE-09-017656

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

<p>MANUFACTURER INFORMATION:  <b>Pioneer Circuits, Inc.</b>          3000 S. Shannon Street          Santa Ana, CA 92704-6321, US</p>		<p>CAGE Code: 65723          Contact: Elias Gabriel          Phone: 714-641-3132 x234          Fax: 714-641-3120          EMail:</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
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Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2
Panel Size:	18" X 24"
Max./Min. Board Thickness:	.275"/Not Specified
Max./Min. Base CU Thickness:	N/A
Max./Min. Through Hole Size:	.252"/.012"
Aspect Ratio:	11:1
Max. Number of Layers:	20
Min. Conductor Width:	.0035"
Min. Conductor Space:	.0035"
Part Mounting:	MIX, SMT, THM
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant
Flex Base Material:	N/A
Finish System:	ENIG, Electrolytic Ni/Au Bondable, HASL, Reflowed Tin/Lead Fused, SMOBC, Selective Tin/Lead Strip
Hole Preparation:	Permanganate Desmear, Plasma Etchback
Alternate Construction:	Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination
Copper Plating:	Acid Copper
Solder Resist:	Dry Film, LPI
Controlled Impedance:	Characteristic & Differential $\pm$ 10%
Hole Fill/Via Plug:	N/A
Flex Usage:	N/A
Hole Wall Conductive Coating:	Electroless Copper

VQE-09-017323  
VQE-09-017656

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

<p>MANUFACTURER INFORMATION:  <b>Pioneer Circuits, Inc.</b>          3000 S. Shannon Street          Santa Ana, CA 92704-6321, US</p>		<p>CAGE Code: 65723          Contact: Elias Gabriel          Phone: 714-641-3132 x234          Fax: 714-641-3120          EMail:</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
<p>Specification: MIL-PRF-31032/3, MIL-PRF-31032/4</p> <p>Panel Size: 18" X 26"</p> <p>Max./Min. Board Thickness: .231"/Not Specified</p> <p>Max./Min. Base CU Thickness: N/A</p> <p>Max./Min. Through Hole Size: .169"/.02"</p> <p>Aspect Ratio: 8.5:1</p> <p>Max. Number of Layers: 22</p> <p>Min. Conductor Width: .003"</p> <p>Min. Conductor Space: .003"</p> <p>Part Mounting: MIX, SMT, THM</p> <p>Rigid Base Material: GF (Epoxy Glass)</p> <p>Flex Base Material: Adhesiveless Epoxy</p> <p>Finish System: ENIG, Electrolytic Ni/Au (Bondable), HASL, Reflowed Tin/Lead (Fused), SMOBC, Selective Tin/Lead Strip</p> <p>Hole Preparation: Permanganate Desmear, Plasma Etchback</p> <p>Alternate Construction: Blind/Buried Vias, Filled Via Holes, Plated Sub-Assemblies, Sequential Lamination</p> <p>Copper Plating: Acid Copper</p> <p>Solder Resist: LPI</p> <p>Controlled Impedance: Characteristic &amp; Differential +/- 10%</p> <p>Hole Fill/Via Plug: N/A</p> <p>Flex Usage: Class A (Flex During Installation)</p> <p>Hole Wall Conductive Coating: Electroless Copper</p>	<p>VQE-09-017323          VQE-09-017656          VQE-10-020651</p>

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

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

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

VQE-09-017323  
VQE-09-017656

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

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

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

VQE-09-017323  
VQE-09-017656

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

<p>MANUFACTURER INFORMATION: <b>PNC, Inc.</b> 115 East Centre Street Nutley, NJ 07110, US</p>		<p>CAGE Code: 66766 Contact: Carmela Conte Phone: 973-284-1600 Fax: EMail: carmela@pnconline.com</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
<p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2 Panel Size: 18" X 22" Max./Min. Board Thickness: .093"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: .12"/.014" Aspect Ratio: 6.6:1 Max. Number of Layers: 10 Min. Conductor Width: .008" Min. Conductor Space: .008" Part Mounting: MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant Flex Base Material: N/A Finish System: HASL Hole Preparation: Permanganate Desmear Alternate Construction: Foil Lamination Copper Plating: Electroplated Acid Copper Solder Resist: LPI Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper</p>	<p>VQE-10-19440</p>

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

<b>MANUFACTURER INFORMATION:</b> <b>Printed Circuits, Inc.</b> 1200 West 96th Street Bloomington, MN 55431, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 65114  <b>Contact:</b> Jim Smith <b>Phone:</b> 612-888-7900 <b>Fax:</b> 612-888-2719 <b>EMail:</b> jsmith@printedcircuits.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/3, MIL-PRF-31032/4 Panel Size: 12" X 18", 18" X 24" Max./Min. Board Thickness: .12"/Not Specified Max./Min. Base CU Thickness: (1/2 oz.) Max./Min. Through Hole Size: Not Specified/.01" Aspect Ratio: 10:1 (Through Hole) Max. Number of Layers: 16 Min. Conductor Width: .004" Min. Conductor Space: .005" (+/- 10%) Part Mounting: MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant Flex Base Material: IPC-4204/1 Acrylic Adhesive IPC-4204/11 Adhesiveless Finish System: Electroless Ni/Au, Electrolytic Ni/Au, Fused SnPb, HASL, SMOBC Hole Preparation: Plasma Desmear, Plasma Etchback Alternate Construction: N/A Copper Plating: Electrolytic Acid Copper Solder Resist: Dry Film, LPI, Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: Class A Flex to Install, Class B Continuous Flex Hole Wall Conductive Coating: Electroless Copper	VQE-01-0024



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

<b>MANUFACTURER INFORMATION:</b> <b>Sanmina-SCI (San Jose)</b> 2050 Bering Drive San Jose, CA 95131, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 3DR67  <b>Contact:</b> Darrell Myers <b>Phone:</b> 408-964-6515 <b>Fax:</b> 408-964-6453 <b>EMail:</b> darrell.myers@sanmina-sci.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-06-011137
Panel Size:	18" X 24"	VQE-10-019381
Max./Min. Board Thickness:	.062"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.25"/.01"	
Aspect Ratio:	6:1 (Through Hole)	
Max. Number of Layers:	8	
Min. Conductor Width:	.003"	
Min. Conductor Space:	.003"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, HASL, ImmAg, OSP	
Hole Preparation:	Plasma Desmear	
Alternate Construction:	Buried Via Mechanical Drill, Foil Lamination, Sequential Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	Dry Film, LPI	
Controlled Impedance:	50-110 ohms ± 5%	
Hole Fill/Via Plug:	Epoxy, Silver	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

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

<b>MANUFACTURER INFORMATION:</b> <b>Sanmina-SCI (San Jose)</b> 2050 Bering Drive San Jose, CA 95131, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 3DR67  <b>Contact:</b> Darrell Myers <b>Phone:</b> 408-964-6515 <b>Fax:</b> 408-964-6453 <b>EMail:</b> darrell.myers@sanmina-sci.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/1, MIL-PRF-31032/2 Panel Size: 18" X 24" Max./Min. Board Thickness: .04"/Not Specified (for Plasma Etchback) .25"/Not Specified (for Plasma Desmear) Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: .25"/.008" Aspect Ratio: 15:1 (Through Hole) 1:2 (Microvias, Laser) Max. Number of Layers: 30 Min. Conductor Width: .003" Min. Conductor Space: .003" Part Mounting: MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant Flex Base Material: N/A Finish System: ENIG, Electrolytic Nickel Gold, HASL, Reflowed Solder Hole Preparation: Plasma Desmear, Plasma Etchback Alternate Construction: Foil Lamination, Min. Blind Via: 0.005" Laser, Min. Buried Via: 0.010" Mechanical Drill, Sequential Lamination Copper Plating: Electrolytic Acid Copper Solder Resist: Dry Film, LPI Controlled Impedance: 50-110 ohms ± 5% Hole Fill/Via Plug: Epoxy, Silver Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper	VQE-06-011137

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

<b>MANUFACTURER INFORMATION:</b> <b>Sanmina-SCI (San Jose)</b> 2050 Bering Drive San Jose, CA 95131, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 3DR67  <b>Contact:</b> Darrell Myers <b>Phone:</b> 408-964-6515 <b>Fax:</b> 408-964-6453 <b>EMail:</b> darrell.myers@sanmina-sci.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification: MIL-PRF-31032/1, MIL-PRF-31032/5 Panel Size: 21" X 24" Max./Min. Board Thickness: .066"/Not Specified Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: .151"/.01" Aspect Ratio: 7:1 Max. Number of Layers: 7 Min. Conductor Width: .005" Min. Conductor Space: .004" Part Mounting: MIX, SMT, THM Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant Rogers 3200 Series Woven Fiberglass, Ceramic Filled Laminate Flex Base Material: N/A Finish System: ENIG Hole Preparation: Plasma Desmear Alternate Construction: Blind Via Mechanical Drill, Sequential Lamination Copper Plating: Electroplated Acid Copper Solder Resist: LPI Controlled Impedance: N/A Hole Fill/Via Plug: Epoxy, Silver Flex Usage: N/A Hole Wall Conductive Coating: Electroless Copper	VQE-11-021514	

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification: N/A Panel Size: N/A Max./Min. Board Thickness: N/A Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: N/A Aspect Ratio: N/A Max. Number of Layers: N/A Min. Conductor Width: N/A Min. Conductor Space: N/A Part Mounting: N/A Rigid Base Material: N/A Flex Base Material: N/A Finish System: N/A Hole Preparation: N/A Alternate Construction: N/A Copper Plating: N/A Solder Resist: N/A Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: N/A	N/A	

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

<b>MANUFACTURER INFORMATION:</b> <b>Sanmina-SCI (San Jose)</b> 2050 Bering Drive San Jose, CA 95131, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 3DR67  <b>Contact:</b> Darrell Myers <b>Phone:</b> 408-964-6515 <b>Fax:</b> 408-964-6453 <b>E-Mail:</b> darrell.myers@sanmina-sci.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
Specification: N/A Panel Size: N/A Max./Min. Board Thickness: N/A Max./Min. Base CU Thickness: N/A Max./Min. Through Hole Size: N/A Aspect Ratio: N/A Max. Number of Layers: N/A Min. Conductor Width: N/A Min. Conductor Space: N/A Part Mounting: N/A Rigid Base Material: N/A Flex Base Material: N/A Finish System: N/A Hole Preparation: N/A Alternate Construction: N/A Copper Plating: N/A Solder Resist: N/A Controlled Impedance: N/A Hole Fill/Via Plug: N/A Flex Usage: N/A Hole Wall Conductive Coating: N/A	N/A

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

<p>MANUFACTURER INFORMATION:  <b>Speedy Circuits, Inc.</b>                      5331 McFadden Avenue                      Huntington Beach, CA 92649-1204, US</p>	<p>PLANT LOCATION:                      Same Address as Manufacturer</p>	<p>CAGE Code: 66982                       Contact: Jan Lesky                      Phone: 714-766-6243                      Fax: 714-899-7074                      EMail:</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-08-016434
Panel Size:	18" X 24"	VQE-10-021007
Max./Min. Board Thickness:	.11"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.194"/.015"	
Aspect Ratio:	7:1	
Max. Number of Layers:	14	
Min. Conductor Width:	.005"	
Min. Conductor Space:	.005"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	Electroless Nickel Immersion Gold, HASL	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	Foil Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	100/50 ohms +/-10% Characteristic, 100/50 ohms +/-10% Differential	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	

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

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

<b>Specification:</b>	MIL-PRF-31032/3, MIL-PRF-31032/4
<b>Panel Size:</b>	18" X 24"
<b>Max./Min. Board Thickness:</b>	.13"/Not Specified
<b>Max./Min. Base CU Thickness:</b>	N/A
<b>Max./Min. Through Hole Size:</b>	.048"/.02"
<b>Aspect Ratio:</b>	7:1
<b>Max. Number of Layers:</b>	18
<b>Min. Conductor Width:</b>	.005"
<b>Min. Conductor Space:</b>	.005"
<b>Part Mounting:</b>	SMT, THM
<b>Rigid Base Material:</b>	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
<b>Flex Base Material:</b>	Adhesiveless Polyimide
<b>Finish System:</b>	Electro-deposited Fused SnPb, Electrolytic Hard Gold, Electrolytic Nickel, Electrolytic Soft Gold, HASL
<b>Hole Preparation:</b>	Plasma Desmear, Plasma Etchback
<b>Alternate Construction:</b>	Foil Lamination
<b>Copper Plating:</b>	Electro-deposited Acid Copper
<b>Solder Resist:</b>	Dry Film, LPI
<b>Controlled Impedance:</b>	100/50 ohms +/-10% Characteristic, 100/50 ohms +/-10% Differential
<b>Hole Fill/Via Plug:</b>	N/A
<b>Flex Usage:</b>	Class A (Flex During Installation), Class B (Dynamic)
<b>Hole Wall Conductive Coating:</b>	Electroless Copper

VQE-08-016434  
 VQE-10-019157  
 VQE-10-021007

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

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

Specification:	MIL-PRF-31032/5
Panel Size:	12" X 18"
Max./Min. Board Thickness:	.068"/Not Specified
Max./Min. Base CU Thickness:	N/A
Max./Min. Through Hole Size:	.125"/.01"
Aspect Ratio:	6:1
Max. Number of Layers:	10
Min. Conductor Width:	.005"
Min. Conductor Space:	.005"
Part Mounting:	SMT, THM
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
Flex Base Material:	N/A
Finish System:	Electro-deposited Fused SnPb, Electrolytic Hard Gold, Electrolytic Nickel, Electrolytic Soft Gold, HASL
Hole Preparation:	Plasma Desmear
Alternate Construction:	Electro-deposited Fused SnPb, Electrolytic Hard and Soft Gold, Electrolytic Nickel, HASL
Copper Plating:	Acid Copper
Solder Resist:	LPI,
Controlled Impedance:	50 ohms +/- 10% (Characteristic, Differential)
Hole Fill/Via Plug:	N/A
Flex Usage:	N/A
Hole Wall Conductive Coating:	Ceramic Filler, Epoxy Resin - Mixed, PTFE Resin, With or Without Woven or Non-woven E-Glass, Woven E-Glass

VQE-09-018657  
 VQE-10-021007







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

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

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

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

<b>Specification:</b> MIL-PRF-31032/3, MIL-PRF-31032/4  <b>Panel Size:</b> 12" X 18" <b>Max./Min. Board Thickness:</b> .094"/Not Specified <b>Max./Min. Base CU Thickness:</b> N/A <b>Max./Min. Through Hole Size:</b> Not Specified/.008" <b>Aspect Ratio:</b> 12:1 (Through Hole) <b>Max. Number of Layers:</b> 12 <b>Min. Conductor Width:</b> .006" <b>Min. Conductor Space:</b> .004" <b>Part Mounting:</b> N/A <b>Rigid Base Material:</b> N/A <b>Flex Base Material:</b> Flexible Polyimide Film/Acrylic IC-4203/1 Flexible Polyimide IPC-4204/11 Woven E-Glass, Polyimide Resin IPC-4101/40 Woven E-Glass, Polyimide Resin IPC-4101/41 Woven E-Glass, Polyimide Resin IPC-4101/42  <b>Finish System:</b> HASL <b>Hole Preparation:</b> Plasma Etchback <b>Alternate Construction:</b> N/A <b>Copper Plating:</b> Electrodeposited Acid Copper <b>Solder Resist:</b> TA140 PSR-4000 HG <b>Controlled Impedance:</b> N/A <b>Hole Fill/Via Plug:</b> N/A <b>Flex Usage:</b> N/A <b>Hole Wall Conductive Coating:</b> Direct Metallization	VQE-04-005354 VQE-08-015729
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**SECTION I  
LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY**

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

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

<b>MANUFACTURER INFORMATION:</b> <b>TTM Technologies (Santa Ana)</b> 2630 South Harbor Boulevard Santa Ana, CA 92704, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 1WQ42  <b>Contact:</b> Terry Lichte <b>Phone:</b> 714-241-0303, x3127 <b>Fax:</b> 714-241-0708 <b>E-Mail:</b> tlichte@ttmtech.comca
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-05-8644
		VQE-06-011211
Panel Size:	18" X 24"	
Max./Min. Board Thickness:	.2"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.044"/.013"	
Aspect Ratio:	14:1 (Through Hole)	
Max. Number of Layers:	24	
Min. Conductor Width:	.003"	
Min. Conductor Space:	.003"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, Fused SnPb, HASL, ImmAg, OSP	
Hole Preparation:	Plasma Desmear, Plasma Etchback	
Alternate Construction:	Aspect Ratio Microvias: 1:1, Min. Blind Via: 0.005" Laser, Min. Buried Via: 0.0135" Mechanical Drill, Sequential Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	Dry Film, LPI	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	N/A	

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

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

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

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

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

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

Specification: MIL-PRF-31032/1, MIL-PRF-31032/2, MIL-PRF-31032/3, MIL-PRF-31032/4

Panel Size: 18" X 24", 18" X 24"

Max./Min. Board Thickness: .12"/Not Specified  
.12"/Not Specified

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

Max./Min. Through Hole Size: .191"/.012"  
.191"/.012"

Aspect Ratio: 6.45:1  
9:1

Max. Number of Layers: 11, 16

Min. Conductor Width: .004"  
.004"

Min. Conductor Space: .004"  
.004"

Part Mounting: MIX, MIX, SM, SM, THM, THM

Rigid Base Material: BI (Aramid Fabric, Non-Woven, Polyimide Resin)  
GF (Woven E-Glass, Epoxy Resin)  
GI (Woven E-Glass, Polyimide Resin)

Flex Base Material: IPC-4203/1 (Acrylic Adhesive Coverlay)  
IPC-4204/11 (Adhesiveless Polyimide)

Finish System: ENIG, ENIG, Electrolytic Ni, Electrolytic Ni, HASL, HASL

Hole Preparation: Plasma Desmear, Plasma Etchback

Alternate Construction: Blind Vias

Copper Plating: Electrolytic Acid Copper, Electrolytic Acid Copper

Solder Resist: LPI, Screen Printed

Controlled Impedance: +/- 10% tolerance

Hole Fill/Via Plug: N/A

Flex Usage: N/A

Hole Wall Conductive Coating: Electroless Copper, Electroless Copper

VQE-03-003888  
 VQE-03-003895  
 VQE-10-020500  
 VQE-10-020500  
 VQE-10-020581  
 VQE-10-020581  
 VQE-11-021181

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

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

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

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

<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	N/A	N/A
Panel Size:	N/A	
Max./Min. Board Thickness:	N/A	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	N/A	
Aspect Ratio:	N/A	
Max. Number of Layers:	N/A	
Min. Conductor Width:	N/A	
Min. Conductor Space:	N/A	
Part Mounting:	N/A	
Rigid Base Material:	N/A	
Flex Base Material:	N/A	
Finish System:	N/A	
Hole Preparation:	N/A	
Alternate Construction:	N/A	
Copper Plating:	N/A	
Solder Resist:	N/A	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	N/A	

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

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

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

VQE-03-003348  
 VQE-09-18855

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

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

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

VQE-03-003348  
 VQE-09-18855

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

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

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

VQE-03-3348  
 VQE-09-18855

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

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

Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2
Panel Size:	18" X 24"
Max./Min. Board Thickness:	.13"/Not Specified
Max./Min. Base CU Thickness:	N/A
Max./Min. Through Hole Size:	.133"/.0118" (drilled)
Aspect Ratio:	11:1 (Through hole)
	2.5:1 (Buried Vias)
Max. Number of Layers:	32
Min. Conductor Width:	.004"
Min. Conductor Space:	.003"
Part Mounting:	MIX, Press Fit, SM, THM
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant
Flex Base Material:	N/A
Finish System:	ENIG, Electrolytic Nickel, Electrolytic Soft & Hard Gold, HASL, Hot Oil Reflow following SnPb plate
Hole Preparation:	Plasma Desmear, Plasma Etchback
Alternate Construction:	Blind and Buried Vias, Buried Resistors, Copper Invar Copper, Micro Vias, Multiple Laminations
Copper Plating:	Acid Copper
Solder Resist:	Dry-Film, LPI, Wet Mask
Controlled Impedance:	Characteristic, Differential, Dual Stripline, Embedded Microstrip, Microstrip, Range 30-150 ohms (+/- 10%)
Hole Fill/Via Plug:	Conductive, Non-conductive
Flex Usage:	N/A
Hole Wall Conductive Coating:	Electroless Copper
Max. Base Cu Weight	1 oz.

VQE-03-003348  
 VQE-09-18855

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

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

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

VQE-03-003348  
 VQE-09-18855

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

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

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

VQE-03-003348  
VQE-09-18855

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

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

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

VQE-03-003348  
 VQE-09-18855



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

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

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

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

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

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

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

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

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

<b>MANUFACTURER INFORMATION:</b> <b>Unicircuit, Inc.</b> 8192 Southpark Lane Littleton, CO 80120, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 66311  <b>Contact:</b> Bob Lageman <b>Phone:</b> 303-730-0505, x110 <b>Fax:</b> <b>E-Mail:</b> blageman@unicircuit.com
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-07-13789
Panel Size:	12" X 18"	VQE-09-17422
Max./Min. Board Thickness:	.12"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	.129"/.02"	
Aspect Ratio:	6:1 (Through Hole)	
Max. Number of Layers:	16	
Min. Conductor Width:	.005"	
Min. Conductor Space:	.005"	
Part Mounting:	SMT, THM	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	HASL, Reflowed Tin Lead	
Hole Preparation:	Plasma Etchback	
Alternate Construction:	Blind Via, Bured Via, Foil Lamination, Laser-drilled Microvias, Sequential Lamination	
Copper Plating:	Electrodeposited Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	100 ohms differential +/-10%, 53 ohms characteristic +/-7%	
Hole Fill/Via Plug:	Conductive, Non-conductive	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Electroless Copper	
Laser Via Hole Size	.006 +/- .001	

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

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

<b>MANUFACTURER INFORMATION:</b> <b>Universal Circuits, Inc.</b> 8860 Zachary Lane North Maple Grove, MN 55369-4524, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 45032  <b>Contact:</b> <b>Phone:</b> <b>Fax:</b> <b>EMail:</b>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

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

VQE-10-019530  
 VQE-10-020323

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

<p>MANUFACTURER INFORMATION:  <b>Universal Circuits, Inc.</b>              8860 Zachary Lane North              Maple Grove, MN 55369-4524, US</p>	<p>PLANT LOCATION:              Same Address as Manufacturer</p>	<p>CAGE Code: 45032               Contact:              Phone:              Fax:              EMail:</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>		<b>QUALIFICATION LETTERS:</b>
Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-10-019530
		VQE-11-021326
Panel Size:	18" X 24"	
Max./Min. Board Thickness:	.062"/Not Specified	
Max./Min. Base CU Thickness:	N/A	
Max./Min. Through Hole Size:	".0138"	
Aspect Ratio:	4.5:1	
Max. Number of Layers:	8	
Min. Conductor Width:	.007"	
Min. Conductor Space:	.006"	
Part Mounting:	SMT	
Rigid Base Material:	GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
Flex Base Material:	N/A	
Finish System:	ENIG, Electrolytic Ni/Au, HASL	
Hole Preparation:	Chemical Desmear, Plasma Etchback	
Alternate Construction:	Foil Lamination	
Copper Plating:	Acid Copper	
Solder Resist:	LPI	
Controlled Impedance:	N/A	
Hole Fill/Via Plug:	N/A	
Flex Usage:	N/A	
Hole Wall Conductive Coating:	Direct Metallization	

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

<p>MANUFACTURER INFORMATION:  <b>Vermont Circuits, Inc.</b>          76 Technology Drive          P.O. Box 1890, Brattleboro, VT 05302-1890, US</p>		<p>CAGE Code: 65200          Contact: Bob Downing          Phone: 802-257-4571          Fax: 802-257-0011          EMail: Bob.Downing@vtcircuits.com</p>
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<b>CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION</b>	<b>QUALIFICATION LETTERS:</b>
<p>Specification: MIL-PRF-31032/1, MIL-PRF-31032/2            Panel Size: 18" X 24"            Max./Min. Board Thickness: .1"/Not Specified            Max./Min. Base CU Thickness: 1"/.5"            Max./Min. Through Hole Size: .04"/.008" ((.0453/.012 Drilled))            Aspect Ratio: 7.5:1            Max. Number of Layers: 10            Min. Conductor Width: .005"            Min. Conductor Space: .005"            Part Mounting: THM            Rigid Base Material: GF: Woven E-Glass, Epoxy Resin, Flame Resistant            Flex Base Material: N/A            Finish System: ENIG, HASL            Hole Preparation: Permanganate Desmear, Plasma Desmear, Plasma Etchback            Alternate Construction: Foil Lamination            Copper Plating: Acid Copper: DC Plate            Solder Resist: LPI            Controlled Impedance: N/A            Hole Fill/Via Plug: N/A            Flex Usage: N/A            Hole Wall Conductive Coating: Electroless Copper</p>	<p>VQE-10-019275</p>

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

<b>MANUFACTURER INFORMATION:</b> <b>Viasystems Corp. (CA)</b> 355 Turtle Creek Court San Jose, CA 95125-1316, US	<b>PLANT LOCATION:</b> Same Address as Manufacturer	<b>CAGE Code:</b> 0MHG5  <b>Contact:</b> Dave Williams <b>Phone:</b> 408-280-0422 <b>Fax:</b> 408-280-0641 <b>EMail:</b> david.williams@viasystems.com
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

<b>Specification:</b> MIL-PRF-31032/1, MIL-PRF-31032/2	VQE-08-016481
<b>Panel Size:</b> 18" X 24"	VQE-08-016632
<b>Max./Min. Board Thickness:</b> .13"/Not Specified	
<b>Max./Min. Base CU Thickness:</b> N/A	
<b>Max./Min. Through Hole Size:</b> .004"/.008" (laser drilled) .25"/.008" (mechanical)	
<b>Aspect Ratio:</b> 0.8:1 (Blind Vias) 10:1 (Through Hole)	
<b>Max. Number of Layers:</b> 20	
<b>Min. Conductor Width:</b> .004"	
<b>Min. Conductor Space:</b> .004"	
<b>Part Mounting:</b> MIX, SMT, THM	
<b>Rigid Base Material:</b> GF: Woven E-Glass, Epoxy Resin, Flame Resistant GI: Glass Base, Woven, Polyimide Resin, Heat Resistant	
<b>Flex Base Material:</b> N/A	
<b>Finish System:</b> ENIG, HASL, Hard Gold, Nickel	
<b>Hole Preparation:</b> Chemical Desmear, Plasma Desmear, Plasma Etchback	
<b>Alternate Construction:</b> Blind Vias, Buried Vias, Sequential Lamination	
<b>Copper Plating:</b> Electrodeposited Acid Copper	
<b>Solder Resist:</b> LPI	
<b>Controlled Impedance:</b> 25-125 ohms +/-10%	
<b>Hole Fill/Via Plug:</b> Non-conductive	
<b>Flex Usage:</b> N/A	
<b>Hole Wall Conductive Coating:</b> N/A	

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

<p>MANUFACTURER INFORMATION:  <b>Viasystems Corp. (OR)</b>  1521 Poplar Lane  Forest Grove, OR 97116, US</p>	<p>PLANT LOCATION:  Same Address as Manufacturer</p>	<p>CAGE Code: 01KV9  Contact: Roger Michalowski  Phone: 781-639-5410  Fax:  EMail: Customerservice@viasystems.com</p>
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**CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION** **QUALIFICATION LETTERS:**

Specification:	MIL-PRF-31032/1, MIL-PRF-31032/2
Panel Size:	18" X 24"
Max./Min. Board Thickness:	.13"/Not Specified
Max./Min. Base CU Thickness:	N/A
Max./Min. Through Hole Size:	.003"/Not Specified (Laser Via) ".008" (Mechanical)
Aspect Ratio:	0.8:1 (Blind Vias) 10:1 (Through Hole)
Max. Number of Layers:	26
Min. Conductor Width:	.004"
Min. Conductor Space:	.004"
Part Mounting:	MIX, SMT, THM
Rigid Base Material:	GF: Woven E-Glass, Epoxy Resin, Flame Resistant G: Glass Base, Woven, Polyimide Resin, Heat Resistant
Flex Base Material:	N/A
Finish System:	ENIG, HASL, Immersion Ag, Ni/Hard-Au
Hole Preparation:	Chemical Desmear Permanganate, Plasma Desmear, Plasma Etchback
Alternate Construction:	Blind Vias, Laser Drilled Vias
Copper Plating:	Electrodeposited Acid Copper
Solder Resist:	LPI
Controlled Impedance:	Differential Methods $\pm 5\%$ at 50 ohms, Microstrip, Single Ended, Single Line
Hole Fill/Via Plug:	N/A
Flex Usage:	N/A
Hole Wall Conductive Coating:	N/A

VQ-09-017325



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

**MIL-PRF-31032/1**

**Accurate Circuit Engineering**

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

**American Standard Circuits**

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

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Calumet Electronics Corp.**

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

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

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

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Cleveland Corp.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**DDi Denver Corp.**

10570 Bradford Road, Littleton, CO 80127, US

**DDi Global Corp. - Anaheim**

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

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

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

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**DDi Ontario**

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

**Dynaco Corp.**

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

**Dynamic & Proto Circuits, Inc.**

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

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Electrotek Corp.**

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

**Endicott Interconnect Technologies, Inc.**

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

**Firan Technology Group**

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

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Hughes Circuits**

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

**Lockheed Martin Systems Integration**

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

**Micom Corp.**

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

**Philway Products, Inc.**

701 Virginia Avenue, Ashland, OH 44806, US

**Pioneer Circuits, Inc.**

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

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

**MIL-PRF-31032/1**

**PNC, Inc.**

115 East Centre Street, Nutley, NJ 07110, US

**Sanmina-SCI (San Jose)**

2050 Bering Drive, San Jose, CA 95131, US

**Speedy Circuits, Inc.**

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

**TTM Technologies (Santa Ana)**

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

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

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

**Unicircuit, Inc.**

8192 Southpark Lane, Littleton, CO 80120, US

**Universal Circuits, Inc.**

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

**Vermont Circuits, Inc.**

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

**Viasystems Corp. (CA)**

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

**Viasystems Corp. (OR)**

1521 Poplar Lane, Forest Grove, OR 97116, US

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

**MIL-PRF-31032/2**

**Accurate Circuit Engineering**

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

**American Standard Circuits**

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

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Calumet Electronics Corp.**

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

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

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

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Cleveland Corp.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**DDi Denver Corp.**

10570 Bradford Road, Littleton, CO 80127, US

**DDi Global Corp. - Anaheim**

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

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

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

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**DDi Ontario**

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

**Dynaco Corp.**

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

**Dynamic & Proto Circuits, Inc.**

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

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Electrotek Corp.**

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

**Endicott Interconnect Technologies, Inc.**

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

**Firan Technology Group**

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

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Hughes Circuits**

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

**Lockheed Martin Systems Integration**

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

**Micom Corp.**

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

**Pioneer Circuits, Inc.**

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

**PNC, Inc.**

115 East Centre Street, Nutley, NJ 07110, US

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

**MIL-PRF-31032/2**

**Sanmina-SCI (San Jose)**

2050 Bering Drive, San Jose, CA 95131, US

**Speedy Circuits, Inc.**

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

**TTM Technologies (Santa Ana)**

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

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

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

**Unicircuit, Inc.**

8192 Southpark Lane, Littleton, CO 80120, US

**Universal Circuits, Inc.**

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

**Vermont Circuits, Inc.**

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

**Viasystems Corp. (CA)**

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

**Viasystems Corp. (OR)**

1521 Poplar Lane, Forest Grove, OR 97116, US

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

**MIL-PRF-31032/3**

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

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

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Cleveland Corp.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**Dynaco Corp.**

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

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Lockheed Martin Systems Integration**

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

**Pioneer Circuits, Inc.**

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

**Printed Circuits, Inc.**

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

**Speedy Circuits, Inc.**

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

**Strataflex Corp.**

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

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

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

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

**MIL-PRF-31032/4**

**Amphenol Printed Circuits**

91 Northeastern Boulevard, Nashua, NH 03062, US

**Cirexx International, Inc.**

791 Nuttman Street, Santa Clara, CA 95054,

**Colonial Circuits, Inc.**

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

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**DDi Cleveland Corp.**

7 Ascot Parkway, Cuyahoga Falls, OH 44223, US

**DDi North Jackson Corp.**

12080 DeBartolo Drive, North Jackson, OH 44451, US

**Dynaco Corp.**

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

**Hamby Corporation**

27704 Avenue Scott, Valencia, CA 91355, US

**Hans Brockstedt GmbH**

Clara-Immerwahr Strasse 7, 24145 Kiel, Germany

**Lockheed Martin Systems Integration**

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

**Pioneer Circuits, Inc.**

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

**Printed Circuits, Inc.**

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

**Speedy Circuits, Inc.**

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

**Strataflex Corp.**

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

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

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

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

**MIL-PRF-31032/5**

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Sanmina-SCI (San Jose)**

2050 Bering Drive, San Jose, CA 95131, US

**Speedy Circuits, Inc.**

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

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

**MIL-PRF-31032/6**

**Electro Plate Circuitry, Inc.**

1430 Century Drive, Carrollton, TX 75006, US

**Global Innovations Corp.**

901 Hensley Drive, Wylie, TX 75098, US

**Speedy Circuits, Inc.**

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



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

**MIL-PRF-31032/Custom**

**Colonial Circuits, Inc.**

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

**Cosmotronic, Inc.**

16721 Noyes Avenue, Irvine, CA 92606, US

**Endicott Interconnect Technologies, Inc.**

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

**TTM Technologies (Santa Clara)**

400 Matthew Street, Santa Clara, CA 95050, US

**TTM Technologies (Stafford)**

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

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

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

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

<p>MANUFACTURER INFORMATION: <b>DDi Denver Corp.</b> 10570 Bradford Road Littleton, CO 80127, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 75815  Contact: Douglas N. Berry Phone: 303-972-4105 Fax: 303-933-2934 EMail: dberry@ddiglobal.com</p>
<p>MANUFACTURER INFORMATION: <b>DDI Global Corp. - Anaheim</b> 1220 N. Simon Circle Anaheim, CA 92806, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 0BSG1  Contact: Rick Sylvain Phone: 714-688-7371 Fax: EMail: rsylvain@ddiglobal.com</p>
<p>MANUFACTURER INFORMATION: <b>DDi Global Corp. - Sterling, VA</b> 1200 Severn Way Dulles, VA 20166-8904, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 0K703  Contact: Juan Vasquez Phone: 703-652-2200 Fax: 703-652-2272 EMail: jvasquez@ddiglobal.com</p>
<p>MANUFACTURER INFORMATION: <b>DDi North Jackson Corp.</b> 12080 DeBartolo Drive North Jackson, OH 44451, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 0GN71  Contact: Cynthia Savakis Phone: 330-538-3900, x211 Fax: 330-538-3820 EMail: quality@sovereign-circuits.com</p>
<p>MANUFACTURER INFORMATION: <b>DDi Ontario</b> 8150 Sheppard Avenue East Scarborough, Ontario, Canada M1B 5K2</p>	<p>PLANT LOCATIONS: 1. Same Address as Manufacturer 2. Coretec, Inc., CAGE Code: 3AF82, 2020 Ellesmere Road, Scarborough, Ontario, Canada M1H 2Z8</p>	<p>CAGE Code: 3AF82  Contact: Noor Al-Shaikh Phone: 416-208-2100 Fax: 416-439-1582 EMail: alshaikh@coretec-inc.com</p>
<p>MANUFACTURER INFORMATION: <b>Dynaco Corp.</b> 1000 South Priest Drive Tempe, AZ 85281-5238, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 61642  Contact: Ted Edwards Phone: 480-736-3728 Fax: 480-921-9830 EMail: tedwards@dynacocorp.com</p>
<p>MANUFACTURER INFORMATION: <b>Dynamic &amp; Proto Circuits, Inc.</b> 869 Barton Street Stoney Creek, Ontario, Canada L8E 5G6</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 38898  Contact: Stephen Hazell Phone: 905-643-9900 Fax: 905-643-9911 EMail: stephenhazell@dapc.com</p>
<p>MANUFACTURER INFORMATION: <b>Electro Plate Circuitry, Inc.</b> 1430 Century Drive Carrollton, TX 75006, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 79616  Contact: James McNeal Phone: 972-466-0818 Fax: 972-466-9078 EMail: jimmm@eplate.com</p>

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

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

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

<p>MANUFACTURER INFORMATION: <b>Micom Corp.</b> 475 Old Highway 8 NW New Brighton, MN 55112, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 34076  Contact: Larry Leonard Phone: 651-604-2639 Fax: 651-636-1352 EMail: lleonard@micomcircuits.com</p>
<p>MANUFACTURER INFORMATION: <b>Philway Products, Inc.</b> 701 Virginia Avenue Ashland, OH 44806, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 21971  Contact: Tom School Phone: 419-281-7777 Fax: 419-289-3447 EMail: quality@philway.com</p>
<p>MANUFACTURER INFORMATION: <b>Pioneer Circuits, Inc.</b> 3000 S. Shannon Street Santa Ana, CA 92704-6321, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 65723  Contact: Elias Gabriel Phone: 714-641-3132 x234 Fax: 714-641-3120 EMail:</p>
<p>MANUFACTURER INFORMATION: <b>PNC, Inc.</b> 115 East Centre Street Nutley, NJ 07110, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 66766  Contact: Carmela Conte Phone: 973-284-1600 Fax: EMail: carmela@pnconline.com</p>
<p>MANUFACTURER INFORMATION: <b>Printed Circuits, Inc.</b> 1200 West 96th Street Bloomington, MN 55431, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 65114  Contact: Jim Smith Phone: 612-888-7900 Fax: 612-888-2719 EMail: jsmith@printedcircuits.com</p>
<p>MANUFACTURER INFORMATION: <b>Sanmina-SCI (San Jose)</b> 2050 Bering Drive San Jose, CA 95131, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 3DR67  Contact: Darrell Myers Phone: 408-964-6515 Fax: 408-964-6453 EMail: darrell.myers@sanmina-sci.com</p>
<p>MANUFACTURER INFORMATION: <b>Speedy Circuits, Inc.</b> 5331 McFadden Avenue Huntington Beach, CA 92649-1204, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 66982  Contact: Jan Lesky Phone: 714-766-6243 Fax: 714-899-7074 EMail:</p>
<p>MANUFACTURER INFORMATION: <b>Strataflex Corp.</b> 11 Dohme Avenue Toronto, Ontario, Canada M4B 1Y7</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 38661  Contact: Peter Pialis Phone: 416-752-2224 Fax: 416-752-6719 EMail: ppialis@strataflex.ca</p>

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

<p>MANUFACTURER INFORMATION: <b>TTM Technologies (Santa Ana)</b> 2630 South Harbor Boulevard Santa Ana, CA 92704, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 1WQ42  Contact: Terry Lichte Phone: 714-241-0303, x3127 Fax: 714-241-0708 E-Mail: tlichte@ttmtech.comca</p>
<p>MANUFACTURER INFORMATION: <b>TTM Technologies (Santa Clara)</b> 400 Matthew Street Santa Clara, CA 95050, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 65916  Contact: Nellie Guitierrez Phone: 408-486-3184 Fax: 408-727-1003 E-Mail: nellie.guitierrez@ttmtech.com</p>
<p>MANUFACTURER INFORMATION: <b>TTM Technologies (Stafford)</b> 4 Old Monson Road P.O. Box 145, Stafford, CT 77497, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 5L706  Contact: Michelle Herbert Phone: 860-684-5881 Fax: 860-684-7425 E-Mail: michele.hebert@tycoelectronics.com</p>
<p>MANUFACTURER INFORMATION: <b>Unicircuit, Inc.</b> 8192 Southpark Lane Littleton, CO 80120, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 66311  Contact: Bob Lageman Phone: 303-730-0505, x110 Fax: E-Mail: blageman@unicircuit.com</p>
<p>MANUFACTURER INFORMATION: <b>Universal Circuits, Inc.</b> 8860 Zachary Lane North Maple Grove, MN 55369-4524, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 45032  Contact: Phone: Fax: E-Mail:</p>
<p>MANUFACTURER INFORMATION: <b>Vermont Circuits, Inc.</b> 76 Technology Drive P.O. Box 1890, Brattleboro, VT 05302-1890, US</p>		<p>CAGE Code: 65200  Contact: Bob Downing Phone: 802-257-4571 Fax: 802-257-0011 E-Mail: Bob.Downing@vtcircuits.com</p>
<p>MANUFACTURER INFORMATION: <b>Viasystems Corp. (CA)</b> 355 Turtle Creek Court San Jose, CA 95125-1316, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 0MHG5  Contact: Dave Williams Phone: 408-280-0422 Fax: 408-280-0641 E-Mail: david.williams@viasystems.com</p>
<p>MANUFACTURER INFORMATION: <b>Viasystems Corp. (OR)</b> 1521 Poplar Lane Forest Grove, OR 97116, US</p>	<p>PLANT LOCATION: Same Address as Manufacturer</p>	<p>CAGE Code: 01KV9  Contact: Roger Michalowski Phone: 781-639-5410 Fax: E-Mail: Customerservice@viasystems.com</p>