QUALIFICATIONS VALIDATED ANNUALLY

QML-31032-12
25 July 2002
SUPERSEDING
QML-31032-11
19 March 2002

QUALIFIED MANUFACTURERS LIST

OF

PRODUCTS QUALIFIED UNDER

PERFORMANCE SPECIFICATION

MIL-PRF-31032

PRINTED CIRCUIT BOARD / PRINTED WIRING BOARD,

GENERAL SPECIFICATION FOR

This list has been prepared for use by or for the Government in the acquisition of printed circuit boards / printed wiring boards (hereafter referred to as printed boards) covered by Department of Defense Performance Specification MIL-PRF-31032. Listing of a manufacturer is not intended to and does not connote endorsement of the manufacturer by the Department of Defense. All listings herein have been qualified under the requirements as specified in the latest effective issue of MIL-PRF-31032. This list is subject to change without notice; revision or amendment of this list will be issued as necessary. The listing of a manufacturer does not in any way release the manufacturer from compliance with the individual item specification requirements.

THE ACTIVITY RESPONSIBLE FOR THIS QML IS THE DEFENSE SUPPLY CENTER COLUMBUS (DSCC-VQE), 3990 EAST BROAD STREET, COLUMBUS, OH 43216-5000.

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.

QML-31032 is available from the DSCC-VQ World Wide Web pages at the following addresses:

Web pages: http://www.dscccols.com/offices/sourcing_and_qualification/

QML: http://www.dscccols.com/programs/qmlqpl/QPLdetail.asp?QPL=31032

DSCC contacts for QML companies can be located in the file "31032 main points-of-contact" at website:

http://www.dscc.dla.mil/offices/sourcing and qualification/offices.asp?section=VQE

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 DSCC to make arrangements for QML availability.

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

SECTION I

LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION

MIL-PRF-31032/1 - Printed Wiring Board, Rigid, Multilayered, Woven E-Glass Reinforced Thermosetting Resin Base Material, With Plated Through Holes, For Soldered Part Mounting.

Diversified Systems
3939 W. 56th Street
Indianapolis, IN 46254

Dynamic & Proto Circuits, Inc.
869 Barton Street
Stoney Creek, Ontario L8E 5G6 Canada

Lockheed Martin Corp.
Missiles and Fire Control Orlando
5600 West Sandlake Road
Orlando, FL 32819-8907

Lockheed Martin Systems Integration-Owego
1801 State Route 17C
Owego, NY 13827

Philway Products, Inc.
701 Virginia Avenue
Ashland, OH 44806

Printed Circuits, Inc.
1200 W. 96th Street
Bloomington, MN 55431-2699

Proto Circuit, Inc.
7 Ascot Parkway
Cuyahoga Falls, OH 44223

SAS Circuits, Inc.
10570 Bradford Road
Littleton, CO 80127

Sanmina Tech Center East
46 Rogers Road
Ward Hill, MA 01835

Teradyne Circuits Operation
Connection Systems Division
91 Northeastern Boulevard
Nashua, New Hampshire 03062

Tyco Printed Circuits Group
Austin Division
12501 Research Boulevard, Module 1
Austin, TX 78759

Tyco Printed Circuits Group
Melbourne Division
200 East Drive
Melbourne, FL 32904

MIL-PRF-31032/2 - Printed Wiring Board, Rigid, Single and Double Layer, Woven E-Glass Reinforced Thermosetting Resin Base Material, With or Without Plated Through Holes, For Soldered Part Mounting.

Diversified Systems
3939 W. 56th Street
Indianapolis, IN 46254

Dynamic & Proto Circuits, Inc.
869 Barton Street
Stoney Creek, Ontario L8E 5G6 Canada

Lockheed Martin Corp.
Missiles and Fire Control Orlando
5600 West Sandlake Road
Orlando, FL 32819-8907

Lockheed Martin Systems Integration-Owego
1801 State Route 17C
Owego, NY 13827

Printed Circuits, Inc.
1200 W. 96th Street
Bloomington, MN 55431-2699

Sanmina Tech Center East
46 Rogers Road
Ward Hill, MA 01835

Teradyne Circuits Operation
Connection Systems Division
91 Northeastern Boulevard
Nashua, New Hampshire 03062

Tyco Printed Circuits Group
Austin Division
12501 Research Boulevard, Module 1
Austin, TX 78759

Tyco Printed Circuits Group
Melbourne Division
200 East Drive
Melbourne, FL 32904

SECTION I

LIST OF MANUFACTURERS BY ASSOCIATED SPECIFICATION

MIL-PRF-31032/3 - Printed Wiring Board, Flexible, Single and Double Layer, With or Without Plated Through Holes, With or Without Stiffeners, For Soldered Part Mounting.

Lockheed Martin Systems Integration-Owego
1801 State Route 17C
Owego, NY 13827

Printed Circuits, Inc.
1200 W. 96th Street
Bloomington, MN 55431-2699

Proto Circuit, Inc.
7 Ascot Parkway
Cuyahoga Falls, OH 44223

Tyco Printed Circuits Group
Austin Division
12501 Research Boulevard, Module 1
Austin, TX 78759

MIL-PRF-31032/4 – Printed Wiring Board, Rigid-Flex or Flexible, Multilayer with Plated Holes, With or Without Stiffiners, for Soldered Part Mounting

Lockheed Martin Systems Integration-Owego
1801 State Route 17C
Owego, NY 13827

Printed Circuits, Inc.
1200 W. 96th Street
Bloomington, MN 55431-2699

Proto Circuit, Inc.
7 Ascot Parkway
Cuyahoga Falls, OH 44223

Tyco Printed Circuits Group
Austin Division
12501 Research Boulevard, Module 1
Austin, TX 78759

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS Diversified Systems 3939 W. 56th Street Indianapolis, IN 46254	PLANT LOCATION Same	CAGE CODE: 5S706 CONTACT: Doreen Palmert PHONE #: 317-299-9547, x161 FAX #: 317-298-2055 EMAIL: dpalmert@divsys.com
CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1 MIL-PRF-31032/2 Panel Size: 18" X 24" Max. Board Thickness: 0.110" Max/Min Hole Size: /0.012" Aspect Ratio: 5.5:1 Max. Number of Layers: 14 Min. Conductor Width: 0.005" Min. Conductor Spacing: 0.005" Part Mounting: SM/THM Base Material: GF (Woven E-glass Epoxy Resin) GI (Polyimide Resin) Finish System: Hot Air Solder Leveling Solder Resist: Liquid Photoimageable Dry Film Hole Preparation: Permanganate Desmear/Etchback Copper Plating: Electro-deposited Acid Copper Controlled Impedance: Embedded Stripline & Microstrip		VQE-01-0309 VQE-02-0015

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS Dynamic & Proto Circuits, Inc. 869 Barton Street Stoney Creek, Ontario L8E 5G6 Canada	PLANT LOCATION Same	CAGE CODE: 38898 CONTACT: Mr. David Foster PHONE #: 905-643-9900 FAX #: 905-643-9911 EMAIL: dfoster@dapc.com
CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1 MIL-PRF-31032/2 Panel Size Max. Board Thickness Max/Min Hole Size Aspect Ratio Max. Number of Layers Min. Conductor Width Min. Conductor Spacing Part Mounting Base Material Finish System Hole Preparation Copper Plating Solder Resist	 16"X18" 0.125" 0.039"/0.018" (0.0135" drilled) 9:3:1 16 0.005" 0.005" SM, THM, MIX GF (Woven E-Glass, Epoxy resin) GI (Woven E-Glass, Polyimide resin) Hot Air Solder Leveling Plasma Etch Acid Copper Liquid Photoimageable Dry film solder resist plugs	VQE-98-1143, VQE-00-0007 VQE-01-0311, VQE-02-0818

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS	PLANT LOCATION	CAGE CODE: 04939
Lockheed Martin Corp. Missiles & Fire Control Orlando 5600 West Sandlake Road Orlando, FL 32819-8907	Same	CONTACT: Vijay Kumar PHONE #: 407-356-0282 FAX #: 407-356-8291 EMAIL: vijay.kumar@lmco.com CONTACT: Paul Rose PHONE #: 407-356-5537 EMAIL: paul.b.rose@lmco.com

CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1		VQE-00-0734
MIL-PRF-31032/2		VQE-02-0254
Panel Size	12" X 18"	
Max. Board Thickness	0.100" (nominal)	
Max/Min Hole Size	0.250"/0.018"	
Aspect Ratio	5.5:1	
Max. Nuber of Layers	12	
Min. Conductor Width	0.005"	
Min. Conductor Spacing	0.005"	
Part Mounting	SMT, THM	
Base Material	GI (Woven E-glass Polyimide Resin)	
Finish System	Reflow Solder/HASL	
Hole Preparation	Plasma Desmear	
Copper Plating	Electro-deposited Acid Copper	

CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1		VQE-00-0193
MIL-PRF-31032/2		
Panel Size	12" X 18"	
Max. Board Thickness	0.076"	
Max/Min Hole Size	0.052"/0.012"	
Aspect Ratio	6:1	
Max. Nuber of Layers	14	
Min. Conductor Width	0.004"	
Min. Conductor Spacing	0.005"	
Part Mounting	SMT	
Base Material	GF (Woven E-glass Epoxy Resin)	
Finish System	HASL	
Hole Preparation	Plasma Desmear	
Copper Plating	Electro-deposited Acid Copper	
Solder Resis t	Dry Film Photo Imageable, SMOBC	

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Lockheed Martin Corp.
Missiles & Fire Control Orlando
5600 West Sandlake Road
Orlando, FL 32819-8907</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 04939

CONTACT: Vijay Kumar
PHONE #: 407-356-0282
FAX #: 407-356-8291
EMAIL: vijay.kumar@lmco.com

CONTACT: Paul Rose
PHONE #: 407-356-5537
EMAIL: paul.b.rose@lmco.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1
MIL-PRF-31032/2
Panel Size: 12" X 18"
Max. Board Thickness: 0.051" (nominal)
Max/Min Hole Size: 0.038"/0.016"
Aspect Ratio: 3:1
Max. Nuber of Layers: 7
Min. Conductor Width: 0.005"
Min. Conductor Spacing: 0.005"
Part Mounting: SMT, THM
Base Material: SC (Woven S-glass Cyanate Ester)
Finish System: Reflow Solder
Hole Preparation: Plasma Desmear
Copper Plating: Electro-deposited Acid Copper</td><td>VQE-02-0960</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Lockheed Martin Systems Integration-Owego
1801 State Route 17C
Owego, NY 13827</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 03640

CONTACT: Chris Conklin
PHONE #: 607-751-4251
FAX #: 607-751-7714
EMAIL: c.j.conklin@lmco.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1, /2

Panel Size: 18" X 24"
Max. Board Thickness: 0.200"
Max/Min Hole Size: /0.020"
Aspect Ratio: 8:1
Max. Number of Layers: 16
Min. Conductor Width: 0.004"
Min. Conductor Spacing: 0.004"
Part Mounting: SMT, THM
Base Material: GF (Woven E-glass Epoxy Resin)
GI (Woven E-glass, Polyimide Resin)
AF (Woven Aramid, Epoxy Resin)
Finish System: Fused SnPb
HASL
Hole Preparation: Permanganate Desmear/Plasma
Etchback
Copper Plating: Electro-deposited Copper
Solder Resist: Liquid Photoimageable</td><td>VQE-99-0130
VQE-00-0961</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1

Panel Size: 18" X 24"
Max. Board Thickness: 0.095"
Max/Min Hole Size: /0.014"
Aspect Ratio: 6.8:1
Max. Number of Layers: 14
Min. Conductor Width: 0.004"
Min. Conductor Spacing: 0.004"
Part Mounting: PTH, SM
Base Material: BI (Aramid fabric, Nonwoven, Polyimide Resin)
Finish System: Fused SnPb, HASL, NiAu
Hole Preparation: Permanganate Desmear
Copper Plating: Electro-deposited Cu
Solder Resist: Liquid Photoimageable</td><td>VQE-01-0539</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS	PLANT LOCATION	CAGE CODE: 03640
Lockheed Martin Systems Integration-Owego 1801 State Route 17C Owego, NY 13827	Same	CONTACT: Chris Conklin PHONE #: 607-751-4251 FAX #: 607-751-7714 EMAIL: c.j.conklin@lmco.com

CAPABILITIES BY TECHNOLOGY/ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1		VQE-01-0540
Panel Size	18" X 24"	
Max. Board Thickness	0.111"	
Max/Min Hole Size	/0.022"	
Aspect Ratio	5.05: 1	
Max. Number of Layers	14	
Min. Conductor Width	0.0045"	
Min. Conductor Spacing	0.004"	
Part Mounting	PTH, SM	
Base Material	GC (Glass Base, Woven E-reinforcement, Majority Cyanate Ester, Flame Resistant	
Finish System	Fused SnPb, HASL, NiAu	
Hole Preparation	Permanganate Desmear	
Copper Plating	Electro-deposited Cu	
Solder Resist	Liquid Photoimageable	

CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/3, /4		VQE-00-0684
Panel Size	18" X 24"	
Max. Board Thickness	0.110"	
Max/Min Hole Size	/0.040"	
Aspect Ratio	2.75:1	
Max. Number of Layers	10	
Min. Conductor Width	0.004"	
Min. Conductor Spacing	0.004"	
Part Mounting	SMT, THM	
Rigid Base Material	GF (Woven E-glass Epoxy Resin) GI (Woven E-glass, Polyimide Resin)	
Flex Base Material	IPC-FC-241/1 through /4 IPC-FC-241/11	
Finish System	Fused SnPb, HASL	
Hole Preparation	Permanganate Desmear/Plasma Etchback	
Copper Plating	Electro-deposited Acid Copper	
Solder Resist	UV-Cured Wet Screen	

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Philway Products, Inc.
701 Virginia Avenue
Ashland, OH 44806</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 21971

CONTACT: Ted Norris
PHONE #: 419-281-7777
FAX #: 419-289-3447
EMAIL:chris@philway.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1

Panel Size: 18" X 21"
Max. Board Thickness: 0.090"
Max. Base Cu Thickness: 0.002"
Max/Min Plated Hole Size: 0.044"/0.012
Aspect Ratio: 4:1
Max. Number of Layers: 12
Min. Conductor Width: 0.005"
Min. Conductor Spacing: 0.005"
Part Mounting: SM, THM, MIX
Base Material: GF (Woven E-Glass, Epoxy resin)
GI (Woven E-Glass, Polyimide resin)
GM (Woven E-Glass, Triazine and/or Bismaleimide Modified Epoxy resin)
Finish System: Hot Air Solder Leveling:
IR Reflow following SnPb plate
Hole Preparation: Permanganate Desmear/Etchback
Copper Plating: Acid Copper
Solder Resist: Liquid Photoimageable</td><td>VQE-99-1107</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS Printed Circuits, Inc. 1200 W. 96th Street Bloomington, MN 55431-2699	PLANT LOCATION Same	CAGE CODE: 65114 CONTACT: Dennis Cantwell PHONE #: 612-888-7900 FAX #: 612-888-2719 EMAIL: dcant@printedcircuits.com
CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1, /2, /3, /4 Panel Size: 12" X 18", 18" X 24" Max. Board Thickness: 0.120" Max/Min Hole Size: /0.010" Aspect Ratio: 10:1 Max. Number of Layers: 16 Min. Conductor Width: 0.004" Min. Conductor Spacing: 0.005" Part Mounting: SM/THM, MIX Base Material: GF (Woven E-glass Epoxy Resin) GI (Woven, E-glass Polyimide Resin) IPC-FC-241/1 through /4 IPC-FC-241/11 Finish System: Fused SnPb HASL Electroplated Nickel/Gold Electroless Nickel/Gold Hole Preparation: Plasma Desmear/Etchback Copper Plating: Acid Copper Solder Resist: Liquid/Dry Film Photo Imageable SMOBC		VQE-01-0024

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Proto Circuit, Inc.
7 Ascot Parkway
Cuyahoga Falls, OH 44223</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 7Z463

CONTACT: Peter Menuez
PHONE #: 330-572-3400
FAX #: 330-572-3434
EMAIL: menuez@protocircuit.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1

Panel Size: 18" X 24"
Max. Board Thickness: 0.126"
Max/Min Hole Size: /0.014"
Aspect Ratio: 5:1
Max. Number of Layers: 16
Min. Conductor Width: 0.004"
Min. Conductor Spacing: 0.004"
Part Mounting: SM/THM
Base Material: GF (Woven E-glass Epoxy resin)
GI (Woven E-glass Polyimide Resin)
AF (Woven Aramid Epoxy Resin)
BI (Non-woven Aramid Polyimide Resin
Finish System: HASL
Fused Tin Lead Plate
Selective Solder Strip-Tin Lead Plate
Hole Preparation: Plasma Etchback
Copper Plating: Acid Copper
Controlled Impedance (max/min/tolerance): 100/50 ohm/±5%
Alternate Construction: Sequential Lamination for Blind & Buried Vias (8 layer max)</td><td>VQE-00-0289
VQE-01-0910</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/3
MIL-PRF-31032/4
Panel Size: 18" X 24"
Max. Board Thickness: 0.126"
Max/Min Hole Size: /0.017"
Aspect Ratio: 10:1
Max. Number of Layers: 11
Min. Conductor Width: 0.003"
Min. Conductor Spacing: 0.003"
Part Mounting: SM/THM
Base Material
Rigid: GF (Woven E-glass Epoxy resin)
GI (Woven E-glass Polyimide Resin)
Flex: Adhesiveless Construction
Finish System: HASL
Hole Preparation: Plasma Etchback
Copper Plating: Acid Copper
Flexibility Class: Class A</td><td>VQE-01-0909</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

SAS Circuits, Inc.
10570 Bradford Road
Littleton, CO 80127</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 75815

CONTACT: Frank Bauer
PHONE #: 303-972-4105
FAX #: 303-933-2934
EMAIL: Frank@sascircuits.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1

Panel Size: 18" X 24"
Max. Board Thickness: 0.100"
Max. Base Cu Thickness: /0.001"
Max/Min Hole Size: 0.044"/0.024"
Aspect Ratio: 4:1
Max. Number of Layers: 10
Min. Conductor Width: 0.010"
Min. Conductor Spacing: 0.010"
Part Mounting: SM, THM, MIX
Base Material: GF (Woven E-glass Epoxy resin)
GI (Woven E-glass Polyimide Resin)
GM (Woven E-glass, Triazine and/or Bismaleimide Modified Epoxy Resin)
Finish System: HASL, IR Reflow following SnPb Plate
Hole Preparation: Permanganate Desmear/Etchback
Copper Plating: Acid Copper
Solder Resist: Liquid Photoimageable, Dry Film</td><td>VQE-02-0317</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Sanmina Tech Center East
46 Rogers Road
Ward Hill, MA 01835</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 65316

CONTACT: Steve Aliquo
PHONE #: 978-556-6152
FAX #: 978-556-6370
EMAIL: steve.aliquo@sanmina.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1
MIL-PRF-31032/2
Panel Size: 18" X 24"
Max. Board Thickness: 0.095"
Max/Min Hole Size: /0.013"
Aspect Ratio: 5.9:1
Max. Number of Layers: 16
Min. Conductor Width: 0.006"
Min. Conductor Spacing: 0.005"
Part Mounting: SM/THM
Base Material: GF (Woven E-glass Epoxy resin)
GI (Woven E-glass Polyimide Resin)
Finish System: HASL, Solder Reflow, Nickel,
Conductive Silver Fill
Hole Preparation: Plasma Desmear, Etchback
Copper Plating: Acid Copper
Solder Resist: Liquid Photo Imageable</td><td>VQE-02-0162</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Teradyne, Inc.
Connection Systems Division
91 Northeastern Boulevard
Nashua, New Hampshire 03062</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 3T000

CONTACT: Mark Buechner
PHONE #: 603-791-3832
FAX #: 603-791-3080
EMAIL:Mark.Buechner
@tcs.teradyne.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1
MIL-PRF-31032/2

Panel Size: 24" X 36"
Max. Board Thickness: 0.322"
Max/Min Hole Size: /0.016"
Aspect Ratio: 8:1
Max. Number of Layers: 27
Min. Conductor Width: 0.004"
Min. Conductor Spacing: 0.004"
Part Mounting: THM, Compliant Pin, SMT
Base Material: GF (Epoxy resin)
GI (Polyimide resin)
Finish System: Fused SnPB
Nickel
Gold
Hole Preparation: Permanganate Desmear/Etchback
Copper Plating: Acid Copper
Solder Resist: Thermal Cured Soldermask and SMOBC</td><td>VQE-97-0649
VQE-97-0721</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

MANUFACTURER NAME & ADDRESS	PLANT LOCATION	CAGE CODE: 1EHD4
Tyco Printed Circuits Group Austin Division 12501 Research Blvd., Module 1 Austin, TX 78759	Same	CONTACT: Scott Grover PHONE #: (512) 250-6456 FAX #: (512) 250-7010 EMAIL: grover@tycoelectronics.com
CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:		QUALIFICATION LETTER:
MIL-PRF-31032/1 MIL-PRF-31032/2		VQE-97-0509 VQE-97-0718
Panel Size	18" X 24"	
Max. Board Thickness	0.150"	
Max/Min Hole Size	/0.010"	
Aspect Ratio	9:1	
Max. Number of Layers	20	
Min. Conductor Width	0.004"	
Min. Conductor Spacing	0.004"	
Part Mounting	THM, SM	
Base Material	BI (Nonwoven aramid reinforced polyimide resin) GF (Epoxy resin) GI (Polyimide resin)	
Finish System	Fused SnPB Hot Air Solder Leveling OSP Nickel Gold	
Hole Preparation	Plasma Desmear/Etchback	
Copper Plating	Acid Copper	
Solder Resist	Liquid Photo Imageable (Spray Coated and Screen Printed), Dry Film Photo Imageable, SMOBC	

MIL-PRF-31032/3		VQE-99-0935
Panel Size	18" X 24"	
Max/Min Hole Size	/0.010"	
Aspect Ratio	9:1	
Min. Conductor Width	0.004"	
Min. Conductor Spacing	0.004"	
Part Mounting	THM	
Flex Base Material	IPC-FC-241/1 IPC-FC-241/11	
Finish System	Fused SnPB, HAL, OSP, Nickel, Gold Immersion Silver	
Copper Plating	Electro-deposited Acid Copper	
Usage	Class A	

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td colspan="2">MANUFACTURER
NAME & ADDRESS

Tyco Printed Circuits Group
Austin Division
12501 Research Blvd., Module 1
Austin, TX 78759</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 1EHD4

CONTACT: Scott Grover
PHONE #: 512-250-6456
FAX #: 512-250-7010
EMAIL: grover@tycoelectronics.com</td></tr>
<tr><td colspan="3">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="3">MIL-PRF-31032/4

Panel Size — 18" X 26"
Max. Board Thickness — 0.150"
Max/Min Hole Size — /0.010"
Aspect Ratio — 9:1
Max. Number of Layers — 20
Internal Connections — Blind Vias
Min. Conductor Width — 0.004"
Min. Conductor Spacing — 0.004"
Part Mounting — THM, SM
Rigid Base Material — GF (Epoxy resin)
GI (Polyimide resin)
Flex Base Material — IPC-FC-241/1
IPC-FC-241/11
Finish System — Fused SnPb, HASL, OSP, Nickel Gold, Immersion Silver
Copper Plating — Electro-deposited Acid Copper
Solder Resist — UV-Cured Wet Screen
Usage — Class A (Flex During Installation)</td><td>VQE-99-0933</td></tr>
</table>

SECTION II

LIST OF MANUFACTURERS' QUALIFIED CAPABILITIES FOR EACH TECHNOLOGY

<table>
<tr><td>MANUFACTURER
NAME & ADDRESS

Tyco Printed Circuits Group
Melbourne Division
200 East Drive
Melbourne, FL 32904</td><td>PLANT LOCATION

Same</td><td>CAGE CODE: 64324

CONTACT: Rocky Stygar
PHONE #: 321-308-8700
FAX #: 321-308-8717
EMAIL:
rocky.stygar@tycoelectronics.com</td></tr>
<tr><td colspan="2">CAPABILITIES BY TECHNOLOGY / ASSOCIATED SPECIFICATION:</td><td>QUALIFICATION LETTER:</td></tr>
<tr><td colspan="2">MIL-PRF-31032/1 & 2

Panel Size: 18" X 24"
Max. Board Thickness: 0.160"
Max/Min Hole Size: 0.172"/0.010"
Aspect Ratio: 8:1
Max. Number of Layers: 24
Min. Conductor Width: 0.004"
Min. Conductor Spacing: 0.004"
Part Mounting: PTH, SM
Base Material: BI (Non-woven aramid reinforced polyimide resin)
BF (Non-woven aramid reinforced epoxy resin)
GF (Woven E-glass, epoxy resin)
GI (Woven E-glass, polyimide resin)
AF (Woven aramid fabric modified epoxy resin)
Finish System: Fused SnPb, HASL, Au, Ni
Hole Preparation: Plasma desmear/Etchback
Copper Plating: Electro-deposited Acid Copper
Solder Resist: Thermal, Liquid Photoimageable</td><td>VQE-02-1481</td></tr>
</table>

SECTION III
ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS

MANUFACTURER'S NAME & ADDRESS	PLANT LOCATION	OTHER INFORMATION
Diversified Systems 3939 W. 56th Street Indianapolis, IN 46254	Same	CAGE CODE: 5S706 CONTACT: Doreen Palmert PHONE #: 317-299-9547, x161 FAX #: 317-298-2055 EMAIL: dpalmert@divsys.com
Dynamic & Proto Circuits, Inc. 869 Barton Street Stoney Creek, Ontario L8E 5G6 Canada	Same	CAGE CODE: 38898 CONTACT: Mr. David Foster PHONE #: 905-643-9900 FAX #: 905-643-9911 EMAIL: dfoster@dapc.com
Lockheed Martin Corp. Missiles & Fire Control Orlando 5600 Sandlake Road Orlando, FL 32819-8907	Same	CAGE CODE: 09205 CONTACT: Vijay Kumar PHONE #: 407-356-0282 FAX #: 407-356-8291 EMAIL: vijay.kumar@lmco.com CONTACT: Paul Rose PHONE #: 407-356-5537 EMAIL: paul.b.rose@lmco.com
Lockheed Martin Systems Integration-Owego 1801 State Route 17C Owego, NY 13827	Same	CAGE CODE: 03640 CONTACT: Chris Conklin PHONE #: 607-751-4251 FAX #: 607-751-7714 EMAIL: c.j.conklin@lmco.com
Philway Products, Inc. 701 Virginia Avenue Ashland, OH 44806	Same	CAGE CODE: 21971 CONTACT: Ted Norris PHONE #: 419-281-7777 FAX #: 419-289-3447 EMAIL: chris@philway.com
Printed Circuits, Inc. 1200 W. 96th Street Bloomington, MN 55431-2699	Same	CAGE CODE: 65114 CONTACT: Dennis Cantwell PHONE #: 612-888-7900 FAX #: 612-888-2719 EMAIL: dcant@printedcircuits.com
Proto Circuit, Inc. 7 Ascot Parkway Cuyahoga Falls, OH 44223	Same	CAGE CODE: 7Z463 CONTACT: Peter Menuez PHONE #: 330-572-3400 FAX #: 330-572-3434 EMAIL: menuez@protocircuit.com
SAS Circuits, Inc. 10570 Bradford Road Littleton, CO 80127	Same	CAGE CODE: 75815 CONTACT: Frank Bauer PHONE #: 303-972-4105 FAX #: 303-933-2934 EMAIL: Frank@sascircuits.com

SECTION III
ALPHABETICAL LIST OF QUALIFIED MANUFACTURERS

MANUFACTURER'S NAME & ADDRESS	PLANT LOCATION	OTHER INFORMATION
Sanmina Tech Center East 40 Rogers Road Ward Hill, MA 01835	Same	CAGE CODE: 65316 CONTACT: Steve Aliquo PHONE #: 978-556-6152 FAX #: 978-556-6370 EMAIL: steve.aliquo@sanmina.com
Teradyne, Inc. Connection Systems Division 91 Northeastern Boulevard Nashua, New Hampshire 03062	Same	CAGE CODE: 3T000 CONTACT: Mark Buechner PHONE #: 603-791-3832 FAX #: 603-791-3080 EMAIL: Mark.Buechner@tcs.teradyne.com
Tyco Printed Circuits Group Austin Division 12501 Research Blvd., Module 1 Austin, TX 78759	Same	CAGE CODE: 1EHD4 CONTACT: Scott Grover PHONE #: 512-250-6456 FAX #: 512-250-7010 EMAIL: grover@tycoelectronics.com
Tyco Printed Circuits Group Melbourne Division 200 East Drive Melbourne, FL 32904	Same	CAGE CODE: 64324 CONTACT: Rocky Stygar PHONE #: 321-308-8700 FAX #: 321-308-8717 EMAIL: rocky.stygar@tycoelectronics.com