DOD CONTRACTS
ITAR REGISTERED
AEROSPACE APPROVED
MIL-PRF-31032
MIL-PRF-55110
AS9100D
ISO 9001
JCP REGISTERED
IPC-6012 CLASS 2/3A
UL CERTIFIED
**MATERIALS**

<table>
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<tr>
<th>FR-4</th>
<th>STANDARD FR4</th>
<th>40 LAYERS</th>
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</thead>
<tbody>
<tr>
<td>ISOLA FR406</td>
<td></td>
<td>40 LAYERS</td>
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</table>

**HALOGEN FREE**

| VENTEC VT-441, VT-447 | | 40 LAYERS |
| ISOLA TERRAGREEN | | 40 LAYERS |

**ROHS**

| ITEQ IT-180A | | 30 LAYERS |
| ISOLA 185HR | | 30 LAYERS |
| ISOLA 370HR | | 40 LAYERS |
| FR408HR | | 40 LAYERS |
| ISOLA I-TERA MT (RF/MW) | | 40 LAYERS |
| NELCO BT-N5000 | | 30 LAYERS |
| NELCO 4000-29 | | 40 LAYERS |
| NELCO 4000-12 & 13SI | | 40 LAYERS |
| NELCO 4000-13EP & EPSI | | 40 LAYERS |
| POLYIMIDE | | 40 LAYERS |
| CYANATE ESTER | | 20 LAYERS |

**RF MATERIALS**

| ROGERS 3000 SERIES | | 20 LAYERS |
| (FR-4 W/ R03000 CAPS) | | |
| ROGERS 4003C & 4350B | | 20 LAYERS |
| ROGERS 5870/5880 | | 8 LAYERS |
| TACONIC RF MATERIALS | | 2 LAYERS |
| ISOLA IS680 | | 40 LAYERS |
| I-TERA RF MT | | 40 LAYERS |
| ISOLA ASTRA MT77 | | 40 LAYERS |

**ADVANCED RF MATERIALS**

| NELCO 9000 SERIES (PTFE) | | 2 LAYERS |
| ROGERS 6000 SERIES | | 4 LAYERS |
| ROGERS 5000 SERIES | | 2 LAYERS |
| ROGERS DlCлад 880 | | 20 LAYERS |
| ROGERS AD300A | | 20 LAYERS |
| ROGERS CUCLAD 250 & 233 | | 20 LAYERS |
| ROGERS CTE | | 20 LAYERS |
| ISOLA I-SPEED | | 40 LAYERS |
| ARLON GENCLAD 280 | | 10 LAYERS |
| ARLON LX250 | | 10 LAYERS |
| ARLON GYN 2.17 DK | | 10 LAYERS |

**ADVANCED HDI & SIGNAL INTEGRITY**

| PANASONIC MEGTRON 6 | | AVAILABLE |
| 3M ECM | | AVAILABLE |
| ROHACELL | | T2 LAYERS |
| TACONIC FASTRISE 27 & 28 BONDPLY | | AVAILABLE |
| ISOLA TACHYON 100G | | 40 LAYERS |
| ISOLA I-TERA MT40 | | 40 LAYERS |
| ROGERS 2929 BONDPLY | | AVAILABLE |
| ISOLA 6700 & 6250 BONDPLY | | AVAILABLE |

**SPECIAL FEATURES**

- HEAVY COPPER: UP TO 20 OZ.
- HEATSINKS: AVAILABLE
- BACKPLATES: AVAILABLE
- 2 LYS UP TO 37” X 96” W/ NPT’S: AVAILABLE
- ROHACELL FOAM BONDING: AVAILABLE
- BURIED CHIPS & RESISTORS: AVAILABLE
- RESISTANCE & CONDUCTANCE TEST: AVAILABLE

**INTERNAL SIZE CAPABILITIES**

**MINIMUM CONDUCTOR WIDTH & SPACING:**
- INTERNAL STARTING COPPER WIDTH 1/2 OZ.
  - 0.00275" LINE / 0.003" SPACE
- INTERNAL STARTING COPPER WIDTH 1 OZ.
  - 0.00375" LINE / 0.0045" SPACE
- INTERNAL STARTING COPPER WIDTH 2 OZ.
  - 0.005" LINE / 0.006" SPACE
- INTERNAL STARTING COPPER WIDTH 3 OZ.
  - 0.009" LINE / 0.011" SPACE
- INTERNAL STARTING COPPER WIDTH 4 OZ.
  - 0.012" LINE / 0.016" SPACE

**EXTERNAL SIZE CAPABILITIES**

**MINIMUM CONDUCTOR WIDTH & SPACING:**
- EXTERNAL COPPER FINISHED THICKNESS 1.0 OZ.
  - 0.00275" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 1.5 OZ.
  - 0.004" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 2.0 OZ.
  - 0.005" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 3.0 OZ.
  - 0.009" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 4.0 OZ.
  - 0.010" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 5.0 OZ.
  - 0.020" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 6.0 OZ.
  - 0.030" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 7.0 OZ.
  - 0.045" FINISHED
- EXTERNAL COPPER FINISHED THICKNESS 8.0 OZ.
  - 0.060" FINISHED

**PAD DIAMETER TO DRILLED HOLE SIZE:**

**IPC-6012 CLASS 2**
- COMPONENT HOLES: DRILLED SIZE PLUS 0.006*
- VIA HOLES: DRILLED SIZE PLUS 0.006*

**PAD DIAMETER TO DRILLED HOLE SIZE:**

**IPC-6012 CLASS 3/3A**
- COMPONENT HOLES: DRILLED SIZE PLUS 0.012*
- VIA HOLES: DRILLED SIZE PLUS 0.010*

**PAD DIAMETER TO LASER ABLATED HOLE SIZE**

**MINIMUM:** DRILLED SIZE PLUS 0.004*
**STANDARD:** DRILLED SIZE PLUS 0.008*

**VIA-IN-PAD**

**EPOXY FILLED / NON-CONDUCTIVE:**

- EPOXY FILLED THRU HOLE CAPABILITY: YES
- EPOXY FILLED THRU HOLE MINIMUM: 0.004" FHS
- EPOXY FILLED THRU HOLE MAXIMUM: 0.040" FHS
- MINIMUM BOARD THICKNESS: 0.019*
- MAXIMUM BOARD THICKNESS: 0.187*
- VIA FILL ASPECT RATIO: 10.1

**COPPER PLATED/FILLED:**

- COPPER FILLED VIA PROCESS: YES
- COPPER FILLED VIA HOLE MIN: 0.003" LASER DRILLED
- COPPER FILLED VIA HOLE MAX: 0.010" LASER DRILLED
- VIA FILL ASPECT RATIO: 0.75:1 STANDARD/1:1 ADVANCED
MECHANICAL

MACHINING DRILL CAPABILITIES
PRIMARY DRILLED HOLE LOCATION TOLERANCE TO DATUM ZERO (DTP) .................................................. 0.005”
2ND DRILL HOLE LOCATION TOLERANCE TO DATUM ZERO (DTP) .................................................. 0.005”
MINIMUM CLEARANCE FROM COPPER CONDUCTOR TO MECHANICAL DRILLED HOLE ....................... 0.004”
MINIMUM CLEARANCE FROM COPPER CONDUCTOR TO A LASER DRILLED HOLE ............................... 0.004”

PLATED THROUGH HOLES
SMALLEST PLATED THROUGH HOLE SIZE WITH 0.001” MINIMUM AVERAGE COPPER REQUIREMENT
FINISHED PANEL THICKNESS < 0.020” .......................................................... 0.003” FINISHED HOLE
FINISHED PANEL THICKNESS 0.031” .......................................................... 0.003” FINISHED HOLE
FINISHED PANEL THICKNESS 0.062” .......................................................... 0.004” FINISHED HOLE
FINISHED PANEL THICKNESS 0.093” .......................................................... 0.008” FINISHED HOLE
FINISHED PANEL THICKNESS 0.125” .......................................................... 0.010” FINISHED HOLE
FINISHED PANEL THICKNESS 0.187” .......................................................... 0.012” FINISHED HOLE
FINISHED PANEL THICKNESS 0.250” .......................................................... 0.018” FINISHED HOLE (EXCLUDING HAL FINISH)
PLATED HOLE SIZE TOLERANCE ................................................................. +/- 0.003” STANDARD; +/- 0.002” SPECIAL
PLATED HOLE SIZE PRESS FIT APPLICATIONS ........................................... +/- 0.002” TYPICAL
ASPECT RATIO (WITH 0.010” DRILL) .......................................................... 18:1 (0.007” FINISH IN 0.130” THICK)
PLATED HOLE SPACING MIN. (DRILLED HOLE TO HOLE) ........................................... 0.008”

NON-PLATED THROUGH HOLES
SMALLEST NON-PLATED HOLE SIZE .......................................................... 0.006” LARGEST NON-PLATED HOLE SIZE ROUTED ............... NO LIMIT
NON-PLATED ROUTED HOLE TOLERANCE ................................................ +/- 0.005” TYPICAL; +/- 0.003” SPECIAL
MINIMUM NPTH TO EDGE OF BOARD SPACING ............................................. 0.010”

BLIND / BURIED VIAS (SEQUENTIAL LAMINATION)
MIN. FINISHED VIA HOLE DIAMETER (EPoxy FILLED) ........................................ 0.006” MAX. FINISHED VIA HOLE DIAMETER (EPoxy FILLED) .......... 0.04”
MAX. ASPECT RATIO FOR EPOxy FILLED VIA HOLES ................................... 10:1
AVAILABLE EPOxy FILl TYPES ................................................................... CONDUCTIVE & NON-CONDUCTIVE

HDI / LASER MICROVIA (µVIA) CAPABILITIES
SMALLEST (AS ABLATED) LASER VIA .......................................................... 0.003” LARGEST (AS ABLATED) LASER VIA .................. 0.010”
VIA ASPECT RATIO (DEPTH TO DIAMETER) ............................................... 0.75:1 STANDARD; 1:1 ADVANCED
CAPTURE PAD SIZE ................................................................. µVIA +0.008” STANDARD; µVIA +0.006” ADVANCED
LANDING PAD SIZE ................................................................. µVIA +0.008” STANDARD; µVIA +0.006” ADVANCED
STACKED VIA ................................................................... YES COPPER FILLED MICROVIA
TYPE I CAPABILITIES ................................................................... YES
TYPE II CAPABILITIES ................................................................... YES
TYPE III CAPABILITIES ................................................................... DESIGN DEPENDENT

CONTROL DEPTH / BACK DRILLING CAPABILITIES
BACKDRILL - PTH STUB REMOVAL .............................................................. PTH + 0.010” DIAMETER (TYPICAL)
MINIMUM BACKSIDE DIELECTRIC SEPARATION ............................................. 0.005”
CONTROL DEPTH DRILL DEPTH TOLERANCE ........................................... +/- 0.004”
EDGE MILLING AVAILABLE ................................................................... YES
MINIMUM BACK DRILL DIAMETER ............................................................. 0.014”
DRILLED HOLE OVER FINISHED HOLE SIZE ........................................... 0.010”
DRILL DEPTH TOLERANCE ................................................................. 0.005” TYPICAL; 0.004” MINIMUM

SCORING CAPABILITIES
ANGLES .................................................................................. STANDARD 30°; AVAILABLE 20°, 45°, & 60°
OFFSET TOLERANCE ................................................................... +/-0.005”
OPTIMUM REMAINING WEB THICKNESS .................................................. TYPICAL MAX. 1/3 OF THICKNESS
REMAINING WEB TOLERANCE ......................................................... +/-0.005” TRUE POSITION TOLERANCE

EDGE CONNECTOR BEVEL CAPABILITIES
FINGER TIP ANGLE ................................................................... 15°, 20°, 30°, 45°
BEVEL DEPTH TOLERANCE ................................................................... +/-0.005”

PROFILE CAPABILITIES
STANDARD ROUTER BIT DIAMETER ...................................................... 0.093”, 0.062”, 0.031” (ROUTER BITS) 0.021” SPECIAL
ROUTED PROFILE TOLERANCE ......................................................... +/-0.005” STANDARD; +/-0.004” SPECIAL
MINIMUM INTERNAL ROUT RADIUS .......................................................... 0.0105”
MINIMUM ROUTED PTH SLOT WIDTH .................................................... 0.022” TYPICAL W/ 0.008” MIN.
CONTROLLED DEPTH MILLING ................................................................ YES
LASER ROUTING ................................................................... 0.001” MIN. RADIUS
SOLDER MASK & LEGEND

SOLDER MASK
- MIN. LPI SOLDER MASK CLEARANCE (FLOOD) 0.002” / SIDE (PAD SIZE + 0.004”)
- MIN. LPI SOLDER MASK CLEARANCE (LDI IMAGED) 1:1 (DESIGN DEPENDENT)
- PAD SIZE LARGER THAN NPTH 0.005” / SIDE (PAD SIZE + 0.010”)
- WEB BETWEEN SURFACE MOUNT PADS 0.004” PREFERRED, 0.002” MINIMUM (GREEN)
- LEW PROCESSING 0.005” MIN. LEW /CLEAR UNDERCOAT
- SOLDER MASK COLORS GREEN, MATTE GREEN, BLUE, RED, BLACK, MATTE BLACK, YELLOW, LEW WHITE, WHITE, ORANGE, PURPLE, PINK, BROWN, CLEAR
- SOLDER MASK TYPE LIQUID PHOTO IMAGEABLE (LPI) LASER DIRECT IMAGING (LDI) SPECIAL
- MIN. MASK DEFINED PAD DIAMETER 0.005”
- SOLDER MASK PLUGGED VIAS YES

LEGEND
- PRINTED LEGEND MINIMUM STROKE/WIDTH 0.005”
- LPI LEGEND CAPABILITY YES
- LPI LEGEND MINIMUM STROKE/WIDTH 0.002”
- SCREENED / LPI LEGEND COLORS WHITE, BLACK, YELLOW, RED, BLUE
- SERIALIZATION / UNIQUE SERIALIZATION YES

SURFACE FINISH OPTIONS

SURFACE FINISH SELECTION
- HOT AIR SOLDER LEVEL (LEAD-FREE, LEAD BASED) YES
- IMMERSION SILVER YES
- OSP YES (OUTSOURCED)
- ELECTROLESS NICKEL IMMERSION GOLD YES
- ENEPIG YES
- IMMERSION TIN YES (OUTSOURCED)
- FULL BODY GOLD YES (OUTSOURCED)
- BONDABLE GOLD YES (OUTSOURCED)
- PLATED NICKEL YES
- ELECTROLESS NICKEL YES
- COPPER YES
- HOT OIL REFLOW YES

MIXED FINISHES
- HASL WITH SELECTIVE GOLD YES
- DUAL PLATING YES
- IMMERSION GOLD W/ HARD GOLD ON FINGERS YES
- RECESS FINGERS YES

USABLE PANEL AREA
- FOR 12” X 18” PANEL 10” X 16” (UP TO 40 LAYERS)
- FOR 18” X 24” PANEL 16.6” X 22” (UP TO 40 LAYERS)
- FOR 18” X 27” PANEL 16” X 25” (UP TO 8 LAYERS)
- FOR 18” X 32” PANEL 16” X 30” (UP TO 8 LAYERS)
- FOR 18” X 36” PANEL 16” X 34” (UP TO 8 LAYERS)
- FOR 18” X 42” PANEL 16” X 40” (UP TO 8 LAYERS)
- FOR 18” X 54” PANEL 16” X 52” (UP TO 8 LAYERS)
- FOR 21” X 24” PANEL 19” X 22” (UP TO 30 LAYERS)
- FOR 21” X 60” PANEL 18” X 58” (UP TO 8 LAYERS)
- FOR 24” X 30” PANEL 22” X 28” (UP TO 8 LAYERS)

STACK UP

OVERALL BOARD THICKNESS 0.010” - 0.250”

OVERALL BOARD TOLERANCES:
-0.020” STANDARD +/-0.004” SPECIAL +/-0.003”
-0.031” STANDARD +/-0.004” SPECIAL +/-0.003”
-0.062” STANDARD +/-0.006” SPECIAL +/-0.003”
-0.093” STANDARD +/-0.009” SPECIAL +/-0.006”
-0.125” STANDARD +/-0.012” SPECIAL +/-0.009”
-0.187” STANDARD +/-0.018” SPECIAL +/-0.014”
-0.250” STANDARD +/-0.025” SPECIAL +/-0.018”

THINNEST DIELECTRIC FINISHED:
OVERALL THICKNESS 0.010” 2 LAYER / 0.015” 4 LAYER
THINNEST PLATED CORE 0.004”

ELECTRICAL PERFORMANCE

TDR TEST TOLERANCE (PRINT & ETCH)
- STANDARD 10% / ADVANCED 5%
- TDR TEST TOLERANCE (PLATED COPPER)
- STANDARD 10% / ADVANCED 5%
- TDR TEST TOLERANCE DIFFERENTIAL MEASUREMENTS
- STANDARD 10% / ADVANCED 5%
- TDR TOLERANCE SINGLE ENDED TOLERANCE
- STANDARD 10% / ADVANCED 5%
- HIPOT TESTING (AC & DC)

DATA & DOCUMENTATION

TOOLING FORMATS
- FILM DATA FORMATS
  - DXF, RS-274-X, RS-274-D, ODB++
- DRILL DATA FORMATS
  - ASCI; EXCEL&N FORMAT; RS-274-X; RS-274-D
- ELECTRICAL TEST FORMATS
  - IPC-D356
- NETLIST COMPARE FORMATS
  - IPC-D356; IPC-D356A

TOOLING COMMUNICATION
- COMPRESSION FORMATS
  - ZIP; TAR; TGZ
- SECURED DATA TRANSFER METHODS
  - SECURE DATA TRANSFER; PGP

MILITARY

ETCH BACK
- IPC CLASS 3 ETCHBACK SPECIFICATION 0.0002” - 0.002”

TESTING CAPABILITIES

MIN. TEST CONTINUITY RESISTANCE 0.1 OHMS
MAX. TEST VOLTAGE 1000 Volts
MAX. TEST ISOLATED RESISTANCE 25 MOHM-260HM
LARGEST TEST - FIXTURED 16” X 22”
LARGEST TEST - FLYING PROBE 27” X 24”
E-TEST PITCH (FIXTURE TEST) 0.020”
E-TEST PITCH (FLYING PROBE TEST) 0.004”
DC LINE RESISTANCE TESTING YES