SCIPP-10/31/00
SLAC PUB#???

GLAST Tracker Subsystem
Tracker Multi Chip Module
Fabrication and Assembly Specifications

Gwelen Paliaga
10/31/00

This document is intended to describe the GLAST Tracker Multi Chip Module in sufficient detail for the development of a manufacturing plan and assembly procedures. This information is intended to be used by contract manufacturers in generating quotations to build these modules. Manufacturing requirements, specifications, and schedule are included and will be subject to changes as the project develops.

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Revision Log

Rev.#	Date	Author(s)	Summary of Revisions/Comments
0	10/31/00	Gwelen Paliaga	Initial Release
1	2/7/01	Gwelen Paliaga	Changes to 3.1 - 3.3, 4.3 - 4.5, 5.4 - 5.8 New sections 4.6 and 6.1-6.2 (schedule)

TBD and TBR Summary

Paragraph	Issue	Organization	Responsible Engineer	ECD
2.2	Design, budget	SCIPP	D. Nelson	
4.1	Comply with MAR	SLAC	T. Borden	
4.2	Needs testing	SCIPP	W. Kroeger	

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1. Definitions:

SCIPP	-Santa Cruz Institute for Particle Physics
SLAC	-Stanford Linear Accelerator Center
GLAST	-Gamma-Ray Large Area Space Telescope
PWB	-Printed Wiring Board
TBD	-To be decided
TBR	-To be reviewed
TMCM or MCM	-Tracker Multi Chip Module. Meant to describe the entire assembly of PCB, ASICS, and flex circuit that comprise the front end electronics on GLAST Tracker Trays.
RAI	-Right Angle Interconnect (composed of a support substrate and a pitch adapter flexible circuit).
Pitch Adapter	-A single layer flexible circuit (Kapton) with traces that fan out GLAST front end ASIC pitch to the detector pitch

2. Introduction

2.1 GLAST is a NASA funded mission under the “Structure and Evolution of the Universe” research division. GLAST is a satellite based gamma-ray telescope that will measure the direction and energy of incident gamma-rays. An important component of GLAST is the Tracker which determines the gamma-ray directions. The Tracker is composed of approx. 300 modules of Silicon Strip Detectors and each module uses 2 MCM’s. The MCM’s carry 26 ASIC’s which amplify, digitize, and manage the signals from the Silicon Detectors. A unique feature of the GLAST TMCM is a Right Angle Interconnect (RAI) structure on the edge of the board. This structure allows wire-bonding in 2 perpendicular planes on the surface and edge of the MCM. This RAI structure allows the Tracker electronics to be placed perpendicular to the detector plane and subsequently the detector modules can be packed more tightly.

2.2 The GLAST instrument will need **715** (TBD) MCM’s for the instrument and spares.

3. TMCM Description (Reference drawings in Appendix)

3.1 Substrate

8 Layer aramid based PWB, 360.2 mm X 26.31 mm, 1.4 mm thick
Wire-bond pad size will have a minimum size of 200 x 500 μm (TBR).

3.2 ASICS

24 ASICS, 2.4 x 13.9 mm, 120 wire-bonds each
2 ASICS 6 x 6 mm, 40 wire-bonds each
All ASICS will have minimum bond pad size of 120 x 150 μm and a minimum pitch of 201 μm.

3.3 RAI

An aramid substrate will be bonded to one edge of the PWB and cut to a 1 mm radius. The Kapton fanout will be bent and epoxied around this radius. One edge, in the plane of the top of the board has traces for wire-bonding to the ASICS. The other edge, perpendicular to the board face, has traces for wire-bonding to GLAST detector modules. The 1552 traces along the edge of the RAI need to be protected and left un-encapsulated for later system integration.

3.4 Connectors

2 Nanonics 37 pin miniature connectors are surface mounted on both ends of the PWB. Reference Appendix for dimensions.

3.5 Passive Components

Number	Component	Size
4	fuse	1812
6	Tant Cap	3528
4	Resistor	1210
84	Resistor	0505
84	capacitor	0805

3.6 Summary of MCM components

Part	Number
Printed wire board	1
Kapton fanout	1
RAI support piece	1
GTFE64 ASIC	24
Controller ASIC	2
Nanonics connector	2
Fuse	4
Capacitors	90
Resistors	88

4. Manufacturing Specifications and Requirements

4.1 Standards

Any assembly house shall follow IPC standards, Mil Spec 55110, ISO 9000, (TBD)

4.2 Die Attach

Comfortable wire-bonding clearances require die alignment to 0.1 mm true position. (Subject to review by assembler)
Conductive epoxy shall be used. (TBR)

4.3 Wire Bonding

All 2960 wire-bonds must be in place, with a minimum of re-bonding.
Periodic pull tests should be done, either non-destructively, or destructively on a test coupon and the data recorded.
Visually inspect wire bonds between the ASICS and RAI

4.4 Testing

I-V test shall be done after loading passives and before die attach.
Functionality test shall be done before encapsulation.

4.5 Handling

No process temperature above 170 C.
The traces on the RAI perpendicular to the tray need to be protected so that, even after encapsulation they provide high quality wire-bondable surfaces. This may require fixturing, masking, plasma cleaning, or a combination.

4.6 Database

Electronically record data from; statistical process control, handling tracking, test, and re-work.

5. Scope of Work Needed

5.1 Passive assembly

Load and solder resistors, capacitors, and fuses

5.2 Test

Test I vs. V for 2V, 3V, and 200V lines. Or another form of verifying correct passive component placement.

5.3 Die Attach

Optically align and epoxy 26 die

5.4 Wire-Bonding

Perform 2960 wire bonds
Visually inspect wire bonds between ASICS and RAI

5.5 Functional Test & Re-Work

Digital test (10 min./board) with SCIPP supplied fixtures and test equipment
Identification of dead die, missed wire-bonds, and repair. *Prototypes have had a very low failure rate.*

5.6 Encapsulation

Glob top type encapsulation of all 26 die. Conformal coat the rest of the board with silicone material.

5.7 Burn In

160 Hrs. Burn in (SCIPP supplied equipment, vendor supplied Ovens)

5.8 Possible Assembly of RAI

If an assembly house is interested, the possibility of assembling the Kapton fanout onto the RAI exists.

6. Schedule

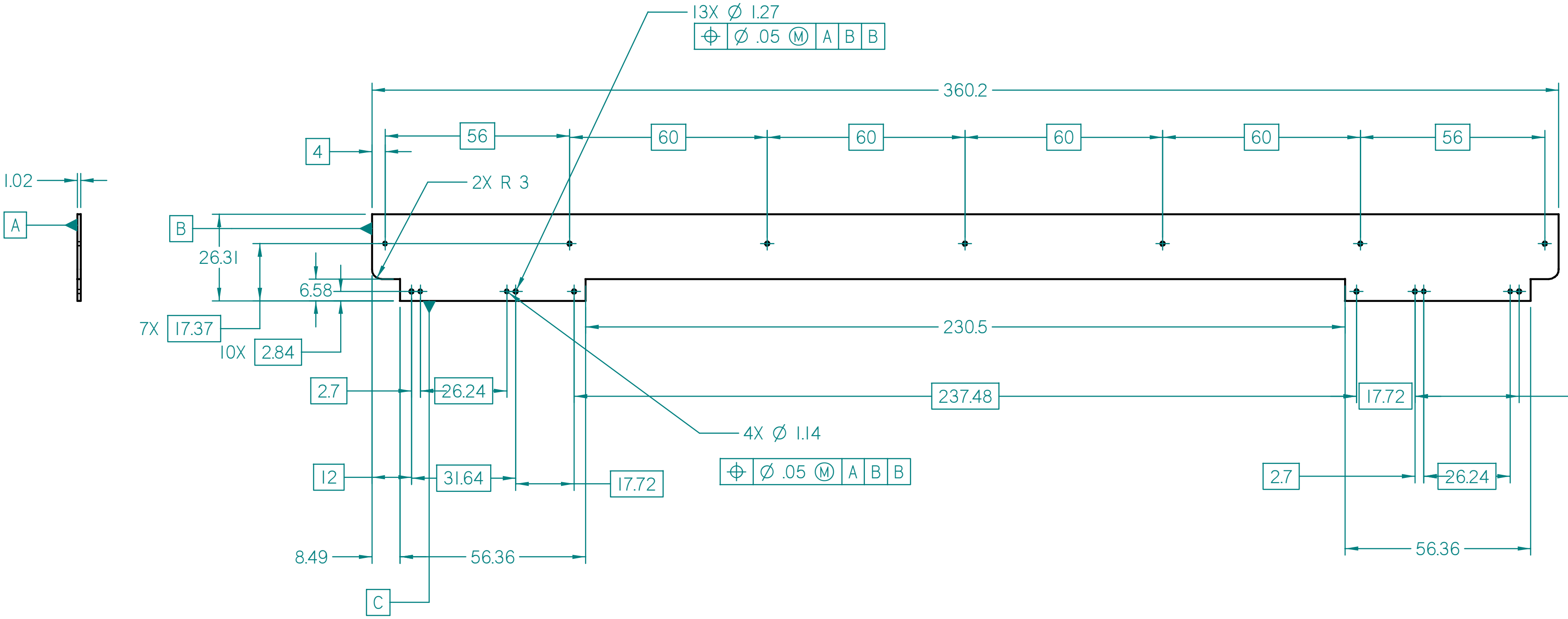
6.1 Prototype run

ASICS will be ready at the earliest 2/02
Projected run of 20-40 MCM's.
PWB's and components can be delivered earlier for fixture design (Possibly 6/01).

6.2 Delivery of Flight Modules

Flight parts delivery by 8/1/02
First delivery needed by 10/1/02
Final modules delivered by 3/1/03
7 months total production time => ~ 26 modules/week

REV	DESCRIPTION	DWN	CHKR	APVD	DATE



CHECK-PRINT

NEXT ASSEMBLIES:

DIMENSIONING AND TOLERANCING IS IN ACCORDANCE WITH ASME Y14.5M-1994.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES:
BREAK EDGES .005-.015
INTERNAL CORNERS R.015 MAX
FRACTIONS ± ---
DEC .xx± .1
.xxx± .05
.xxxx± ---
125 √
ALL SURF

SCALE: 1:1
DO NOT SCALE DRAWING
CAD FILE NAME: hdi 89501.dft

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		DATE	APPROVALS
ENGR	T. BORDEN		---
DWN	BHATNAGAR		---
CHKR	---		---

LAT
TRAY
HDI COMBINED BOARD
HDI COMBINED BOARD

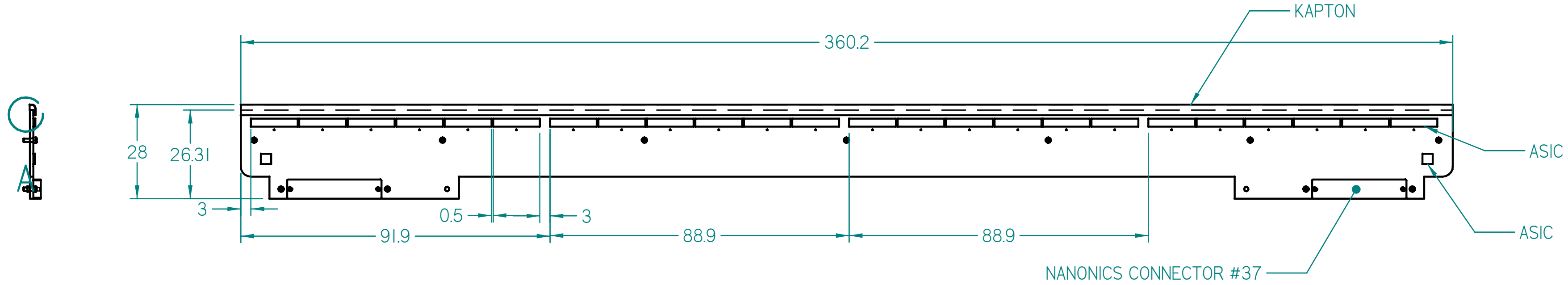
--- 0 C

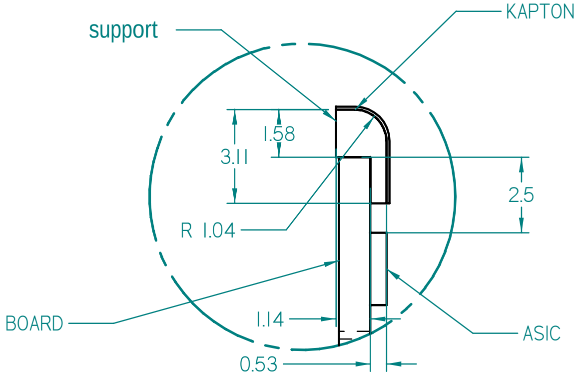
SH 1 OF 1

C 0 ---

LAT

REV	DESCRIPTION	DWN	CHKR	APVD	DATE





DETAIL A

CHECK-PRINT

ALL DIMENSIONS ARE IN MM.

NEXT ASSEMBLIES:

DIMENSIONING AND TOLERANCING IS IN ACCORDANCE WITH ASME Y14.5M-1994.

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DIMENSIONS ARE IN INCHES.
TOLERANCES:
BREAK EDGES .005-.015
INTERNAL CORNERS R.015 MAX
FRACTIONS ± ---
DEC .xx ± .1
.xxx ± .05
.xxxx ± ---
125 ALL SURF

SCALE: 1:1
DO NOT SCALE DRAWING
CAD FILE NAME: Draft1

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ENGR T. BORDEN
DWN BHATNAGAR
CHKR PALIAGA
DATE
APPROVALS
R. JOHNSON

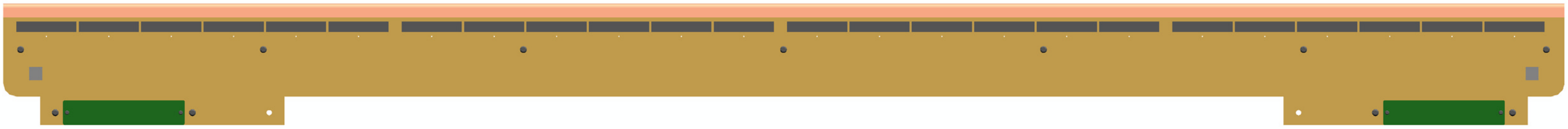
LAT TRACKER
TRAY ASSEMBLY
TMCM ASSY

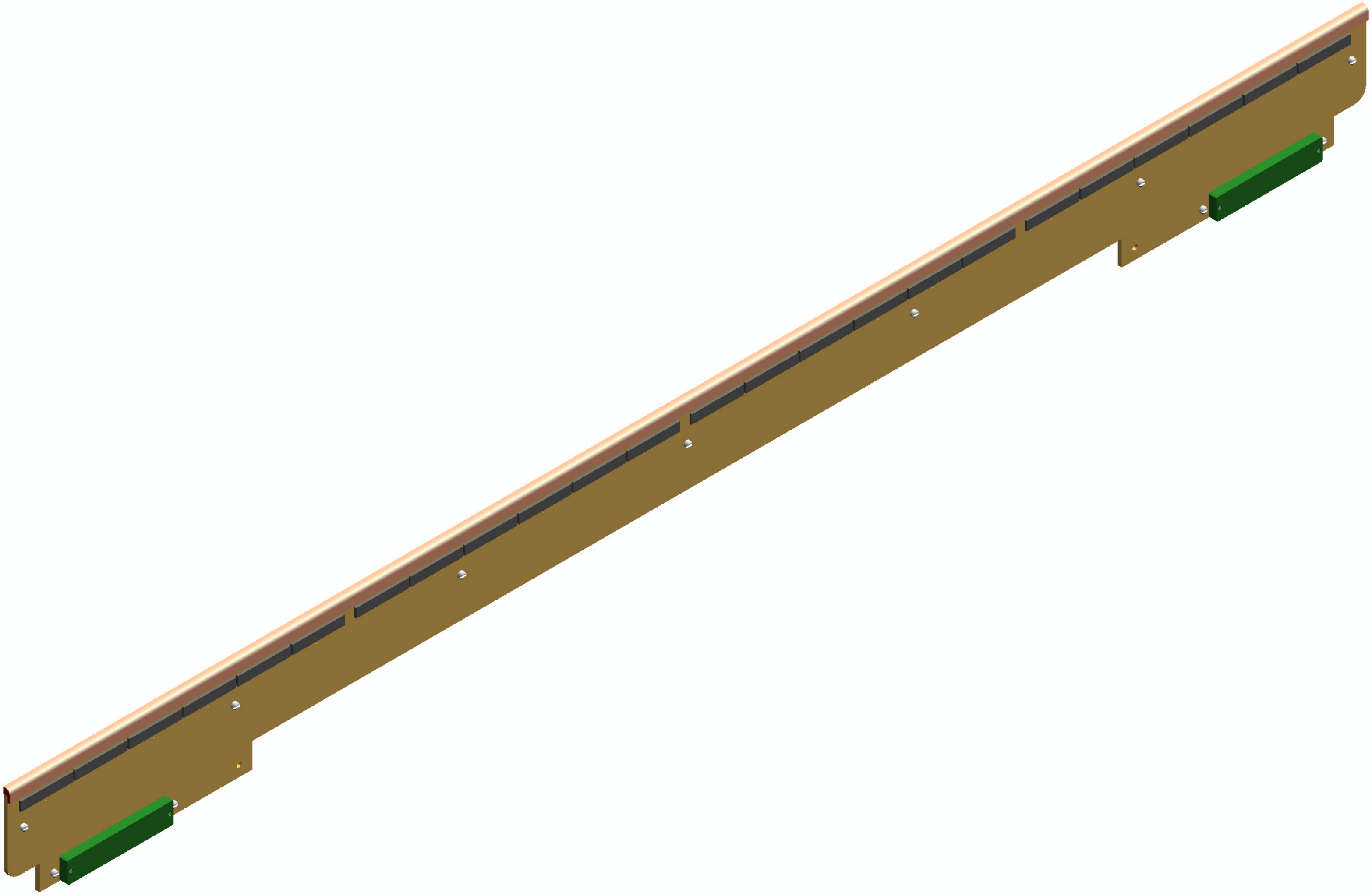
SK-TMCM-001 0 C

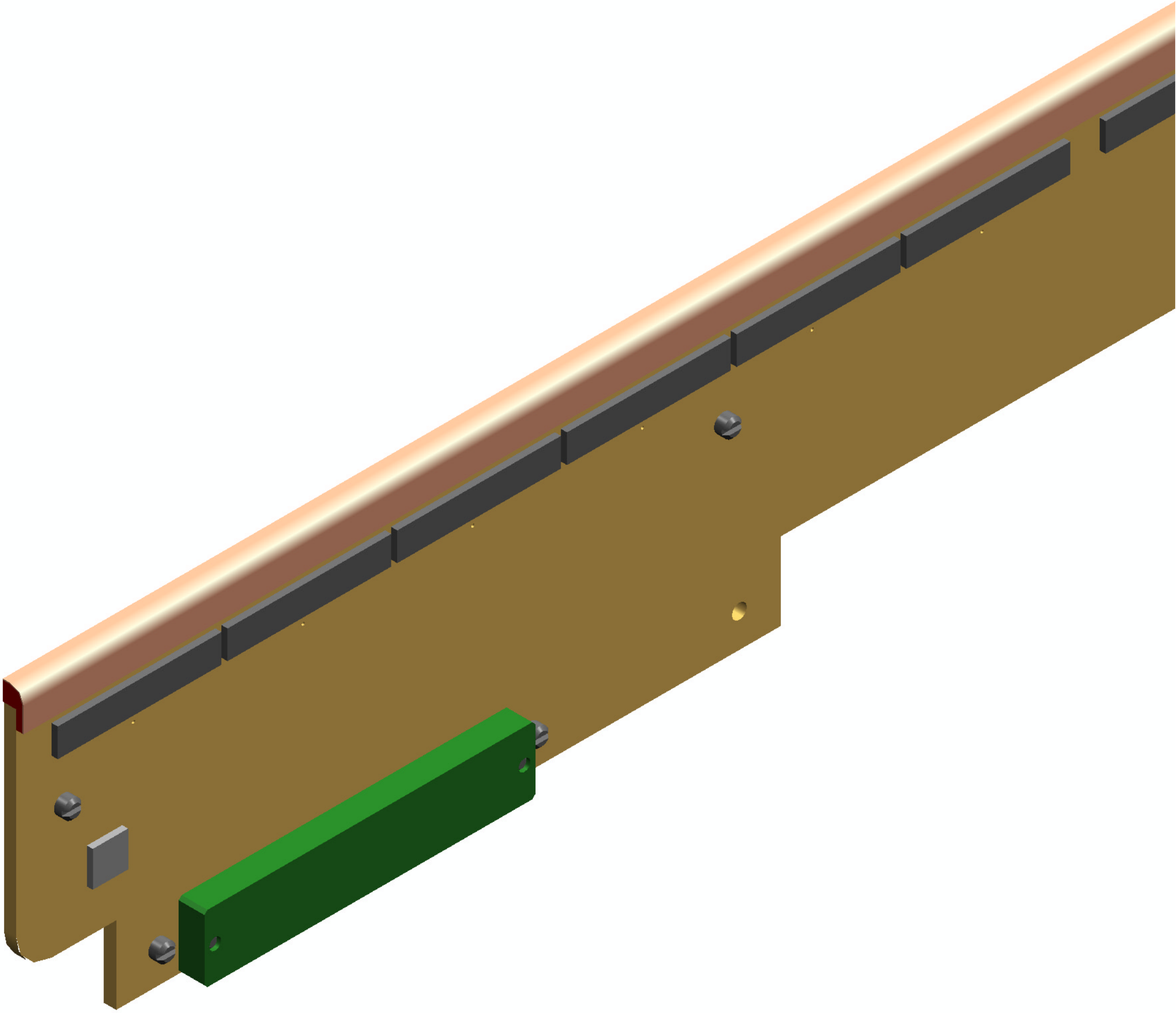
LAT

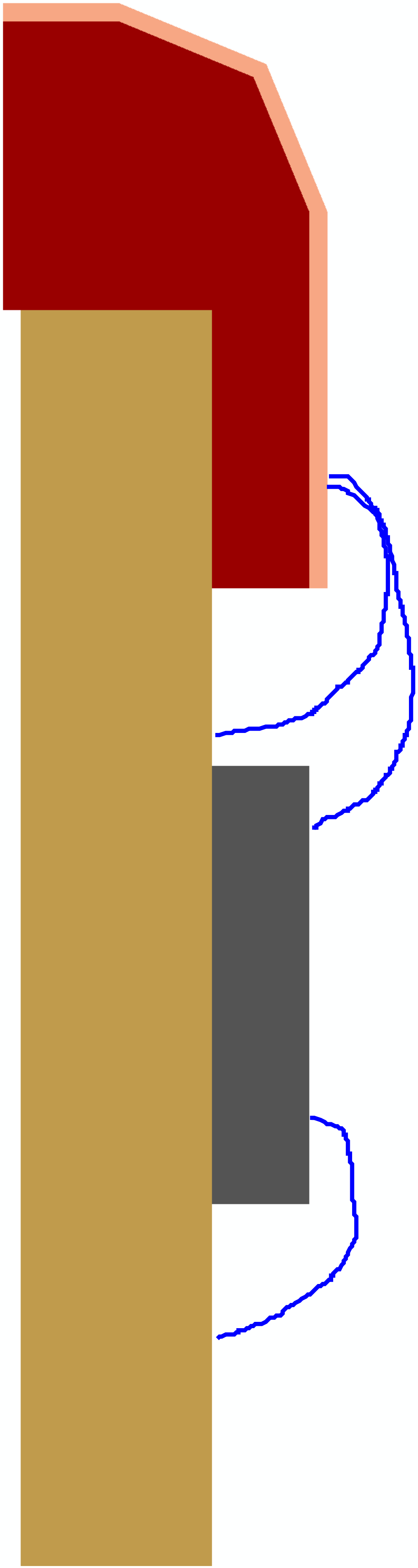
C
0
SK-TMCM-001

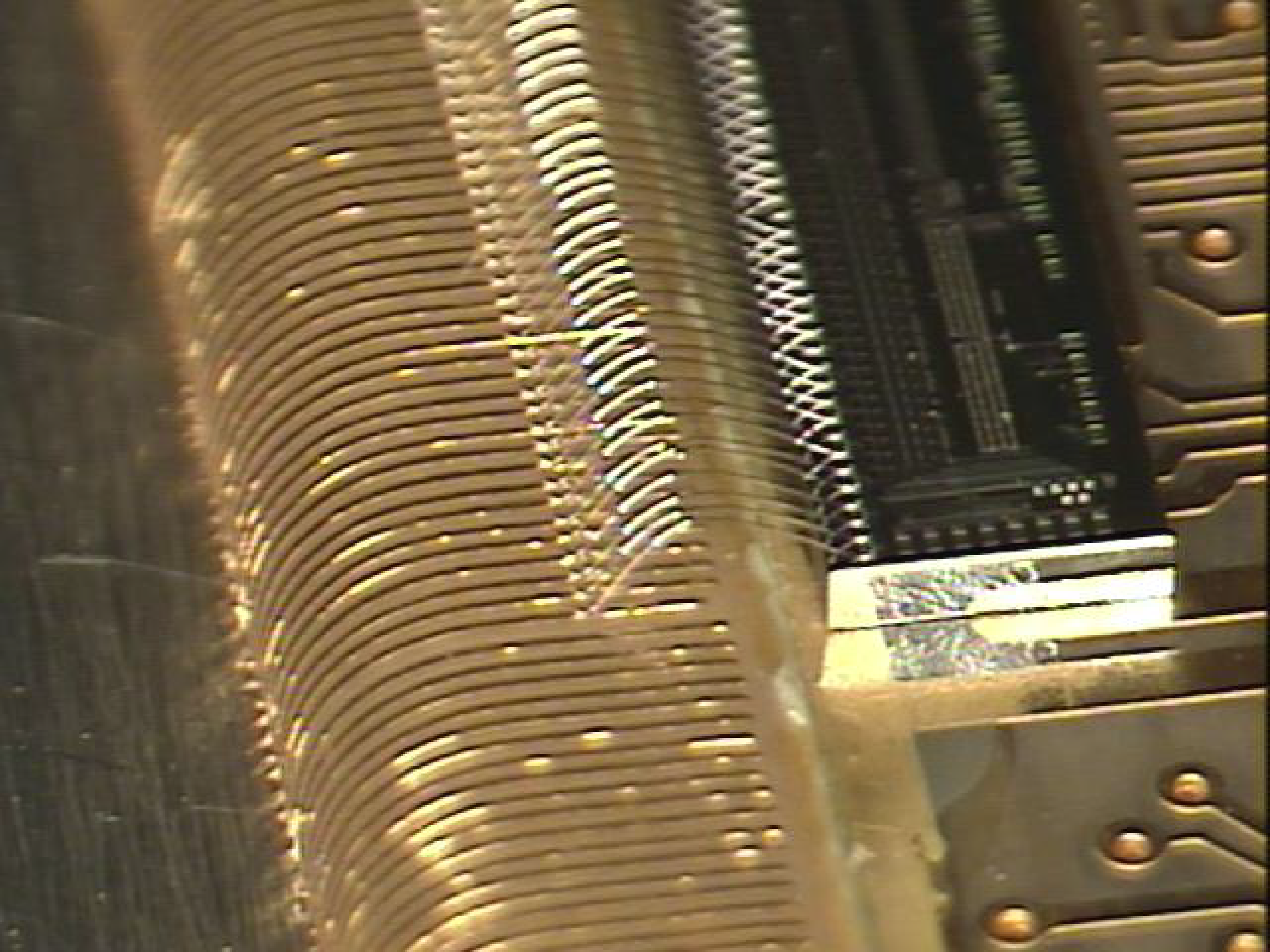
SH 1 OF 1











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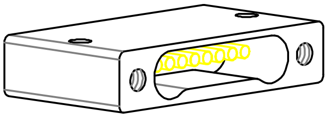

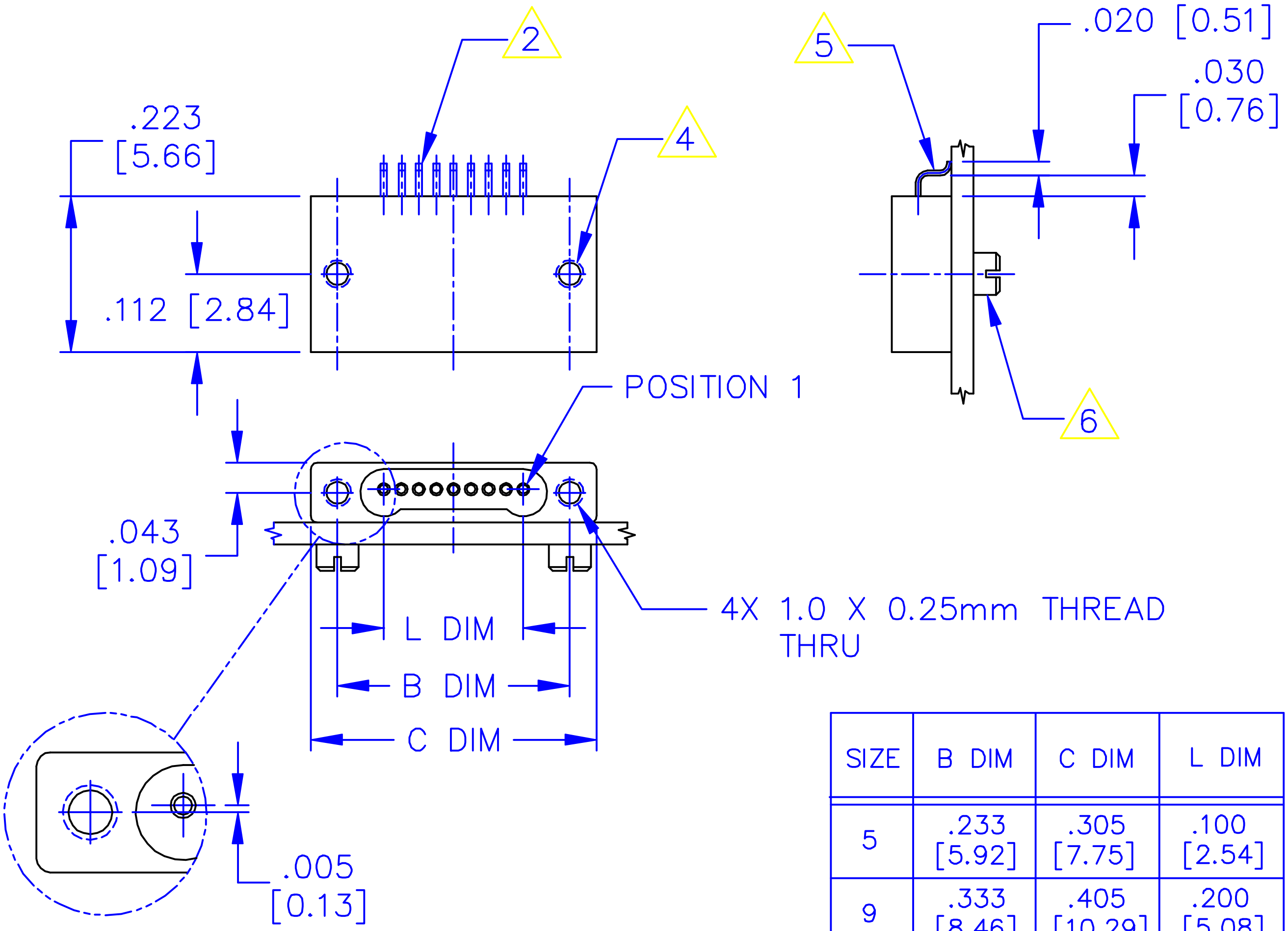

SIZE	B DIM	C DIM	L DIM
5	.233 [5.92]	.305 [7.75]	.100 [2.54]
9	.333 [8.46]	.405 [10.29]	.200 [5.08]
15	.483 [12.27]	.555 [14.10]	.350 [8.89]
25	.733 [18.62]	.805 [20.45]	.600 [15.24]
37	1.033 [26.24]	1.105 [28.07]	.900 [22.86]
51	1.383 [35.13]	1.455 [36.96]	1.250 [31.75]

6. SCREWS ARE SHOWN FOR REFERENCE ONLY AND ARE NOT INCLUDED AS PART OF THE CONNECTOR.

5. PRIOR TO INSTALLATION, THE SURFACE MOUNT LEADS WILL BE LOCATED FLUSH TO .006 ABOVE THE MOUNTING PLANE.

4. MID-BODY MOUNTING HOLES: STANDARD FOR METAL AND PLASTIC SHELLS.

3. REFER TO N10138/131 FOR INFORMATION CONCERNING PAD LAYOUT ON PC BOARD.

2. TERMINATION TYPE L2.

1. REFER TO CATALOG FOR COMPLETE INFORMATION ON ORDERING CONNECTORS .

NANONICS®

NANONICS CORPORATION
21644 N. 14TH AVENUE
PHOENIX, AZ 85027-2840
602-581-8188

HORIZONTAL, SURFACE MOUNT RECEPTACLE, SINGLE ROW DUALOBE PLASTIC OR METAL

ALL DIMENSIONS ARE IN INCHES
.XX = ±.010
.XXX = ±.005
DIMENSIONS APPLY AFTER PLATING

INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982

	NAME	DATE
DRAWN BY	D. RYAN	4-20-92
CHECKED BY	E. PAULUS	5-15-89
APP'D BY		
CUST/ PROJECT		

SIZE	DRAWING NUMBER	REV
A	N10138/130	N

SCALE: 4:1 CODE IDENT OPJN9 SHEET 1 OF 1

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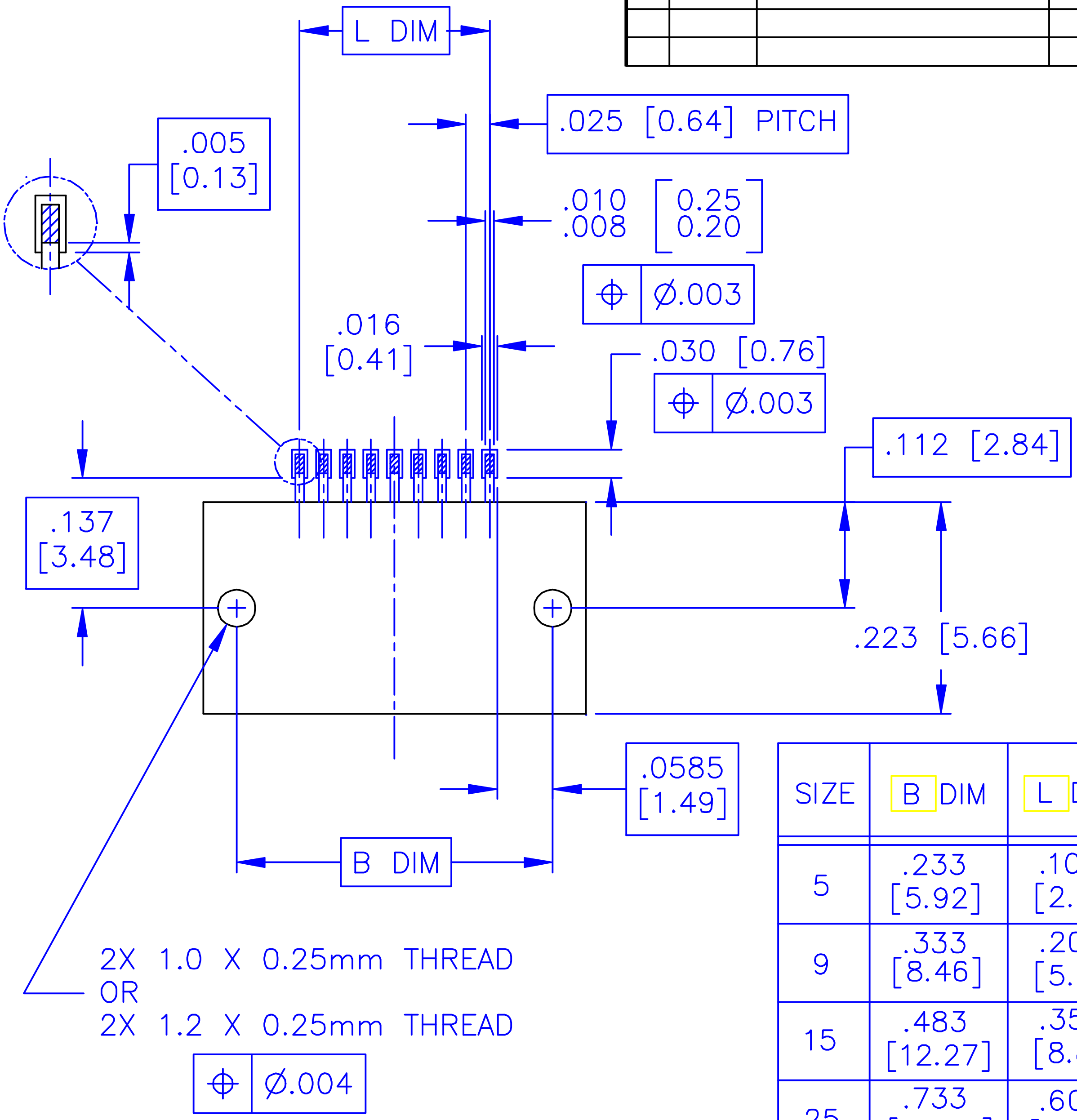

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DIMENSIONS APPLY AFTER PLATING

INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982

	NAME	DATE
DRAWN BY	D. RYAN	4-21-92
CHECKED BY	E. PAULUS	6-3-98
APP'D BY		
CUST/ PROJECT		

HORIZONTAL, SURFACE MOUNT RECEPTACLE, LAYOUT, SINGLE ROW DUALOBE

SIZE	DRAWING NUMBER	REV
A	N10138/131	J

SCALE: 6:1 CODE IDENT OPJN9 SHEET 1 OF 2