NOTES: (UNLESS OTHERWISE SPECIFIED)

1. THREE DIMENSIONAL CAD GEOMETRY PROVIDED BY APPLE INC. SHALL BE USED FOR CREATION OF THIS PART OR ASSEMBLY. DRAWING SHALL BE USED FOR DIMENSIONAL INSPECTION OR TO IDENTIFY CRITICAL TOLERANCES AND REFERENCE FEATURES.
2. ALL DIMENSIONS AND TOLERANCES APPLY PER ASME Y14.5M, 2009. IT IS EXPECTED THAT THE SUPPLIER UNDERSTAND AND COMPLY WITH ALL TOLERANCES AS DESCRIBED IN THIS STANDARD AND APPLIED TO THIS DRAWING.
3. ALL DIMENSIONS MEASURED IN FREE STATE UNLESS SPECIFIED BY APPLE INC. PD AND APPLE INC. SQE.
4. UNLESS OTHERWISE SPECIFIED, ALL SURFACES TO BE WITHIN A SURFACE PROFILE TOLERANCE OF ⌓ 0.20 A B C.
5. DIMENSIONS DESIGNATED WITH THE SYMBOL (SPC) SHALL BE MONITORED WITH STATISTICAL PROCESS CONTROLS. THE PROCESS CONTROL DATA (CP, CPK, ETC.) OF THE PART MUST BE VALIDATED AND APPROVED BY APPLE INC. SQE.
6. DIMENSIONS DESIGNATED WITH THE (FAI) SYMBOL SHALL BE FIRST ARTICLE INSPECTION DIMENSIONS. THREE SAMPLE PARTS MUST BE FULLY INSPECTED. FAI REPORT MUST BE VALIDATED AND APPROVED BY APPLE INC. SQE.
7. ALL TOOLING, FIXTURING AND OTHER UNIQUE ITEMS THAT ARE USED TO CREATE OR INSPECT THIS PART ARE THE PROPERTY OF APPLE INC. AND SHALL BE PERMANENTLY MARKED WITH APPLE INC. NAME AND APPROPRIATE APPLE INC. PART NUMBER.
8. THE DESIGN OF ALL TOOLING OR FIXTURING SHALL BE APPROVED BY THE APPROPRIATE APPLE INC. ENGINEER PRIOR TO TOOL OR FIXTURE FABRICATION.
9. ALL HOMOGENEOUS MATERIALS MUST COMPLY WITH THE FOLLOWING ENVIRONMENTAL SPECIFICATIONS:
   * APPLE REGULATED SUBSTANCES SPECIFICATION, 069-0135

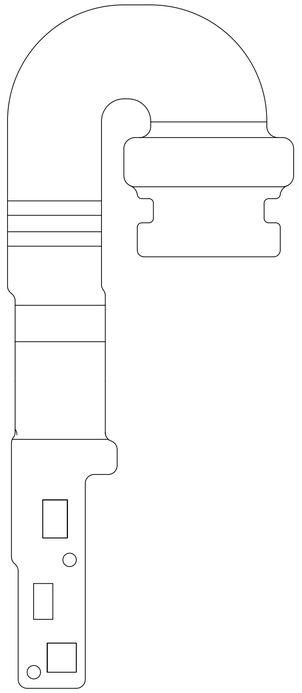
   ALL ADHESIVES, COATINGS AND PAINTS, PRINTING INKS, AND CLEANING AGENTS USED IN THE MANUFACTURING OF THIS PART MUST COMPLY WITH THE APPLE VOC SPECIFICATION, 099-22549

   ALL MATERIALS WITH RECYCLED OR RENEWABLE CONTENT MUST COMPLY WITH THE APPLE RECYCLED & RENEWABLE MATERIAL SPECIFICATION, 099-15583
10. DIMENSIONS LABELED FOR DATA COLLECTION WITH (DC) REQUIRE INSPECTION ON ALL SAMPLES PER APPLE INC. PD AND SQE APPROVED METHOD.
11. MEASURE ALL ITEMS LABELED WITH (100%) FLAG AND SCREEN TO THE INDICATED TOLERANCE.
12. FCCL MATERIAL: SKI R1205DNX(II)
13. FLEXIBLE PRINTED CIRCUIT COMPLIES WITH APPLE SAFETY SPEC 080-2265 & 062-9728.
14. SILK SCREEN THICKNESS IS NOT INCLUDED IN FLEX THICKNESS DIMENSIONS UNLESS OTHERWISE NOTED.
15. FLEX COPPER SHOULD BE HYPER ANNEALED (HA) COPPER AND BUTTON PLATED.
16. COLORED (RED) RELEASE LINERS WITH TABS (LESS THAN 0.1mm THK) MUST BE ADDED TO EXPOSED ADHESIVES. LINERS FOR ONE-TIME USE ONLY.

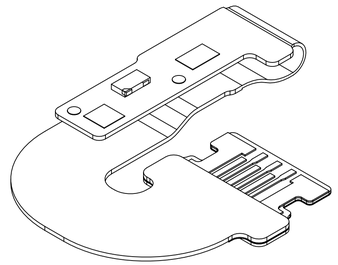
17. APPLY UNDERFILL HENKEL UF3808 TO COMPONENT. UNDERFILL WETTING AREA: 0.23mm MAX FOOTPRINT IN Y; 0.14mm MAX FOOTPRINT IN X. GLUE WEIGHT 0.025-0.03mg (REFERENCE ONLY).
18. ON A LOT BASIS, TEST 32 PCS AS INDICATED & ACCEPT OR REJECT LOT BASED ON 100% PASS:
    * ONE CYCLE: USE A MANDREL OF DIMENSIONED RADIUS FOR BENDING TO INDICATED ANGLE AND RETURN PART TO FLATTENED STATE.
    * REPEAT FOR 10 CYCLES AND INSPECT FLEX INCLUDING TRACES AND COVERLAY FOR ANY EVIDENCE OF CRACKING.
    * INSPECT FLEX FOR FUNCTIONALITY ACCORDING TO ERS 099-2514.
19. DO NOT PRE-BEND. SHIP ON FLAT SHEET FIRST.
20. MEAURE ALL PSA/HAF DIMENSIONS AFTER ATTACH ON FPC BEFORE PRE-LAMINATION
21. REFER TO LAYER STACK-UP TABLE FOR FLEX THICKNESS REGIONS. ALL THICKNESSES ARE MEASURED AFTER COMPRESSION.
22. ALL COVERLAY TO BE MATTE BLACK. MATERIAL: TAIFLEX FHB0520L3D1BT OR DUPONT HXC1220.
23. ALL PUNCH STEP AND PROTRUSIONS ALONG BOARD OUTLINE MUST MEET BOARD OUTLINE REQUIREMENT OF ±0.20 SPECIFIED ON PAGE 2 OF MCO.
24. SOLDER BUMP HEIGHT OF 47.5μm±25μm (FAI/SQ) (SPC/AP)
    * Sn-Ag-Cu BASED Pb FREE SOLDER OR APPLE APPROVED EQUIVALENT
    * DISPENSE NORTH PAD (TP0301) SOLDER PASTE AT 0.50 × 0.45 mm (REFERENCE)
    * DISPENSE SOUTH PAD (TP0300) SOLDER PASTE AT 0.55 × 0.55 mm (REFERENCE)
25. ZIF STIFFENERS:
    * ADDITIONAL SPECIFICATIONS TBD
26. ALL EXPOSED COPPER TO BE ENIG PLATED. ENIG (Ni: 4 ±2μm, Au 0.025 - 0.1μm)
27. SILKSCREEN BOARD REVISION AND VENDOR MARKING ALLOWED IN INDICATED AREAS.
28. ADHESIVE PEEL TESTS. REFER TO APPLE COMPONENT ERS 099-2514 FOR MEASUREMENT METHODS AND QUANTITY. HAF: AVERAGE > 2.0N, MINIMUM > 1.5N; PSA: AVERAGE > 0.6N, MINIMUM > 0.4 N; NO Cpk REQUIREMENT.
29. BARCODE MUST BE SCANNABLE WITHIN 500 ms USING COGNEX DM302 SCANNER, COGNEX DM370 SCANNER OR APPLE ENGINEERING APPROVED EQUIVALENT. REFER TO APPLE SPEC 081-2110 FOR BARCODE DEFINITION. PAPER BARCODE TO HAVE WHITE BACKGROUND WITH BLACK INK NO DEFECTS OR SCRATCHES ALLOWED IN BARCODE AREA.
30. SUPPLIER MUST PROVIDE FAI & SPC MEASUREMENT REPORT FOR ZIF TAIL PER 099-41290 DRAWING

REV	ECO#	DESCRIPTION OF REVISION
07		[2D,3D] ADDED ZIF, ADDED TRANSITION REGIONS IN MCO GPITTIS 07/06/23
08	0045307417	[3D] COMBINED BOARD OUTLINE TO ONE BODY GPITTIS 07/07/23
10		[2D,3D] UPDATED ADHESIVE CLEARANCES, ADDED VESTAGE TAB GUIDANCE, IMPROVED 2D NOTES GPITTIS 07/18/23
11		[2D,3D] REDUCED BEND AREA FOR ADHESIVE CLEARANCE GPITTIS 07/18/23
12		[2D] REVISED VESTIGE TAB BOUNDARIES, REMOVED DETAIL FOR ZIF EXPOSED COPPER, UPDATED ADHESIVE TYPE GPITTIS 07/19/23
13	0045720038	[2D,3D] UPDATED TOP SILVERSCREEN BOUNDARY, IMPROVED MCO GPITTIS 07/20/23
14	0045984923	[2D] UPDATED VESTIGE TAB LOCATIONS GPITTIS 07/20/23
15	0046009485	[2D] UPDATED FAI AND DIMENSIONS GPITTIS 07/21/23

TOP VIEW

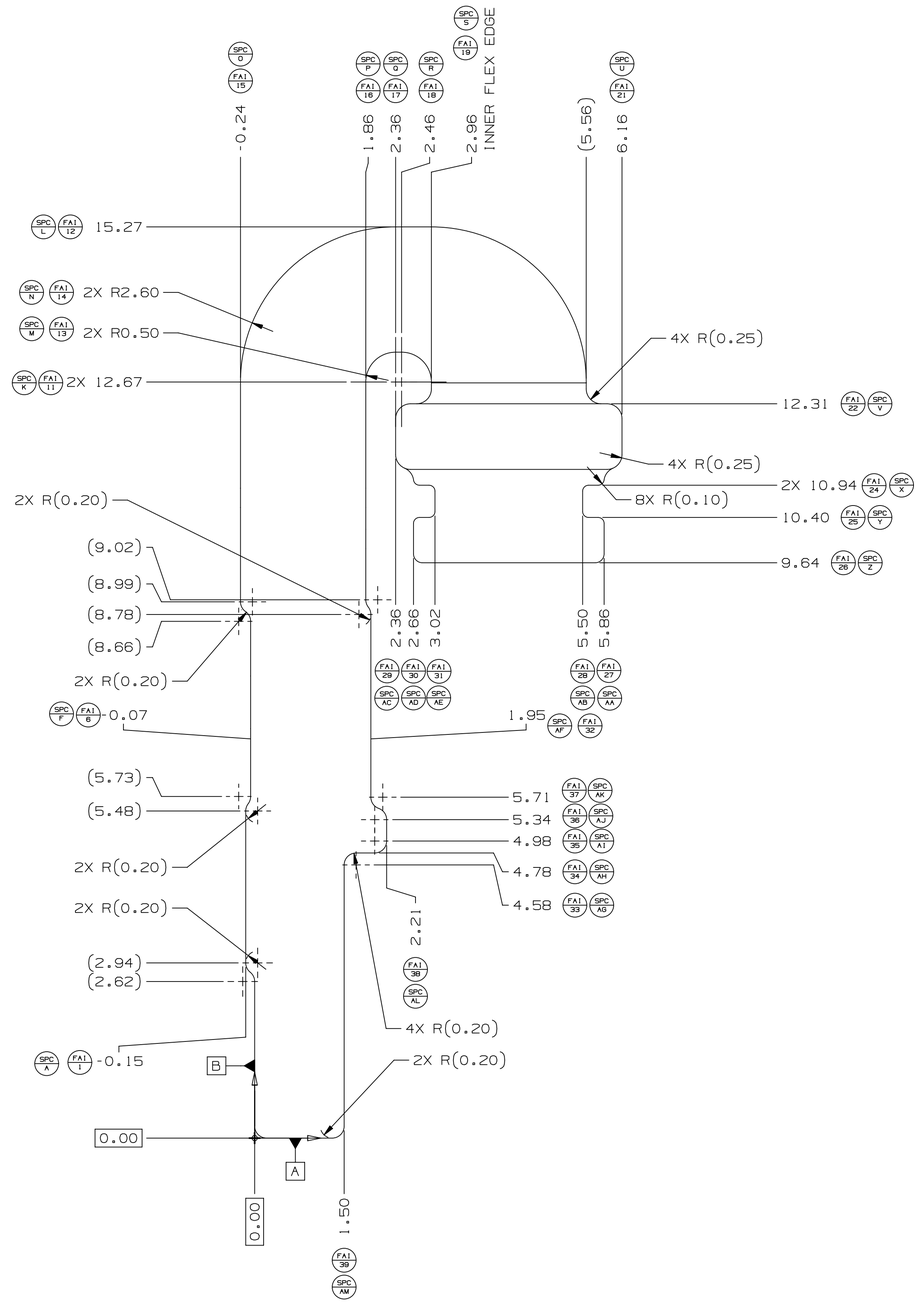


3D ISOMETRIC VIEW



METRIC	Apple Inc.
DRAFTER: APPLE PD — DATE: 07/13/23	NOTICE OF PROPRIETARY PROPERTY: THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC. THE POSSESSOR AGREES TO THE FOLLOWING: (i) TO MAINTAIN THIS DOCUMENT IN CONFIDENCE (ii) NOT TO REPRODUCE OR COPY IT (iii) NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART (iv) ALL RIGHTS RESERVED
DESIGNER: APPLE PD — DATE: 07/13/23	TITLE: FLEX, X3133
DIMENSIONS ARE IN MILLIMETERS TOLERANCES X.X ±0.4 X.XX ±0.20 X.XXX ±0.050 ANGLES ±0.5° DO NOT SCALE DRAWINGS	DRAWING NUMBER: 056-18216 — REV.: 16
THIRD ANGLE PROJECTION — SIZE: D	SCALE: NONE — SHT 1 OF 9

BOARD OUTLINE



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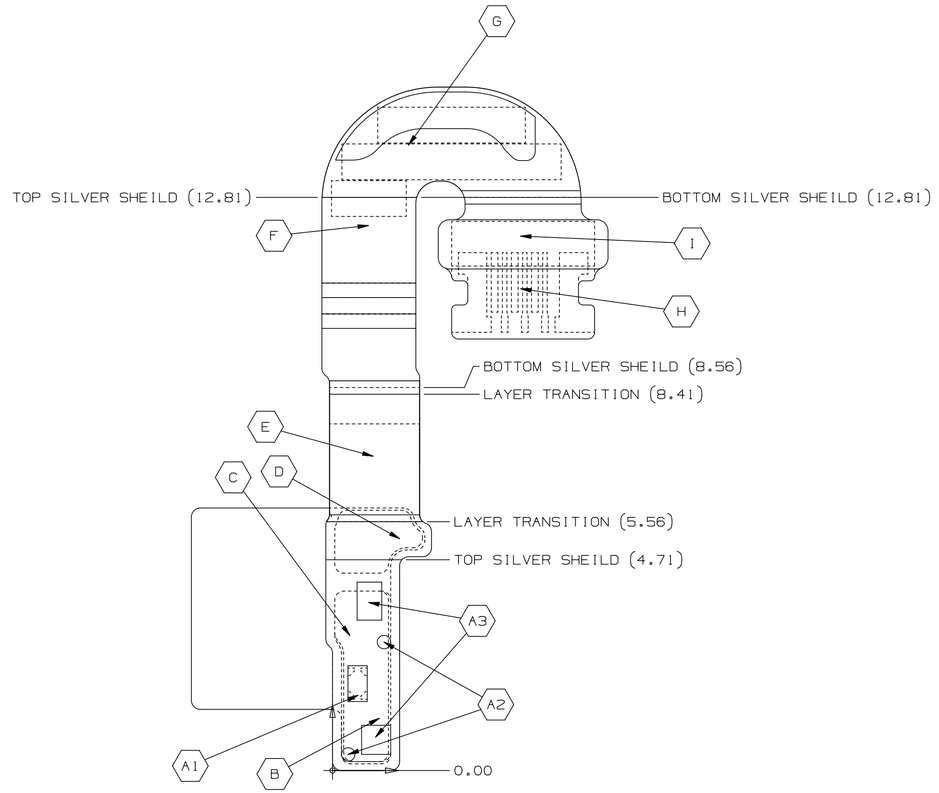
SIZE	DRAWING NUMBER	REV.
D	056-18216	16
SCALE: NONE	SHT 2 OF 9	

NX GENERATED

LAYER STACK-UP



21 STACKUP (UNIT: um)	A1	A2	A3	B	C	D	E	F	G	H	I
	HES	EXPOSED COPPER	24 COPPER SOLDER PAD	INTERNAL NO TOP Cu	INTERNAL	TOP Ag	180 BEND	TOP + BOTTOM Ag	BOTTOM Ag	1X STIFFENER	2X STIFFENER
	2-LYR	2-LYR	2-LYR	1-LYR	2-LYR	2-LYR	1-LYR	2-LYR	2-LYR	2-LYR	2-LYR
PI STIFFENER	-	-	-	-	-	-	-	-	-	-	50.0
ADHESIVE	-	-	-	-	-	-	-	-	-		25.0
PI STIFFENER	-	-	-	-	-	-	-	-	-	25.0	25.0
ADHESIVE	-	-	-	-	-	-	-	-	-	25.0	25.0
AG SHIELD	-	-	-	-	-	10.0	10.0	10.0	-	-	-
LPI	20.0	-	-	20.0	20.0	-	-	-	-	-	-
COVERLAY	-	-		-	-	12.5	-	12.5	12.5	12.5	12.5
ADHESIVE	-	-		-	-	20.0	-	20.0	20.0	20.0	20.0
ENIG	-	4.0	4.0	-	-	-	-	-	-	-	-
TOP COPPER	12.0	12.0	12.0	-	12.0	12.0	-	12.0	12.0	12.0	12.0
PI BASE	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
BOTTOM COPPER	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
ENIG	-	-		-	-	-	-	-	-	4.0	-
ADHESIVE	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	-	20.0
COVERLAY	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	12.5
LPI	-	-	-	-	-	-	-	-	-	-	-
AG SHIELD	-	-	-	-	-	-	-	10.0	10.0	-	-
CONFIG 1: UNCOMPRESSED	(89.0)	(73.0)	(73.0)	(77.0)	(89.0)	(111.5)	(67.0)	(121.5)	(111.5)	(123.0)	(226.5)
COMPRESSED	83.0±20.0 FAI 104 SPC BY	64.0±20.0 FAI 105 SPC BZ	64.0±20.0 FAI 106 SPC CA	71.5±20.0 FAI 107 SPC CB	83.5±20.0 FAI 108 SPC CC	97.0±20.0 FAI 109 SPC CD	59.0±20.0 FAI 110 SPC CE	105.0±20.0 FAI 111 SPC CF	97.0±20.0 FAI 112 SPC CG	120.0±20.0 FAI 113 SPC CH	222.0±20.0 FAI 114 SPC CI

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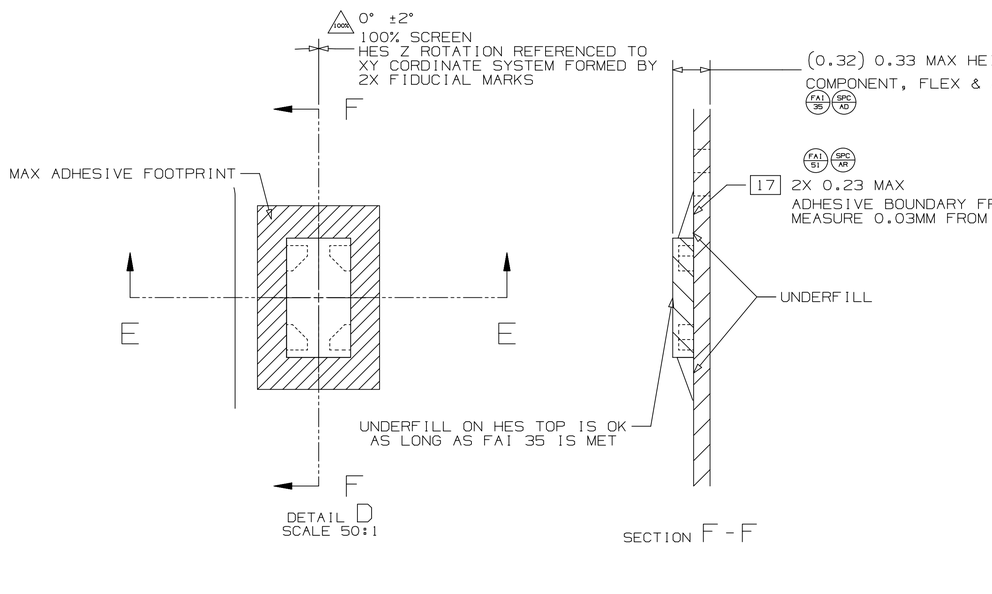
SIZE	DRAWING NUMBER	REV.
D	056-18216	16

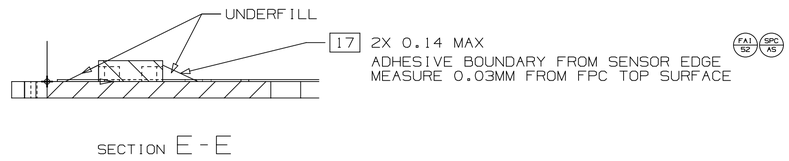
SCALE: NONE SHT 3 OF 9

NX GENERATED

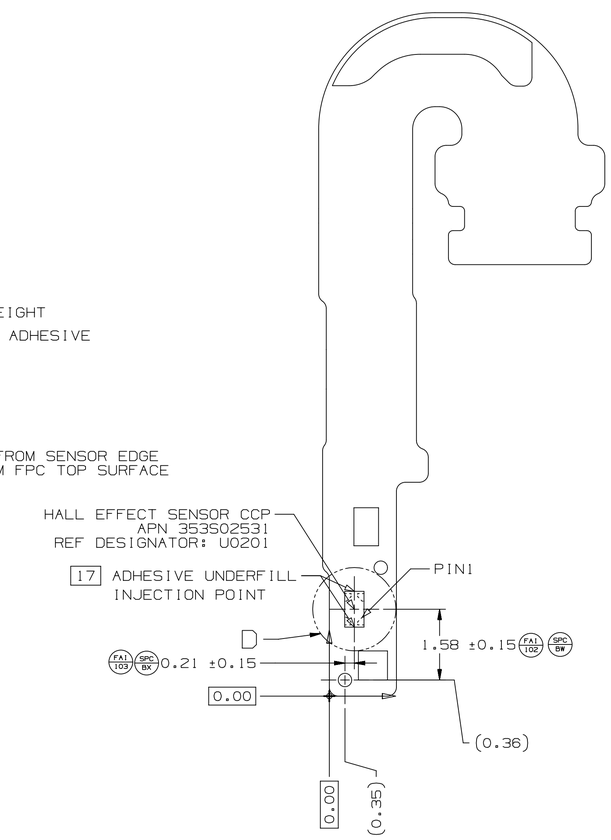
COMPONENTS

HALL-EFFECT SENSOR DETAIL

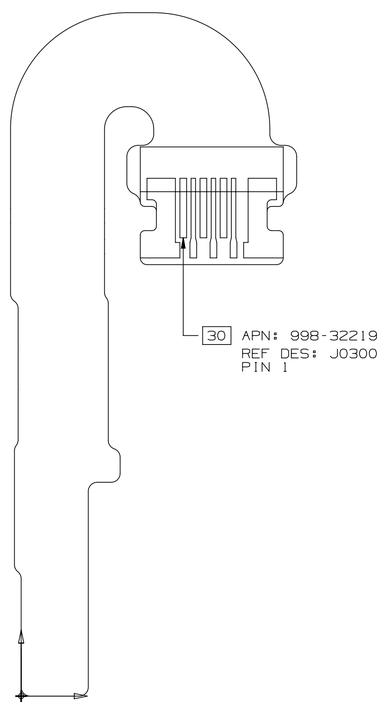




TOPSIDE COMPONENTS
TOP VIEW



BOTTOMSIDE COMPONENTS
VIEW THROUGH TOP



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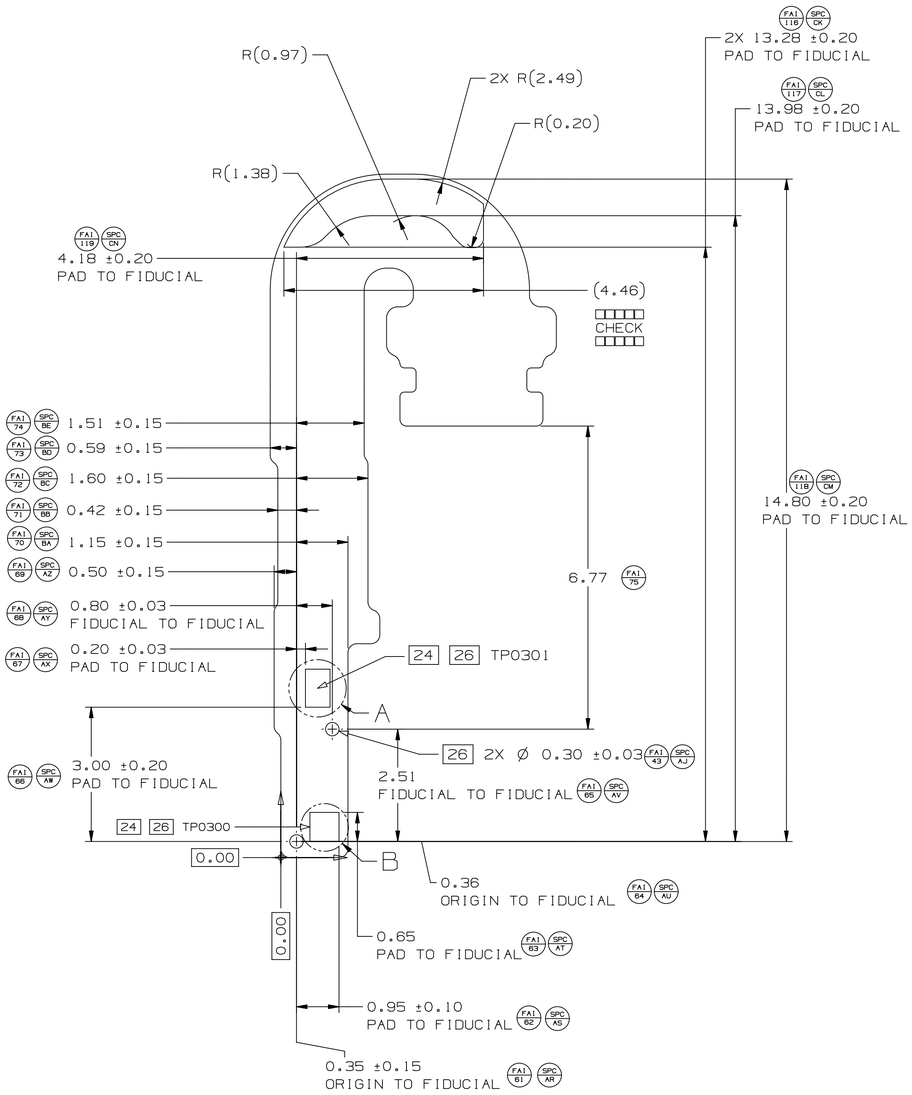
SIZE	DRAWING NUMBER	REV.
D	056-18216	16
SCALE: NONE	SHT 4 OF 9	

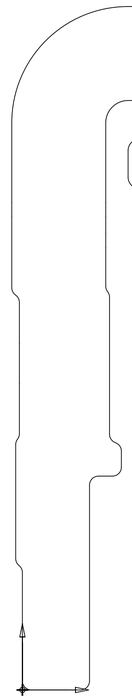
NX GENERATED

EXPOSED COPPER

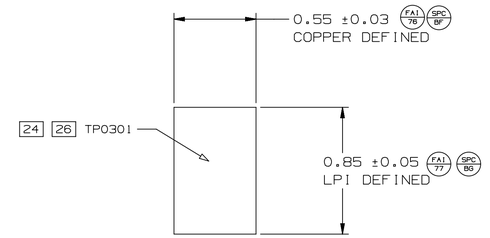
TOP SIDE EXPOSED COPPER



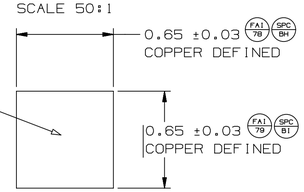
BOTTOM SIDE EXPOSED COPPER
VIEW THROUGH TOP



EXPOSED COPPER DETAIL



DETAIL A
SCALE 50:1



DETAIL B
SCALE 50:1

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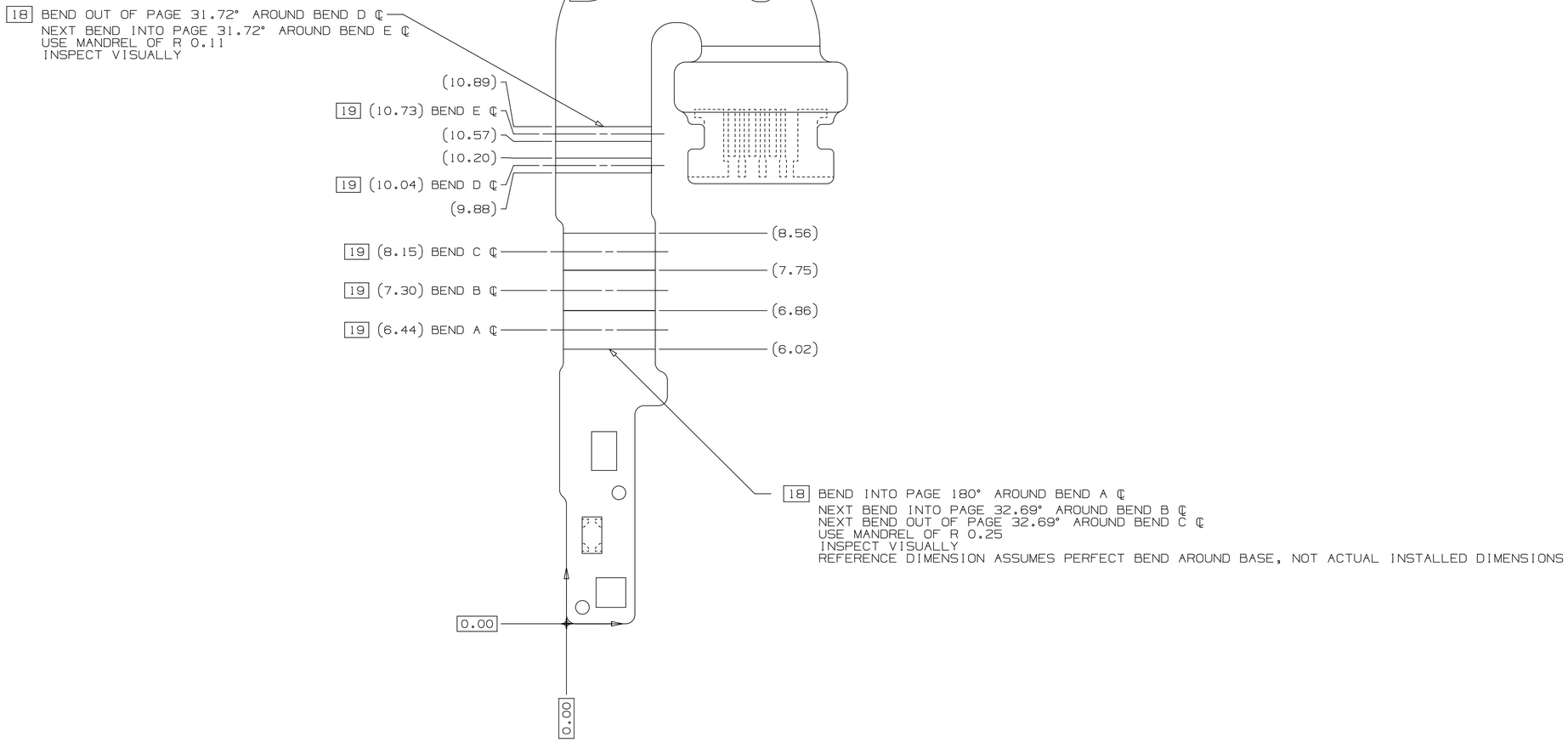
SIZE	DRAWING NUMBER	REV.
D	056-18216	16
SCALE: NONE	SHT 5 OF 9	

NX GENERATED

BENDING REGIONS

BEND REGIONS
TOP VIEW



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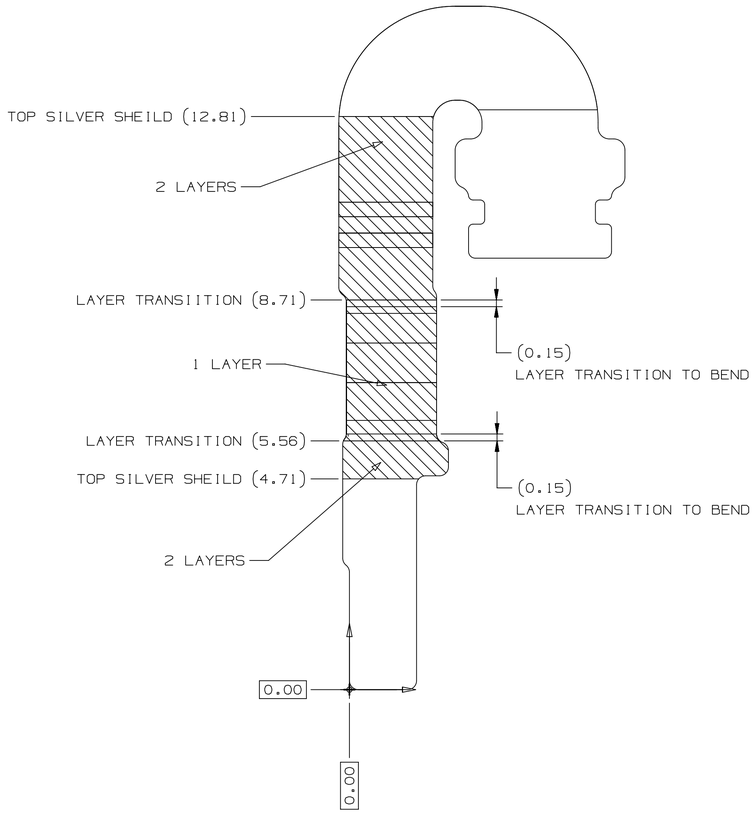
SIZE	DRAWING NUMBER	REV.
D	056-18216	16
SCALE: NONE	SHT 6 OF 9	

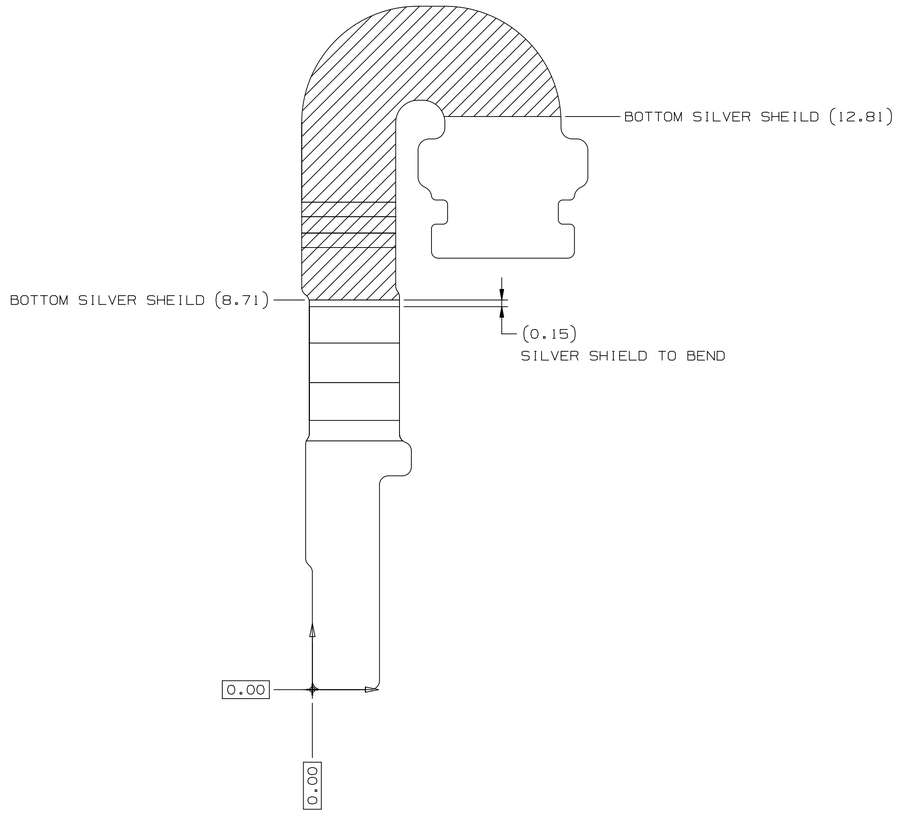
SILVER SHIELD AND LAYER TRASITION

SILVER SHIELD: TATSUTA SF-PC5900-M (AFTER COMPRESSION 0.008mm)

TOPSIDE SILVER SHIELD AND LAYER TRASITION
TOP VIEW



BOTTOMSIDE SILVER SHIELD
VIEW THROUGH TOP



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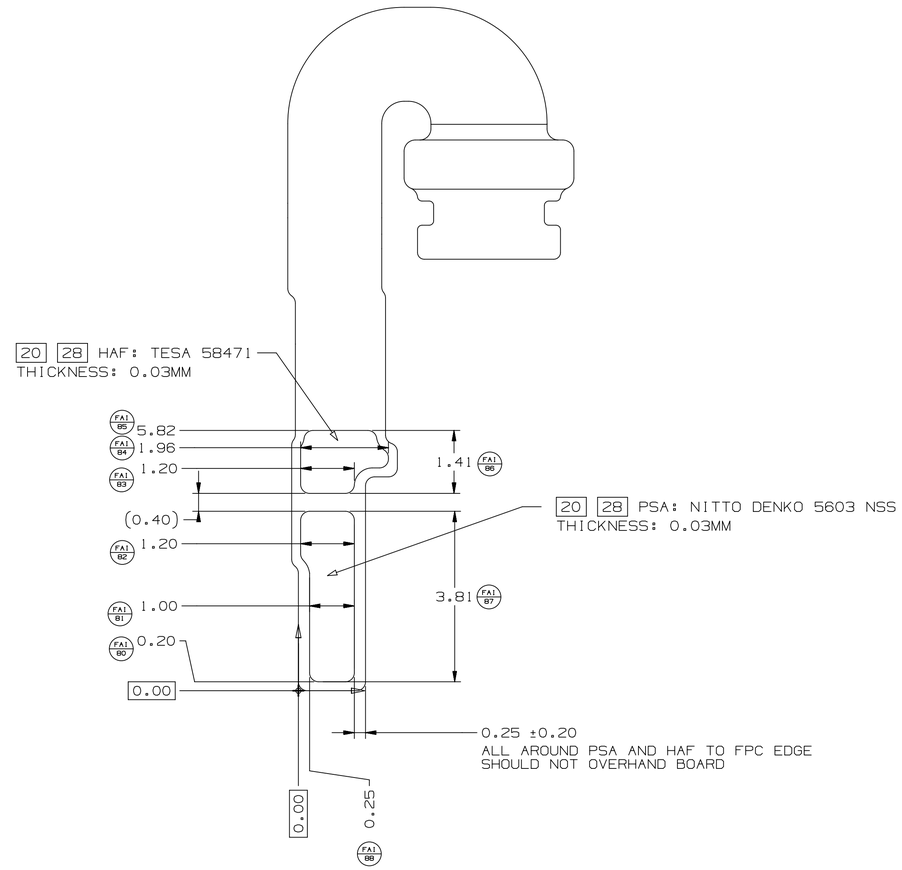
SIZE	DRAWING NUMBER	REV.
D	056-18216	16

SCALE: NONE SHT 7 OF 9

NX GENERATED

ADHESIVE AREAS

BOTTOMSIDE ADHESIVE
(VIEW THROUGH TOP)



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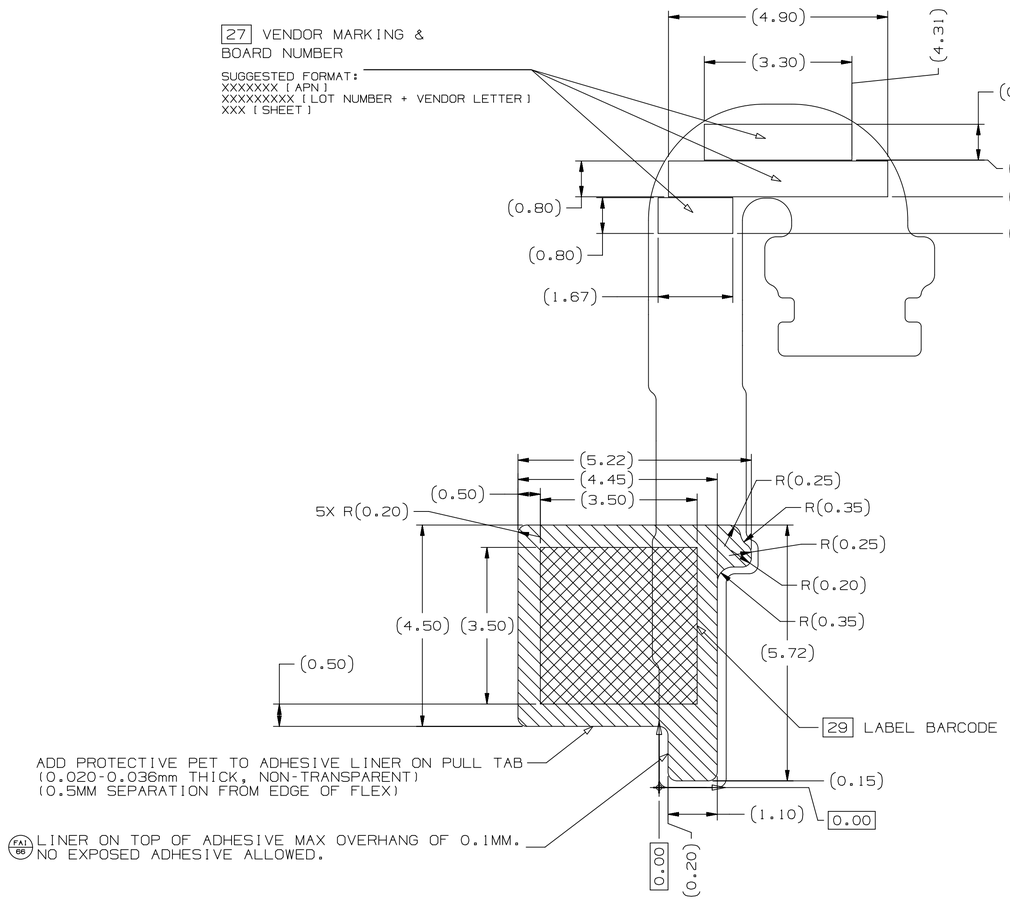
SIZE	DRAWING NUMBER	REV.
D	056-18216	16

SCALE: NONE | SHT 8 OF 9

NX GENERATED

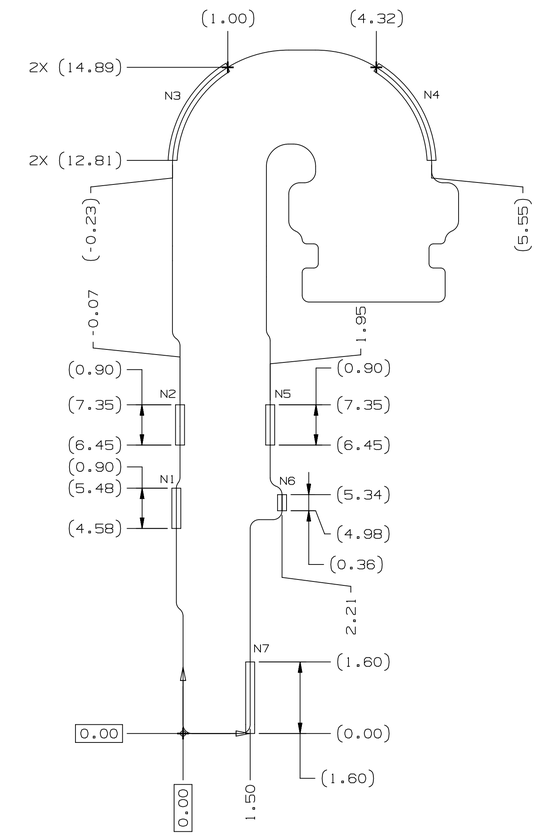
LINERS, VESTIGE TABS, SILKSCREEN, & BARCODE

BOTTOMSIDE ADHESIVE LINERS AND MARKINGS
VIEW THROUGH TOP



ALLOWABLE VESTIGE TABS
TOP VIEW

23 ALLOWABLE PUNCH STEP AND PROTRUSION LOCATIONS FAI 121 SPC 69
MEASURE AT LOCATIONS N1-N7



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SIZE	DRAWING NUMBER	REV.
D	056-18216	16
SCALE: NONE	SHT 9 OF 9	

NX GENERATED