

# TANDEX TEST LABS, INC.

15849 Business Ctr. Dr. Irwindale CA. 91706  
Phone : (626)-962-7166 Fax :(626)-960-6896

## DESTRUCTIVE PHYSICAL ANALYSIS

TANDEX TEST LABS, INC.

TTL # TAN-258-90-W

Date: October 7, 1999

Part Number: AD590MF/883B

Part Type: Temperature Sensor

Date Code: 9746E

Manufacturer: Analog Devices

Quantity: Two (2)

Purchase Order: 99117339

Prepared by: \_\_\_\_\_  
Rose Marie Escandon

Approved by: \_\_\_\_\_

## TANDEX TEST LABS TTL# TAN-258-90-W

Summary

Two (2) Temperature Sensors P/N: (AD590MF/883B), were submitted by TANDEX for Destructive Physical Analysis (DPA). This Analysis was performed in accordance with Mil-Std-1580 and applicable military standards. The parts were serialized 1 and 2 by Tandex Test Labs respectively.

1. **External Visual Inspection** was performed in accordance with Mil-Std 883, Method 2009 on both devices. No anomalous conditions were noted. See DPA form on page 3 and figure number 1.
2. **Radiographic Inspection** was performed on both devices in accordance with Mil-Std-883, Method 2012. All devices met the specified requirements. See DPA form on page 4 and figure number 7
3. **Hermetic Seal Testing** was performed in accordance with Mil-Std-883 Method 1014. Both devices tested met the specified requirements. See DPA Form on page 5.
4. **Internal Visual Inspection** was performed in accordance with Mil-Std-883 Method 2010. Both devices met the specified requirements. See DPA form on page 6 and Figures 2 and 3.
5. **Bond Pull Testing** was performed in accordance with Mil-Std-883 Method 2011. All of the wires tested exceeded the minimum specified requirements. see DPA form on page 7.
6. **Scanning Electron Microscopy (S.E.M.) Examination** was performed in accordance with Mil-Std-883 Method 2018. Sample number 1 exhibited adequate metallization coverage. See DPA form on page 8 and figures 4 through 6.
7. **Die Shear Testing** was performed in accordance with Mil-Std-883 Method 2019. Sample number 2 exceeded the minimum specified shear force requirements. See DPA form on page 9.
8. **Baseline Documentation** a photograph of the internal construction was on file from a previous order, and internal construction was identical to this part number.

**Conclusion:**

**This lot meets the specified DPA Requirements.**

**TANDEX TEST LABS TTL # TAN-258-90-W**  
**EXTERNAL VISUAL EXAMINATION**

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date Sept. 30, 1999
Lot Date Code 9746E	Sample Qty. 2	Serial Numbers 1-2	Test Specifications Mil-Std-883 Method 2009
Misc. ID No. SA#525263	Qty. Accept 2	Qty. Reject 0	Qty. Suspect 0

**Notes:**

S/N	Inspection Codes / Comments	A/R/S
1	NONE	A
2	NONE	A

**INSPECTION CODES**

**A: Markings**

- 1: Illegible
- 2: Incorrect
- 3: Other

**B: Leads**

- 1: Leads to short
- 2: Leads to long
- 3: Lead(s) missing
- 4: Lead(s) misaligned
- 5: Leads bent

**C: Device/Package**

- 1: Cracked
- 2: Chipped
- 3: Dented
- 4: Poor Lid Seal
- 5: Other

**D: Glass Seal**

- 1: Cracked
- 2: Chip-Out
- 3: Bubbles
- 4: Pinholes
- 5: Other

**E: Other Defects**

- 1: Specify

- 2: Specify

**NONE: No Anomalies**

**\* Non Rejectable Anomaly**

**\*\* DPA Induced, Non**

\_\_\_\_\_  
**Technician Stamp:**

### Radiographic Inspection

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date September 30,1999
Lot Date Code 9746E	Sample Qty. 2	Serial Numbers 1-2	Test Specifications Mil-Std-883 Method 2012
Misc. ID No. SA#525263	Qty. Accept 2	Qty. Reject 0	Qty. Suspect 0

**Notes:**

S/N	Inspection Codes / Comments
1	G3. Inadequate bonding material
2	G3. Inadequate bonding material

**INSPECTION CODES:**

**A. Metal Film Defects**

- 1:Scratches
- 2: Voids
- 3: Corrosion
- 4: Adherence

**B. Oxide and Diffusion**

- 1: Oxide Fault
- 2: Diffusion Fault
- 3: Scratches in Diffusion/Oxide

**C. Scribing and Die Defects**

- 1: Chipouts into active area
- 2: Crack pointing toward or into Active Area
- 3: Part of another die(active area) still attached
- 4: Less than 0.5 mil passivation between active metal and die edge.
- 5: Semicircular crack whose Chord > 75% of narrowest distance of unglassivated metallization

**D. Bonds**

- 1: Bonds misaligned with bonding pad
- 2: Wire tail extends over adjacent unpassivated metallization
- 3: Excessive wire tail
- 4: Post bond encapsulated in frit material

**E. Internal Lead Wire Defects**

- 1: Any wire which reduces the the distance between unglassivated metallization,another wire,and/or the plane of the lid less than 2.0 mils.
- 2: Missing or Extra Wire
- 3: Excessive or inadequate loop in wire
- 4: Wire touching portion of package
- 5: Broken wire

**F. Foreign Material**

- 1: Foreign Particles on the die surface
- 2: Embedded foreign particles.
- 3: Chemical Processing material.
- 4: Other

**G. Die Mounting**

- 1: Extraneous bonding material
- 2: Excessive bonding material
- 3: Inadequate bonding material

**H. Glassivation Defects**

- 1: Cracking
- 2: Voids
- 3: Scratches

**NONE: No Anomalies**

**\*Non-Rejectable Anomaly**

**\*\* DPA Induced, Non-Rejectable anomaly**

**\*\*\*Not addressed by the specification**

**Technician Stamp:**

TANDEX TEST LABS TTL Job # TAN-258-90-W  
 Hermetic Seal Testing

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date October 1, 1999
Lot Date Code 9746E	Sample Qty. 2	Serial Numbers 1-2	Test Specifications Mil-Std-883 Method 1014
Misc. ID No. SA#525263	Qty. Accept 2	Qty. Reject 0	Qty. Suspect 0

NOTES:

Leak Rate		Fine Leak		Gross Leak	
S/N		Pass	Fail	Pass	Fail
1	1X 10 <sup>-8</sup> CC/sec He	X		X	
2	1X 10 <sup>-8</sup> CC/sec He	X		X	

John R. Espenschied

Technician Stamp:

**TANDEX TEST LABS TTL Job # TAN-258-90-W**  
**Internal Visual Examination**

TTL Job No.	Part Number	Part Type	Date
Lot Date Code	Sample Qty.	Serial Numbers	Test Specifications
Misc. ID No.	Qty. Accept	Qty. Reject	Qty. Suspect

**Notes :**

S/N	Inspection Codes / Comments	A/R/S
1	NONE	A
2	NONE	A

**INSPECTION CODES:**

**A. Metal Film Defects**

- 1:Scratches
- 2: Voids
- 3: Corrosion
- 4: Adherence

**B. Oxide and Diffusion Faults**

- 1: Oxide Fault
- 2: Diffusion Fault
- 3: Scratches in Diffusion/Oxide

**C. Scribing and Die Defects**

- 1: Chipouts into active area
- 2: Crack pointing toward or into Active Area
- 3: Part of another die(active area) still attached
- 4: Less than 0.5 mil passivation between active metal and die edge.
- 5: Semicircular crack whose Chord > 75% of narrowest distance of unglassivated metallization

**D. Bonds**

- 1: Bonds misaligned with bonding pad
- 2: Wire tail extends over adjacent unpassivated metallization
- 3: Excessive wire tail
- 4: Post bond encapsulated in frit material

**E. Internal Lead Wire Defects**

- 1: Any wire which reduces the distance between unglassivated metallization,another wire,and/or the plane of the lid less than 2.0 mils.
- 2: Missing or Extra Wire
- 3: Excessive or inadequate loop in wire
- 4: Wire touching portion of package
- 5: Broken wire

**F. Foreign Material**

- 1: Foreign Particles on the die surface
- 2: Embedded foreign particles.
- 3: Chemical Processing material.
- 4: Other

**G. Die Mounting**

- 1: Extraneous bonding material
- 2: Excessive bonding material
- 3. Inadequate bonding material

**H. Glassivation Defects**

- 1: Crazing
- 2: Voids
- 3: Scratches

**NONE: No Anomalies**

**\*Non-Rejectable Anomaly**

**\*\* DPA Induced, Non-Rejectable anomaly**

**\*\*\*Not addressed by the specification**

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**Technician Stamp:**

WIRE BOND PULL  
BOND STRENGTH TESTING

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date October 5, 1999
Lot Date Code 9746E	Sample Qty. 2	Serial Numbers 1-2	Test Specifications Mil-Std-883 Method 2011
Misc. ID No. SA#525263	Qty. Accept 2	Qty. Reject 0	Qty. Suspect 0

WIRE TYPE AL	PACKAGE TYPE AU	BOND TYPE WEDGE
DIE METALIZATION AL	WIRE SIZE 0.0010	MINIMUM PULL STRENGTH 1.5

S/N 1			S/N 2			S/N								
Wire NO	FORCE	CODE	WIRE NO	FORCE	CODE	WIRE NO	FORCE	CODE	WIRE NO	FORCE	CODE	WIRE NO	FORCE	CODE
1	8.7	D	1	10.4	G	1			1			1		
2	8.1	D	2	7.6	J	2			2			2		
3			3			3			3			3		
4			4			4			4			4		
5			5			5			5			5		

CODE INDEX

- A. NO BREAKS UP TO \_\_\_\_\_ gms.
- B. BOND LIFTS FROM DIE.
- C. BOND LIFTS FROM POST.
- D. WIRE BREAKS AT SUBSTRATE/HEEL.
- E. BOND REMOVES UNDERLYING METALLIZATION.
- F. NO CONNECTION.
- G. WIRE BREAKS AT DIE/HEEL.
- H. WIRE BREAKS AT POST/HEEL.
- J. WIRE BREAKS AT SPAN.
- X. BOND DAMAGE PRIOR TO TESTING.

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Technician Stamp:

TANDEX TEST LABS TTL # TAN-258-90-W  
SEM EXAMINATION

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date October 5, 1999
Lot Date Code 9746E	Sample Qty. 1	Serial Numbers 1	Test Specifications Mil-Std-883 Method 2018
Misc. ID No. SA#525263	Qty. Accept 1	Qty. Reject 0	Qty. Suspect 0

**NOTES:**

S/N	Investigation Findings / Comments	A/R/S
1	NONE	A

Each sample was inspected for the general metallization condition at a magnification between 1,000 X and 6,000 X over 25% of the total metallization (unless specified differently). Each sample was inspected from four (4) viewing directions at a magnification between 5,000 X and 20,000 X for metallization oxide step coverage (performed on at least one of each type of oxide step).

Inspection required Yes: X No:    Devices constructed with expanded Metallization Yes: X No:

Sample Glassivated Yes: X No:    Dual Level Metallization Yes:    No: X

Glassivation Removed Using **PLASMA ETCHING**

Beam accelerating voltage **15 kV** Viewing angle **60 deg**

**Technician Stamp:**



Die Shear Testing

TTL Job No. TAN-258-90-W	Part Number AD590MF/883B	Part Type Temperature Sensors	Date October 6, 1999
Lot Date Code 9746E	Sample Qty. 1	Serial Numbers 2	Test Specifications Mil-Std-883 method 2019
Misc. ID No. SA#525263	Qty. Accept 1	Qty. Reject 0	Qty. Suspect 0

Notes:

S/N	DEST.FORCE Kg.	% MATERIAL REMAINING	Type	Of	Shear	A/R/S
			Full	Partial	None	
2	2.85	85%	X			A

Die Size: 64.24 mils X 39.6 mils = 25.43 x 10-4 inches

Die Material: Silicon

Die Attach Method: Eutectic

- >50% Material Remaining @ 1.00 x Minimum Force = .99 Kg.
- <50% Material Remaining @ 1.25 x Minimum Force = 1.23 Kg.  
Minimum Acceptable Strength
- 0% Material Remaining @ 2.00 x Minimum Force = 1.98 Kg.

TECHNICIAN STAMP:

TANDEX TEST LABS TTL # TAN-258-90-W

# Photodocumentation

ALL MAGNIFICATIONS ARE APPROXIMATE

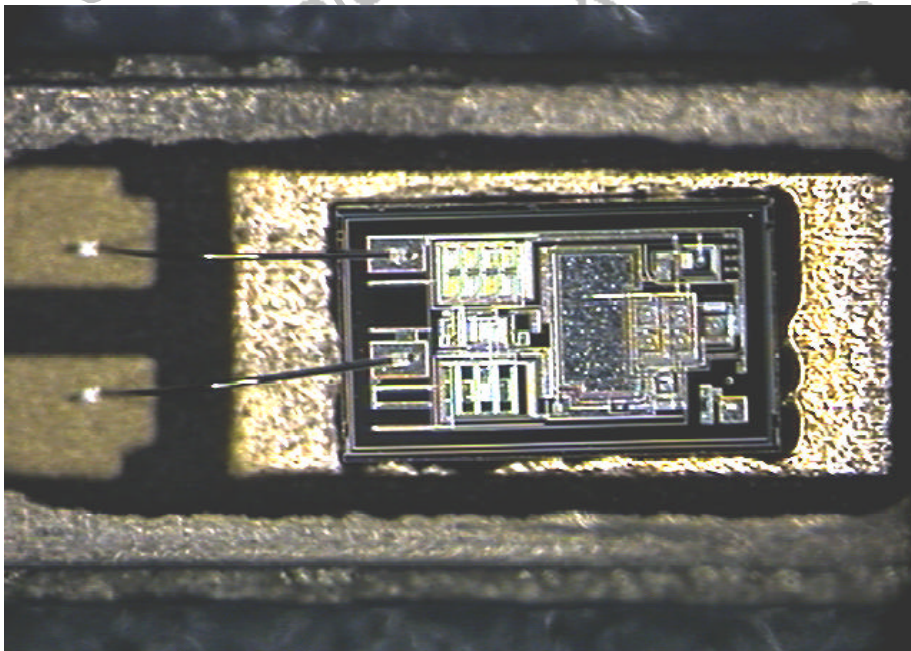


**Fig: 1**

**Mag : 10X**

**S/N : 1 and 2**

**Description : External photo showing part markings.**

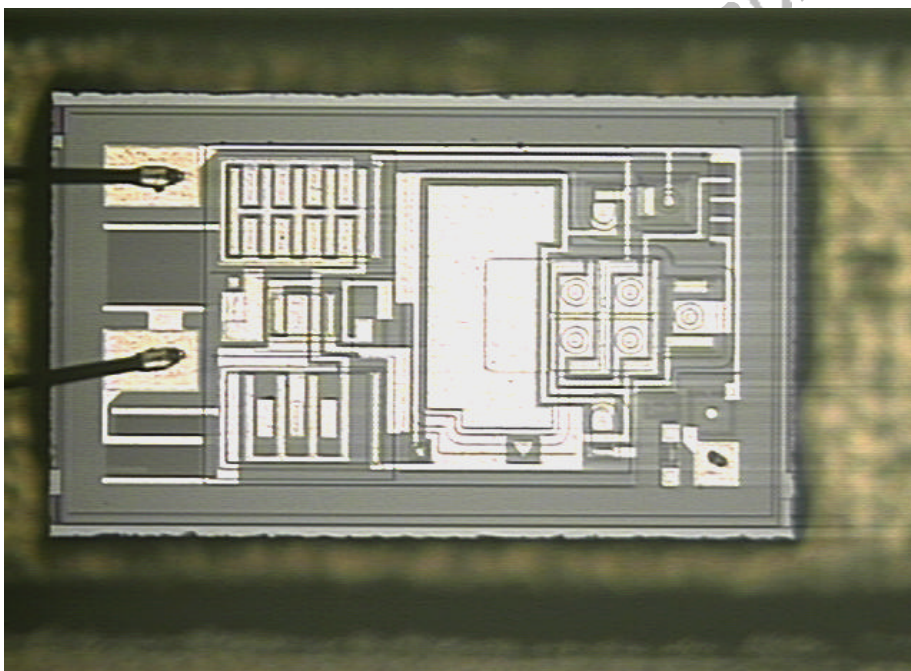


**Fig: 2**

**Mag: 20X**

**S/N: Typical**

**Description:**

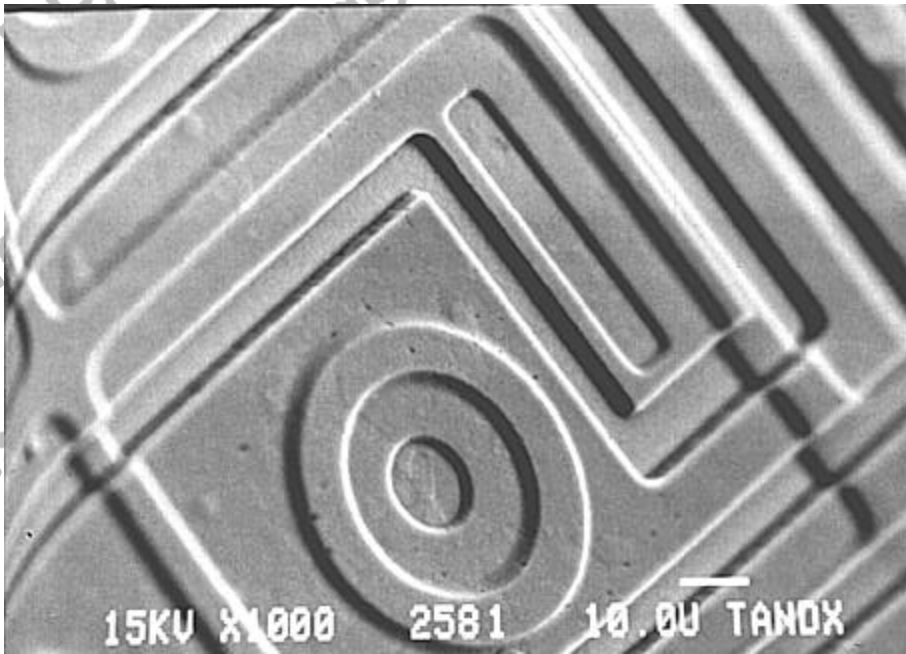
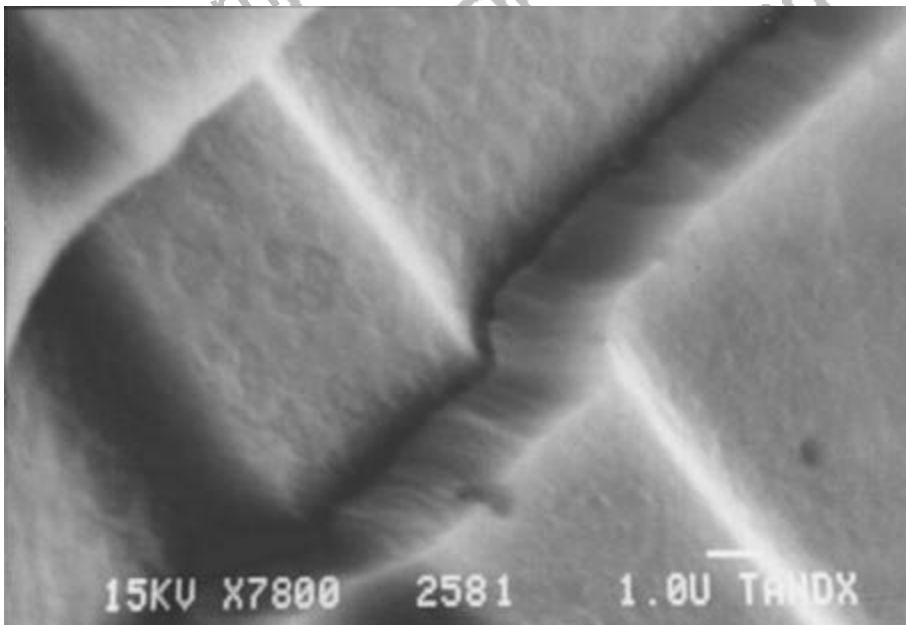
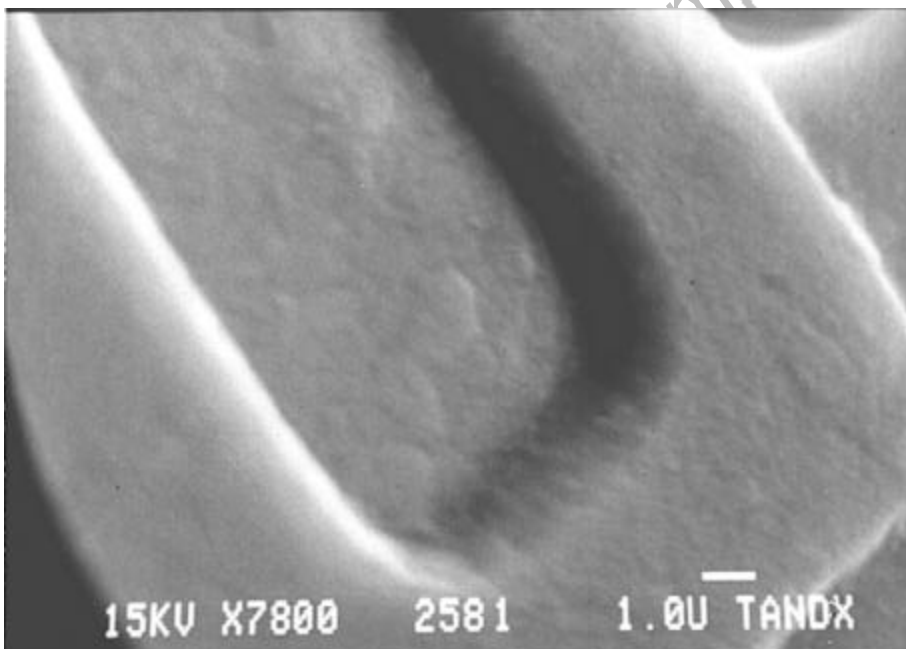


**Fig: 3**

**Mag: 80X**

**S/N: Typical**

**Description: Overall Die**

**Fig: 4****Mag : 1000X****S/N : 1****Description:SEM photo of worst case General Metallization Coverage .****Fig: 5****Mag : 7800X****S/N : 1****Description:SEM photo of worst case Metallization typical step.****Fig: 6****Mag : 7800X****S/N : 1****Description:SEM photo of worst case Metallization typical contact window.**



# TANDEX TEST LABS, INC.

15849 BUSINESS CENTER DRIVE, IRWINDALE, CALIFORNIA 91706 (626) 962-7166

## DPA FLOW

MIL-STD-1580 SECTION 11.0 I.C.

OPERATION	DATE	QTY	STAMP	COMMENTS (IF APPLICABLE)
<b>EXTERNAL VISUAL:</b> MIL-STD-883, METHOD 2009 RECORD IDENTIFICATION MARKINGS. EXAMINE PARTS, AT 10 X MINIMUM FOR DEFECTS IN SEAL, PLATING, PER MIL-STD-883, METHOD 2009.	9/30/99	ALL		
<b>EXTERNAL PHOTO:</b> PHOTO(S) SHOWING ALL PART MARKINGS.	9/30/99	TBD		
<b>RADIOGRAPHY:</b> TWO VIEWS ROTATED 90 DEGREES APART PER MIL-STD-883, METHOD 2012.	9/30/99	ALL		
<b>SEAL:</b> FINE AND GROSS PER MIL-STD-883, METHOD 1014 RECORD BOTH FINE AND GROSS LEAK TESTS.	10/1/99	ALL		
ENGINEERING REVIEW:	10/4/99			
<b>DELID:</b> TTL STANDARD PROCEDURE	10/4/99	ALL		
<b>INTERNAL VISUAL INSPECTION:</b> MIL-STD-883, METHOD 2010	10/4/99	ALL		
<b>INTERNAL PHOTODOCUMENTATION:</b> 1 TYPICAL OVERALL CAVITY. 1 OVERALL OF DIE. DOCUMENT ANY ANOMALIES.	10/4/99	ALL		
<b>BOND PULL:</b> MIL-STD-883, METHOD 2011 CONDITION D.	10/4/99	ALL		
<b>SEM:</b> PER MIL-STD-883, METHOD 2018 (EXPANDED METALLIZATION ONLY) DOCUMENT ANY BOND PULL FAILURES.	10/4/99	ONE		
<b>DIE SHEAR:</b> MIL-STD-883, METHOD 2019.	10/6/99	ONE		
<b>BASE LINE DOCUMENTATION:</b> WITH DATA OBTAINED CHECK FOR CONFIGURATIONS. SEE PARA 3.3.6 OF MIL-STD-883 METHOD 5009.	10/5/99	ONE		
DATA ASSEMBLY	10/7/99			
REPORT	10/7/99			
QCI REVIEW				
<b>SUBMITTED TO SHIPPING</b>				

# TANDEX TEST LABS, INC.

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Phone: (626)-962-7166 FAX (626)-960-6896

## TESTING CERTIFICATION

METHOD OF TESTING: DESTRUCTIVE PHYSICAL ANALYSIS IN ACCORDANCE WITH MIL-STD-1580A AND APPLICABLE MILITARY STANDARDS

TEST REPORT: TAN-258-90-W

DATE: October 7, 1999

P.O. NUMBER : 99117339

DESCRIPTION: Temperature Sensors

CUSTOMER: TANDEX TEST LABS

PART NUMBER: AD590MF/883B

ADDRESS: 15849 BUSINESS CTR. DRIVE

DATE CODE: 9746E

IRWINDALE, CA. 91706

MANUFACTURER: ANALOG DEVICES

QUANTITY TESTED: 2

QUANTITY PASSED: 2

QUANTITY FAILED: 0

I hereby certify that the subject components have been processed and inspected in accordance with instructions with specifications referenced in your purchase order. Physical records and/or data pertinent to applicable military, proprietary, and/or commercial specifications are on file and available upon request for inspection at this facility.

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QUALITY ASSURANCE