Reliability Qualification Report
Device Qualification

Date: 10/16/2002 **PCN:**

Laura Rivers
Reliability Engineer
602 244 5474

Scott Savage
Reliability Manager
602 244 4848

1) Introduction:

Qualification of NUF2221W1T2 series of devices designed for applications requiring Line Termination, EMI Filtering and ESD Protection.These are intented for use in upstream USB ports, Cellular phones, Wireless equipment and computer applications. Offering an integrated solution, offering better ESD protection than available from a discete implemetation because of reduced parasitic inductances, in a small package (SC88/SOT363) reducing PCB space and cost.

ESD Ratings: Jedec MM Class C, Jedec HBM 3B.
Compliant with IEC61000-4-2 (Level 4) 8KV (contact) 15KV (air)

2) Device Description:

Qual ID	1564	**Wafer Fab Site**	ISMF	Seremban, Malaysia	
Device	NUF2221W1T2	**Assembly Site**	SBN	Seremban, Malaysia	
Line Source	ZLU22N	**Final Test Site**	AIT BATAM, IDN	Batam, Indonesia	
Parent Tech	ZENER	**Reliability Lab**	SBN	Seremban, Malaysia	
Technology	ZENER	**Max. Current**	100mA	**Max. Voltage**	7V
Package	SC88/SOT363	**Die Size**	670 X 500	**Flag Size**	1.1mm X 0.625mm
Polarity	PN				

Related Qualification Report(s):

This series of devices is qualified by similarity based upon the NZMM7V04T4, rel report # 0450 , for die technology and the NL27WZU04DFT2, rel report# 1242, for package technology. Full characterization of the NUF2221W1T2 has also been completed.

3) Qualification Results Analysis:

no anomalies were observed.

4) Conclusion:

The NUF2221W1T2 and NUF2xx1W1T2 series of devices have been found to meet or exceed all qualification requirements, by similarity, according to ON Semiconductor Product Qualification Process, 12MRB17722C.
These devices are fully qualified.

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Quality and Continuous Improvement

Reliability Customer Report

Package Qualification

Date: 02/19/01 **PCN: n/a**

Chuck Reed/Laura Rivers
Reliability Engineer
602 244 5474

Thomas Grzybowski
Reliability Manager
602-244-4331

1) Introduction:

This product is being developed for a Motorola cellular phone application. The device has 21 zener diodes and 9 resistors. The FAB facility is ISMF and assembly is Amkor.

2) Device Descriptions:

Qual ID	0450	**Wafer Fab Site**	ISMF	
Device	NZMM7V0T4	**Assembly Site**	Amkor (ATP4)	
Line Source	ZLDMC7V0	**Final Test Site**	Amkor (ATK1)	
Parent Tech	ZENER	**Reliability Lab**	FET TESTER	52nd St., Phoenix, AZ
Technology	ZENER	**Max. Current**		**Max. Voltage**
Package	24 MLP2	**Die Size**	53 MILS X 53 MILS	**Flag Size**
Polarity	PN			

Qual ID	0477	**Wafer Fab Site**	ISMF	
Device	NZMM7V0T4	**Assembly Site**	Amkor (ATP4)	
Line Source	ZLDMC7V0	**Final Test Site**	Amkor (ATK1)	
Parent Tech	ZENER	**Reliability Lab**	FET TESTER	52nd St., Phoenix, AZ
Technology	ZENER	**Max. Current**		**Max. Voltage**
Package	24 MLP2	**Die Size**	53 MILS X 53 MILS	**Flag Size**
Polarity	PN			

2) Device Descriptions continued:

Qual ID	0668	**Wafer Fab Site**	ISMF		
Device	NZMM7V0T4	**Assembly Site**	Amkor (ATP4)		
Line Source	ZLDMC7V0	**Final Test Site**	Amkor (ATK1)		
Parent Tech	ZENER	**Reliability Lab**	FET TESTER	52nd St., Phoenix, AZ	
Technology	ZENER	**Max. Current**		**Max. Voltage**	
Package	24 MLP2	**Die Size**	53 MILS X 53 MILS	**Flag Size**	
Polarity	PN				

Qual ID	0669	**Wafer Fab Site**	ISMF		
Device	NZMM7V0T4	**Assembly Site**	Amkor (ATP4)		
Line Source	ZLDMC7V0	**Final Test Site**	Amkor (ATK1)		
Parent Tech	ZENER	**Reliability Lab**	FET TESTER	52nd St., Phoenix, AZ	
Technology	ZENER	**Max. Current**		**Max. Voltage**	
Package	24 MLP2	**Die Size**	53 MILS X 53 MILS	**Flag Size**	
Polarity	PN				

Qual ID	n/a	**Wafer Fab Site**			
Device		**Assembly Site**			
Line Source		**Final Test Site**			
Parent Tech		**Reliability Lab**			
Technology		**Max. Current**		**Max. Voltage**	
Package		**Die Size**		**Flag Size**	
Polarity					

Qual ID	n/a	**Wafer Fab Site**			
Device		**Assembly Site**			
Line Source		**Final Test Site**			
Parent Tech		**Reliability Lab**			
Technology		**Max. Current**		**Max. Voltage**	
Package		**Die Size**		**Flag Size**	
Polarity					

Qual ID	n/a	**Wafer Fab Site**			
Device		**Assembly Site**			
Line Source		**Final Test Site**			
Parent Tech		**Reliability Lab**			
Technology		**Max. Current**		**Max. Voltage**	
Package		**Die Size**		**Flag Size**	
Polarity					

3) Qualification Results Analysis:

Life and environmental tests passed with zero qualification related failures.

4) Conclusion:

The 24 pin EMI filter qualification of the NZMM7V0T4 product meets or exceeds reliability qualification test requirements per 12MSB17722C issue B. Zero devices in any subgroup experienced failure due to the standard testing. This qualifies other dice in the family such as: NZF220DFT1 and NZF220TT1.

5) Test Description & Condition:

Auto	Autoclave	**AUTOCLAVE** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
Auto-PC	Autoclave - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
Bond Pull	Bond Pull Strength	**BOND PULL STRENGTH** The purpose of this test is to determine bond pull strength of wire to die, substrate, or package header connections. The wires may be bonded by soldering, thermocompression, ultrasonic, or related bonding techniques. **Test Conditions:** TA = 25°C **Common Failure Modes:** Parametric shifts, open, and/or intermittent **Common Failure Mechanisms:** Corrosion or contaminants from foreign material within the package. Silicon or metalization defects.
Bond Shear	Bond Shear	**BOND SHEAR** The purpose of this test is to determine bond shear strength of wire to die, substrate, or package header connections. The wires may be bonded by soldering, thermocompression, ultrasonic, or related bonding techniques. **Test Conditions:** TA = 25°C **Common Failure Modes:** Parametric shifts, open, and/or intermittent **Common Failure Mechanisms:** Corrosion or contaminants from foreign material within the package. Silicon or metalization defects.
DPA	Destructive Physical Analysis	**DESTRUCTIVE PHYSICAL ANALYSIS** The purpose of this test is to determine conformance with applicable design and process requirements. **Test Conditions:** TA = 25°C **Common Failure Modes:** Electrical, mechanical and physical failures **Common Failure Mechanisms:** Various material and manufacturing defects.
DPA-H3TRB	Destructive Physical Analysis H3TRB	**DESTRUCTIVE PHYSICAL ANALYSIS** The purpose of this test is to determine conformance with applicable design and process requirements. **Test Conditions:** TA = 25°C **Common Failure Modes:** Electrical, mechanical and physical failures **Common Failure Mechanisms:** Various material and manufacturing defects.

5) Test Description & Condition continued:

DPA-H3TRB-PC	Destructive Physical Analysis H3TRB-PC	**DESTRUCTIVE PHYSICAL ANALYSIS** The purpose of this test is to determine conformance with applicable design and process requirements. **Test Conditions:** TA = 25°C **Common Failure Modes:** Electrical, mechanical and physical failures **Common Failure Mechanisms:** Various material and manufacturing defects.
DPA-TC-PC	Destructive Physical Analysis TC-PC	**DESTRUCTIVE PHYSICAL ANALYSIS** The purpose of this test is to determine conformance with applicable design and process requirements. **Test Conditions:** TA = 25°C **Common Failure Modes:** Electrical, mechanical and physical failures **Common Failure Mechanisms:** Various material and manufacturing defects.
DPATC	Destructive Physical Analysis TC	**DESTRUCTIVE PHYSICAL ANALYSIS** The purpose of this test is to determine conformance with applicable design and process requirements. **Test Conditions:** TA = 25°C **Common Failure Modes:** Electrical, mechanical and physical failures **Common Failure Mechanisms:** Various material and manufacturing defects.
ESD	Electrostatic Discharge	**ELECTROSTATIC DISCHARGE** The purpose of this test is to measure the relative ability of the part to withstand accidental electrostatic discharge. Both the Human Body Model and the Machine Model are used in testing. Devices are divided into groups and tested at specified increments across the ESD test range (per JEDEC). Data is recorded and devices are rated at the highest level at which they passed. If devices show no failures at the max increment, they are rated as being greater than (>) that voltage. If devices fail at some lower increment, they are rated as being equal (=) to that voltage.
H3TRB	High Humidity High Temperature Reverse Bias	**HIGH HUMIDITY HIGH TEMPERATURE BIAS** This test designed to measure the moisture resistance of plastic encapsulated devices. A bias is applied to create an electrolytic cell necessary to accelerate corrosion of the die metallization. With time, this is a catastrophically destructive test. **Test Conditions:** TA = 85°C, rh = 85% **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
H3TRB-PC	High Humidity High Temperature Reverse Bias-PC	**HIGH HUMIDITY HIGH TEMPERATURE BIAS + MOISTURE LEVEL PRECONDITIONING** This test designed to measure the moisture resistance of plastic encapsulated devices. A bias is applied to create an electrolytic cell necessary to accelerate corrosion of the die metallization. With time, this is a catastrophically destructive test. **Test Conditions:** TA = 85°C, rh = 85% **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing

5) Test Description & Condition continued:

HTRB	High Temperature Reverse Bias	**HIGH TEMPERATURE REVERSE BIAS** The purpose of this test is to align mobile ions by means of temperature and voltage stress to form a high-current leakage path between two or more junctions. **Test Conditions:** TA = 150°C **Common Failure Modes:** Parametric shifts in leakage and gain **Common Failure Mechanisms:** Ionic contamination on the surface or under the metallization of the die
IOL	Intermittent Operational Life	**INTERMITTENT OPERATIONAL LIFE** The purpose of this test is the same as Operating Life in addition to checking the integrity of both wire and die bonds by means of thermal stressing. **Test Conditions:** TA = 25°C, Ton = Toff = 2 minutes, delta Tj => 100°C **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Foreign material, crack and bulk die defects, metallization, wire and die bond defects
IOL-PC	Intermittent Operational Life - PC	**INTERMITTENT OPERATIONAL LIFE + MOISTURE LEVEL PRECONDITIONING** The purpose of this test is the same as Operating Life in addition to checking the integrity of both wire and die bonds by means of thermal stressing. **Test Conditions:** TA = 25°C, Ton = Toff = 2 minutes, delta Tj => 100°C **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Foreign material, crack and bulk die defects, metallization, wire and die bond defects
MSL 1	Moisture Level 1	**MOISTURE LEVEL PRECONDITIONING** These tests are performed to simulate the board mounting process where parts are subjected to a high temperature for a short duration. These tests detect mold compound delamination from the die and leadframe. The failure mechanisms are corrosion, fractured wirebonds and passivation cracks. 10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@220°C + 1X Flux Immersion + DI Rinse
TC	Temperature Cycle	**TEMPERATURE CYCLING** The purpose of this test is to evaluate the ability of the device to withstand both exposure to extreme temperatures and transitions between temperature extremes. This testing will also expose excessive thermal mismatch between materials. **Test Conditions:** TA = -65°C to 150°C, air to air **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Wire bond, cracked or lifted die and package failure
TC-PC	Temperature Cycle - PC	**TEMPERATURE CYCLING + MOISTURE LEVEL PRECONDITIONING** The purpose of this test is to evaluate the ability of the device to withstand both exposure to extreme temperatures and transitions between temperature extremes. This testing will also expose excessive thermal mismatch between materials. **Test Conditions:** TA = -65°C to 150°C, air to air **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Wire bond, cracked or lifted die and package failure

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Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
Auto	TA = +121°C, RH = 100%, PSIG = 15, N/A	0450A	0 Hr.	30	0	
		0450A	**96 Hr.**	30	0	
		0477B	0 Hr.	77	0	
		0477B	**96 Hr.**	77	0	
		0668A	0 Hr.	77	0	
		0668A	**96 Hr.**	77	0	
		0669A	0 Hr.	77	0	
		0669A	**96 Hr.**	77	0	
Auto-PC	After MSL-1 pre-conditioning: TA = +121°C, RH = 100%, PSIG = 15, N/A	0477A	0 Hr.	76	0	
		0477A	**96 Hr.**	76	0	
		0668A	0 Hr.	77	0	
		0668A	**96 Hr.**	77	0	
		0669A	0 Hr.	68	0	
		0669A	**96 Hr.**	68	0	
Bond Pull	Cond. C or D; pre- or post mold, N/A	0477A	**Results**	5	0	
Bond Shear	Cond. C or D; pre- or post mold, N/A	0477A	**Results**	5	0	
DPA-H3TRB-PC	Random Sample of Good H3TRB devices per CDF-AEC-Q101-004 Section 4, N/A	0477A	Results	2	0	
		0668A	Results	2	0	
		0669A	Results	2	0	

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Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
DPA-TC	Random Sample of Good Temp Cycle devices per CDF-AEC-Q101-004 Section 4, N/A	0450A	**Results**	2	0	
		0477A	**Results**	2	0	
DPA-TC-PC	Random Sample of Good Temp Cycle devices per CDF-AEC-Q101-004 Section 4, N/A	0477A	**Results**	2	0	
Elect Dis	As Specified, N/A	0477A	**Results**	20	0	
ESD	MM, N/A	0477A	**Results**	5	0	
H3TRB	TA = +85°C, RH = 85%, +4.8 volts to pins 1-24 in parallel, to ground connection. Note: pin 1 = pin 24 and pin 3 = pin 22.	0450A	0 Hr.	29	0	
		0450A	504 Hr.	29	0	
		0450A	**1008 Hr.**	29	0	
		0477A	0 Hr.	71	0	
		0477A	504 Hr.	71	0	
		0477A	**1008 Hr.**	71	0	
		0668A	0 Hr.	77	0	
		0668A	504 Hr.	77	0	
		0668A	**1008 Hr.**	77	0	
		0669A	0 Hr.	77	0	
		0669A	504 Hr.	77	0	
		0669A	**1008 Hr.**	77	0	

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Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
H3TRB-PC	After MSL-1 pre-conditioning: TA = +85°C; RH = 85%, +4.8 volts to pins 1-24 in parallel, to ground connection.	0477A	0 Hr.	59	0	
		0477A	504 Hr.	59	0	
		0477A	**1008 Hr.**	59	0	
		0668A	0 Hr.	77	0	
		0668A	1008 Hr.	77	0	
		0669A	0 Hr.	77	0	
		0669A	504 Hr.	77	0	
HTRB	TA = +150°C, +4.8 volts to pins 1-24 in parallel, to ground connection.	0450A	0 Hr.	28	0	
		0450A	504 Hr.	28	0	
		0450A	**1008 Hr.**	28	0	
		0477A	0 Hr.	77	0	
		0477A	504 Hr.	77	0	
		0477A	**1008 Hr.**	77	0	
		0668A	0 Hr.	77	0	
		0668A	504 Hr.	77	0	
		0668A	**1008 Hr.**	77	0	
		0669A	0 Hr.	77	0	

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
		0669A	504 Hr.	77	0	
		0669A	**1008 Hr.**	77	0	
IOL	TA = +25°C, delta Tj => 100°C, 2 minutes on/off, Delta Tj of 100C	0450A	0 Cyc.	29	0	
		0450A	7500 Cyc.	29	0	
		0450A	**15000 Cyc.**	20	0	
		0477B	0 Cyc.	72	0	
		0477B	7500 Cyc.	72	0	
		0477B	**15000 Cyc.**	72	0	
	By similarity with MMUN1001LT1, 3 lots.		0 Cyc.	249	0	
	By similarity with MMUN1001LT1, 3 lots.		**10000 Cyc.**	249	0	
IOL-PC	After MSL-1 pre-conditioning: TA = +25°C, delta Tj => 100°C, 2 minutes on/off,	0477A	0 Cyc.	75	0	
		0477A	7500 Cyc.	75	0	
		0477A	**15000 Cyc.**	75	0	
MSL 1	10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@220°C + 1X Flux Immersion + DI Rinse, N/A	0477A	0 Hr.	307	0	
		0477A	Readout	307	0	
		0668A	0 Hr.	320	0	
		0668A	Readout	320	0	

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
		0669A	0 Hr.	320	0	
		0669A	Readout	320	0	
TC	Air to Air; -65°C to +150°C, N/A	0450A	0 Cyc.	30	0	
		0450A	500 Cyc.	30	0	
		0450A	**1000 Cyc.**	30	0	
		0477A	0 Cyc.	77	0	
		0477A	500 Cyc.	77	0	
		0477A	1000 Cyc.	77	0	
		0668A	0 Cyc.	77	0	
		0668A	500 Cyc.	77	0	
		0668A	1000 Cyc.	77	0	
		0669A	0 Cyc.	77	0	
		0669A	500 Cyc.	77	0	
		0669A	1000 Cyc.	77	0	
TC-PC	After MSL-1 pre-conditioning: Air to Air; -65°C to +150°C, N/A	0477A	0 Cyc.	77	0	
		0477A	500 Cyc.	77	0	
		0477A	1000 Cyc.	77	0	

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
TC-PC	CONTINUED	0668A	0 Cyc.	76	0	
		0668A	500 Cyc.	76	0	
		0668A	1000 Cyc.	76	0	
		0669A	0 Cyc.	77	0	
		0669A	500 Cyc.	77	0	
		0669A	1000 Cyc.	77	0	

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Electrical Characterization

*Note: No parametric limits have been negotiated for low/high (-55C/+150C) temperatures.

Parameter	Spec Min	Max	Reading Min	Max	X Bar	Sigma	Cp	Cpk
25 Degrees C initial								
Vz @ 1mA, (Volts)	6 V	8 V	6.68	6.78	6.74	0.0163	82	15.1
Ir @ 3V, (Amperes)	n/a	1 UA	-1.45E-10	1.59E-09	3.61E-10	1.15E-10	2909	2907
25 Degrees C final								
Vz @ 1mA, (Volts)	6 V	8V	6.69	6.78	6.74	0.0152	88	16.4
Ir @ 3V, (Amperes)	n/a	1 UA	1.92E-10	4.68E-08	1.14E-09	2.70E-09	123	123
High Spec Temp Extreme +150C								
Vz @ 1mA	-	-	-	-	-	-	-	-
Ir @ 3V	-	-	-	-	-	-	-	-

8x20 surge to destruction study with all diodes in parallel. The highest peak power survived [by all units] was 251W.
The highest current survived [by all units] was 18.3A.

1. 290.70 W
2. 251.37 W
3. 262.60 W
4. 260.24 W
5. 254.33 W

Wire bond tests

– Visual 45 pcs Pass
– Wire pull 45 wires 1.72 Cpk
– Ball shear 45 balls 1.69 Cpk

Reliability Summary

Date: 11/15/2000 Motorola Part # NZMM7V0T4

Supplier: ON Semiconductor

TEST	CONDITIONS	Samples/Fail
PTH	121C @ 2 atmospheres, saturated (100% RH), t = 96 hours.	231/0
PTH-PC	Ditto PTH after MSL-1 preconditioning.	221/0
H3TRB	Ta=85°C; RH=85%; +4.8 volts to pins 1-24 in parallel to ground; t=500 hours.	231/0
H3TRB-PC	Ditto H3TRB after MSL-1 preconditioning.	219/0
H3TRB-PC-DPA	H3TRB-PC survivors.	6/0
HTRB	Ta=150°C; +4.8 volts to pins 1-24 in parallel to ground, t=500 hours.	231/0
TC	Air to Air; -65°C to +150°C, 500 cycles	231/0
TC-PC	Ditto TC after MSL-1 preconditioning.	231/0
TC-PC-DPA	TC-PC survivors	6/0
IOL	Delta Tj>=100C, 7500 cycles, Ton=Toff=2 minutes.	231/0
ESD	Machine Model, >2KV (units passed >30KV)	5/0
SURGE	>50W (units passed >250W)	5/0
BOND SHEAR	10 bonds from at least 5 units. (45 bonds were sheared.)	5/0
WIRE PULL	10 wires from at least 5 units. (45 wires were pulled.)	5/0

REL ID:= 450

LOT ID:= a

Rel Test:= AC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	9.24	9.33	9.302	0.020069	-154.5015	9.23	9.32	9.296	0.021909	-141.4341
12	VZ(pin 12)	9.25	9.33	9.304333	0.01888	-164.2755	9.24	9.32	9.297333	0.020998	-147.5902
13	VZ(pin 13)	9.25	9.33	9.306667	0.020229	-153.3584	9.25	9.33	9.3	0.020172	-153.6808
22	Delta Vz(T4-T13)	-0.0128	0.004	-0.003773	0.00417	0.301638	-0.0124	0.0028	-0.00368	0.004141	0.296189
33	IR(pin 4)	1.02E-11	4.35E-11	2.43E-11	8.8E-12	-0.920435	-3.29E-10	4.86E-11	-1.02E-10	8.82E-11	0.38447
41	IR(pin 12)	1.54E-11	5.11E-11	3.48E-11	8.21E-12	-1.410966	-3.58E-11	6.52E-11	2.53E-11	2.59E-11	-0.325931
45	VF(pin 4)	2.1764	2.4092	2.294667	0.068845	-11.11025	2.1744	2.4188	2.295053	0.071759	-10.66094
53	VF(pin 12)	2.1652	2.4208	2.29708	0.075097	-10.19601	2.1572	2.4244	2.29784	0.078145	-9.801632
63	Vres(pins 12-13)	0.99344	1.048	1.012629	0.012391	-27.24093	0.99096	1.0472	1.011417	0.012507	-26.95707

Test Number	Test Name	Delta Min	Delta Max	Delta Mean	Delta(%) Min	Delta(%) Max	Delta(%) Mean
4	VZ(pin 4)	-0.01	-0.01	-0.006	-0.108225	-0.107181	-0.064502
12	VZ(pin 12)	-0.01	-0.01	-0.007	-0.108108	-0.107181	-0.075234
13	VZ(pin 13)	0	0	-0.006667	0	0	-0.071633
22	Delta Vz(T4-T13)	0.0004	-0.0012	9.33E-05	-3.125	-30	-2.472637
33	IR(pin 4)	-3.39E-10	5.12E-12	-1.26E-10	-3315.234	11.76471	-518.5159
41	IR(pin 12)	-5.12E-11	1.41E-11	-9.44E-12	-333.3333	27.5646	-27.16741
45	VF(pin 4)	-0.002	0.0096	0.000387	-0.091895	0.398473	0.016851
53	VF(pin 12)	-0.008	0.0036	0.00076	-0.369481	0.148711	0.033085
63	Vres(pins 12-13)	-0.00248	-0.0008	-0.001212	-0.249638	-0.076336	-0.119688

REL ID:= 450

LOT ID:= a

Rel Test:= H3TRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	9.21	9.31	9.276333	0.025795	-119.8707	9.21	9.31	9.273793	0.025272	-122.3201
12	VZ(pin 12)	9.23	9.31	9.279667	0.022967	-134.6827	9.23	9.31	9.277586	0.022465	-137.6594
13	VZ(pin 13)	9.23	9.31	9.281667	0.022296	-138.7622	9.23	9.3	9.27931	0.023289	-132.8155
22	Delta Vz(T4-T13)	-0.0224	0.0084	-0.004467	0.006739	0.220954	-0.0228	0.0084	-0.004648	0.006853	0.226092
33	IR(pin 4)	-6.4E-12	4.99E-11	2.14E-11	1.24E-11	-0.575756	-6.66E-11	1.98E-11	-1.11E-11	2E-11	0.185157
41	IR(pin 12)	2.56E-12	5.12E-11	2.49E-11	1.05E-11	-0.791943	0	9.47E-11	1.63E-11	1.82E-11	-0.298078
45	VF(pin 4)	2.0788	2.4008	2.277827	0.07161	-10.60286	2.0696	2.3644	2.260587	0.072301	-10.42209
53	VF(pin 12)	2.1088	2.4172	2.279627	0.069401	-10.94899	2.0992	2.3692	2.262747	0.067454	-11.18169
63	Vres(pins 12-13)	1.0036	1.0488	1.028547	0.012898	-26.58221	1.0028	1.0476	1.027347	0.012714	-26.93449

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	-0.00254	0	0	-0.027384
12	VZ(pin 12)	0	0	-0.00208	0	0	-0.02242
13	VZ(pin 13)	0	-0.01	-0.002356	0	-0.107411	-0.025387
22	Delta Vz(T4-T13)	-0.0004	0	-0.000182	1.785714	0	4.065101
33	IR(pin 4)	-6.02E-11	-3.01E-11	-3.25E-11	940.625	-60.25641	-151.8821
41	IR(pin 12)	-2.56E-12	4.35E-11	-8.63E-12	-100	85	-34.58783
45	VF(pin 4)	-0.0092	-0.0364	-0.01724	-0.442563	-1.516161	-0.756863
53	VF(pin 12)	-0.0096	-0.048	-0.01688	-0.455235	-1.985769	-0.740474
63	Vres(pins 12-13)	-0.0008	-0.0012	-0.0012	-0.079713	-0.114416	-0.116666

REL ID:= 450
LOT ID:= a
Rel Test:= HTRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	9.23	9.31	9.283667	0.018473	-167.5147	9.23	9.72	9.323793	0.113528	-27.37583
12	VZ(pin 12)	9.23	9.31	9.285	0.019783	-156.445	9.23	9.73	9.325517	0.109564	-28.3717
13	VZ(pin 13)	9.24	9.31	9.286333	0.018659	-165.8949	9.24	9.73	9.327931	0.10887	-28.55981
22	Delta Vz(T4-T13)	-0.0116	0.012	-0.00384	0.005467	0.234132	-0.0152	0.0416	-0.002855	0.01011	0.094135
33	IR(pin 4)	6E-13	5.63E-11	2.39E-11	1.26E-11	-0.632669	6E-13	5.63E-11	2.39E-11	1.26E-11	-0.632669
41	IR(pin 12)	1.28E-12	5.38E-11	2.76E-11	1.24E-11	-0.742245	1.28E-12	5.38E-11	2.76E-11	1.24E-11	-0.742245
45	VF(pin 4)	2.124	2.3784	2.281067	0.069591	-10.92604	2.124	2.3784	2.281067	0.069591	-10.92604
53	VF(pin 12)	2.1016	2.4048	2.291387	0.073276	-10.42357	2.1016	2.4048	2.291387	0.073276	-10.42357
63	Vres(pins 12-13)	1.0012	1.0456	1.021973	0.014083	-24.1899	1.0012	1.0456	1.021973	0.014083	-24.1899

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.41	0.040126	0	4.403867	0.432226
12	VZ(pin 12)	0	0.42	0.040517	0	4.511278	0.436373
13	VZ(pin 13)	0	0.42	0.041598	0	4.511278	0.447945
22	Delta Vz(T4-T13)	-0.0036	0.0296	0.000985	31.03448	246.6667	-25.64745
33	IR(pin 4)	0	0	0	0	0	0
41	IR(pin 12)	0	0	0	0	0	0
45	VF(pin 4)	0	0	0	0	0	0
53	VF(pin 12)	0	0	0	0	0	0
63	Vres(pins 12-13)	0	0	0	0	0	0

REL ID:= 477

LOT ID:= a

Rel Test:= AC_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.8	6.88	6.848571	0.019447	-117.3872	6.8	6.88	6.848158	0.019981	-114.2463
12	VZ(pin 12)	6.8	6.88	6.851299	0.017041	-134.0158	6.8	6.89	6.850789	0.017871	-127.7831
13	VZ(pin 13)	6.8	6.89	6.852468	0.018221	-125.3614	6.8	6.89	6.852632	0.018502	-123.459
22	Delta Vz(T4-T13)	-0.0492	0.0464	-0.00439	0.018799	0.077836	-0.0492	0.0464	-0.004653	0.019005	0.081602
33	IR(pin 4)	1.48E-10	5.58E-10	2.44E-10	9.14E-11	-0.889065	6.56E-11	2.99E-08	6.37E-10	3.41E-09	-0.062288
41	IR(pin 12)	-3.07E-11	7.16E-10	2.6E-10	1.1E-10	-0.787276	1.43E-10	3.05E-08	1.04E-09	3.85E-09	-0.090468
45	VF(pin 4)	1.0288	1.174	1.080836	0.034189	-10.53773	1.0252	1.1828	1.080626	0.03778	-9.534486
53	VF(pin 12)	1.028	1.1912	1.085631	0.039899	-9.069914	1.0252	1.197199	1.088095	0.04275	-8.484259
63	Vres(pins 12-13)	0.92316	1.0304	0.960121	0.023109	-13.84929	0.9222	1.0308	0.960104	0.023168	-13.81377

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	-0.000414	0	0	-0.006038
12	VZ(pin 12)	0	0.01	-0.000509	0	0.145349	-0.007433
13	VZ(pin 13)	0	0	0.000164	0	0	0.002394
22	Delta Vz(T4-T13)	0	0	-0.000263	0	0	5.991903
33	IR(pin 4)	-8.28E-11	2.94E-08	3.93E-10	-55.79203	5265.207	161.0864
41	IR(pin 12)	1.74E-10	2.97E-08	7.84E-10	-566.5365	4155.688	302.1515
45	VF(pin 4)	-0.0036	0.0088	-0.00021	-0.349922	0.749574	-0.019439
53	VF(pin 12)	-0.0028	0.005999	0.002464	-0.272374	0.50361	0.22692
63	Vres(pins 12-13)	-0.00096	0.0004	-1.68E-05	-0.103991	0.03882	-0.001753

REL ID:= 477

LOT ID:= a

Rel Test:= H3TRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.79	6.89	6.844935	0.020237	-112.7463417	6.79	6.88	6.841948	0.019402	-117.5501
12	VZ(pin 12)	6.78	6.9	6.845584	0.019091	-119.527096	5.8	6.89	6.828701	0.12031	-18.91967
13	VZ(pin 13)	6.79	6.9	6.847143	0.019253	-118.5469801	5.67	6.9	6.829351	0.135388	-16.8143
22	Delta Vz(T4-T13)	-0.0588	0.0424	-0.002197	0.018272	0.040086516	-0.0592	1.18	0.013132	0.135971	-0.032194
33	IR(pin 4)	1.2E-10	4.02E-10	2.13E-10	5.7E-11	-1.242642362	-1.29E-10	3.51E-07	7.48E-09	4.63E-08	-0.05386
41	IR(pin 12)	-3.33E-11	4.86E-10	2.34E-10	6.76E-11	-1.155301238	4.86E-11	4.41E-07	1.04E-08	6.27E-08	-0.055224
45	VF(pin 4)	1.0424	1.2108	1.089667	0.035242	-10.30640601	1.0424	1.2148	1.090847	0.036195	-10.04589
53	VF(pin 12)	1.039199	1.225999	1.087626	0.036306	-9.985752589	1.039199	1.23	1.089236	0.037067	-9.795209
63	Vres(pins 12-13)	0.9354	1.035599	0.987463	0.026466	-12.43670901	0.93484	1.0352	0.987165	0.026228	-12.54579

				Delta	Delta(%)		Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Delta(%) Max	Mean
4	VZ(pin 4)	0	-0.01	-0.002987	0	-0.145137881	-0.043638
12	VZ(pin 12)	-0.98	-0.01	-0.016883	-14.45428	-0.144927536	-0.246628
13	VZ(pin 13)	-1.12	0	-0.017792	-16.49485	0	-0.259849
22	Delta Vz(T4-T13)	-0.0004	1.1376	0.01533	0.680272	2683.018868	-697.6359
33	IR(pin 4)	-2.49E-10	3.51E-07	7.27E-09	-206.9884	87311.61239	3418.209
41	IR(pin 12)	8.19E-11	4.41E-07	1.02E-08	-245.8583	90664.80263	4332.455
45	VF(pin 4)	0	0.004	0.001179	0	0.330360093	0.108221
53	VF(pin 12)	0	0.004001	0.00161	0	0.326346106	0.148062
63	Vres(pins 12-13)	-0.00056	-0.000399	-0.000298	-0.059867	-0.038528427	-0.030197

REL ID:= 477

LOT ID:= a

Rel Test:= HTRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.8	6.88	6.845065	0.017519	-130.2433	6.8	6.89	6.846234	0.017399	-131.1595
12	VZ(pin 12)	6.8	6.89	6.843117	0.016957	-134.5223	6.8	6.89	6.844286	0.017504	-130.3374
13	VZ(pin 13)	6.79	6.88	6.845455	0.018104	-126.0401	6.79	6.89	6.846234	0.018781	-121.5085
22	Delta Vz(T4-T13)	-0.0428	0.044	-0.000192	0.018241	0.003512	-0.0428	0.0428	-0.000405	0.018244	0.007403
33	IR(pin 4)	1.3E-10	3.98E-10	2.14E-10	5.71E-11	-1.2469	1.63E-10	3.12E-09	3.52E-10	4.33E-10	-0.270652
41	IR(pin 12)	1.28E-11	1.02E-09	2.45E-10	1.24E-10	-0.660285	5.42E-11	2.81E-09	3.43E-10	3.22E-10	-0.354583
45	VF(pin 4)	1.0324	1.1628	1.082	0.027192	-13.26372	1.0336	1.184	1.093792	0.034187	-10.66489
53	VF(pin 12)	1.0108	1.154	1.079766	0.026294	-13.68842	1.0172	1.172	1.090519	0.03221	-11.2855
63	Vres(pins 12-13)	0.947	1.035599	0.988604	0.022346	-14.74688	0.95584	1.0436	0.997156	0.022172	-14.99104

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.01	0.001169	0	0.145349	0.017076
12	VZ(pin 12)	0	0	0.001169	0	0	0.01708
13	VZ(pin 13)	0	0.01	0.000779	0	0.145349	0.011383
22	Delta Vz(T4-T13)	0	-0.0012	-0.000213	0	-2.727273	110.8108
33	IR(pin 4)	3.21E-11	2.72E-09	1.38E-10	24.62435	682.98	64.7697
41	IR(pin 12)	4.14E-11	1.79E-09	9.72E-11	323.75	176.1071	39.57765
45	VF(pin 4)	0.0012	0.0212	0.011792	0.116234	1.823185	1.089853
53	VF(pin 12)	0.0064	0.018	0.010753	0.633162	1.559792	0.995888
63	Vres(pins 12-13)	0.00884	0.008001	0.008552	0.933474	0.772596	0.865031

REL ID:= 477

LOT ID:= a

Rel Test:= TC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.8	6.87	6.843636	0.015467	-147.487	6.79	6.87	6.841429	0.017525	-130.1234
12	VZ(pin 12)	6.79	6.87	6.841429	0.018261	-124.8834	6.78	6.87	6.84039	0.018669	-122.1347
13	VZ(pin 13)	6.79	6.88	6.838831	0.020454	-111.4524	6.79	6.88	6.837662	0.020384	-111.813
22	Delta Vz(T4-T13)	-0.0356	0.0432	0.004244	0.01852	-0.076389	-0.0352	0.0436	0.004281	0.018702	-0.076294
33	IR(pin 4)	1.36E-10	4.56E-10	2.03E-10	5.98E-11	-1.131223	-1.03E-09	4.71E-10	1.82E-10	1.57E-10	-0.386148
41	IR(pin 12)	2.81E-11	6.24E-10	2.23E-10	7.84E-11	-0.94718	1.56E-10	6.44E-10	2.3E-10	7.53E-11	-1.018398
45	VF(pin 4)	1.0384	1.1192	1.076026	0.019544	-18.35251	1.0568	1.146	1.098415	0.022575	-16.21855
53	VF(pin 12)	1.0324	1.126	1.076473	0.020987	-17.09762	1.0496	1.1508	1.098483	0.026699	-13.7143
63	Vres(pins 12-13)	0.951	1.0352	0.990563	0.021335	-15.4766	0.95328	1.0364	0.99219	0.021391	-15.46139

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	-0.01	0	-0.002208	-0.147059	0	-0.032261
12	VZ(pin 12)	-0.01	0	-0.001039	-0.147275	0	-0.015186
13	VZ(pin 13)	0	0	-0.001169	0	0	-0.017091
22	Delta Vz(T4-T13)	0.0004	0.0004	3.64E-05	-1.123596	0.925926	0.856793
33	IR(pin 4)	-1.17E-09	1.55E-11	-2.12E-11	-859.434	3.398016	-10.46064
41	IR(pin 12)	1.27E-10	1.94E-11	7.16E-12	453.2006	3.100775	3.210569
45	VF(pin 4)	0.0184	0.0268	0.022389	1.771957	2.394568	2.080754
53	VF(pin 12)	0.0172	0.0248	0.02201	1.666021	2.202487	2.044678
63	Vres(pins 12-13)	0.00228	0.0012	0.001627	0.239748	0.11592	0.164251

REL ID:= 477

LOT ID:= a

Rel Test:= TC_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.81	6.89	6.856104	0.018364	-124.4454	6.81	6.89	6.857273	0.018399	-124.2339
12	VZ(pin 12)	6.82	6.9	6.860649	0.015839	-144.3788	6.82	6.9	6.861818	0.01502	-152.2826
13	VZ(pin 13)	6.82	6.89	6.861039	0.016826	-135.9207	6.82	6.89	6.861818	0.01668	-137.1249
22	Delta Vz(T4-T13)	-0.0484	0.0448	-0.004421	0.015996	0.092122	-0.046	0.0444	-0.004223	0.016112	0.087374
33	IR(pin 4)	7.67E-11	4.94E-10	2.42E-10	7.37E-11	-1.093926	-1.51E-09	1.46E-09	2.47E-10	2.59E-10	-0.317362
41	IR(pin 12)	3.6E-13	6.88E-10	2.58E-10	8.94E-11	-0.963143	-1.04E-10	9.4E-10	2.62E-10	1.18E-10	-0.737936
45	VF(pin 4)	1.0412	1.2104	1.106099	0.041869	-8.805941	1.0516	1.22	1.122592	0.038166	-9.804461
53	VF(pin 12)	1.03	1.23	1.113839	0.044017	-8.434987	1.0376	1.2316	1.132208	0.044275	-8.523996
63	Vres(pins 12-13)	0.92528	1.031999	0.96239	0.021807	-14.71091	0.92612	1.034	0.963589	0.021929	-14.64689

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.001169	0	0	0.017048
12	VZ(pin 12)	0	0	0.001169	0	0	0.017037
13	VZ(pin 13)	0	0	0.000779	0	0	0.011357
22	Delta Vz(T4-T13)	0.0024	-0.0004	0.000197	-4.958678	-0.892857	-4.465335
33	IR(pin 4)	-1.59E-09	9.65E-10	4.9E-12	-2069.744	195.4085	2.024822
41	IR(pin 12)	-1.04E-10	2.51E-10	3.73E-12	-28877.78	36.5502	1.444238
45	VF(pin 4)	0.0104	0.0096	0.016494	0.998847	0.793126	1.491147
53	VF(pin 12)	0.0076	0.0016	0.018369	0.737864	0.130081	1.649151
63	Vres(pins 12-13)	0.00084	0.002001	0.0012	0.090783	0.193896	0.124638

REL ID:= 477

LOT ID:= b

Rel Test:= AUTO

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.78	6.88	6.844935	0.017368	-131.3721	6.78	6.88	6.846494	0.017974	-126.9695
12	VZ(pin 12)	6.78	6.88	6.846494	0.016604	-137.4447	6.78	6.88	6.847403	0.016336	-139.7243
13	VZ(pin 13)	6.79	6.87	6.847143	0.014406	-158.438	6.79	6.87	6.848571	0.014022	-162.8054
22	Delta Vz(T4-T13)	-0.068	0.0448	-0.00241	0.014075	0.057086	-0.0688	0.0452	-0.002192	0.013951	0.05238
33	IR(pin 4)	1.33E-10	4.58E-10	2.05E-10	6.78E-11	-1.004847	1.52E-10	1.62E-07	1.02E-08	2.64E-08	-0.129376
41	IR(pin 12)	1.6E-10	6.28E-10	2.24E-10	7.83E-11	-0.953507	1.75E-10	1.91E-06	1.95E-07	3.55E-07	-0.182605
45	VF(pin 4)	1.0348	1.1984	1.077823	0.030987	-11.59433	1.0328	1.2012	1.078176	0.030025	-11.96978
53	VF(pin 12)	1.0348	1.1496	1.076961	0.025729	-13.95269	1.0332	1.1708	1.078815	0.028103	-12.79578
63	Vres(pins 12-13)	0.95124	1.024799	0.982684	0.021911	-14.9495	0.95184	1.024799	0.982702	0.021837	-15.00088

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.001558	0	0	0.022768
12	VZ(pin 12)	0	0	0.000909	0	0	0.013278
13	VZ(pin 13)	0	0	0.001429	0	0	0.020864
22	Delta Vz(T4-T13)	-0.0008	0.0004	0.000218	1.176471	0.892857	-9.051724
33	IR(pin 4)	1.98E-11	1.62E-07	1E-08	14.91096	35335.41	4908.524
41	IR(pin 12)	1.57E-11	1.91E-06	1.94E-07	9.842224	303489.6	86749.98
45	VF(pin 4)	-0.002	0.0028	0.000353	-0.193274	0.233645	0.032767
53	VF(pin 12)	-0.0016	0.0212	0.001855	-0.154619	1.84412	0.172201
63	Vres(pins 12-13)	0.0006	0	1.82E-05	0.063076	0	0.001857

REL ID:= 477

LOT ID:= b

Rel Test:= IOL

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.79	6.88	6.844416	0.017282	-132.0144	6.79	15	7.052987	1.306374	-1.799634
12	VZ(pin 12)	6.78	6.88	6.846104	0.016635	-137.1821	6.78	15	7.053766	1.306226	-1.800037
13	VZ(pin 13)	6.8	6.88	6.843506	0.017454	-130.6948	6.8	15	7.052078	1.306539	-1.799176
22	Delta Vz(T4-T13)	-0.0636	0.0428	0.00093	0.018618	-0.016648	-0.0632	0.0408	0.000358	0.018468	-0.00647
33	IR(pin 4)	1.18E-10	3.78E-10	2.42E-10	5.15E-11	-1.564351	2.28E-12	1.73E-09	4.19E-10	3.5E-10	-0.399531
41	IR(pin 12)	1.58E-10	4.1E-10	2.62E-10	5.6E-11	-1.560668	-1.4E-12	3.73E-09	5.32E-10	7.05E-10	-0.25157
45	VF(pin 4)	1.042	1.2256	1.091745	0.026822	-13.56778	0.9804	5.0008	1.335521	0.972988	-0.457533
53	VF(pin 12)	1.0516	1.198	1.091075	0.022968	-15.83442	0.97936	5.0016	1.288207	0.875381	-0.490532
63	Vres(pins 12-13)	0.94888	1.021199	0.978807	0.017955	-18.17141	0.94912	2.5016	1.019571	0.244248	-1.391443

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	8.12	0.208571	0	118.0233	3.047323
12	VZ(pin 12)	0	8.12	0.207662	0	118.0233	3.033292
13	VZ(pin 13)	0	8.12	0.208571	0	118.0233	3.047727
22	Delta Vz(T4-T13)	0.0004	-0.002	-0.000571	-0.628931	-4.672897	-61.45251
33	IR(pin 4)	-1.15E-10	1.35E-09	1.77E-10	-98.06386	356.4504	73.36256
41	IR(pin 12)	-1.6E-10	3.32E-09	2.69E-10	-100.8836	809.4727	102.6866
45	VF(pin 4)	-0.0616	3.7752	0.243776	-5.911708	308.0287	22.32902
53	VF(pin 12)	-0.07224	3.8036	0.197131	-6.869532	317.4958	18.06764
63	Vres(pins 12-13)	0.00024	1.480401	0.040764	0.025293	144.9669	4.164625

REL ID:= 668

LOT ID:= a

Rel Test:= AC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.74	6.82	6.778875	0.018623	-121.3346	6.74	6.82	6.78	0.018759	-120.4757
12	VZ(pin 12)	6.74	6.82	6.77925	0.017413	-129.7705	6.73	6.82	6.779875	0.018106	-124.8172
13	VZ(pin 13)	6.74	6.81	6.77825	0.018878	-119.6829	6.74	6.81	6.779375	0.019509	-115.8309
22	Delta Vz(T4-T13)	-0.034	0.0412	0.000415	0.015505	-0.008922	-0.034	0.0476	0.000585	0.015782	-0.012356
33	IR(pin 4)	1.38E-10	6.57E-10	3.02E-10	9.42E-11	-1.069431	3.83E-11	1.27E-07	2.07E-09	1.42E-08	-0.048614
41	IR(pin 12)	1.68E-10	6.55E-10	3.27E-10	1.09E-10	-1.003264	1.59E-10	0.000102	1.27E-06	1.14E-05	-0.037305
45	VF(pin 4)	1.0684	1.178	1.118755	0.019124	-19.49977	1.0676	1.1804	1.11806	0.019711	-18.90734
53	VF(pin 12)	1.0748	1.1628	1.11657	0.016028	-23.22135	1.0748	1.1624	1.115845	0.016539	-22.48904
63	Vres(pins 12-13)	0.93336	1.0156	0.968793	0.019054	-16.94778	0.93312	1.0156	0.968843	0.018935	-17.05579

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.001125	0	0	0.016596
12	VZ(pin 12)	-0.01	0	0.000625	-0.148368	0	0.009219
13	VZ(pin 13)	0	0	0.001125	0	0	0.016597
22	Delta Vz(T4-T13)	0	0.0064	0.00017	0	15.53398	40.96386
33	IR(pin 4)	-1E-10	1.26E-07	1.76E-09	-72.30903	19207.87	583.1368
41	IR(pin 12)	-8.96E-12	0.000102	1.27E-06	-5.343511	15518425	388997.3
45	VF(pin 4)	-0.0008	0.0024	-0.000695	-0.074878	0.203735	-0.062119
53	VF(pin 12)	0	-0.0004	-0.000725	0	-0.0344	-0.064925
63	Vres(pins 12-13)	-0.00024	0	5.1E-05	-0.025714	0	0.005263

REL ID:= 668

LOT ID:= a

Rel Test:= AC-PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.76	6.81	6.79025	0.009933	-227.861	6.76	6.82	6.791625	0.010607	-213.4252
12	VZ(pin 12)	6.77	6.82	6.7925	0.009209	-245.8581	6.77	6.85	6.793625	0.01139	-198.8192
13	VZ(pin 13)	6.77	6.81	6.791125	0.009139	-247.687	6.76	6.83	6.791375	0.01188	-190.5623
22	Delta Vz(T4-T13)	-0.0316	0.0352	-0.000145	0.013781	0.003507	-0.0312	0.0352	4.5E-05	0.013841	-0.001084
33	IR(pin 4)	1.83E-10	6.23E-10	3.09E-10	9.41E-11	-1.093937	-4.84E-09	0.002266	2.83E-05	0.000253	-0.037279
41	IR(pin 12)	1.77E-10	7.85E-10	3.35E-10	1.08E-10	-1.031747	2.09E-10	0.005155	6.45E-05	0.000576	-0.037327
45	VF(pin 4)	1.1	1.183599	1.124765	0.016396	-22.8663	1.1028	1.5444	1.181585	0.098522	-3.997692
53	VF(pin 12)	1.088799	1.1672	1.124215	0.015543	-24.11016	1.0948	1.5452	1.18137	0.101048	-3.897051
63	Vres(pins 12-13)	0.93416	1.008	0.973483	0.017875	-18.1532	0.93332	1.0068	0.972797	0.017847	-18.16895

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.01	0.001375	0	0.146843	0.02025
12	VZ(pin 12)	0	0.03	0.001125	0	0.439883	0.016562
13	VZ(pin 13)	-0.01	0.02	0.00025	-0.14771	0.293686	0.003681
22	Delta Vz(T4-T13)	0.0004	0	0.00019	-1.265823	0	-131.0345
33	IR(pin 4)	-5.02E-09	0.002266	2.83E-05	-2744.872	3.64E+08	9174734
41	IR(pin 12)	3.24E-11	0.005155	6.45E-05	18.34239	6.57E+08	19287794
45	VF(pin 4)	0.0028	0.360801	0.05682	0.254545	30.48338	5.05172
53	VF(pin 12)	0.006001	0.378	0.057155	0.551158	32.3852	5.083995
63	Vres(pins 12-13)	-0.00084	-0.0012	-0.000686	-0.08992	-0.119048	-0.07052

REL ID:= 668
LOT ID:= a
Rel Test:= H3TRB

Test Number	Test Name	Initial Min	Initial Max	Initial Mean	Initial StDev	Initial Cpk	Qual Point Min	Qual Point Max	Qual Point Mean	Qual Point StDev	Qual Point Cpk
4	VZ(pin 4)	6.75	6.81	6.7875	0.012579	-179.8652	6.75	6.81	6.787875	0.013187	-171.5744
12	VZ(pin 12)	6.75	6.82	6.7875	0.012779	-177.0546	6.75	6.82	6.787375	0.012703	-178.0985
13	VZ(pin 13)	6.75	6.81	6.786375	0.01139	-198.6071	6.75	6.81	6.78625	0.011515	-196.4469
22	Delta Vz(T4-T13)	-0.0348	0.0268	0.00101	0.011813	-0.028499	-0.0348	0.0264	0.001185	0.011902	-0.033186
33	IR(pin 4)	1.72E-10	9.29E-10	3.21E-10	1.09E-10	-0.981853	-6.68E-08	2.55E-07	-1.14E-08	3.72E-08	0.101837
41	IR(pin 12)	2.03E-10	7.74E-10	3.39E-10	1.02E-10	-1.112583	-5.99E-08	2.71E-07	6.56E-09	4.47E-08	-0.048942
45	VF(pin 4)	1.0836	1.174	1.120415	0.019008	-19.64817	1.0836	1.1744	1.119745	0.019755	-18.89408
53	VF(pin 12)	1.076	1.1784	1.1174	0.02044	-18.22215	1.074	1.1952	1.11695	0.021846	-17.04257
63	Vres(pins 12-13)	0.93716	1.0024	0.973321	0.014222	-22.8128	0.93536	0.99744	0.971776	0.014114	-22.94998

Test Number	Test Name	Delta Min	Delta Max	Delta Mean	Delta(%) Min	Delta(%) Max	Delta(%) Mean
4	VZ(pin 4)	0	0	0.000375	0	0	0.005525
12	VZ(pin 12)	0	0	-0.000125	0	0	-0.001842
13	VZ(pin 13)	0	0	-0.000125	0	0	-0.001842
22	Delta Vz(T4-T13)	0	-0.0004	0.000175	0	-1.492537	17.32673
33	IR(pin 4)	-6.7E-08	2.54E-07	-1.17E-08	-39052.89	27326.58	-3637.962
41	IR(pin 12)	-6.01E-08	2.71E-07	6.22E-09	-29568.71	34936.16	1832.248
45	VF(pin 4)	0	0.0004	-0.00067	0	0.034072	-0.059799
53	VF(pin 12)	-0.002	0.0168	-0.00045	-0.185874	1.425662	-0.040263
63	Vres(pins 12-13)	-0.0018	-0.00496	-0.001545	-0.19207	-0.494812	-0.158735

REL ID:= 668

LOT ID:= a

Rel Test:= H3TRB_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.76	6.81	6.78925	0.010527	-214.974	6.76	6.81	6.789625	0.010487	-215.804
12	VZ(pin 12)	6.76	6.81	6.788625	0.010156	-222.8069	6.76	6.81	6.789375	0.010354	-218.581
13	VZ(pin 13)	6.77	6.81	6.78825	0.008827	-256.3516	6.77	6.81	6.788875	0.009	-251.4447
22	Delta Vz(T4-T13)	-0.0244	0.0248	-0.000145	0.011539	0.004189	-0.0248	0.0272	0.00029	0.012036	-0.008031
33	IR(pin 4)	8.19E-11	6.75E-10	2.99E-10	1.01E-10	-0.983935	1.95E-10	4.47E-07	5.98E-09	5E-08	-0.039868
41	IR(pin 12)	1.52E-10	7.17E-10	3.28E-10	1.11E-10	-0.987966	2.33E-10	4.22E-07	9.91E-09	5.93E-08	-0.055683
45	VF(pin 4)	1.0748	1.1768	1.12252	0.020148	-18.57146	1.0736	1.1884	1.12275	0.021873	-17.11032
53	VF(pin 12)	1.074	1.1624	1.114545	0.017158	-21.6531	1.072	1.1632	1.11462	0.018195	-20.41985
63	Vres(pins 12-13)	0.94952	1.0092	0.98607	0.014711	-22.34333	0.9488	1.007599	0.985216	0.014574	-22.53382

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.000375	0	0	0.005523
12	VZ(pin 12)	0	0	0.00075	0	0	0.011048
13	VZ(pin 13)	0	0	0.000625	0	0	0.009207
22	Delta Vz(T4-T13)	-0.0004	0.0024	0.000435	1.639344	9.677419	-300
33	IR(pin 4)	1.13E-10	4.47E-07	5.68E-09	137.5	66149.93	1899.515
41	IR(pin 12)	8.08E-11	4.21E-07	9.58E-09	53.06176	58770.47	2920.678
45	VF(pin 4)	-0.0012	0.0116	0.00023	-0.111649	0.985724	0.020491
53	VF(pin 12)	-0.002	0.0008	7.51E-05	-0.18622	0.068823	0.006735
63	Vres(pins 12-13)	-0.00072	-0.001601	-0.000854	-0.075828	-0.158641	-0.086557

REL ID:= 668

LOT ID:= a

Rel Test:= HTRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.74	6.81	6.77275	0.017573	-128.4715	6.74	6.81	6.772625	0.017983	-125.5349
12	VZ(pin 12)	6.73	6.81	6.768625	0.0177	-127.4724	6.73	6.81	6.768875	0.017062	-132.2381
13	VZ(pin 13)	6.74	6.82	6.769875	0.018315	-123.2141	6.74	6.82	6.77025	0.018279	-123.4628
22	Delta Vz(T4-T13)	-0.0344	0.0508	0.003075	0.015854	-0.064654	-0.0344	0.05	0.002865	0.015882	-0.060129
33	IR(pin 4)	3.57E-11	4.55E-09	2.93E-10	4.97E-10	-0.196674	1.65E-10	4.45E-09	7.36E-10	8.16E-10	-0.300719
41	IR(pin 12)	1.2E-10	2.06E-09	2.79E-10	2.19E-10	-0.425061	2.33E-10	4.02E-09	7.79E-10	7.49E-10	-0.346691
45	VF(pin 4)	1.064	1.168	1.114555	0.020069	-18.51233	1.0548	1.1724	1.10612	0.021897	-16.83807
53	VF(pin 12)	1.0628	1.1788	1.11491	0.021085	-17.62599	1.056	1.1896	1.108495	0.024772	-14.91571
63	Vres(pins 12-13)	0.93228	0.99188	0.968517	0.01351	-23.89552	0.93876	1.0008	0.975996	0.01397	-23.28827

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	-0.000125	0	0	-0.001846
12	VZ(pin 12)	0	0	0.00025	0	0	0.003694
13	VZ(pin 13)	0	0	0.000375	0	0	0.005539
22	Delta Vz(T4-T13)	0	-0.0008	-0.00021	0	-1.574803	-6.829268
33	IR(pin 4)	1.3E-10	-1.02E-10	4.42E-10	363.7892	-2.250945	150.731
41	IR(pin 12)	1.13E-10	1.96E-09	5E-10	93.61702	94.85736	179.2179
45	VF(pin 4)	-0.0092	0.0044	-0.008435	-0.864662	0.376712	-0.75681
53	VF(pin 12)	-0.0068	0.0108	-0.006415	-0.639819	0.916186	-0.575383
63	Vres(pins 12-13)	0.00648	0.00892	0.007479	0.69507	0.899302	0.772262

REL ID:= 668

LOT ID:= a

Rel Test:= TC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.73	6.81	6.765625	0.020429	-110.3949	6.73	6.82	6.769125	0.020635	-109.3465
12	VZ(pin 12)	6.73	6.84	6.765375	0.01728	-130.5064	6.73	6.84	6.766625	0.01757	-128.3718
13	VZ(pin 13)	6.74	6.82	6.765	0.015508	-145.4063	6.74	6.82	6.7665	0.015598	-144.6038
22	Delta Vz(T4-T13)	-0.0516	0.0452	0.00124	0.018192	-0.022721	-0.0528	0.0496	0.003	0.018486	-0.054094
33	IR(pin 4)	1.35E-11	4.71E-10	2.22E-10	8.02E-11	-0.922248	3.33E-11	1.08E-08	3.92E-10	1.19E-09	-0.109596
41	IR(pin 12)	1.15E-10	7.92E-10	2.61E-10	1.05E-10	-0.825086	1.21E-10	7.94E-10	2.78E-10	1.13E-10	-0.816229
45	VF(pin 4)	1.0644	1.16	1.11698	0.018991	-19.60557	1.0748	1.4456	1.1418	0.058428	-6.514034
53	VF(pin 12)	1.0792	1.1848	1.119775	0.021966	-16.99245	1.0812	1.1952	1.12423	0.02652	-14.13056
63	Vres(pins 12-13)	0.91952	0.9846	0.957155	0.017681	-18.04443	0.92036	0.9854	0.959148	0.017087	-18.71122

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.01	0.0035	0	0.146843	0.051732
12	VZ(pin 12)	0	0	0.00125	0	0	0.018476
13	VZ(pin 13)	0	0	0.0015	0	0	0.022173
22	Delta Vz(T4-T13)	-0.0012	0.0044	0.00176	2.325581	9.734513	141.9355
33	IR(pin 4)	1.98E-11	1.03E-08	1.7E-10	146.8843	2197.045	76.76788
41	IR(pin 12)	5.84E-12	1.92E-12	1.7E-11	5.071205	0.242522	6.525481
45	VF(pin 4)	0.0104	0.2856	0.02482	0.977076	24.62069	2.222068
53	VF(pin 12)	0.002	0.0104	0.004455	0.185322	0.877785	0.397842
63	Vres(pins 12-13)	0.00084	0.0008	0.001993	0.091352	0.081251	0.208221

REL ID:= 668

LOT ID:= a

Rel Test:= TC_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.77	6.81	6.788875	0.009678	-233.8358	6.77	6.83	6.799125	0.011821	-191.7279
12	VZ(pin 12)	6.77	6.8	6.789	0.00773	-292.7704	6.77	6.84	6.79625	0.01226	-184.7757
13	VZ(pin 13)	6.76	6.81	6.788625	0.009513	-237.8806	6.76	6.84	6.795875	0.013187	-171.7766
22	Delta Vz(T4-T13)	-0.028	0.032	0.00011	0.01221	-0.003003	-0.024	0.0352	0.00279	0.011925	-0.077989
33	IR(pin 4)	1.64E-10	9.13E-10	3.09E-10	1.12E-10	-0.91428	1.95E-10	1.99E-07	7.58E-09	2.92E-08	-0.086544
41	IR(pin 12)	2.05E-10	7.58E-10	3.22E-10	1.04E-10	-1.03603	-6.86E-08	2.91E-08	-5.23E-10	1.08E-08	0.016101
45	VF(pin 4)	1.0924	1.1816	1.12113	0.016216	-23.04541	1.1136	1.5332	1.22038	0.107541	-3.782691
53	VF(pin 12)	1.0848	1.1608	1.11578	0.016298	-22.82078	1.0976	1.494	1.19764	0.102401	-3.898525
63	Vres(pins 12-13)	0.94028	1.0136	0.976649	0.016666	-19.53377	0.94208	1.0144	0.978392	0.016507	-19.75652

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.02	0.01025	0	0.293686	0.150982
12	VZ(pin 12)	0	0.04	0.00725	0	0.588235	0.10679
13	VZ(pin 13)	0	0.03	0.00725	0	0.440529	0.106796
22	Delta Vz(T4-T13)	0.004	0.0032	0.00268	-14.28571	10	2436.364
33	IR(pin 4)	3.07E-11	1.98E-07	7.27E-09	18.72559	21689.2	2357.426
41	IR(pin 12)	-6.88E-08	2.83E-08	-8.45E-10	-33600	3734.987	-262.6112
45	VF(pin 4)	0.0212	0.3516	0.09925	1.940681	29.75626	8.852679
53	VF(pin 12)	0.0128	0.3332	0.08186	1.179941	28.70434	7.336574
63	Vres(pins 12-13)	0.0018	0.0008	0.001742	0.191432	0.078927	0.178416

REL ID:= 669

LOT ID:= a

Rel Test:= AC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.71	6.76	6.742875	0.011605	-193.6833	6.71	6.76	6.743375	0.011577	-194.1544
12	VZ(pin 12)	6.72	6.77	6.7425	0.01085	-207.1437	6.72	6.77	6.744	0.010978	-204.7818
13	VZ(pin 13)	6.72	6.77	6.742875	0.011046	-203.4825	6.72	6.77	6.74375	0.010952	-205.2599
22	Delta Vz(T4-T13)	-0.038	0.0296	-0.00012	0.013637	0.002933	-0.0372	0.0296	-0.00061	0.013978	0.014547
33	IR(pin 4)	1.94E-10	1.08E-09	3.77E-10	1.45E-10	-0.865921	1.22E-10	1.74E-08	8.5E-10	2.29E-09	-0.124024
41	IR(pin 12)	2.39E-10	8.86E-10	3.84E-10	1.25E-10	-1.025702	2.05E-10	1.24E-07	8.1E-09	2.06E-08	-0.131319
45	VF(pin 4)	1.0528	1.1496	1.08193	0.019775	-18.23732	1.052	1.602	1.089245	0.061636	-5.890751
53	VF(pin 12)	1.0532	1.1844	1.084235	0.025808	-14.00403	1.0528	1.6212	1.09201	0.065776	-5.534017
63	Vres(pins 12-13)	0.95388	1.0168	0.986099	0.017154	-19.16204	0.9534	1.0168	0.986073	0.017236	-19.07025

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.0005	0	0	0.007415
12	VZ(pin 12)	0	0	0.0015	0	0	0.022247
13	VZ(pin 13)	0	0	0.000875	0	0	0.012977
22	Delta Vz(T4-T13)	0.0008	0	-0.00049	-2.105263	0	408.3333
33	IR(pin 4)	-7.17E-11	1.63E-08	4.73E-10	-36.95607	1519.048	125.4237
41	IR(pin 12)	-3.43E-11	1.23E-07	7.72E-09	-14.3383	13937.31	2013.002
45	VF(pin 4)	-0.0008	0.4524	0.007315	-0.075988	39.35282	0.676109
53	VF(pin 12)	-0.0004	0.4368	0.007775	-0.037979	36.87943	0.717092
63	Vres(pins 12-13)	-0.00048	0	-2.65E-05	-0.050321	0	-0.00269

REL ID:= 669

LOT ID:= a

Rel Test:= AC_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.7	6.77	6.739875	0.014275	-157.3795	6.7	15	7.168734	1.820281	-1.312752
12	VZ(pin 12)	6.7	6.77	6.738625	0.014473	-155.1962	6.7	15	7.477975	2.36048	-1.055996
13	VZ(pin 13)	6.7	6.78	6.73825	0.015733	-142.7613	6.7	15	7.164177	1.821307	-1.311179
22	Delta Vz(T4-T13)	-0.04	0.0348	0.001815	0.016889	-0.035823	-0.0316	0.0592	0.004294	0.018002	-0.079501
33	IR(pin 4)	1.84E-10	2.71E-09	3.54E-10	2.81E-10	-0.419642	-1.16E-09	1.98E-07	4.69E-09	2.49E-08	-0.062809
41	IR(pin 12)	2.2E-10	1.15E-09	3.91E-10	1.49E-10	-0.873124	-1.14E-10	5.16E-07	1.32E-08	6.28E-08	-0.070159
45	VF(pin 4)	1.0452	1.1508	1.08689	0.025625	-14.13864	1.048	5.0012	1.767555	1.435462	-0.41045
53	VF(pin 12)	1.0496	1.1496	1.09448	0.023324	-15.64144	1.0616	5.0016	1.877095	1.513495	-0.413413
63	Vres(pins 12-13)	0.9528	1.0164	0.983239	0.01648	-19.88796	0.957	2.5016	1.125558	0.433597	-0.865287

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	8.23	0.428859	0	121.5657	6.363014
12	VZ(pin 12)	0	8.23	0.73935	0	121.5657	10.97182
13	VZ(pin 13)	0	8.22	0.425927	0	121.2389	6.321036
22	Delta Vz(T4-T13)	0.0084	0.0244	0.002479	-21	70.11494	136.5659
33	IR(pin 4)	-1.35E-09	1.95E-07	4.34E-09	-731.0547	7190.285	1224.681
41	IR(pin 12)	-3.33E-10	5.15E-07	1.28E-08	-151.6464	44814.72	3284.183
45	VF(pin 4)	0.0028	3.8504	0.680665	0.267891	334.5846	62.62503
53	VF(pin 12)	0.012	3.852	0.782615	1.143293	335.0731	71.50567
63	Vres(pins 12-13)	0.0042	1.4852	0.142319	0.440806	146.1236	14.4745

REL ID:= 669

LOT ID:= a

Rel Test:= H3TRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.69	6.78	6.74475	0.013499	-166.5529	6.7	6.78	6.745875	0.012798	-175.7051
12	VZ(pin 12)	6.71	6.78	6.742875	0.010814	-207.8408	6.71	6.78	6.743625	0.011052	-203.3996
13	VZ(pin 13)	6.71	6.78	6.744	0.011092	-202.6641	6.71	6.78	6.74475	0.010905	-206.1625
22	Delta Vz(T4-T13)	-0.026	0.0416	0.0016	0.014501	-0.036778	-0.0264	0.0412	0.00158	0.014529	-0.03625
33	IR(pin 4)	-5.63E-11	7.85E-10	3.29E-10	1.1E-10	-0.991364	-1.78E-10	9.51E-10	3.36E-10	1.43E-10	-0.784415
41	IR(pin 12)	2.23E-10	7.12E-10	3.56E-10	1.13E-10	-1.053806	2.25E-10	3.43E-09	4.29E-10	3.87E-10	-0.369426
45	VF(pin 4)	1.0472	1.1312	1.077286	0.019451	-18.46156	1.0444	1.13	1.07608	0.020226	-17.73454
53	VF(pin 12)	1.0412	1.1528	1.081772	0.025143	-14.34165	1.0384	1.1532	1.08091	0.025901	-13.91072
63	Vres(pins 12-13)	0.94732	1.0108	0.980615	0.015704	-20.81513	0.94592	1.0092	0.979238	0.015559	-20.97971

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0.01	0	0.001125	0.149477	0	0.01668
12	VZ(pin 12)	0	0	0.00075	0	0	0.011123
13	VZ(pin 13)	0	0	0.00075	0	0	0.011121
22	Delta Vz(T4-T13)	-0.0004	-0.0004	-2E-05	1.538462	-0.961538	-1.25
33	IR(pin 4)	-1.21E-10	1.66E-10	7.21E-12	215.2699	21.16532	2.193106
41	IR(pin 12)	1.88E-12	2.72E-09	7.32E-11	0.84154	382.0415	20.56914
45	VF(pin 4)	-0.0028	-0.0012	-0.001206	-0.26738	-0.106082	-0.111948
53	VF(pin 12)	-0.0028	0.0004	-0.000862	-0.26892	0.034698	-0.079697
63	Vres(pins 12-13)	-0.0014	-0.0016	-0.001376	-0.147785	-0.15829	-0.14034

REL ID:= 669

LOT ID:= a

Rel Test:= H3TRB_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.72	6.77	6.74175	0.010765	-208.7545	6.72	6.79	6.744	0.012788	-175.7837
12	VZ(pin 12)	6.72	6.77	6.742875	0.009704	-231.6261	6.72	6.79	6.744625	0.011577	-194.1904
13	VZ(pin 13)	6.72	6.76	6.742625	0.010403	-216.0578	6.72	6.79	6.745	0.012013	-187.1638
22	Delta Vz(T4-T13)	-0.0276	0.0268	-0.00086	0.012697	0.022578	-0.0276	0.0272	-0.00062	0.012581	0.016427
33	IR(pin 4)	2.01E-10	7.78E-10	3.59E-10	1.15E-10	-1.043961	-1.54E-10	1.5E-08	6.3E-10	1.67E-09	-0.125896
41	IR(pin 12)	1.77E-10	1.45E-09	3.86E-10	1.69E-10	-0.762313	-3.58E-11	4.14E-09	6.03E-10	6.18E-10	-0.324959
45	VF(pin 4)	1.0456	1.123999	1.07629	0.017109	-20.96963	1.0444	1.3024	1.076705	0.0311	-11.5403
53	VF(pin 12)	1.049999	1.1348	1.082115	0.018055	-19.97845	1.0476	1.3296	1.082765	0.03391	-10.64358
63	Vres(pins 12-13)	0.95308	1.008	0.98566	0.016036	-20.48868	0.95184	1.0072	0.98504	0.016109	-20.38271

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.02	0.00225	0	0.295421	0.033374
12	VZ(pin 12)	0	0.02	0.00175	0	0.295421	0.025953
13	VZ(pin 13)	0	0.03	0.002375	0	0.443787	0.035224
22	Delta Vz(T4-T13)	0	0.0004	0.00024	0	1.492537	-27.90698
33	IR(pin 4)	-3.55E-10	1.42E-08	2.71E-10	-176.5572	1824.342	75.50342
41	IR(pin 12)	-2.13E-10	2.69E-09	2.17E-10	-120.212	185.0496	56.04542
45	VF(pin 4)	-0.0012	0.178401	0.000415	-0.114767	15.87199	0.038563
53	VF(pin 12)	-0.002399	0.1948	0.00065	-0.228476	17.16602	0.060071
63	Vres(pins 12-13)	-0.00124	-0.0008	-0.00062	-0.130105	-0.079365	-0.062949

REL ID:= 669

LOT ID:= a

Rel Test:= HTRB

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.68	6.77	6.737875	0.015483	-145.0573	6.7	6.77	6.7385	0.014504	-154.8603
12	VZ(pin 12)	6.68	6.77	6.74025	0.017573	-127.855	6.7	6.77	6.74075	0.016209	-138.6242
13	VZ(pin 13)	6.68	6.77	6.739375	0.016939	-132.6167	6.7	6.77	6.74025	0.015909	-141.2237
22	Delta Vz(T4-T13)	-0.0392	0.0224	-0.00159	0.011923	0.044453	-0.0392	0.0208	-0.00184	0.011915	0.051478
33	IR(pin 4)	2.29E-10	5.53E-10	3.4E-10	7.42E-11	-1.526148	2.15E-10	4.68E-08	1.53E-09	5.38E-09	-0.09496
41	IR(pin 12)	2.32E-10	7.17E-10	3.81E-10	1.04E-10	-1.220833	2.76E-10	6.32E-09	1.01E-09	1.18E-09	-0.284882
45	VF(pin 4)	1.0512	1.1456	1.086795	0.021038	-17.21977	1.0488	1.1476	1.086095	0.022405	-16.15848
53	VF(pin 12)	1.0512	1.1696	1.087225	0.024419	-14.84121	1.0492	1.1828	1.0871	0.026753	-13.54495
63	Vres(pins 12-13)	0.95144	1.007599	0.980061	0.012795	-25.53203	0.95944	1.0156	0.988561	0.013319	-24.74067

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0.02	0	0.000625	0.299401	0	0.009276
12	VZ(pin 12)	0.02	0	0.0005	0.299401	0	0.007418
13	VZ(pin 13)	0.02	0	0.000875	0.299401	0	0.012983
22	Delta Vz(T4-T13)	0	-0.0016	-0.00025	0	-7.142857	15.72327
33	IR(pin 4)	-1.39E-11	4.62E-08	1.19E-09	-6.079665	8361.372	351.2007
41	IR(pin 12)	4.43E-11	5.61E-09	6.32E-10	19.10016	782.1231	165.922
45	VF(pin 4)	-0.0024	0.002	-0.0007	-0.228311	0.174581	-0.064407
53	VF(pin 12)	-0.002	0.0132	-0.000125	-0.190259	1.128591	-0.011491
63	Vres(pins 12-13)	0.008	0.008001	0.0085	0.840831	0.794066	0.867292

REL ID:= 669

LOT ID:= a

Rel Test:= TC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.7	6.77	6.729625	0.016493	-136.0121	6.7	6.78	6.732	0.017459	-128.5311
12	VZ(pin 12)	6.7	6.76	6.727875	0.016512	-135.8188	6.7	6.76	6.729375	0.017455	-128.511
13	VZ(pin 13)	6.7	6.75	6.72825	0.014476	-154.928	6.7	6.77	6.72925	0.015076	-148.7874
22	Delta Vz(T4-T13)	-0.0232	0.0284	0.001075	0.011861	-0.030211	-0.022	0.0308	0.002585	0.011683	-0.073755
33	IR(pin 4)	2.27E-10	8.78E-10	3.79E-10	1.24E-10	-1.018684	2.17E-10	8.72E-10	3.79E-10	1.28E-10	-0.986782
41	IR(pin 12)	2.46E-10	1.15E-09	4.11E-10	1.47E-10	-0.930786	2.05E-11	1.63E-09	4.24E-10	2.04E-10	-0.693545
45	VF(pin 4)	1.049999	1.158	1.101345	0.027077	-13.55797	1.0556	1.388	1.12994	0.052922	-7.117051
53	VF(pin 12)	1.0488	1.1452	1.098505	0.025394	-14.41927	1.0524	1.4464	1.11386	0.04997	-7.430143
63	Vres(pins 12-13)	0.95696	1.0144	0.989678	0.011996	-27.50083	0.95876	1.0424	0.992059	0.013497	-24.50026

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0.01	0.002375	0	0.14771	0.035292
12	VZ(pin 12)	0	0	0.0015	0	0	0.022295
13	VZ(pin 13)	0	0.02	0.001	0	0.296296	0.014863
22	Delta Vz(T4-T13)	0.0012	0.0024	0.00151	-5.172414	8.450704	140.4651
33	IR(pin 4)	-9.64E-12	-6.4E-12	2.7E-13	-4.247444	-0.728863	0.071208
41	IR(pin 12)	-2.25E-10	4.77E-10	1.3E-11	-91.66667	41.42361	3.152952
45	VF(pin 4)	0.005601	0.23	0.028595	0.533429	19.86183	2.596375
53	VF(pin 12)	0.0036	0.3012	0.015355	0.343249	26.30108	1.397803
63	Vres(pins 12-13)	0.0018	0.028	0.002381	0.188096	2.760252	0.240582

REL ID:= 669

LOT ID:= a

Rel Test:= TC_PC

		Initial					Qual Point				
Test Number	Test Name	Min	Max	Mean	StDev	Cpk	Min	Max	Mean	StDev	Cpk
4	VZ(pin 4)	6.69	6.75	6.719875	0.014007	-159.9209	6.69	6.75	6.72175	0.01385	-161.7695
12	VZ(pin 12)	6.69	6.76	6.718375	0.015298	-146.3871	6.69	6.76	6.72	0.015261	-146.7752
13	VZ(pin 13)	6.7	6.76	6.718	0.013632	-164.2742	6.7	6.76	6.719875	0.013547	-165.3439
22	Delta Vz(T4-T13)	-0.0404	0.0428	0.00196	0.015251	-0.042838	-0.0404	0.0432	0.002625	0.015223	-0.05748
33	IR(pin 4)	2.46E-10	9.32E-10	4.11E-10	1.25E-10	-1.091899	-1.2E-13	1.33E-09	4.48E-10	1.83E-10	-0.815688
41	IR(pin 12)	2.44E-10	1.13E-09	4.38E-10	1.42E-10	-1.026467	8.96E-12	1.23E-09	4.8E-10	1.94E-10	-0.824766
45	VF(pin 4)	1.068	1.1488	1.10646	0.018962	-19.45068	1.0668	1.398399	1.11853	0.045741	-8.151217
53	VF(pin 12)	1.072	1.155599	1.11297	0.019108	-19.41545	1.07	1.4596	1.12083	0.053264	-7.014251
63	Vres(pins 12-13)	0.9538	1.007599	0.990317	0.011942	-27.64191	0.95456	1.0084	0.990465	0.011927	-27.68046

				Delta	Delta(%)	Delta(%)	Delta(%)
Test Number	Test Name	Delta Min	Delta Max	Mean	Min	Max	Mean
4	VZ(pin 4)	0	0	0.001875	0	0	0.027902
12	VZ(pin 12)	0	0	0.001625	0	0	0.024187
13	VZ(pin 13)	0	0	0.001875	0	0	0.02791
22	Delta Vz(T4-T13)	0	0.0004	0.000665	0	0.934579	33.92857
33	IR(pin 4)	-2.46E-10	3.97E-10	3.72E-11	-100.0488	42.55666	9.045965
41	IR(pin 12)	-2.35E-10	1.02E-10	4.15E-11	-96.32907	9.090909	9.471669
45	VF(pin 4)	-0.0012	0.249599	0.01207	-0.11236	21.72693	1.090869
53	VF(pin 12)	-0.002	0.304001	0.00786	-0.186567	26.30679	0.706222
63	Vres(pins 12-13)	0.00076	0.000801	0.000148	0.079681	0.079496	0.014898

Reliability Customer Report
Family Qualification

Date: 10/31/2001 **PCN:**

Ken Fergus
Reliability Engineer
602-244-7079

Mark Wasilewski
Reliability Manager
602-244-5114

1) Introduction:

This report is a summary of reliability data for the Logic Two-Gate and Analog Switch devices in the SC88 package.
Also included is 260 deg C IR preconditioning test results which will allow this package to utilize lead free plating in the future.

Data References:

2) Device Description:

Qual ID	1242	**Wafer Fab Site**	Chartered	Singapore
Device	NL27WZU04DFT2	**Assembly Site**	Sbn	Malaysia
Line Source	n/a	**Final Test Site**	Sbn	Malaysia
Parent Tech	0.6 micron Cmos	**Reliability Lab**	T.5 3rd. D Bldg.	Phoenix, Az
Technology	Cmos	**Max. Current**		**Max. Voltage**
Package	SC-88	**Die Size**	451 um X 911 um	**Flag Size**
Polarity	n/a			

Related Qualification Report(s):

The following Standard Logic devices are qualified by similarity based on the data in this report:
NL27WZ04DFT2, NL27WZ06DFT2, NL27WZ07DFT2, NL27WZ14DFT2, NL27WZ16DFT2, NL27WZU04DFT2, NLAST4599DFT2/4, NLAS4599DFT2/4.

3) Qualification Results Analysis:

See attached reliability reports

4) Conclusion:

Full qualification is granted for Logic Two-Gate and Analog Switches in the SC88 package.

SBN ON SEMICONDUCTOR
R E L I A B I L I T Y R E P O R T

DEVICE: NL27WZU04DFT2

PACKAGE: Case: 419B **, Style:** 0537

ASSEM. LINE: N/A

FAB SITE: N/A

WAFER LINE: N/A

ASSY. SITE: SBN site-1

MFG. DATE: 0130

REQUESTOR: TS Teo

Reference no. 48ON04308D

TRACKING NUMBER: ZQ013001A-C

PURPOSE:

This qualification is to quality New Product Introduction of SC88 Logic which transferred from HANA to be assembled and tested in SBN.

TEST PERFORMED:

Environmental Tests

Autoclave
Temp Cycle
Solder Heat
HTS

Note: with pre-cond process

Life Tests

N/A

TEST RESULTS:

Full reliability testing (without Preconditioning) of SC88 package qualification meets or exceeds the requirement set forth in the ON Semiconductor's Production Reliability Qualification Process (12MSB17722C).

REVIEWED BY: _____ **APPROVED BY:** _____

TK Yew
RELIABILITY ENGINEER

Abdul Razak
R & QA Manager

DATE: August 24, 2001

ENVIRONMENTAL & LIFE TEST

ACCEPTANCE CRITERIA

Target device: NL27WZU04DFT2

PARAMETER	MEASUREMENT CONDITIONS	FAILURE DEFINITION				
		INITIAL-ENDPOINTS			DELTA LIMITS	
		MIN	MAX	UNITS	MAX	BASE
VIH	Vcc=2.3V to 5.5V	0.8Vcc		V	-	Initial
VIL	Vcc=2.3V to 5.5V		0.2Vcc	V	-	Initial
VOH	VOH=VIN=VIL, VCC=2.3, IOH = 100uA	2.1		V	-	Initial
	VOH=VIN=VIL, VCC=2.7, IOH = 100uA	2.4		V	-	Initial
	VOH=VIN=VIL,VCC=3.0, IOH = 100uA	2.7		V	-	Initial
	VOH=VIN=VIL,VCC=4.5, IOH = 100uA	4.0		V	-	Initial
	VOH=VIN=GND,VCC=2.3, IOH= - 8mA	1.9		V	-	Initial
	VOH=VIN=GND, VCC=2.7, IOH= - 12mA	2.2		V	-	Initial
	VOH=VIN=GND,VCC=3.0, IOH=-16mA	2.4		V	-	Initial
	VOH=VIN=GND, VCC=3.0, IOH= -24mA	2.3		V	-	Initial
	VOH=VIN=GND, VCC=4.5, IOH= -32mA	3.8		V	-	Initial
VOL	VOL=VIN=VIH, VCC=2.3, IOL= 100uA		0.2	V	-	Initial
	VOL=VIN=VIH,VCC=2.7, IOL= 100uA		0.3	V	-	Initial
	VOL=VIN=VIH, VCC=3.0, IOL= 100uA		0.3	V	-	Initial
	VOL=VIN=VIH, VCC=4.5, IOL= 100uA		0.5	V	-	Initial
	VOL=VIN=VCC, VCC=2.3, IOL= 8mA		0.3	V	-	Initial
	VOL=VIN=VCC,VCC=2.7, IOL= 12mA		0.4	V	-	Initial
	VOL=VIN=VCC, VCC=3.0, IOL= 16mA		0.4	V	-	Initial
	VOL=VIN=VCC, VCC=3.0, IOL=24mA		0.55	V	-	Initial

ENVIRONMENTAL & LIFE TEST

ACCEPTANCE CRITERIA

Target device: NL27WZU04DFT2

PARAMETER	MEASUREMENT CONDITIONS	FAILURE DEFINITION				
		INITIAL-ENDPOINTS			DELTA LIMITS	
		MIN	MAX	UNITS	MAX	BASE
VOL	VOL=VIN=VCC, VCC=4.5, IOL = 32mA		0.55	V	-	Initial
IIN	VIN=VCC or GND, VCC=5.5,		± 0.1	uA	-	Spec Width
ICC	VIN=VCC or GND,VCC=5.5,		1	uA	-	Spec Width

ENVIRONMENTAL TEST SUMMARY

NL27WZU04DFT2

TESTS		TEST CONDITIONS	INTERVAL	SAMPLE SIZE	REJECTS		
					CAT.	LIM.	DEL.
Autoclave	507	Ta=121°C, P=15psig, RH=100%	96hrs	231	0	0	0
Temp Cycle	501	Ta= -65/150°C, Air to Air, Dwell >10 min	500cyc	231	0	0	0
			1000cyc	231	0	0	0
Solder Heat	504	Ta=260°C	1x	135	0	0	0
HTS		Ta=150°C	500hrs	231	0	0	0
			1000hrs	231	0	0	0

Note: without Precond Process

RELIABILITY REPORT*

REJECT SUMMARY

ENVIRONMENTAL:

No Reject found.

CONCLUSION:

Full reliability testing (without preconditioning) of SC88 package qualification meets or exceeds the requirement set forth in the ON Semiconductor's Product Reliability Qualification Process (12MSB17722C)

Reliability Customer Report
Site Qualification

Date: 02/16/01 **PCN: N/A**

Lyle Stewart/Carolyn Anitllon
Reliability Engineer
602-244-7519

Mark Wasilewski
Reliability Manager
602-244-5114

1) Introduction:

Qualification of HANA SC88 Assembly and Test Process For NLAST4599 New Product Design

NOTE: The **"bold lettering"** in the interval column of the test summary indicates the qualification points.

2) Device Description:

Qual ID	0831	**Wafer Fab Site**	Chartered		
Device	NLAST4599DF	**Assembly Site**	Hana (B)		
Line Source	AST4599	**Final Test Site**	Hana (B)		
Parent Tech	C-MOS	**Reliability Lab**	T.5 3rd. B Bldg.		
Technology	0.6 um CMOS	**Max. Current**	20mA	**Max. Voltage**	7V
Package	SC-88	**Die Size**	451 um X 911 um	**Flag Size**	1113 um X 610 um
Polarity	INTEGRATED				

Related Qualification Report(s):

The following Standard Logic Devices are qualified by similarity based on the data in this report:
NL27WZ04DFT2, NL27WZ06DFT2, NL27WZ07DFT2, NL27WZ14DFT2, NL27WZ16DFT2, NL27WZU04DFT2, NLAS4599DFT2

3) Qualification Results Analysis:

Zero qualification related failures were observed during reliabiltiy testing.

4) Conclusion:

By successfully completing all reliability testing under the terms of ON Semiconductor Reliability Document 12MSB17722C, HANA has been granted full qualification to assemble and test Standard Logic SC88 product.

5) Test Description & Condition:

Auto	Autoclave	**AUTOCLAVE** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
Auto-PC	Autoclave - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
Bond Pull	Bond Pull Strength	**BOND PULL STRENGTH** The purpose of this test is to determine bond pull strength of wire to die, substrate, or package header connections. The wires may be bonded by soldering, thermocompression, ultrasonic, or related bonding techniques. **Test Conditions:** TA = 25°C **Common Failure Modes:** Parametric shifts, open, and/or intermittent **Common Failure Mechanisms:** Corrosion or contaminants from foreign material within the package. Silicon or metalization defects.
Bond Shear	Bond Shear	**BOND SHEAR** The purpose of this test is to determine bond shear strength of wire to die, substrate, or package header connections. The wires may be bonded by soldering, thermocompression, ultrasonic, or related bonding techniques. **Test Conditions:** TA = 25°C **Common Failure Modes:** Parametric shifts, open, and/or intermittent **Common Failure Mechanisms:** Corrosion or contaminants from foreign material within the package. Silicon or metalization defects.
HAST	Highly Accelerated Stress Test	**HIGHLY ACCELERATED STRESS TEST** HAST uses a pressurized environment to produce extremely severe temperature, humidity and bias conditions. HAST accelerates the same failure mechanisms as High Humidity High Temperature Bias. **Test Conditions:** TA = 130°C, rh = 85%, p = 18.8 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
HAST-PC	Highly Accelerated Stress Test - PC	**HIGHLY ACCELERATED STRESS TEST + MOISTURE LEVEL PRECONDITIONING** HAST uses a pressurized environment to produce extremely severe temperature, humidity and bias conditions. HAST accelerates the same failure mechanisms as High Humidity High Temperature Bias. **Test Conditions:** TA = 130°C, rh = 85%, p = 18.8 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing

5) Test Description & Condition continued:

HT Bake	High Temperature Bake	**HIGH TEMPERATURE BAKE** High temperature storage life testing is performed to accelerate failure mechanisms which are thermally activated through the application of extreme temperatures. **Test Conditions:** TA = 150°C **Common Failure Modes:** Parametric shifts in leakage and gain **Common Failure Mechanisms:** Bulk die and diffusion defects
HTB	High Temperature Bake	**HIGH TEMPERATURE BAKE** High temperature storage life testing is performed to accelerate failure mechanisms which are thermally activated through the application of extreme temperatures. **Test Conditions:** TA = 175°C **Common Failure Modes:** Parametric shifts in leakage and gain **Common Failure Mechanisms:** Bulk die and diffusion defects
HTOL	High Temperature Operating Life	**HIGH TEMPERATURE OPERATING LIF**E The purpose of this test is to evaluate the bulk stability of the die and to generate defects resulting from manufacturing aberrations that are manifested as time and stress-dependent failures. **Test Conditions:** TA = 145°C **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Foreign material, crack die, bulk die, metallization, wire and die bond defects
MSL 1	Moisture Level 1	**MOISTURE LEVEL PRECONDITIONING** These tests are performed to simulate the board mounting process where parts are subjected to a high temperature for a short duration. These tests detect mold compound delamination from the die and leadframe. The failure mechanisms are corrosion, fractured wirebonds and passivation cracks. 10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@235°C + 1X Flux Immersion + DI Rinse
Phys Dim	Physical Dimensions	
Solder	Solderability	**SOLDERABILITY** The purpose of this test is to measure the ability of device leads/terminals to be soldered after an extended period of storage or shelf life. **Test Conditions:** Steam aging = 8 hours **Common Failure Modes:** Pin holes, dewetting, non-wetting **Common Failure Mechanisms:** Poor plating, contaminated leads

5) Test Description & Condition continued:

TC	Temperature Cycle	**TEMPERATURE CYCLING** The purpose of this test is to evaluate the ability of the device to withstand both exposure to extreme temperatures and transitions between temperature extremes. This testing will also expose excessive thermal mismatch between materials. **Test Conditions:** TA = -65°C to 150°C, air to air **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Wire bond, cracked or lifted die and package failure
TC-PC	Temperature Cycle - PC	**TEMPERATURE CYCLING + MOISTURE LEVEL PRECONDITIONING** The purpose of this test is to evaluate the ability of the device to withstand both exposure to extreme temperatures and transitions between temperature extremes. This testing will also expose excessive thermal mismatch between materials. **Test Conditions:** TA = -65°C to 150°C, air to air **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Wire bond, cracked or lifted die and package failure

ON Semiconductor

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
HT Bake	TA = +150°C, N/A	0831A	0 Hr.	84	0	
			168 Hr.	84	0	
			504 Hr.	84	0	
HT Bake	TA = +150°C, Use High Temp Solder per best Lab practice	0831B	0 Hr.	84	0	
			168 Hr.	84	0	
			504 Hr.	84	0	
HT Bake	TA = +150°C, Use High Temp Solder per best Lab practice	0831C	0 Hr.	84	0	
			168 Hr.	84	0	
			504 Hr.	84	0	
HTOL	TA = +145°C, Vcc = 5.0V	0831A	0 Hr.	84	0	
			504 Hr.	84	0	
		0831B	0 Hr.	84	0	
			504 Hr.	84	0	
		0831C	0 Hr.	84	0	
			504 Hr.	84	0	
HAST	TA = +130°C, RH = 85%, PSIG = 18.8, Vcc = 5.0V	0831A	0 Hr.	84	0	
			96 Hr.	84	0	

ON Semiconductor

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
HAST	TA = +130°C, RH = 85%, PSIG = 18.8, N/A	0831B	0 Hr.	84	0	
			96 Hr.	84	0	
		0831C	0 Hr.	84	0	
			96 Hr.	84	0	
HAST-PC	TA = +130°C, RH = 85%, PSIG = 18.8, Vcc = 5.0V	0831A	0 Hr.	84	0	
			96 Hr.	73	0	
		0831B	0 Hr.	84	0	
			96 Hr.	84	0	
		0831C	0 Hr.	84	0	
			96 Hr.	84	0	
MSL 1	10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@235°C + 1X Flux Immersion + DI Rinse + Visual, N/A	0831A	0 Hr.	252	0	
			Readout	252	0	
			Readout	252	0	
		0831B	0 Hr.	252	0	
			Readout	252	0	
			Readout	252	0	
		0831C	0 Hr.	252	0	

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
			Readout	252	0	
			Readout	252	0	
Phys Dim	Case Outline, N/A	0831A	**Results**	10	0	
Solder	8 Hours steam aging prior to testing; 1 hour gold plated leads, N/A	0831A	**Results**	10	0	
TC	Air to Air; -65°C to +150°C, N/A	0831A	0 Cyc.	84	0	
			500 Cyc.	75	0	
		0831B	0 Cyc.	84	0	
			500 Cyc.	84	0	
		0831C	0 Cyc.	84	0	
			500 Cyc.	84	0	
TC-PC	Air to Air; -65°C to +150°C, N/A	0831A	0 Cyc.	84	0	
			500 Cyc.	74	0	
		0831B	0 Cyc.	84	0	
			500 Cyc.	84	0	
		0831C	0 Cyc.	84	0	
			500 Cyc.	84	0	

Reliability Customer Report
Package Qualification

Date: 10/08/2001 **PCN:**

Laura Rivers
Reliability Engineer

Mark Wasilewski
Reliability Manager
602-244-5114

1) Introduction:

Qualification of Pb-Free Solder for the SC88 and SC88A packages with 100% Sn plating. Solder used was Sn/Ag/Cu.

The data for this report was used to qualify the SC88 because the metal to pkg ratio is at it worst case in the SC88A. Therefore the delamination, etc will be less in the SC88. This also qualifies the SC70 packages. This is for all technologies.

2) Device Description:

Qual ID	1008	**Wafer Fab Site**		
Device	MSQA6V1W5T2	**Assembly Site**	SBN	Seremban Malaysia
Line Source	ZK6V1QA	**Final Test Site**	Sbn	Seremban Malaysia
Parent Tech	ZENER	**Reliability Lab**	FET TESTER	Phoenix, AZ, USA
Technology	Zener	**Max. Current**		**Max. Voltage**
Package	SC-88A	**Die Size**	27 X 26	**Flag Size**
Polarity	PN			

Related Qualification Report(s):

Packages qualified for Pb-free based upon this report are;
SC70, SC88, SC88A for all technologies.

3) Qualification Results Analysis:

no anomalies observed.

4) Conclusion:

All testing was successfully performed in accordance with ON Semiconductor qualification specification 12MSB17722C and a 260 C MSL 1 preconditioning profile for Pb-free products. SC70, SC88 and SC88A are now considered fully qualified for Pb-free processing per the qualification process shown in this report.

5) Test Description & Condition:

MSL 1	Moisture Level 1	**MOISTURE LEVEL PRECONDITIONING** These tests are performed to simulate the board mounting process where parts are subjected to a high temperature for a short duration. These tests detect mold compound delamination from the die and leadframe. The failure mechanisms are corrosion, fractured wirebonds and passivation cracks. 10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@260°C + 1X Flux Immersion + DI Rinse
Auto-PC	Autoclave - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
TC-PC	Temperature Cycle - PC	**TEMPERATURE CYCLING + MOISTURE LEVEL PRECONDITIONING** The purpose of this test is to evaluate the ability of the device to withstand both exposure to extreme temperatures and transitions between temperature extremes. This testing will also expose excessive thermal mismatch between materials. **Test Conditions:** TA = -65°C to 150°C, air to air **Common Failure Modes:** Parametric shifts and catastrophic **Common Failure Mechanisms:** Wire bond, cracked or lifted die and package failure
Solder	Solderability	**SOLDERABILITY** The purpose of this test is to measure the ability of device leads/terminals to be soldered after an extended period of storage or shelf life. **Test Conditions:** Steam aging = 8 hours **Common Failure Modes:** Pin holes, dewetting, non-wetting **Common Failure Mechanisms:** Poor plating, contaminated leads
SAT-PC	Scanning Acoustic Tomography (SAT) - PC	**SOLDERABILITY** The purpose of this test is to measure the ability of device leads/terminals to be soldered after an extended period of storage or shelf life. **Test Conditions:** Steam aging = 8 hours **Common Failure Modes:** Pin holes, dewetting, non-wetting **Common Failure Mechanisms:** Poor plating, contaminated leads
SAT-PC	Scanning Acoustic Tomography (SAT) - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing

5) Test Description & Condition continued:

SAT-PC	Scanning Acoustic Tomography (SAT) - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing
SAT-PC	Scanning Acoustic Tomography (SAT) - PC	**AUTOCLAVE + MOISTURE LEVEL PRECONDITIONING** Autoclave is an environmental test which measures device resistance to moisture penetration and the resultant effects of galvanic corrosion. Autoclave is a highly accelerated and destructive test. **Typical Test Conditions:** TA = 121°C, rh = 100%, p = 15 psig **Common Failure Modes:** Parametric shifts, high leakage and/or catastrophic **Common Failure Mechanisms:** Die corrosion or contaminants such as foreign material on or within the package materials. Poor package sealing

ON Semiconductor

Test Summary

Test Name	Test Conditions & Bias	Lot ID	Interval	SS	Rej	Comment
MSL1	10TC + 24Hr Bake@125°C + 168Hr 85/85 + 3 IR@260°C + 1X Flux Immersion + DI Rinse - amount for pre conditioned tests.	1008A,B,C	**Results**	all	0	
Auto-PC	TA = +121°C, RH = 100%, PSIG = 15, N/A	1008A,B,C	0 Hr.	240	0	
			96 Hr.	240	0	
SAT	SAT shall be performed on 7 units from each group at Zero hours processing	1008A,B,C	**Results**	21	0	
SAT	SAT shall be performed on 7 units from each group after 3X IR reflow	1008A,B,C	**Results**	21	0	
SAT	SAT shall be performed on 7 units fromeach group after 500 cycles Temp cycle	1008A,B,C	**Results**	21	0	
SAT	SAT shall be performed on 7 units from each group after 1000 cycles Temp cycle	1008A,B,C	**Results**	21	0	
Solder	8 Hours steam aging prior to testing; solderability shall be tested at 260 C using Sn/Ag/Cu solder	1008A,B,C	**Results**	30	0	
TC-PC	Air to Air; -65°C to +150°C, N/A (ss includes samples for SAT)	1008A,B,C	0 Cyc.	324	0	
			500 Cyc.	324	0	
			1000 Cyc.	324	0	
Solder Heat	All groups, A,B,C shall be tested at 260 C.	1008A,B,C	**Results**	90	0	