RELIABILITY REPORT

FOR

MAX6377xRxx

PLASTIC ENCAPSULATED DEVICES

September 13, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX6377 successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

Table of Contents

I. Device Description

A. General

The MAX6377 is an ultra-low-power circuit used for monitoring battery, power-supply, and regulated system voltages. The detector contains a precision bandgap reference, comparator, and internally trimmed resistors that set specified trip threshold voltages. This device provides excellent circuit reliability and low cost by eliminating external components and adjustments when monitoring nominal system voltages from 2.5V to 5V.

This circuit performs a single function: it asserts an output signal whenever the V_{CC} supply voltage falls below a preset threshold. The MAX6377, open-drain, has an active-low output (OUT-bar is logic low when V_{CC} is below V_{TH}). The part is guaranteed to be in the correct output logic state for V_{CC} down to 1V. The detector is designed to ignore fast transients on V_{CC}. The MAX6377 has a voltage threshold between 2.20V and 3.08V in approximately 100mV increments

Ultra-low supply current of 500nA makes this parts ideal for use in portable equipment. The device is available in a space-saving SC70 package or in a tiny SOT23 package.

B. Absolute Maximum Ratings

Item	Rating
Terminal Voltage (with respect to GND)	
VCC	-0.3V to +6V
OUT (open-drain)	-0.3V to +6V
Input Current (VCC)	20mA
Output Current (OUT, OUT)	20mA
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
3-Pin SC70	174mW
3-Pin SOT23	320mW
Derates above +70°C	
3-Pin SC70	2.17mW/°C
3-Pin SOT23	4mW/°C

II. Manufacturing Information

A. Description/Function:	3-Pin, Ultra-Low-Power SC70/SOT µP Reset Circuits
B. Process:	S12 (Standard 1.2 micron silicon gate CMOS)
C. Number of Device Transistors:	419
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Malaysia or Thailand
F. Date of Initial Production:	May, 1998

III. Packaging Information

	3-Pin SOT23	**3-Pin SC70**
A. Package Type:		
B. Lead Frame:	Alloy 42	Alloy 42 or Copper
C. Lead Finish:	Solder Plate	Solder Plate or 100% Matte Tin
D. Die Attach:	Non-Conductive Epoxy	Non-Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-1601-0132	# 05-1601-0078
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C:	Level 1	Level 1

IV. Die Information

A. Dimensions:	44 x 31 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts: Jim Pedicord (Manager, Reliability Operations)
Bryan Preeshl (Managing Director of QA**)**

B. Outgoing Inspection Level: 0.1% for all electrical parameters guaranteed by the Datasheet.
0.1% For all Visual Defects.

C. Observed Outgoing Defect Rate: < 50 ppm

D. Sampling Plan: Mil-Std-105D

VI. Reliability Evaluation

A. Accelerated Life Test

The results of the 135°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 160 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 6.79 \times 10^{-9}$

$\lambda = 6.79$ F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Attached Burn-In Schematic (Spec. # 06-4392) shows the static Burn-In circuit. Maxim performs failure analysis on any lot that exceeds this reliability control level. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

C. E.S.D. and Latch-Up Testing

The MS45-7 die type has been found to have all pins able to withstand a transient pulse of ±2000V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX6377xRxx

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		160	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SOT23 SC70	77 77	0 0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
Mechanical Stress (Note 2)					
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality		77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except V_{PS1} 3/	All V_{PS1} pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground

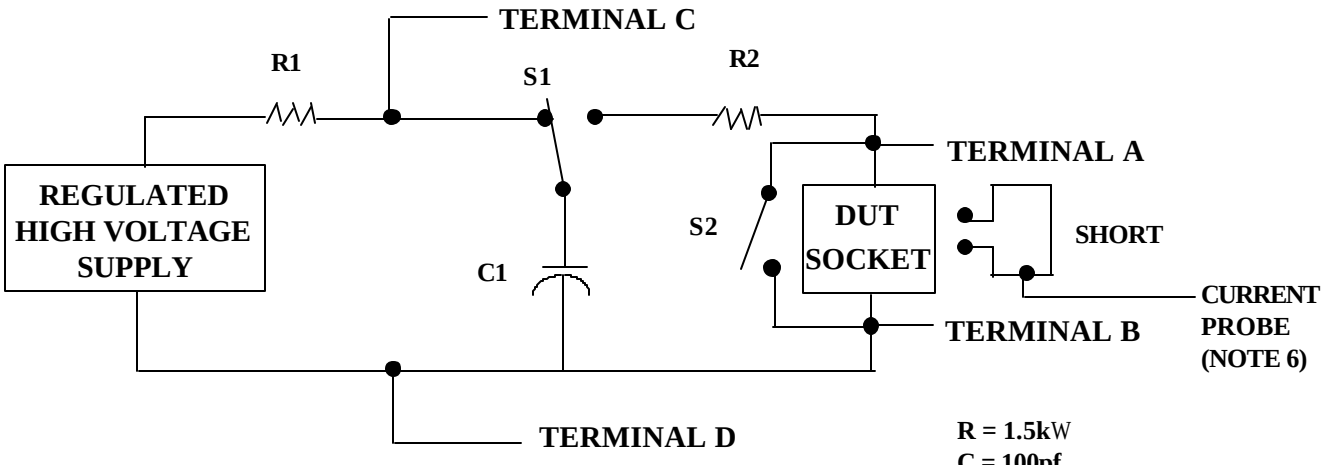
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

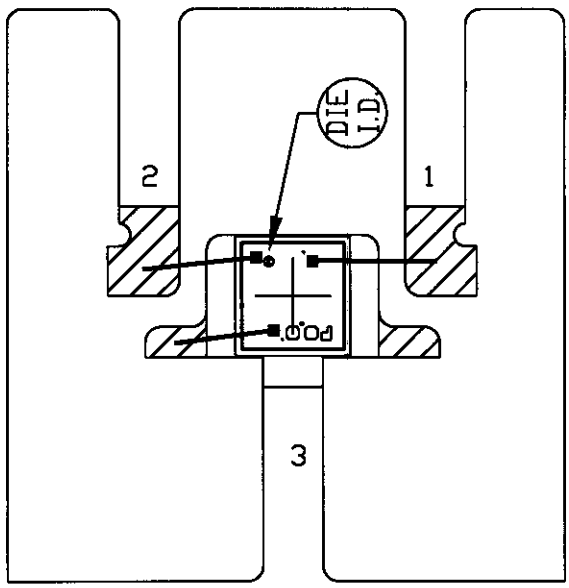
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.

c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



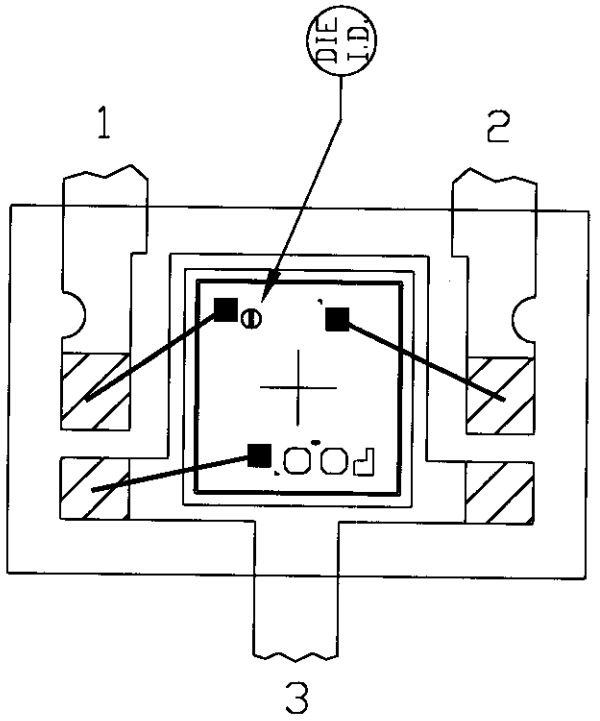
Mil Std 883D
Method 3015.7
Notice 8



USE NON-CONDUCTIVE EPOXY

BONDING AREA

PKG. CODE: U3-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY
CAV./PAD SIZE: 45x32	PKG. DESIGN			BOND DIAGRAM #: 05-1601-0132 / REV: A



USE NON-CONDUCTIVE EPOXY

SCALE: 40x

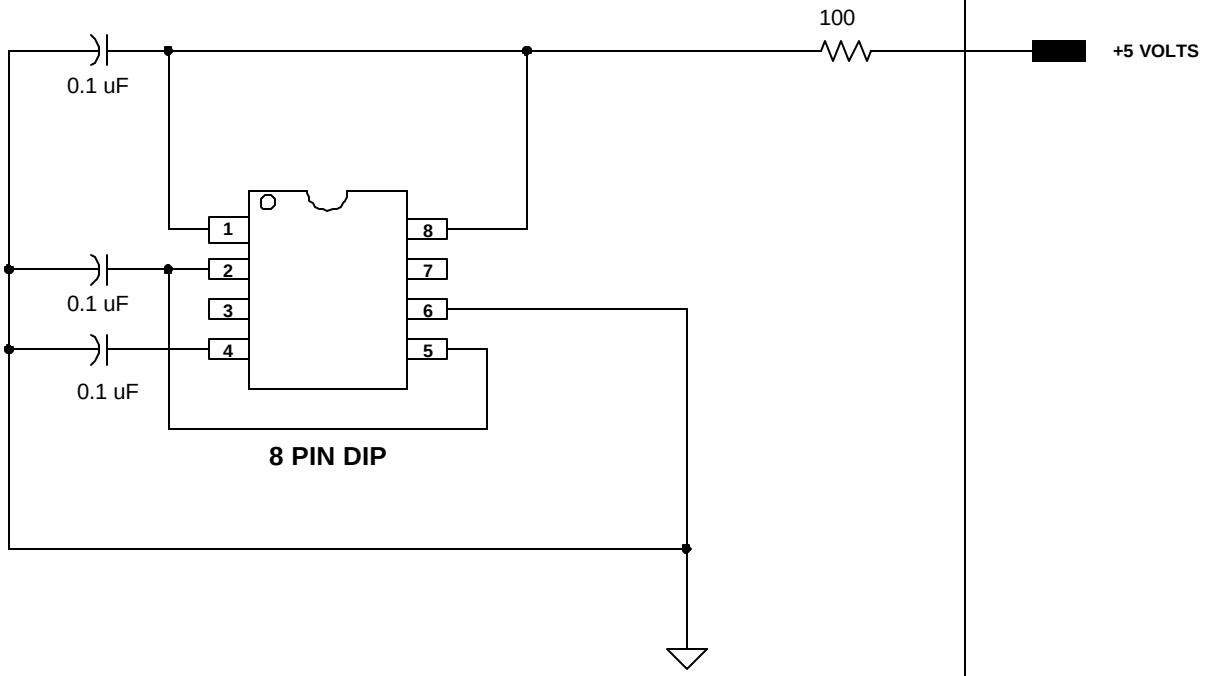
CAVITY DOWN

BONDABLE AREA

PKG.CODE: X3-2		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 34x35	PKG. DESIGN			BUILDSHEET NUMBER: 05-1601-0078 / REV.: B

ONCE PER SOCKET

ONCE PER BOARD



8 PIN DIP

DEVICES: MAX 6326/6327/6328/6346/6347/6348/6375/6376/6377/6378/6379/6380/750/750A/758/758A
MAX. EXPECTED CURRENT = 2 mA

DRAWN BY: TODD BEJSOVEC
NOTES: MS45 only for MAX 6326-6380.