RELIABILITY REPORT

FOR

MAX16013Txx

PLASTIC ENCAPSULATED DEVICES

July 13, 2006

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

Jim Pedicord
Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX16013 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 MAX16013 is an ultra-small, low-power, overvoltage protection circuit for high-voltage, high-transient systems such as those found in automotive, telecom, and industrial applications. This device operates over a wide 5.5V to 72V supply voltage range, making it also suitable for other applications such as battery stacks, notebook computers, and servers.

The MAX16013 is an overvoltage protection circuit that is capable of driving two p-channel MOSFETs to prevent reverse-battery and overvoltage conditions. One MOSFET (P1) eliminates the need for external diodes, thus minimizing the input voltage drop. The second MOSFET (P2) isolates the load or regulates the output voltage during an overvoltage condition.

The MAX16013 is available in a small 6-pin TDFN package. This device is fully specified from -40°C to +125°C.

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B. Absolute Maximum Ratings

Item	Rating
(All pins referenced to GND, unless otherwise noted.)	
VCC	-0.3V to +80V
EN, EN, LOGIC	-0.3V to (VCC + 0.3V)
INA+, INB-, IN+, IN-, REF, SET	-0.3V to +12V
OUTA, OUTB, OUT	-0.3V to +80V
GATE1, GATE2 to VCC	-12V to +0.3V
GATE1, GATE2	-0.3V to (VCC + 0.3V)
Current Sink/Source (all pins)	50mA
Continuous Power Dissipation (TA = +70°C)	
6-Pin TDFN (derate 18.2mW/°C above +70°C)	1455mW
8-Pin TDFN (derate 18.2mW/°C above +70°C)	1455mW
Operating Temperature Range	-40°C to +125°C
Maximum Junction Temperature	+150°C
Storage Temperature Range	-60°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

II. Manufacturing Information

A. Description/Function:	Ultra-Small, Overvoltage Protection/ Detection Circuits
B. Process:	BCD80
C. Number of Device Transistors:	419
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Thailand
F. Date of Initial Production:	April, 2005

III. Packaging Information

A. Package Type:	**6-pin TDFN-6**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate or 100% Matte Tin
D. Die Attach:	Silver-filled Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	# 05-9000-1822
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C:	Level 1

IV. Die Information

A. Dimensions:	61 x 62 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:	3 microns (as drawn)
F. Minimum Metal Spacing:	3 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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 96 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 11.45 \times 10^{-9}$ $\lambda = 11.45$ F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure reliability of its processes. The reliability required for lots which receive a burn-in qualification is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on rejects from lots exceeding this level. The attached Burn-In Schematic (Spec. # 06-6520) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1N**). Current monitor data for the BCD80 Process results in a FIT Rate of 0.38 @ 25C and 6.67 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

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

The MS94-2 die type has been found to have all pins able to withstand a transient pulse of ±2500V, per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of ±250mA.

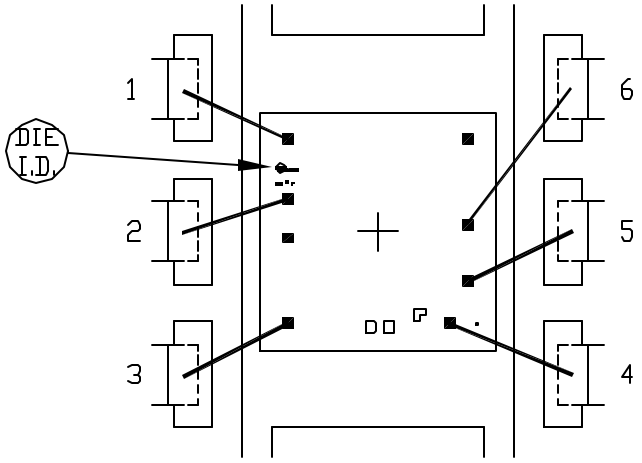
Table 1
Reliability Evaluation Test Results

MAX16013Txx

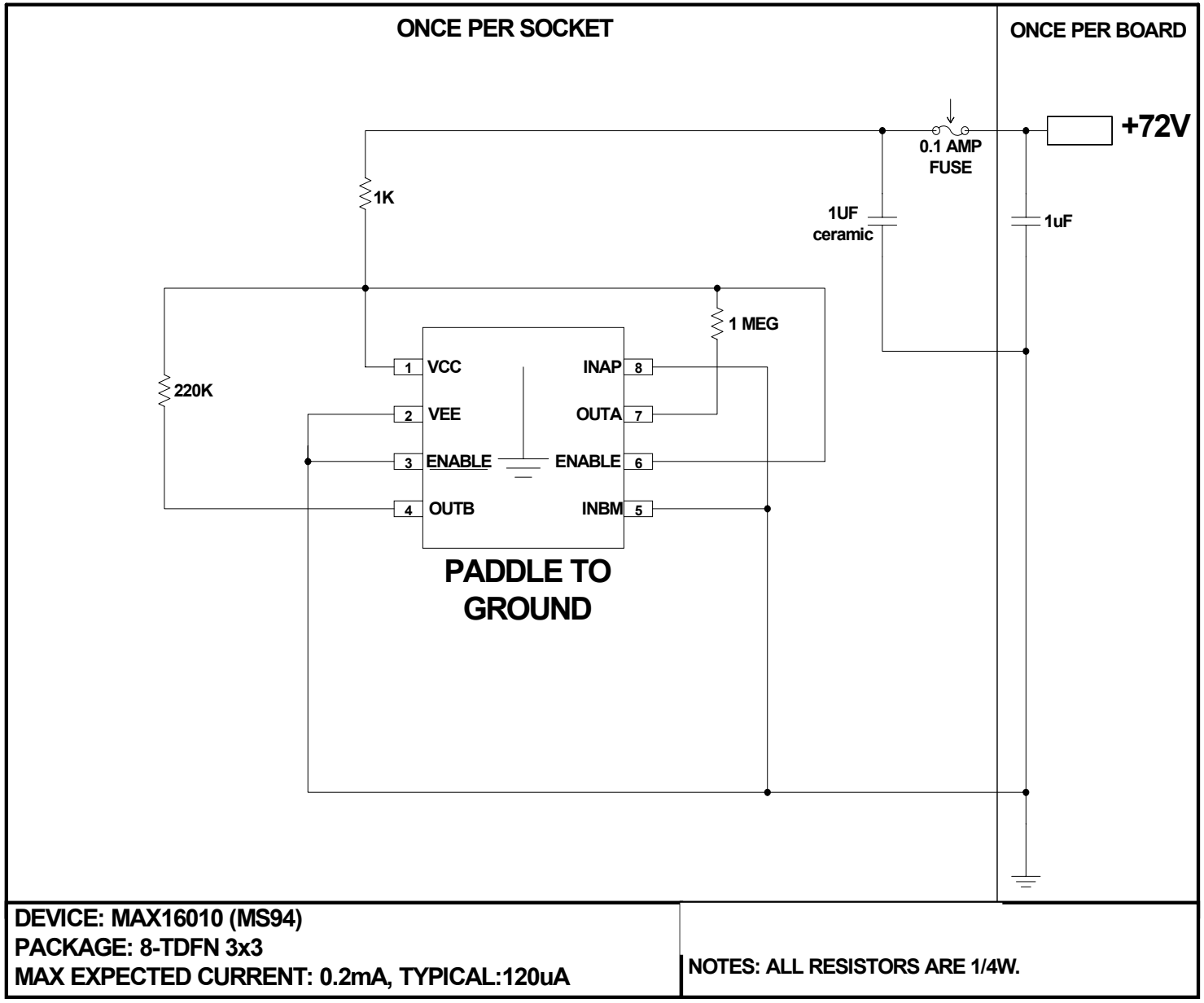
TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 150°C Biased Time = 192 hrs.	DC Parameters & functionality		96	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	TDFN	77	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

3x3x0.8 MM TDFN PKG. EXPOSED PAD PKG.



PKG. CODE: T633-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY
CAV./PAD SIZE: 71x102	PKG.			BOND DIAGRAM #: 05-9000-1822 REV: A
	DESIGN			



DEVICE: MAX16010 (MS94)
PACKAGE: 8-TDFN 3x3
MAX EXPECTED CURRENT: 0.2mA, TYPICAL:120uA

NOTES: ALL RESISTORS ARE 1/4W.