

RELIABILITY REPORT
FOR
MAX16046ETN+
(MAX16046/MAX16048)
PLASTIC ENCAPSULATED DEVICES

February 6, 2009

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX16046ETN+ 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.

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I. Device Description

A. General

The MAX16046/MAX16048 EEPROM-configurable system managers monitor, sequence, track, and margin multiple system voltages. The MAX16046 manages up to twelve system voltages simultaneously, and the MAX16048 manages up to eight supply voltages. These devices integrate an analog-to-digital converter (ADC) for monitoring supply voltages, digital-to-analog converters (DAC) for adjusting supply voltages, and configurable outputs for sequencing and tracking supplies (during power-up and power-down). Nonvolatile EEPROM registers are configurable for storing upper and lower voltage limits, setting timing and sequencing requirements, and for storing critical fault data for readback following failures. An internal 1% accurate 10-bit ADC measures each input and compares the result to one upper, one lower, and one selectable upper or lower limit. A fault signal asserts when a monitored voltage falls outside the set limits. Up to three independent fault output signals are configurable to assert under various fault conditions. The integrated sequencer/tracker allows precise control over the power-up and power-down order of up to twelve (MAX16046) or up to eight (MAX16048) power supplies. Four channels (EN_OUT1-EN_OUT4) support closed-loop tracking using external series MOSFETs. Six outputs (EN_OUT1-EN_OUT6) are configurable with charge-pump outputs to directly drive MOSFETs without closed-loop tracking. The MAX16046/MAX16048 include twelve/eight integrated 8-bit DAC outputs for margining power supplies when connected to the trim input of a point-of-load (POL) module. The MAX16046/MAX16048 include six programmable general-purpose inputs/outputs (GPIOs). GPIOs are EEPROM configurable as dedicated fault outputs, as a watchdog input or output (WDI/WDO), as a manual reset (active-low MR), or for margin control inputs. The MAX16046/MAX16048 feature two methods of fault management for recording information during system shutdown events. The fault logger records a failure in the internal EEPROM and sets a lock bit protecting the stored fault data from accidental erasure. An I²C or a JTAG serial interface configures the MAX16046/MAX16048. These devices are offered in a 56-pin 8mm x 8mm TQFN package or a 64-pin 10mm x 10mm TQFP package and are fully specified from -40°C to +85°C.

II. Manufacturing Information

A. Description/Function:	12-/8-Channel EEPROM-Programmable System Managers with Nonvolatile Fault Registers
B. Process:	B8
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	Thailand
F. Date of Initial Production:	Oct 26, 2007

III. Packaging Information

A. Package Type:	56-pin TQFN 8x8
B. Lead Frame:	Copper
C. Lead Finish:	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:	#05-9000-2780
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 3
J. Single Layer Theta Ja:	35°C/W
K. Single Layer Theta Jc:	0.6°C/W
L. Multi Layer Theta Ja:	21°C/W
M. Multi Layer Theta Jc:	0.6°C/W

IV. Die Information

A. Dimensions:	258 X 235 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	3.0 microns (as drawn)
F. Minimum Metal Spacing:	3.0 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: Ken Wendel (Director, Reliability Engineering)
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 22.4 \times 10^{-9}$$

$\lambda = 22.4$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the B8 Process results in a FIT Rate of 2.71 @ 25C and 17.30 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The MT07 die type has been found to have all pins able to withstand a HBM transient pulse of 2000V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of 250mA.

Table 1
Reliability Evaluation Test Results

MAX16046ETN+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
Moisture Testing (Note 2) 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