



RELIABILITY REPORT
FOR
MAX5954_ETX+T
PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

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SAN JOSE, CA 95134

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Conclusion

The MAX5954_ETX+T successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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I. Device Description

A. General

The MAX5954 hot-plug controller is designed for PCI Express™ applications. The device provides hot-plug control for 12V, 3.3V, and 3.3V auxiliary supplies of a single PCI Express (PCI-E) slot. The MAX5954's logic inputs/outputs allow interfacing directly with the system hot-plug management controller or through an SMBus™ with an external I/O expander. Integrated debounced attention switch and present-detect signals are included to simplify system design. The MAX5954 drives two external n-channel MOSFETs to control the 12V and 3.3V main outputs. The 3.3V auxiliary output is controlled through an internal 0.3Ω n-channel MOSFET. An internal charge pump provides gate drive for the 12V output while the gate drive of the 3.3V output is driven by the 12V input supply. The 3.3V auxiliary output is completely independent from the main outputs with its own charge pump. At power-up, the MAX5954 keeps all of the external MOSFETs off until the supplies rise above their respective undervoltage-lockout (UVLO) thresholds. The device keeps the internal MOSFET off only until the auxiliary input supply rises above its UVLO threshold. Upon a turn-on command, the MAX5954 enhances the external and internal MOSFETs slowly with a constant gate current to limit the power-supply inrush current. The MAX5954 actively limits the current of all outputs at all times and shuts down if an overcurrent condition persists for longer than a programmable overcurrent timeout. Thermal-protection circuitry also shuts down all outputs if the die temperature exceeds +150°C. After an overcurrent or overtemperature fault condition, the MAX5954L latches off while the MAX5954A automatically restarts after a restart time delay. The device is available in a 36-pin (6mm x 6mm) thin QFN package and operates over the -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	Single PCI Express, Hot-Plug Controller
B. Process:	B8
C. Fabrication Location:	USA
D. Assembly Location:	Taiwan, China, Thailand
E. Date of Initial Production:	January 13, 2006

III. Packaging Information

A. Package Type:	36-pin TQFN 6x6
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Bondwire:	Au (1 mil dia.)
E. Mold Material:	Epoxy with silica filler
F. Assembly Diagram:	#05-9000-2055
G. Flammability Rating:	Class UL94-V0
H. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
I. Single Layer Theta Ja:	38°C/W
J. Single Layer Theta Jc:	1.4°C/W
K. Multi Layer Theta Ja:	28°C/W
L. Multi Layer Theta Jc:	1.4°C/W

IV. Die Information

A. Dimensions:	113X105 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Minimum Metal Width:	0.8 microns (as drawn)
E. Minimum Metal Spacing:	0.8 microns (as drawn)
F. Isolation Dielectric:	SiO ₂
G. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Eric Wright (Reliability Engineering) Brian Standley (Manager, Reliability) Bryan Preeshl (Vice President 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 135C 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)

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the B8 Process results in a FIT Rate of 0.06 @ 25C and 0.99 @ 55C (0.8 eV, 60% UCL)

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

The NP74-2 die type has been found to have all pins able to withstand an HBM transient pulse of +/-400V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX5954_ETX+T

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

Note 1: Life Test Data may represent plastic DIP qualification lots.