RELIABILITY REPORT

FOR

MAX6654MEE

PLASTIC ENCAPSULATED DEVICES

February 17, 2016

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
Sokhom Chum
Quality Assurance
Reliability Engineer

Conclusion

The MAX6654MEE 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.

Table of Contents

I. Device Description

A. General

The MAX6654 is a precise digital thermometer that reports the temperature of both a remote P-N junction and its own die. The remote junction can be a diode-connected transistor-typically a low-cost, easily mounted 2N3904 NPN type or 2N3906 PNP type-that replaces conventional thermistors or thermocouples. Remote accuracy is ±1°C for multiple transistor manufacturers, with no calibration needed. The remote junction can also be a common-collector PNP, such as a substrate PNP of a microprocessor (µP). The 2-wire serial interface accepts standard System Management Bus (SMBus), Write Byte, Read Byte, Send Byte, and Receive Byte commands to program the alarm thresholds and to read temperature data. Measurements can be done automatically and autonomously, with the conversion rate programmed by the user, or programmed to operate in a single-shot mode. The adjustable conversion rate allows the user to optimize supply current and temperature update rate to match system needs. When the conversion rate is faster than 1Hz, the conversion results are available as a 7-bit-plus-sign byte with a 1°C LSB. When the conversion rate is 1Hz or slower, the MAX6654 enters the extended mode. In this mode, 3 additional bits of temperature data are available in the extended resolution register, providing 10-bit-plus-sign resolution with a 0.125°C LSB. Singleshot conversions also have 0.125°C per LSB resolution when the conversion rate is 1Hz or slower. A parasitic resistance cancellation (PRC) mode can also be invoked for conversion rates of 1Hz or slower by setting bit 4 of the configuration register to 1. In PRC mode, the effect of series resistance on the leads of the external diode is canceled. The 11-bit conversion in PRC mode is performed in <500ms and is disabled for conversion rates faster than 1Hz. The one-shot conversion is also 11 bits in < 500ms. The MAX6654 default low-temperature measurement limit is 0°C. This can be extended to -64°C by setting bit 5 of the configuration register to 1. The MAX6654 is available in a small, 16-pin QSOP surface-mount package.

II. Manufacturing Information

A. Description/Function:	1°C Accurate Remote/Local Temperature Sensor with SMBus Serial Interface
B. Process:	B8
C. Number of Device Transistors:	
D. Fabrication Location:	California or Texas
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	October 21, 2000

III. Packaging Information

A. Package Type:	16-pin QSOP
B. Lead Frame:	Copper
C. Lead Finish:	85Sn/15Pb plate
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-2901-0001
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	120°C/W
K. Single Layer Theta Jc:	37°C/W
L. Multi Layer Theta Ja:	103.7°C/W
M. Multi Layer Theta Jc:	37°C/W

IV. Die Information

A. Dimensions:	72X99 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.8 microns (as drawn)
F. Minimum Metal Spacing:	0.8 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Don Lipps (Manager, Reliability Engineering) 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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 160 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 6.87 \times 10^{-9}$

λ = 6.87 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 0.01 @ 25C and 0.23 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (ESD lot S4IAE3010B D/C 0333, Latch-Up lot S4IAEA006A, D/C 0331)

The TS04 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX6654MEE

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135°C	DC Parameters	80	0	I4IABA076A, D/C 0216
	Biased	& functionality	80	0	I22HMQ001C, D/C 0036
	Time = 192 hrs.				

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