RELIABILITY REPORT

FOR

MAX17055ETB+T

PLASTIC ENCAPSULATED DEVICES

April 5, 2017

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

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Conclusion

The MAX17055ETB+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 MAX17055 is a low 7µA operating current fuel gauge which implements Maxim ModelGauge^{tm} m5 EZ algorithm. ModelGauge m5 EZ makes fuel gauge implementation easy by eliminating battery characterization requirements and simplifying host software interaction. The ModelGauge m5 EZ robust algorithm provides tolerance against battery diversity for most lithium batteries and applications. ModelGauge m5 EZ algorithm combines the short-term accuracy and linearity of a coulomb counter with the long-term stability of a voltage-based fuel gauge, along with temperature compensation to provide industry-leading fuel gauge accuracy. The MAX17055 automatically compensates for cell aging, temperature, and discharge rate, and provides accurate state of charge (SOC in %) and remaining capacity in milliampere-hours (mAh). As the battery approaches the critical region near empty, the ModelGauge m5 algorithm invokes a special error correction mechanism that eliminates any error. It also provides three methods for reporting the age of the battery: reduction in capacity, increase in battery resistance, and cycle odometer. The MAX17055 provides precision measurements of current, voltage, and temperature. Temperature of the battery pack is measured using an internal temperature measurement or external thermistor. A 2-wire I²C interface provides access to data and control registers. The MAX17055 is available in a lead-free, tiny 0.4mm Pitch 1.4mm x 1.5mm, 9-pin WLP package, and a 2mm x 2.5mm, 10-pin TDFN package.

II. Manufacturing Information

A. Description/Function:	7µA 1-Cell Fuel Gauge with ModelGauge m5 EZ
B. Process:	S18
C. Number of Device Transistors:	285000
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	December 21, 2016

III. Packaging Information

A. Package Type:	10-pin TDFN-Cu	9-bump WLP
B. Lead Frame:	Copper	N/A
C. Lead Finish:	100% matte Tin	N/A
D. Bondwire:	Cu (0.8 mil dia.)	N/A
E. Mold Material:	Epoxy with silica filler	None
F. Assembly Diagram:	#05-100407	#05-100487
G. Flammability Rating:	Class UL94-V0	Class UL94-V0
H. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1	Level 1
I. Single Layer Theta Ja:	N/A°C/W	N/A°C/W
J. Single Layer Theta Jc:	N/A°C/W	N/A°C/W
K. Multi Layer Theta Ja:	102°C/W	83.98°C/W
L. Multi Layer Theta Jc:	2.9°C/W	N/A°C/W

IV. Die Information

A. Dimensions:	56.6929X60.2362 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:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 microns (as drawn)
G. Isolation Dielectric:	SiO_2
H. 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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 80 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 13.7 \times 10^{-9}$

$\lambda = 13.7$ 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 S18 Process results in a FIT Rate of 0.40 @ 25C and 6.96 @ 55C (0.8 eV, 60% UCL)

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

The BC19-0 die type has been found to have all pins able to withstand an HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

Table 1

Reliability Evaluation Test Results

MAX17055ETB+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	80	0	

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