RELIABILITY REPORT

FOR

MAX17201

PLASTIC ENCAPSULATED DEVICES

August 18, 2016

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
Eric Wright
Quality Assurance
Reliability Engineer

Conclusion

The MAX17201 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 MAX1720x/MAX1721x are ultra-low power stand-alone fuel gauge ICs that implement the Maxim ModelGauge™ m5 algorithm without requiring host interaction for configuration. This feature makes the MAX1720x/MAX1721x excellent pack-side fuel gauges. The MAX17201/MAX17211 monitor a single cell pack. The MAX17205/MAX17215 monitor and balance a 2S or 3S pack or monitor a multiple-series cell pack. To prevent battery pack cloning, the ICs integrate SHA- 256 authentication with a 160-bit secret key. Each IC incorporates a unique 64-bit ID. The ModelGauge™ m5 algorithm combines the short-term accuracy and linearity of a coulomb counter with the longterm stability of a voltage-based fuel gauge, along with temperature compensation to provide industry-leading fuel gauge accuracy. The IC automatically compensates for cell aging, temperature, and discharge rate, and provides accurate state of charge (SOC) in milliampere-hours (mAh) or percentage (%) over a wide range of operating conditions. As the battery approaches the critical region near empty, the ModelGauge m5 algorithm invokes a special error correction mechanism that eliminates any error. The ICs provide accurate estimation of time-to-empty and time-to-full, Cycle+™ age forecast, and three methods for reporting the age of the battery: reduction in capacity, increase in battery resistance, and cycle odometer. The ICs provide precision measurements of current, voltage, and temperature. Temperature of the battery pack is measured using an internal temperature measurement and up to two external thermistors supported by ratio metric measurements on auxiliary inputs. A Maxim 1-Wire® (MAX17211/ MAX17215) or 2-wire I^2C (MAX17201/MAX17205) interface provides access to data and control registers. The ICs are available in lead-free, 3mm x 3mm, 14-pin TDFN and 1.6mm x 2.4mm 15-bump WLP packages.

II. Manufacturing Information

A. Description/Function:	Stand-Alone ModelGauge m5 Fuel Gauge with SHA-256 Authentication
B. Process:	S18
C. Number of Device Transistors:	440000
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	March 29, 2016

III. Packaging Information

A. Package Type:	14-pin TDFN	15-bump WLP
B. Lead Frame:	Copper	N/A
C. Lead Finish:	100% Matte Tin	N/A
D. Die Attach:	Conductive	None
E. Bondwire:	Copper	N/A
F. Mold Material:	Epoxy with silica filler	None
G. Assembly Diagram:	#05-100117	#05-100305
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1	Level 1
J. Single Layer Theta Ja:	54°C/W	N/A°C/W
K. Single Layer Theta Jc:	8°C/W	N/A°C/W
L. Multi Layer Theta Ja:	41°C/W	16.22°C/W
M. Multi Layer Theta Jc:	8°C/W	N/A°C/W

IV. Die Information

A. Dimensions:	64.5669X94.0945 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. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts: Eric Wright (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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 80 \times 2}$$

(Chi square value for MTTF upper limit)

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

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

λ = 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 BC25-0 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

MAX17201

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.