

RELIABILITY REPORT
FOR
MAX14920ECB+
PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX14920ECB+ 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 MAX14920/MAX14921 battery measurement analog front-end devices accurately sample cell voltages and provide level shifting for primary/secondary battery packs up to 16 cells/+65V (max). The MAX14920 monitors up to 12 cells, while the MAX14921 monitors up to 16 cells. Both devices simultaneously sample all cell voltages, allowing accurate state-of-charge and source-resistance determination. All cell voltages are level shifted to ground reference with unity gain, simplifying external ADC data conversion. The devices have a low-noise, low-offset amplifier that buffers differential voltages of up to +5V, allowing monitoring of all common lithium-ion (Li+) cell technologies. The resulting cell voltage error is $\pm 0.5\text{mV}$. The devices' high accuracy make them ideal for monitoring cell chemistries with very flat discharge curves, such as lithium-metal phosphate. Passive-cell balancing is supported by external FET drivers. Integrated diagnostics in the devices allow open-wire detection and undervoltage/overvoltage alarms. The devices are controlled by a daisy-chainable SPI interface. The MAX14920 is available in a 64-pin (10mm x 10mm) TQFP package with an exposed pad. The MAX14921 is available in an 80-pin (12mm x 12mm) TQFP package. Both devices are specified over the -40°C to $+85^{\circ}\text{C}$ extended temperature range.

II. Manufacturing Information

A. Description/Function:	High-Accuracy 12-/16-Cell Measurement AFEs
B. Process:	S18
C. Number of Device Transistors:	13771
D. Fabrication Location:	California
E. Assembly Location:	Korea, Taiwan
F. Date of Initial Production:	March 26, 2013

III. Packaging Information

A. Package Type:	64-pin TQFP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-4821
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:	N/A
K. Single Layer Theta Jc:	N/A
L. Multi Layer Theta Ja:	31.9°C/W
M. Multi Layer Theta Jc:	2°C/W

IV. Die Information

A. Dimensions:	110.2362X110.2362 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.18um
F. Minimum Metal Spacing:	0.18um
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 2.64 \times 10^{-9}$$

$$\lambda = 2.64 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot SAKK7Q002B, D/C 1250)

The AK35-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX14920ECB+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C Biased Time = 1000 hrs.	DC Parameters & functionality	80	0	TATS4Z001E, D/C 1427

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