RELIABILITY REPORT

FOR

MAX1535CETJ+
(MAX1535B/MAX1535C/MAX1535D)

PLASTIC ENCAPSULATED DEVICES

January 19, 2009

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX1535CETJ+ successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim"s continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim"s quality and reliability standards.

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I. Device Description

A. General

The MAX1535B/MAX1535C/MAX1535D are highly integrated, multichemistry battery chargers that simplify construction of advanced smart chargers with a minimum number of external components. They use Intel's system management bus (SMBus™) to control the charge voltage, charge current, and the maximum current drawn from the AC adapter. High efficiency is achieved through use of a constant off-time step-down topology with synchronous rectification. In addition to support of the Smart-Battery-Charger Specifications Rev 1.1, the MAX1535B/MAX1535C/MAX1535D include additional features. The maximum current drawn from the AC adapter is programmable to avoid overloads when supplying the load and the battery charger simultaneously. This enables the user to reduce the cost of the AC adapter. The MAX1535B/MAX1535C/MAX1535D provide a digital output that indicates the presence of an AC adapter. Based on the presence or absence of the AC adapter, the MAX1535B/MAX1535C/MAX1535D automatically select the appropriate source for supplying power to the system by controlling two external p-channel MOSFETs. Under system control, the MAX1535B/MAX1535C/MAX1535D allow the battery to undergo a relearning or conditioning cycle in which the battery is completely discharged through the system load and then recharged. The MAX1535B/MAX1535C/MAX1535D are capable of charging 2, 3, or 4 lithium-ion (Li+) cells in series, providing charge currents as high as 8A. The DC-DC converter in the MAX1535B/MAX1535C/MAX1535D uses a high-side p-channel switch with an n-channel synchronous rectifier. The charge current and input current-limit sense amplifiers have low input-offset errors and can use small-value sense resistors (0.01 , typ). The MAX1535B/MAX1535C/MAX1535D are available in a 5mm x 5mm, 32-pin, thin QFN package and operate over the extended -40°C to +85°C temperature range. An evaluation kit is available to reduce design time.

II. Manufacturing Information

A. Description/Function:	Highly Integrated Level 2 SMBus Battery Chargers
B. Process:	B12
C. Number of Device Transistors:	
D. Fabrication Location:	California
E. Assembly Location:	ASAT China, UTL Thailand
F. Date of Initial Production:	April 26, 2003

III. Packaging Information

A. Package Type:	32-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-0444
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:	47°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	1.7°C/W

IV. Die Information

A. Dimensions:	136 X 136 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Ken Wendel (Director, Reliability Engineering) Bryan Preeshl (Managing Director 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 48 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 22.4 \times 10^{-9}$

$\lambda = 22.4$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at http://www.maxim-ic.com/. Current monitor data for the B12 Process results in a FIT Rate of 3.13 @ 25C and 54.16 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The PD31-4 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX1535CETJ+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
Moisture Testing (Note 2)				
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
Mechanical Stress (Note 2)				
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data