

RELIABILITY REPORT
FOR
MAX8844ZETD+
PLASTIC ENCAPSULATED DEVICES

April 5, 2009

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX8844ZETD+ fails to meet the quality and reliability standards required of all Maxim products.

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I. Device Description

A. General

The MAX8844Z/MAX8844Y intelligent, stand-alone constant-current, constant-voltage (CCCV), thermally regulated dual input linear chargers are designed for charging a single-cell lithium-ion (Li+) battery. The MAX8844Z/MAX8844Y integrate a current-sense circuit, MOSFET pass element, thermal-regulation circuitry, and eliminate the external reverse-blocking Schottky diode to create the simplest and smallest charging solutions for handheld equipment. The IC controls the charging sequence from the prequalification state through constant current fast-charge, top-off charge, and full-charge indication. Proprietary thermal-regulation circuitry limits the die temperature during fast-charging or when the IC is exposed to high ambient temperatures, allowing maximum charging current without damaging the IC. The MAX8844Z/MAX8844Y achieve high flexibility by providing adjustable fast-charge currents (SETI) and an adjustable top-off current threshold (MIN) through external resistors. The IC features a booting assistant circuit that distinguishes input sources and battery connection and provides an enable signal (ABO, active-low ABO) for system booting. The ICs also integrate two input overvoltage-protected LDO outputs (SAFEOUT, SAFEUSB) for low-voltage-rated USB or charger inputs in system, and a battery pack detection circuit (DETBAT) that disables the charger when the battery pack is absent. Other features include an active-low control input (active-low EN), an active-low input power source detection output (active-low POK), and a fully charged top-off threshold detection output (active-low CHG). The MAX8844Z/MAX8844Y automatically select between either the USB or IN source. If both sources are present at the same time, highest priority is given to the IN source. The IN source is selected to ensure the shortest charging time for the system since it is able to deliver the highest current. The MAX8844Z/MAX8844Y accept an input supply range from 4.25V to 28V (IN and USB), but disable charging if the input voltage exceeds +7.5V to protect against unqualified or faulty AC adapters. The ICs operate over the extended temperature range (-40°C to +85°C) and are available in a compact 14-pin, thermally enhanced, lead-free TDFN 3mm x 3mm package (0.8mm max height).

II. Manufacturing Information

A. Description/Function:	28V Dual Input Linear Li+ Battery Chargers with Battery Detection and Overvoltage-Protected Output
B. Process:	S4
C. Number of Device Transistors:	6154
D. Fabrication Location:	Texas
E. Assembly Location:	UTL Thailand
F. Date of Initial Production:	February 16, 2009

III. Packaging Information

A. Package Type:	14-pin TDFN 3x3
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
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:	54°C/W
K. Single Layer Theta Jc:	8.3°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	8.3°C/W

IV. Die Information

A. Dimensions:	66 X 67 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 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:

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

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

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

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

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 S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 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 PR34 die type has been found to have all pins able to withstand a HBM transient pulse of +/-500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX8844ZETD+

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