

RELIABILITY REPORT
FOR
MAX77816_EWP+T
WAFER LEVEL DEVICES

October 15, 2017

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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Conclusion

The MAX77816_EWP+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 MAX77816 is a high-current, high-efficiency buck-boost regulator targeting single-cell Li-ion battery-powered applications. It supports a wide output voltage range from 2.60V to 5.14V. The IC allows 5A (TYP) maximum switch current. In buck mode, the output current can go as high as 4A, and in boost mode, the maximum output current can be 3A. A unique control algorithm allows high efficiency, outstanding line/load transient response, and seamless transition between buck and boost modes. The IC features I2C-compatible serial interface. The I2C interface allows the output voltage to be dynamically adjusted thus enabling finer control of system power consumption. The I2C interface also provides features such as enable control and device status monitoring. The multifunction GPIO pin is register settable to 5 different options such as FPWM mode enable and inductor peak current level selection. These options provide design flexibility that allows the IC to cover a wide range of applications and use cases.

II. Manufacturing Information

A. Description/Function:	High-Efficiency Buck-Boost Regulator with 5A Switches
B. Process:	S18
C. Number of Device Transistors:	61389
D. Fabrication Location:	Taiwan
E. Assembly Location:	Taiwan
F. Date of Initial Production:	July 5, 2017

III. Packaging Information

A. Package Type:	20-bump WLP
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	None
E. Bondwire:	N/A (N/A mil dia.)
F. Mold Material:	None
G. Assembly Diagram:	#05-100741
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:	N/A°C/W
K. Single Layer Theta Jc:	N/A°C/W
L. Multi Layer Theta Ja:	55.49°C/W
M. Multi Layer Theta Jc:	N/A°C/W

IV. Die Information

A. Dimensions:	85.0394X73.2283 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Minimum Metal Width:	0.23 microns (as drawn)
E. Minimum Metal Spacing:	0.23 microns (as drawn)
F. Isolation Dielectric:	SiO ₂
G. 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:

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

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

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 PB91-0 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

MAX77816_EWP+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	48	0	

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