

RELIABILITY REPORT
FOR
MAX15166EWE+T
WAFER LEVEL PRODUCTS

April 14, 2015

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
Sokhom Chum
Quality Assurance
Reliability Engineer

Conclusion

The MAX15166EWE+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.

Table of Contents

I.Device Description	IV.Die Information
II.Manufacturing Information	V.Quality Assurance Information
III.Packaging Information	VI.Reliability Evaluation
.....Attachments	

I. Device Description

A. General

The MAX15066/MAX15166 current-mode, synchronous, DC-DC buck converters deliver an output current up to 4A with high efficiency. The devices operate from an input voltage of 4.5V to 16V and provides an adjustable output voltage from 0.606V to 90% of the input voltage. The devices are ideal for distributed power systems, notebook computers, nonportable consumer applications, and preregulation applications. The devices feature a PWM mode operation with an internally fixed switching frequency of 500kHz (MAX15066) and 350kHz (MAX15166) capable of 90% maximum duty cycle. The devices automatically enter skip mode at light loads. The current-mode control architecture simplifies compensation design and ensures a cycle-by-cycle current limit and fast response to line and load transients. A high gain transconductance error amplifier allows flexibility in setting the external compensation, simplifying the design and allowing for an all-ceramic design. The synchronous buck regulators feature internal MOSFETs that provide better efficiency than asynchronous solutions, while simplifying the design relative to discrete controller solutions. In addition to simplifying the design, the integrated MOSFETs minimize EMI, reduce board space, and provide higher reliability by minimizing the number of external components. Additional features include an externally adjustable soft-start, independent enable input and power-good output for power sequencing, and thermal shutdown protection. The devices offer overcurrent protection (high-side sourcing) with hiccup mode during an output short-circuit condition. The devices ensure safe startup when powering into a prebiased output. The MAX15066/MAX15166 are available in a 2mm x 2mm, 16-bump (4 x 4 array), 0.5mm pitch wafer-level package (WLP) and are fully specified from -40°C to +85°C.

II. Manufacturing Information

A. Description/Function:	High-Efficiency, 4A, Step-Down DC-DC Regulator with Internal Power Switches
B. Process:	S45
C. Number of Device Transistors:	5721
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Japan
F. Date of Initial Production:	June 28, 2013

III. Packaging Information

A. Package Type:	16-pin WLP
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	N/A
E. Bondwire:	N/A
F. Mold Material:	N/A
G. Assembly Diagram:	#05-9000-4047
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
K. Single Layer Theta Jc:	N/A
L. Multi Layer Theta Ja:	49°C/W
M. Multi Layer Theta Jc:	N/A

IV. Die Information

A. Dimensions:	83X83 mils
B. Passivation:	Si ₃ N 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:	Metal1 = 0.5 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 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: 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 46 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 23.9 \times 10^{-9}$$

$$\lambda = 23.9 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 S45 Process results in a FIT Rate of 0.13 @ 25C and 2.31 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (ESD lot TI0ZAQ001B D/C 1002, Latch-Up lot TI0ZAQ001A D/C 1002)

The NQ58 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

MAX15166EWE+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	46	0	T10ZAQ001B, D/C 1002

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