

RELIABILITY REPORT FOR
MAX8972AEWI+T / MAX8972BEWI+T
WAFER LEVEL DEVICES

May 15, 2014

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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Quality Assurance
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Conclusion

The MAX8972AEWI+T / MAX8972BEWI+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 MAX8972_ high-efficiency, two-phase, DC-DC stepdown switching regulator delivers up to 6A of output current in a compact footprint with excellent transient response. Each phase operates at a 2.25MHz fixed frequency, allowing the use of small magnetic components. Maxim Integrated's proprietary Rotational Phase Spreading algorithm optimizes efficiency at low output currents. Software-selectable forced-PWM mode allows either fixed-frequency operation or improved efficiency at light load with a variable frequency in skip mode. The dual-inductor architecture reduces the size of the external components while providing the benefit of ripple current cancellation. The MAX8972_ operates from a 2.6V to 4.5V input voltage range. An I2C 3.0-compatible serial interface, supporting clock rates up to 3.4MHz, controls key regulator parameters such as output voltage, output slew rate, and on/off control. Output voltage is programmable from 0.60625V to 1.4V in 6.25mV increments. The default output voltage is factory programmable. An EN input enables and disables the output, while a DVS pin selects two different output voltages without relying on the serial interface. Fully differential remote sense ensures precise DC regulation at the point of load. Total output error is less than 0.8% over, line, and temperature at 1.2V output. Output ripple is typically < 1% of the output voltage setting when the processor is in the Idle state (light loads) and < 0.5% at medium and high loads. Other features include internal soft-start control circuitry to reduce inrush current, guaranteed monotonic voltage adjustment, over-current protection, and over-temperature protection. The MAX8972_ operates over the -40°C to +85°C extended temperature range and is packaged in an ultra-small WLP package.

II. Manufacturing Information

A. Description/Function:	6A, Dual-Phase Step-Down Switching Regulator
B. Process:	S18
C. Number of Device Transistors:	100802
D. Fabrication Location:	USA
E. Assembly Location:	USA
F. Date of Initial Production:	March 14, 2014

III. Packaging Information

A. Package Type:	28-bump WLP 4x7
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:	#05-9000-4964
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:	41°C/W
M. Multi Layer Theta Jc:	N/A°C/W

IV. Die Information

A. Dimensions:	80.7086 X 127.9527 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:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 96 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 11.5 \times 10^{-9}$$

$$\lambda = 11.5 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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

B. E.S.D. and Latch-Up Testing (lot TAKK4Q001C, D/C 1316)

The PQ80-0 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 +/-250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results
MAX8972AEWI+T / MAX8972BEWI+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C	DC Parameters	48	0	TAKK4Q001D, D/C 1316
	Biased	& functionality	48	0	TAKK4Q001C, D/C 1316
	Time = 192 hrs.				

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