

RELIABILITY REPORT
FOR
MAX1876AEEG+
PLASTIC ENCAPSULATED DEVICES

June 18, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
Ken Wendel
Quality Assurance
Director, Reliability Engineering

Conclusion

The MAX1876AEEG+ 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 MAX1858A/MAX1875A/MAX1876A dual, synchronized, step-down controllers generate two outputs from input supplies ranging from 4.5V to 23V. Each output is adjustable from sub-1V to 18V and supports loads of 10A or higher. Input voltage ripple and total RMS input ripple current are reduced by synchronized 180° out-of-phase operation.

The switching frequency is adjustable from 100kHz to 600kHz with an external resistor. Alternatively, the controller can be synchronized to an external clock generated by another MAX1858A/MAX1875A/MAX1876A or a system clock. One MAX1858A/MAX1875A/MAX1876A can be set to generate an in-phase, or 90° out-of-phase, clock signal for synchronization with additional controllers. This allows two controllers to operate either as an interleaved two- or four-phase system with each output shifted by 90°. The MAX1858A/MAX1875A/MAX1876A feature soft-start. The MAX1858A also features first-on/last-off power sequencing and soft-stop.

The MAX1858A/MAX1875A/MAX1876A eliminate the need for current-sense resistors by utilizing the low-side MOSFET's on-resistance as a current-sense element. This protects the DC-DC components from damage during output-overload conditions or output short-circuit faults without requiring a current-sense resistor. Adjustable foldback current limit reduces power dissipation during short-circuit conditions. The MAX1858A/MAX1876A include a power-on reset (POR) output to signal the system when both outputs reach regulation.

The MAX1858A/MAX1875A/MAX1876A ensure that the output voltage does not swing negative when the input power is removed or when EN is driven low. The MAX1875A/MAX1876A also allow prebias startup without discharging the output.

The MAX1858A/MAX1875A/MAX1876A are available in a 24-pin QSOP package. Use the MAX1875 evaluation kit or the MAX1858 evaluation kit to evaluate the MAX1858A/MAX1875A/MAX1876A.

II. Manufacturing Information

A. Description/Function:	Dual 180° Out-of-Phase Buck Controllers with Sequencing/Prebias Startup and POR
B. Process:	B8
C. Number of Device Transistors:	6688
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	October 17, 2003

III. Packaging Information

A. Package Type:	24-pin QSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-2301-0114
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:	105°C/W
K. Single Layer Theta Jc:	34°C/W
L. Multi Layer Theta Ja:	88°C/W
M. Multi Layer Theta Jc:	34°C/W

IV. Die Information

A. Dimensions:	80 X 103 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5% Cu
D. Backside Metallization:	None
E. Minimum Metal Width:	0.8 microns (as drawn)
F. Minimum Metal Spacing:	0.8 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 78 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.8 \times 10^{-9}$$

$$\lambda = 13.8 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 B8 Process results in a FIT Rate of 1.29 @ 25C and 15.6 @ 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 PY99-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500 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

MAX1876AEEG+

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	310	6
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