

RELIABILITY REPORT  
FOR  
**MAX8556ETE**  
PLASTIC ENCAPSULATED DEVICES

July 19, 2004

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



Jim Pedicord  
Quality Assurance  
Manager, Reliability Operations

Reviewed by



Bryan J. Preeshl  
Quality Assurance  
Managing Director

## Conclusion

The MAX8556 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 MAX8556 low-dropout linear regulator operates from input voltages as low as 1.425V and is able to deliver up to 4A of continuous output current with a typical dropout voltage of only 100mV. The output voltage is adjustable from 0.5V to  $V_{IN} - 0.2V$ .

Designed with an internal p-channel MOSFET pass transistor, the MAX8556 maintains a low 800 $\mu$ A typical supply current, independent of the load current and dropout voltage. Using a p-channel MOSFET eliminates the need for an additional external supply or a noisy internal charge pump. Other features include a logic-controlled shutdown mode, built-in soft-start, short-circuit protection with foldback current limit, and thermal-overload protection. The MAX8556 features a POK output that transitions high when the regulator output is within  $\pm 10\%$  of its nominal output voltage.

The MAX8556 is available in a 16-pin thin QFN 5mm x 5mm package with exposed paddle.

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
IN, EN, POK, POR to GND	-0.3V to +4V
FB, OUT to GND	-0.3V to ( $V_{IN} + 0.3V$ )
Output Short-Circuit Duration	Continuous
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )	
16-Pin Thin QFN (5mm x 5mm)	2666.7mW
Derates above +70°C (Note 1)	
16-Pin Thin QFN (5mm x 5mm)	33.3mW/°C

**Note 1:** Maximum power dissipation is obtained using JEDEC JESD51-5 and JESD51-7 standards.

## II. Manufacturing Information

A. Description/Function:	4A Ultra-Low-Input-Voltage LDO Regulators
B. Process:	S4
C. Number of Device Transistors:	3137
D. Fabrication Location:	California, USA
E. Assembly Location:	Thailand, Hong Kong or Thailand
F. Date of Initial Production:	April, 2004

## III. Packaging Information

A. Package Type:	<b>16-Pin QFN (5x5)</b>
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (2.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	# 05-9000-0801
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-A:	Level 1

## IV. Die Information

A. Dimensions:	110 x 90 mils
B. Passivation:	$\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1, Metal2 & Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1, Metal2 & Metal3 = 0.4 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	$\text{SiO}_2$
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information


- A. Quality Assurance Contacts: Jim Pedicord (Manager, Reliability Operations)  
Bryan Preeshl (Managing Director)
- 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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 77 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

 Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 14.28 \times 10^{-9}$$

$$\lambda = 14.28 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-6240) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1N**).

### B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

### C. E.S.D. and Latch-Up Testing

The PN29 die type has been found to have all pins able to withstand a transient pulse of  $\pm 1500\text{V}$ , per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of  $\pm 250\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX8556ETE**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>PACKAGE</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		77	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	QFN	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
<b>Mechanical Stress</b> (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

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except $V_{PS1}$ <u>3/</u>	All $V_{PS1}$ pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.

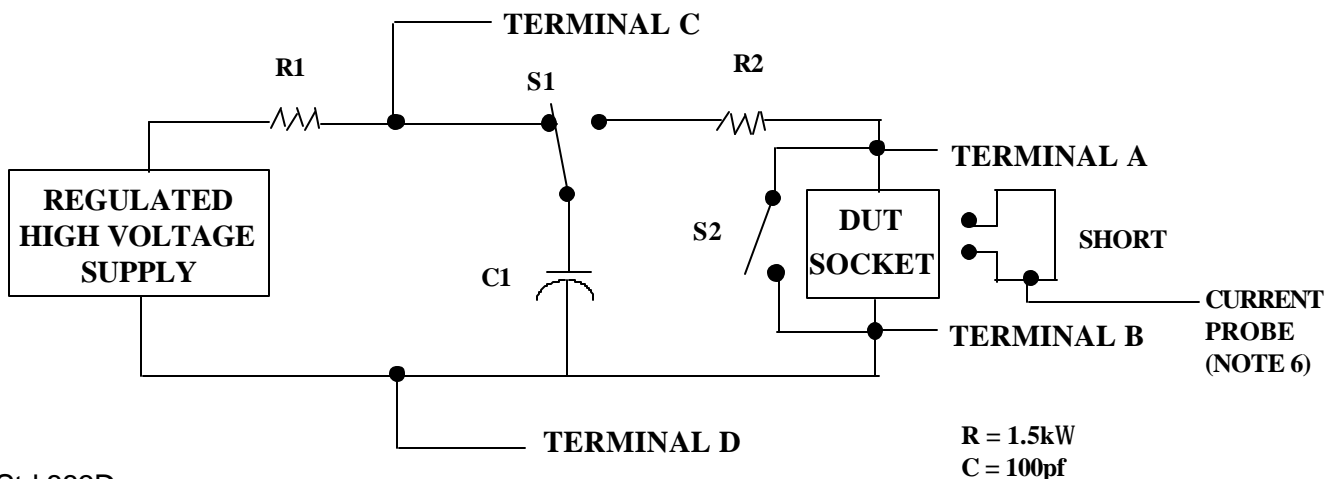
2/ No connects are not to be tested.

3/ Repeat pin combination I for each named Power supply and for ground

(e.g., where  $V_{PS1}$  is  $V_{DD}$ ,  $V_{CC}$ ,  $V_{SS}$ ,  $V_{BB}$ , GND,  $+V_S$ ,  $-V_S$ ,  $V_{REF}$ , etc).

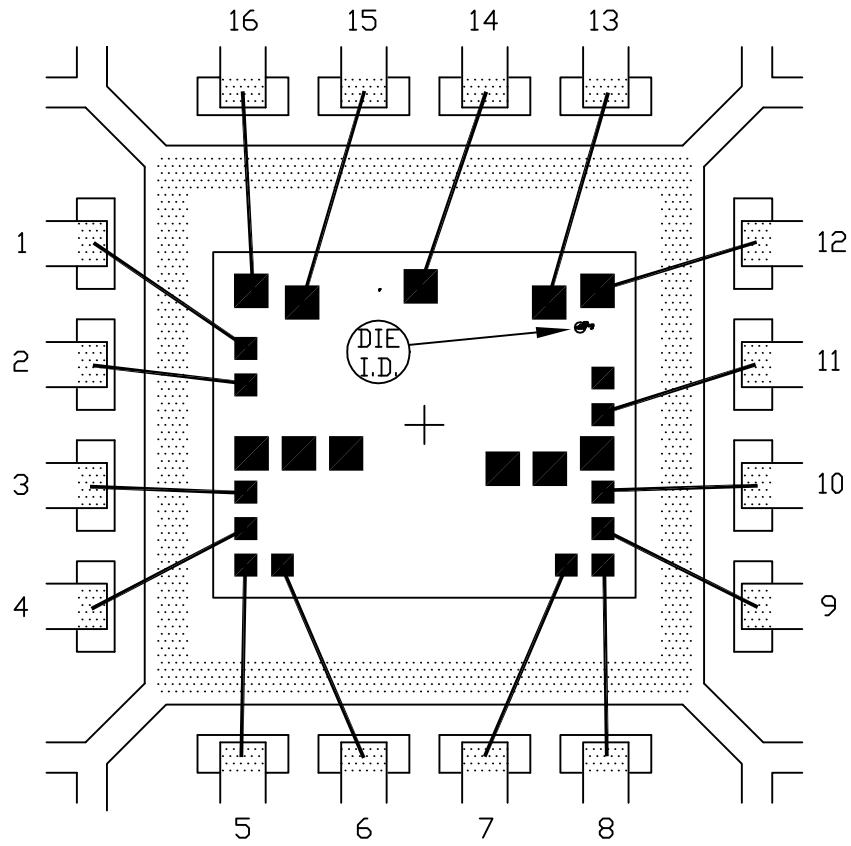
3.4 Pin combinations to be tested.

- a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.
- b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g.,  $V_{SS1}$ , or  $V_{SS2}$  or  $V_{SS3}$  or  $V_{CC1}$ , or  $V_{CC2}$ ) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.
- c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



5x5x0.8mm THIN QFN PKG.

EXPOSED PAD PKG.



 BONDABLE AREA

PKG. CODE: T1655-2		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 146x146	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0801	REV: C

