

RELIABILITY REPORT  
FOR  
MAX6766TTLD2+  
PLASTIC ENCAPSULATED DEVICES

April 28, 2015

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
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## Conclusion

The MAX6766TTLD2+ 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 MAX6765-MAX6774B are low-quiescent-current, high-voltage linear regulators that operate from 4V to 72V and deliver up to 100mA of load current. These low-power devices consume only 31 $\mu$ A of quiescent current, making them ideal for always-on automotive modules. These devices are offered with fixed standard output options of 5.0V, 3.3V, 2.5V, and 1.8V, or can be adjusted from 1.8V to 11V with two external resistors. The MAX6765-MAX6774B feature a push-pull or open-drain, active-low RESET output with either fixed or adjustable thresholds. Whenever the regulator's output falls below the reset threshold, the active-low RESET output asserts and remains asserted for at least the minimum reset timeout period after the output voltage exceeds its threshold. The minimum reset timeout period is offered with fixed values from 75 $\mu$ s to 200ms or can be adjusted externally with a small capacitor. These devices provide three regulator enable modes to accommodate several power-on schemes. The MAX6765/MAX6766/MAX6769/MAX6770/MAX6773/MAX6773B/MAX6774 MAX6774B feature a single traditional enable input (ENABLE) to turn on and off the regulator. The MAX6771/MAX6772 provide dual enable inputs (ENABLE1 and ENABLE2) to turn on and off the regulator either through an ignition switch or a bus transceiver. The MAX6767/MAX6768 provide a hold input (active-low HOLD) in addition to the enable input to allow for the implementation of a self-holding circuit without requiring external components. Setting active-low HOLD low after enabling the regulator forces the regulator to remain on even if ENABLE is subsequently set low. Releasing active-low HOLD shuts down the regulator. The MAX6773/MAX6773B/MAX6774/MAX6774B also include a watchdog input that monitors a pulse train from the microprocessor ( $\mu$ P) and generates a reset pulse if the watchdog input remains high or low for a duration longer than the 1.6s (typ) (MAX6773/MAX6774) or 50ms (typ) (MAX6773B/MAX6774B) watchdog timeout period. The MAX6765-MAX6774B are available in a small, thermally enhanced 3mm x 3mm TDFN package that can dissipate up to 1.951W, thereby supporting continuous regulator operation during high ambient temperatures, high battery voltage, and high load-current conditions. The MAX6765-MAX6774B are fully specified for a -40°C to +125°C operating temperature range.

## II. Manufacturing Information

A. Description/Function:	Automotive Micropower Linear Regulators with Supervisor
B. Process:	BCD8
C. Number of Device Transistors:	1246
D. Fabrication Location:	Oregon
E. Assembly Location:	Taiwan, Thailand
F. Date of Initial Production:	January 20, 2007

## III. Packaging Information

A. Package Type:	6-pin TDFN 3x3
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-2474
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:	55°C/W
K. Single Layer Theta Jc:	8.5°C/W
L. Multi Layer Theta Ja:	42°C/W
M. Multi Layer Theta Jc:	8.5°C/W

## IV. Die Information

A. Dimensions:	70X94 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	3.0 microns (as drawn)
F. Minimum Metal Spacing:	3.0 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- |                                   |   |
|-----------------------------------|---|
| A. Quality Assurance Contacts:    | Don Lipps (Manager, Reliability Engineering)<br>Bryan Preeshl (Vice President of QA)            |
| B. Outgoing Inspection Level:     | 0.1% for all electrical parameters guaranteed by the Datasheet.<br>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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 237 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 0.89 \times 10^{-9}$$

$\lambda = 0.89$  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 BCD8 Process results in a FIT Rate of 0.04 @ 25C and 0.69 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (ESD lot N0000A133A, Latch-Up lot N981AQ001B D/C 0630)

The MT06-1 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.

**Table 1**  
Reliability Evaluation Test Results

**MAX6766TTLD2+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C	DC Parameters	80	0	J984DQ001A, D/C 1121
	Biased	& functionality	78	0	J982DA018A, D/C 1146
	Time = 1000 hrs.		79	0	J982DA017A, D/C 1145

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