

RELIABILITY REPORT  
FOR  
MAX15035ETL+  
PLASTIC ENCAPSULATED DEVICES

March 31, 2009

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX15035ETL+ fails to meet the quality and reliability standards required of all Maxim products.

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### I. Device Description

#### A. General

The MAX15035 pulse-width modulation (PWM) controller provides high efficiency, excellent transient response, and high DC-output accuracy. Combined with the internal low on-resistance MOSFETs, the MAX15035 provides a highly efficient and compact solution for small form factor applications that need a high-power density. Maxim's proprietary Quick-PWM(tm) quick-response, constant on-time PWM control scheme handles wide input/output voltage ratios (low-duty-cycle applications) with ease and provides 100ns instant-on response to load transients while maintaining a relatively constant switching frequency. The output voltage can be dynamically controlled using the dynamic REFIN, which supports input voltages between 0V to 2V. The REFIN adjustability combined with a resistive voltage-divider on the feedback input allows the MAX15035 to be configured for any output voltage between 0V to 0.9VIN. The controller senses the current across the synchronous rectifier to achieve a low-cost and highly efficient valley current-limit protection. External current-limit control is provided to allow higher current-limit settings for applications with heatsinks and air flow, or for lower current applications that need lower current-limit settings to avoid overdesigning the application circuit. The adjustable current limit provides a high degree of flexibility, allowing thermally compensated protection or foldback current-limit protection using a voltage divider partially derived from the output. The MAX15035 includes a voltage-controlled soft-start and soft-shutdown to limit the input surge current, provide a monotonic power-up into a precharged output, and provide a predictable soft-start time. The controller also includes output fault protection-undervoltage and overvoltage protection-as well as thermal-fault protection. The MAX15035 is available in a small 40-pin, 6mm x 6mm, TQFN package.

## II. Manufacturing Information

A. Description/Function:	15A Step-Down Regulator with Internal Switches
B. Process:	Hybrid (S45U)
C. Number of Device Transistors:	
D. Fabrication Location:	California
E. Assembly Location:	Carsem Malaysia
F. Date of Initial Production:	April 26, 2008

## III. Packaging Information

A. Package Type:	40-pin TQFN 6x6
B. Lead Frame:	
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1

## IV. Die Information

A. Dimensions:	41x94 mils (PE04 Die Type)
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- |                                   |   |
|-----------------------------------|---|
| A. Quality Assurance Contacts:    | Ken Wendel (Director, Reliability Engineering)<br>Bryan Preeshl (Managing Director 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 f biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 22.4 \times 10^{-9}$$

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 Reliability Monitor Report found at <http://www.maxim-ic.com/qa/reliability/monitor/>. Current monitor data for the S45U Process results in a FIT Rate of 0.30 @ 25C and 3.68 @ 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 PE29 die type has been found to have all pins able to withstand a HBM transient pulse of +/-500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-100 mA, 1.5x VCCMax Overvoltage per JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX15035ETL+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)	Ta = f Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2) 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