

RELIABILITY REPORT
FOR
MAX1946ETA+T
PLASTIC ENCAPSULATED DEVICES

November 21, 2012

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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| Approved by |
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| Quality Assurance |
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Conclusion

The MAX1946ETA+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 MAX1946 single current-limited switch with auto-reset supplies a guaranteed 500mA load in accordance with USB specifications. The MAX1946 operates from a 2.7V to 5.5V input supply and consumes only 40 μ A of quiescent current when operating and only 3 μ A in shutdown. Selectable active-high/active-low control logic and shutdown control provide additional flexibility. An autoreset feature latches the switch off in the event of a short circuit, saving system power. The switch reactivates upon removal of the shorted condition. The MAX1946 provides several safety features to protect the USB port. Built-in thermal-overload protection turns off the switch when the die temperature exceeds +160°C. Accurate internal current-limiting circuitry protects the input supply against both overload and short-circuit conditions. An open-drain fault signal, (active-low FAULT), notifies the microprocessor (μ P) when a thermal overload, current-limit, undervoltage lockout (UVLO), or short-circuit fault occurs. A 20ms fault-blanking feature enables the circuit to ignore momentary faults, such as those caused when hot-swapping a capacitive load, preventing false alarms to the host system. The fault-blanking feature prevents fault signals from being issued when the device powers up the load. The MAX1946 is available in a space-saving 8-pin (3mm x 3mm) TDFN package and operates over the extended (-40°C to +85°C) temperature range.

II. Manufacturing Information

| | |
|----------------------------------|--|
| A. Description/Function: | Single USB Switch with Autoreset and Fault Blanking in Tiny TDFN |
| B. Process: | B8 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | USA |
| E. Assembly Location: | China, Malaysia, Taiwan and Thailand |
| F. Date of Initial Production: | July 27, 2002 |

III. Packaging Information

| | |
|--|--------------------------|
| A. Package Type: | 8-pin TDFN 3x3 |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive |
| E. Bondwire: | Au (1.3 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-0015 |
| 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: | 54°C/W |
| K. Single Layer Theta Jc: | 8°C/W |
| L. Multi Layer Theta Ja: | 41°C/W |
| M. Multi Layer Theta Jc: | 8°C/W |

IV. Die Information

| | |
|----------------------------|---|
| A. Dimensions: | 44 X 82 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: | Metal1 = 0.8 / Metal 2 = 1.2 microns (as drawn) |
| F. Minimum Metal Spacing: | Metal1/2 = 1.2 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: Richard Aburano (Manager, Reliability Engineering)
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 186 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 5.9 \times 10^{-9}$$

$$\lambda = 5.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 B8 Process results in a FIT Rate of 0.04 @ 25C and 0.60 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot ILV0DQ003A, D/C 0308)

The PM73 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 800V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of 250mA.

Table 1
Reliability Evaluation Test Results

MAX1946ETA+T

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|----------------------------------|-----------------|------------------------|-------------|--------------------|----------------------|
| Static Life Test (Note 1) | Ta = 135°C | DC Parameters | 45 | 0 | ILV0BQ001C, D/C 0224 |
| | Biased | & functionality | 46 | 0 | ILV0DQ003B, D/C 0308 |
| | Time = 192 hrs. | | 48 | 0 | SLV0EQ001A, D/C 0328 |
| | | | 47 | 0 | DLV0FQ001C, D/C 0505 |

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