



RELIABILITY REPORT
FOR
MAX16059ATT16+T
PLASTIC ENCAPSULATED DEVICES

October 15, 2010

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

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| Approved by |
| Don Lipps |
| Quality Assurance |
| Manager, Reliability Engineering |

Conclusion

The MAX16059ATT16+T 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 MAX16056-MAX16059 are ultra-low-current 125nA (typ) microprocessor (μ P) supervisory circuits that monitor a single system supply voltage. These devices assert an active-low reset signal whenever the VCC supply voltage drops below the factory trimmed reset threshold, manual reset is pulled low, or the watchdog timer runs out (MAX16056/MAX16058). The reset output remains asserted for an adjustable reset timeout period after VCC rises above the reset threshold. Factory-trimmed reset threshold voltages are offered from 1.575V to 4.625V in approximately 100mV increments (see Table 1 in the full data sheet). These devices feature adjustable reset and watchdog timeout using external capacitors. The MAX16056/MAX16058 contain a watchdog timer with a watchdog select input (WDS) that multiplies the watchdog timeout period by 128. The MAX16057/MAX16059 do not have the watchdog feature. The MAX16056-MAX16059 are available in either push-pull or open-drain output-type configurations (see the *Ordering Information* in the full data sheet). These devices are fully specified over the -40°C to $+125^{\circ}\text{C}$ automotive temperature range. The MAX16056/MAX16058 are available in the 8-pin TDFN package, and the MAX16057/MAX16059 are available in the 6-pin TDFN package.

II. Manufacturing Information

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|----------------------------------|--|
| A. Description/Function: | 125nA Supervisory Circuits with Capacitor-Adjustable Reset and Watchdog Timeouts |
| B. Process: | C6 |
| C. Number of Device Transistors: | 4406 |
| D. Fabrication Location: | California |
| E. Assembly Location: | Thailand |
| F. Date of Initial Production: | July 16, 2009 |

III. Packaging Information

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|--|--------------------------|
| 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: | #05-9000-3394 |
| 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: | 55 X 63 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: | 0.6 microns (as drawn) |
| F. Minimum Metal Spacing: | 0.6 microns (as drawn) |
| G. Bondpad Dimensions: | 5 mil. Sq. |
| H. Isolation Dielectric: | SiO ₂ |
| I. Die Separation Method: | Wafer Saw |

V. Quality Assurance Information

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|-----------------------------------|---|
| A. Quality Assurance Contacts: | 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:

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

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

$$\lambda = 22.9 \times 10^{-9}$$
$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the C6 Process results in a FIT Rate of 0.43 @ 25C and 7.50 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot S0000Q243B, D/C 0903)

The MT14-1 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 and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX16059ATT16+T

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|----------------------------------|---|----------------------------------|-------------|--------------------|---------------------|
| Static Life Test (Note 1) | Ta = 135°C Biased Time = 192 hrs. | DC Parameters & functionality | 48 | 0 | S0000Q245A, DC 0907 |

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