

RELIABILITY REPORT
FOR
MAX5417LETA+
PLASTIC ENCAPSULATED DEVICES

January 29, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

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| Approved by |
| Ken Wendel |
| Quality Assurance |
| Director, Reliability Engineering |

Conclusion

The MAX5417LETA+ 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 MAX5417/MAX5418/MAX5419 nonvolatile, linear taper, digital potentiometers perform the function of a mechanical potentiometer, but replace the mechanics with a simple 2-wire digital interface, allowing communication with multiple devices. Each device performs the same function as a discrete potentiometer or variable resistor and has 256 tap points. The devices feature an internal, nonvolatile EEPROM used to store the wiper position for initialization during power-up. The fast-mode I²C-compatible serial interface allows communication at data rates up to 400kbps, minimizing board space and reducing interconnection complexity in many applications. Each device is available with one of four factory-preset addresses (see the Selector Guide) and features an address input for a total of eight unique address combinations. The MAX5417/MAX5418/MAX5419 provide three nominal resistance values: 50k (MAX5417), 100k (MAX5418), or 200k (MAX5419). The nominal resistor temperature coefficient is 35ppm/°C end-to-end, and only 5ppm/°C ratiometric. This makes the devices ideal for applications requiring a low-temperature-coefficient variable resistor, such as low-drift, programmable gain amplifier circuit configurations. The MAX5417/MAX5418/MAX5419 are available in a 3mm x 3mm 8-pin TDFN package, and are specified over the extended -40°C to +85°C temperature range.

II. Manufacturing Information

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|----------------------------------|--------------------------------------------------------------------------|
| A. Description/Function: | 256-Tap, Nonvolatile, I ² C-Interface, Digital Potentiometers |
| B. Process: | E35X, 0.35 μ m 3 Poly 3 Metal CMOS |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | Dallas TX |
| E. Assembly Location: | ISPL Philippines, UTL Thailand, Unisem Malaysia |
| F. Date of Initial Production: | January 24, 2004 |

III. Packaging Information

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|--------------------------------------------------------------------------|--------------------------|
| A. Package Type: | 8-pin TDFN 3x3 |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive Epoxy |
| E. Bondwire: | Gold (1 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-0848 |
| 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: | 8.3°C/W |
| L. Multi Layer Theta Ja: | 41°C/W |
| M. Multi Layer Theta Jc: | 8.3°C/W |

IV. Die Information

| | |
|----------------------------|-------------------------------|
| A. Dimensions: | 61 X 45 mils |
| B. Passivation: | TEOS Ox-Nit 2-Mask Laser/Pass |
| C. Interconnect: | Al/Cu |
| D. Backside Metallization: | None |
| E. Minimum Metal Width: | 0.4 μ m |
| F. Minimum Metal Spacing: | 0.35 μ m |
| G. Bondpad Dimensions: | 5 mil. Sq. |
| H. Isolation Dielectric: | Silicon Dioxide |
| I. Die Separation Method: | Saw |

V. Quality Assurance Information

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|-----------------------------------|-------------------------------------------------------------------------------------------------|
| A. Quality Assurance Contacts: | Ken Wendel (Director, Reliability Engineering) Bryan Preeshl (Managing Director 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)

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

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

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the E35X Process results in a FIT Rate of 0.28 @ 25C and 17.30 @ 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 DP16 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX5417LETA+

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES |
|-----------------------------------------------------------|----------------------------------------------------|----------------------------------|-------------|--------------------|
| Static Life Test (Note 1) | Ta = 135°C Biased Time = 192 hrs. | DC Parameters & functionality | 48 | 0 |
| Moisture Testing (Note 2) 85/85 | Ta = 85°C RH = 85% Biased Time = 1000hrs. | DC Parameters & functionality | 77 | 0 |
| Mechanical Stress (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