

RELIABILITY REPORT  
FOR  
MAX5395LATA+T / MAX5395MATA+T  
PLASTIC ENCAPSULATED DEVICES

September 30, 2013

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

| Approved by                      |
|----------------------------------|
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| Quality Assurance                |
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## Conclusion

The MAX5395LATA+T / MAX5395MATA+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 MAX5395 single, 256-tap volatile, low-voltage linear taper digital potentiometer offers three end-to-end resistance values of 10k , 50k , and 100k . Potentiometer terminals are independent of supply for voltages up to 5.25V with single-supply operation from 1.7V to 5.5V (charge pump enabled). User-controlled shutdown modes allow the H, W, or L terminal to be opened with the wiper position set to zero-code, midcode, full-code, or the value contained in the wiper register. Ultra-low-quiescent supply current ( $< 1\text{ }\mu\text{A}$ ) can be achieved for supply voltages between 2.6V and 5.5V by disabling the internal charge pump and not allowing potentiometer terminals to exceed the supply voltage by more than 0.3V. The MAX5395 provides a low 50ppm/°C end-to-end temperature coefficient and features an I<sup>2</sup>C serial interface. The small package size, low operating supply voltage, low supply current, and automotive temperature range of the MAX5395 make the device uniquely suited for the portable consumer market, battery-backup industrial applications, and automotive market. The MAX5395 is available in a lead-free, 8-pin TDFN (2mm x 2mm) package. The device operates over the -40°C to +125°C automotive temperature range.

## II. Manufacturing Information

|                                  |  |
|----------------------------------|--|
| A. Description/Function:         | Single, 256-Tap Volatile, I <sup>2</sup> C, Low-Voltage Linear Taper Digital Potentiometer |
| B. Process:                      | S18  |
| C. Number of Device Transistors: | 14559  |
| D. Fabrication Location:         | USA  |
| E. Assembly Location:            | China, Taiwan and Thailand   |
| F. Date of Initial Production:   | July 31, 2012  |

## III. Packaging Information

|  |                          |
|--|--------------------------|
| A. Package Type:   | 8-pin TDFN 2x2           |
| 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:   | #05-9000-4734            |
| 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:  | 110°C/W                  |
| K. Single Layer Theta Jc:  | 8°C/W                    |
| L. Multi Layer Theta Ja:   | 83.9°C/W                 |
| M. Multi Layer Theta Jc:   | 8°C/W                    |

## IV. Die Information

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 63.7795X34.6457 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:    | 0.23 microns (as drawn)   |
| F. Minimum Metal Spacing:  | 0.23 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:    | Richard Aburano (Manager, Reliability Engineering)<br>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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.7 \times 10^{-9}$$

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S18 Process results in a FIT Rate of 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot SAFW7Q001C, D/C 1218)

The DP36-0 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  
**MAX5395LATA+T / MAX5395MATA+T**

| TEST ITEM                        | TEST CONDITION                          | FAILURE IDENTIFICATION           | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS             |
|----------------------------------|---|----------------------------------|-------------|--------------------|----------------------|
| <b>Static Life Test</b> (Note 1) | Ta = 135°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | 80          | 0                  | SAFW7Q001C, D/C 1218 |

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