

RELIABILITY REPORT  
FOR  
MAX2039ETP+  
PLASTIC ENCAPSULATED DEVICES

September 3, 2009

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

|                                   |
|-----------------------------------|
| <b>Approved by</b>                |
| Ken Wendel                        |
| Quality Assurance                 |
| Director, Reliability Engineering |

## Conclusion

The MAX2039ETP+ 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 MAX2039 high-linearity passive upconverter or downconverter mixer is designed to provide 7.3dB NF and a 7.1dB conversion loss for an RF frequency range of 1700MHz to 2200MHz to support UMTS/WCDMA, DCS, and PCS base-station transmitter or receiver applications. The IIP3 is typically +34.5dBm and +33.5dBm for downconversion and upconversion operation, respectively. With an LO frequency range of 1500MHz to 2000MHz, this particular mixer is ideal for low-side LO injection architectures. (For a pin-to-pin-compatible mixer meant for high-side LO injection, contact the factory.) In addition to offering excellent linearity and noise performance, the MAX2039 also yields a high level of component integration. This device includes a double-balanced passive mixer core, a dual-input LO selectable switch, and an LO buffer. On-chip baluns are also integrated to allow for a single-ended RF input for downconversion (or RF output for upconversion), and single-ended LO inputs. The MAX2039 requires a nominal LO drive of 0dBm, and supply current is guaranteed to be below 135mA. The MAX2039 is pin compatible with the MAX2031 815MHz to 995MHz mixer, making this family of passive upconverters and downconverters ideal for applications where a common PC board layout is used for both frequency bands. The MAX2039 is available in a compact 20-pin thin QFN package (5mm x 5mm) with an exposed paddle. Electrical performance is guaranteed over the extended -40°C to +85°C temperature range.

**II. Manufacturing Information**

|                                  |  |
|----------------------------------|--|
| A. Description/Function:         | High-Linearity, 1700MHz to 2200MHz Upconversion/Downconversion Mixer with LO Buffer/Switch |
| B. Process:                      | G4   |
| C. Number of Device Transistors: |  |
| D. Fabrication Location:         | Oregon   |
| E. Assembly Location:            | China, Thailand  |
| F. Date of Initial Production:   | October 22, 2004   |

**III. Packaging Information**

|  |                          |
|--|--------------------------|
| A. Package Type:   | 20-pin TQFN 5x5          |
| 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:   | #05-9000-1285            |
| 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:  | 48°C/W                   |
| K. Single Layer Theta Jc:  | 2.1°C/W                  |
| L. Multi Layer Theta Ja:   | 32°C/W                   |
| M. Multi Layer Theta Jc:   | 2.7°C/W                  |

**IV. Die Information**

|                            |  |
|----------------------------|--|
| A. Dimensions:             | 94 X 94 mils   |
| B. Passivation:            | Si <sub>3</sub> N <sub>4</sub>   |
| C. Interconnect:           | Au   |
| D. Backside Metallization: | None   |
| E. Minimum Metal Width:    | 1.2 microns (as drawn) Metal 1, 2 & 3<br>5.6 microns (as drawn) Metal 4  |
| F. Minimum Metal Spacing:  | 1.6 microns (as drawn) Metal 1, 2 & 3,<br>4.2 microns (as drawn) Metal 4 |
| 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)  
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 150°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

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

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

$$\lambda = 9.98 \times 10^{-9}$$

$\lambda = 9.98 \text{ F.I.T. (60\% confidence level @ 25°C)}$

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 G4 Process results in a FIT Rate of 0.02 @ 25C and 0.37 @ 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 CR21-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-800 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

**MAX2039ETP+**

| TEST ITEM                         | TEST CONDITION                                    | FAILURE IDENTIFICATION        | SAMPLE SIZE | NUMBER OF FAILURES |
|-----------------------------------|---|-------------------------------|-------------|--------------------|
| <b>Static Life Test</b> (Note 1)  |   |                               |             |                    |
|                                   | Ta = 150°C<br>Biased<br>Time = 192 hrs.           | DC Parameters & functionality | 48          | 0                  |
| <b>Moisture Testing</b> (Note 2)  |   |                               |             |                    |
| HAST                              | Ta = 130°C<br>RH = 85%<br>Biased<br>Time = 96hrs. | DC Parameters & functionality | 77          | 0                  |
| <b>Mechanical Stress</b> (Note 2) |   |                               |             |                    |
| Temperature<br>Cycle              | -65°C/150°C<br>1000 Cycles<br>Method 1010         | DC Parameters & functionality | 77          | 0                  |

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

Note 2: Generic Package/Process data