

RELIABILITY REPORT  
FOR  
MAX2135AETN+  
PLASTIC ENCAPSULATED DEVICES

March 04, 2011

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

|                                  |
|----------------------------------|
| <b>Approved by</b>               |
| Don Lipps                        |
| Quality Assurance                |
| Manager, Reliability Engineering |

## Conclusion

The MAX2135AETN+ 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 MAX2135A low-power, 6MHz ISDB-T and 6MHz/7MHz/8MHz DVB-T low-IF diversity tuner directly converts broadcast ISDB-T and DVB-T signals to a low-IF using a broadband I/Q downconverter. The operating frequency range covers the VHF and UHF broadcast TV bands from 90MHz to 862MHz. The MAX2135A integrates LNAs, RF variable-gain amplifiers (VGAs), VHF and UHF tracking filters, I/Q downconverting mixers, baseband VGAs, and low-IF filters. The device also includes a fully monolithic VCO and tank circuit as well as a complete frequency synthesizer including an on-chip crystal oscillator and output buffer/divider. The device incorporates a 2-wire (I<sup>2</sup>C) serial control interface with multiple read and write addresses. A low-power standby mode is available whereupon the signal path is shut down while leaving the serial control interface and register circuits active. Additionally, the entire device can be shut down by an external pin. The MAX2135A is available in a 56-pin thin QFN package (7mm x 7mm) with an exposed paddle. Electrical performance is guaranteed over the extended -40°C to +85°C temperature range.

## II. Manufacturing Information

|                                  |                              |
|----------------------------------|------------------------------|
| A. Description/Function:         | ISDB-T/DVB-T Diversity Tuner |
| B. Process:                      | MB3                          |
| C. Number of Device Transistors: | 68633                        |
| D. Fabrication Location:         | California                   |
| E. Assembly Location:            | Thailand                     |
| F. Date of Initial Production:   | January 10, 2010             |

## III. Packaging Information

|  |                          |
|--|--------------------------|
| A. Package Type:   | 56-pin TQFN 7x7          |
| 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:   | #05-9000-3373            |
| 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:  | 36°C/W                   |
| K. Single Layer Theta Jc:  | 1°C/W                    |
| L. Multi Layer Theta Ja:   | 25°C/W                   |
| M. Multi Layer Theta Jc:   | 1°C/W                    |

## IV. Die Information

|                            |                           |
|----------------------------|---------------------------|
| A. Dimensions:             | 146.85 X 144.49 mils      |
| B. Passivation:            | BCB                       |
| C. Interconnect:           | Al with top layer 100% Cu |
| D. Backside Metallization: | None                      |
| E. Minimum Metal Width:    | 0.35µm F.                 |
| Minimum Metal Spacing:     | 0.35µm                    |
| 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 96 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 11.5 \times 10^{-9}$$

$\lambda = 11.5$  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 MB3 Process results in a FIT Rate of 0.08 @ 25C and 1.33 @ 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 WG53-1 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.

**Table 1**  
Reliability Evaluation Test Results

**MAX2135AETN+**

| TEST ITEM                         | TEST CONDITION                                    | FAILURE IDENTIFICATION        | SAMPLE SIZE | NUMBER OF FAILURES |
|-----------------------------------|---|-------------------------------|-------------|--------------------|
| <b>Static Life Test</b> (Note 1)  |   |                               |             |                    |
|                                   | Ta = 135°C<br>Biased<br>Time = 192 hrs.           | DC Parameters & functionality | 96          | 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