

RELIABILITY REPORT
FOR
MAX2991ECM+
PLASTIC ENCAPSULATED DEVICES

November 23, 2010

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX2991ECM+ 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 MAX2991 power-line communication analog front-end (AFE) is a state-of-the-art integrated circuit that delivers high integration and superb performance, while reducing the total system cost. The MAX2991 is the first AFE specifically designed for OFDM (orthogonal frequency division multiplexing) modulated signal transmission over power lines. Operating in the 10kHz to 490kHz band, the programmable filters allow compliance with CENELEC, FCC, and ARIB standards using the same device. The MAX2991 transceiver provides two main paths: transmit (Tx) path and receive (Rx) path. The transmit path injects an OFDM modulated signal into the AC or DC line. The transmit path is composed of a digital IIR filter, digital-to-analog converter (DAC), followed by a lowpass filter, and a preline driver. The receiver path is for the signal enhancement, filtering, and digitization of the received signal. The receiver is composed of a lowpass and a highpass filter, a two-stage automatic gain control (AGC), and an analog-to-digital converter (ADC). The integrated AGC maximizes the dynamic range of the signal up to 60dB, while the lowpass filter removes any out-of-band noise, and selects the desired frequency band. The ADC converts the enhanced and amplified input signal to a digital format. An integrated offset cancellation loop minimizes the DC offset. The MAX2991, along with the MAX2990 PLC baseband modem, delivers the most cost-effective data communication solution over power-line networks in the market. The MAX2991 is specified over the -40°C to +85°C temperature range and is available in a 48-pin LQFP package.

II. Manufacturing Information

A. Description/Function:	Power-Line Communications (PLC) Integrated Analog Front-End Transceiver
B. Process:	TS18
C. Number of Device Transistors:	228412
D. Fabrication Location:	Taiwan
E. Assembly Location:	Korea
F. Date of Initial Production:	January 19, 2010

III. Packaging Information

A. Package Type:	48-pin LQFP
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:	#05-9000-3741
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:	N/A
K. Single Layer Theta Jc:	N/A
L. Multi Layer Theta Ja:	46°C/W
M. Multi Layer Theta Jc:	10°C/W

IV. Die Information

A. Dimensions:	152.55X147.34 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:	0.18μm F.
Minimum Metal Spacing:	0.18μm
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

- 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 TS18 Process results in a FIT Rate of 0.24 @ 25C and 4.14 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot QWUZCQ001C, DC 0944)

The WV19 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 +/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX2991ECM+

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	QWUZCQ001C, DC 0944

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