



RELIABILITY REPORT
FOR
MAX2037CCQ+
PLASTIC ENCAPSULATED DEVICES

January 7, 2009

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX2037CCQ+ 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 MAX2037 8-channel variable-gain amplifier (VGA) is designed for high linearity, high dynamic range, and low-noise performance targeting ultrasound imaging and Doppler applications. Each amplifier features differential inputs and outputs and a total gain range of typically 42dB. In addition, the VGAs offer very low output-referred noise performance suitable for interfacing with 12-bit ADCs. The MAX2037 VGA is optimized for less than $\pm 0.25\text{dB}$ absolute gain error to ensure minimal channel-to-channel ultrasound beamforming focus error. The device's differential outputs are designed to directly drive ultrasound ADCs through an external passive anti-aliasing filter. A switchable clamp is also provided at each amplifier's outputs to limit the output signals, thereby preventing ADC overdrive or saturation. Dynamic performance of the device is optimized to reduce distortion to support second-harmonic imaging. The device achieves a second-harmonic distortion specification of -70dBc at $V_{\text{OUT}} = 1.5\text{VP-P}$ and $f_{\text{IN}} = 5\text{MHz}$, and an ultrasound-specific* two-tone third-order intermodulation distortion specification of -52dBc at $V_{\text{OUT}} = 1.5\text{VP-P}$ and $f_{\text{IN}} = 5\text{MHz}$. The MAX2037 operates from a $+5.0\text{V}$ power supply, consuming only 120mW/channel . The device is available in a 100-pin TQFP package with an exposed paddle. Electrical performance is guaranteed over a 0°C to $+70^\circ\text{C}$ temperature range.

MAX2034MAX2035MAX2037EEPW AnalogMixed-Signal IC Technical Innovation Award Winner 2006

II. Manufacturing Information

A. Description/Function:	Ultrasound Variable-Gain Amplifier
B. Process:	CB4
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	ATK Korea
F. Date of Initial Production:	July 22, 2006

III. Packaging Information

A. Package Type:	100-pin TQFP
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:	#05-9000-2417
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 3
J. Multi Layer Theta Ja:	22°C/W
K. Multi Layer Theta Jc:	2°C/W

IV. Die Information

A. Dimensions:	241 X 236 mils
B. Passivation:	Si ₃ N ₄ (Silicon nitride)
C. Interconnect:	Gold
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
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:	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 (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)

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

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

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 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 CB4 Process results in a FIT Rate of 0.14 @ 25C and 2.42 @ 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 CR26 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX2037CCQ+

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

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

Note 2: Generic Package/Process data