RELIABILITY REPORT

FOR

MAX2038CCQ+

PLASTIC ENCAPSULATED DEVICES

April 3, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
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Conclusion

The MAX2038CCQ+ 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 MAX2038 8-channel variable-gain amplifier (VGA) and programmable octal mixer array 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 42dB (typ). In addition, the VGAs offer very low output-referred noise performance suitable for interfacing with 12-bit ADCs. The MAX2038 VGA is optimized for less than Â±0.25dB absolute gain error to ensure minimal channel-to-channel ultrasound beamforming focus error. The deviceâ€™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 amplifierâ€™s output 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 VOUT = 1.5VP-P and fIN = 5MHz and an ultrasound-specific*, two-tone, third-order intermodulation distortion specification of -52dBc at VOUT = 1.5V P-P and fIN = 5MHz. The MAX2038 also integrates an octal quadrature mixer array and programmable LO phase generators for a complete CW beamforming solution. The LO phase selection for each channel can be programmed using a digital serial interface and a single high-frequency clock or the LOs for each complex mixer pair can be directly driven using separate 4 x LO clocks. The serial interface is designed to allow multiple devices to be easily daisy chained to minimize program interface wiring. The LO phase dividers can be programmed to allow 4, 8, or 16 quadrature phases. The input path of each CW mixer consists of a selectable lowpass filter for optimal CWD noise performance. The outputs of the mixers are summed into I and Q differential current outputs. The mixers and LO generators are designed to have exceptionally low noise performance of -155dBc/Hz at 1kHz offset from a 1.25MHz carrier. The MAX2038 operates from a +5.0V power supply, consuming only 120mW/channel in VGA mode and 269mW/channel in normal power CW mode. A low-power CW mode is also available and consumes only 226mW/channel. The device is available in a lead-free 100-pin TQFP package (14mm x 14mm x 1mm) with an exposed pad. Electrical performance is guaranteed over a 0°C to +70°C temperature range.

II. Manufacturing Information

A. Description/Function:	Ultrasound VGA Integrated with CW Octal Mixer
B. Process:	CB4
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	ATK Korea
F. Date of Initial Production:	Feb 23, 2007

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:	#05-9000-2116
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_3N_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:

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

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

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

$\lambda = 9.98$ 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 +/-2000 V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100 mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX2038CCQ+

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

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data