

RELIABILITY REPORT
FOR
MAX1058BETM+
PLASTIC ENCAPSULATED DEVICES

September 12, 2011

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
Sokhom Chum
Quality Assurance
Reliability Engineer

Conclusion

The MAX1058BETM+ 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 MAX1020/MAX1022/MAX1057/MAX1058 integrate a multichannel, 10-bit, analog-to-digital converter (ADC) and an octal, 10-bit, digital-to-analog converter (DAC) in a single IC. These devices also include a temperature sensor and configurable general-purpose I/O ports (GPIOs) with a 25MHz SPI(tm)/QSPI(tm)/MICROWIRE(tm)-compatible serial interface. The ADC is available in 8/12/16 inputchannel versions. The octal DAC outputs settle within 2.0µs, and the ADC has a 225ksps conversion rate. All devices include an internal reference (2.5V or 4.096V) providing a well-regulated, low-noise reference for both the ADC and DAC. Programmable reference modes for the ADC and the DAC allow the use of an internal reference, an external reference, or a combination of both. Features such as an internal ±1°C accurate temperature sensor, FIFO, scan modes, programmable internal or external clock modes, data averaging, and AutoShutdown(tm) allow users to minimize both power consumption and processor requirements. The low glitch energy (4nV•s) and low digital feedthrough (0.5nV•s) of the integrated octal DACs make these devices ideal for digital control of fast-response closed-loop systems. The devices are guaranteed to operate with a supply voltage from +2.7V to +3.6V (MAX1057) and from +4.75V to +5.25V (MAX1020/MAX1022/MAX1058). The devices consume 2.5mA at 225ksps throughput, only 22µA at 1ksps throughput, and under 0.2µA in the shutdown mode. The MAX1057/MAX1058 feature 12 GPIOs, while the MAX1020 offers four GPIOs that can be configured as inputs or outputs. The MAX1057/MAX1058 are available in 48-pin thin QFN packages. The MAX1020/MAX1022 are available in 36-pin thin QFN packages. All devices are specified over the -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	10-Bit, Multichannel ADCs/DACs with FIFO, Temperature Sensing, and GPIO Ports
B. Process:	C6Y
C. Number of Device Transistors:	58131
D. Fabrication Location:	Japan
E. Assembly Location:	Taiwan
F. Date of Initial Production:	April 24, 2004

III. Packaging Information

A. Package Type:	TQFN 7x7 48L
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:	#05-9000-0626 / B
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	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:	164 X 166 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	0.6 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:Wafer	Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)
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 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)

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 C6Y Process results in a FIT Rate of 0.90 @ 25C and 15.55 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot IEQ0BQ003B D/C 0410)

The CO01 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX1058BETM+

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	IEQ0FQ003A, D/C 0523

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