



RELIABILITY REPORT  
FOR MAX7060ATG+  
PLASTIC ENCAPSULATED DEVICES

June 14, 2010

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX7060ATG/V+ 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 MAX7060 frequency and power-programmable ASK/FSK transmitter operates at 280MHz to 450MHz frequencies. This device incorporates a fully integrated fractional-N synthesizer, which allows the user to set the RF operating frequency to a large fraction of the 280MHz to 450MHz frequency range with a single crystal. For example, the MAX7060 can be tuned from 285MHz to 420MHz with a 15MHz crystal. The RF output power is user-controlled between +14dBm and -14dBm, with a 5V supply or with battery voltages as low as 3.2V. At the minimum specified battery voltage of 2.1V, the RF output power-control range is between +10dBm and -14dBm. To maintain a good output power match across a broad range of frequencies, the MAX7060 also contains a programmable matching capacitor connected in parallel with the power amplifier (PA) output. ASK modulation is accomplished by switching the PA on and off, so excellent modulation (on/off) ratios are achieved. ASK amplitude shaping is available to reduce the width of the transmission spectrum. FSK modulation is accomplished by changing the coefficients of the high-resolution fractional-N synthesizer, so FSK deviation is extremely accurate. Data rates up to 50kbps Manchester coded for ASK and 70kbps Manchester coded for FSK can be maintained while still satisfying regulatory emission-bandwidth standards. The full set of configuration functions are handled by an on-chip serial peripheral interface (SPI(tm)). There is also a manual mode where a limited number of settings can be made directly through selected pins. The startup time is very short, and data can be transmitted 250µs after the enable command. The MAX7060 operates from a 2.1V to 3.6V supply, or internal regulators can be used for supply voltages between 4.5V and 5.5V. The standby current in the 3V mode is 400nA at room temperature, and can be reduced to 5nA using the low-power shutdown (LSHDN) pin. The MAX7060 is available in a 24-pin (4mm x 4mm) thin QFN package and is specified for the automotive temperature range from -40°C to +125°C.

**II. Manufacturing Information**

A. Description/Function:	280MHz to 450MHz Programmable ASK/FSK Transmitter
B. Process:	TS35
C. Number of Device Transistors:	18477
D. Fabrication Location:	Taiwan
E. Assembly Location:	China and Thailand
F. Date of Initial Production:	January 21, 2010

**III. Packaging Information**

A. Package Type:	24-pin TQFN 4x4
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:	#05-9000-3786
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:	48°C/W
K. Single Layer Theta Jc:	2.7°C/W
L. Multi Layer Theta Ja:	36°C/W
M. Multi Layer Theta Jc:	2.7°C/W

**IV. Die Information**

A. Dimensions:	80 X 70 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
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:	Richard Aburano (Manager, Reliability Operations) 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:

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

(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 TS35 Process results in a FIT Rate of 0.11 @ 25C and 1.93 @ 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 LF51 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 1500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/- 250mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX7060ATG/V+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (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