

RELIABILITY REPORT
FOR
MAX5073ATI+T / MAX5073ETI+T
PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

160 RIO ROBLES
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Conclusion

The MAX5073ETI+T successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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I. Device Description

A. General

The MAX5073 is a dual-output DC-DC converter with integrated high-side n-channel power MOSFETs. Each output can be configured either as a buck converter or a boost converter. The device is capable of operating from a wide 5.5V to 23V input voltage range. Each output is programmable down to 0.8V in the buck mode and up to 28V in the boost mode with an output voltage accuracy of $\pm 1\%$. In the buck mode, converter 1 and converter 2 can deliver 2A and 1A, respectively. The output switching frequency of each converter can be programmed from 200kHz to 2.2MHz to avoid harmonics in a radio power supply or to reduce the size of the power supply. Each output operates 180° out-of-phase thus reducing input-capacitor ripple current, size, and cost. A SYNC input facilitates external frequency synchronization. Moreover, a CLKOUT output provides out-of-phase clock signal with respect to converter 2, allowing four-phase operation using two MAX5073 ICs in master-slave configuration. The MAX5073 includes an internal digital soft-start that reduces inrush current, eliminates output-voltage overshoot, and ensures monotonic rise in output voltage during power-up. The device includes individual shutdown and a power-good output for each converter. Protection features include output short-circuit protection for buck mode and maximum duty-cycle limit for boost operation, as well as thermal shutdown. The MAX5073 is available in a thermally enhanced 28-pin thin QFN package that can dissipate 2.7W at +70°C ambient temperature. The device is rated for operation over the -40°C to +85°C extended, or -40°C to +125°C automotive operating temperature range.

II. Manufacturing Information

A. Description/Function:	2.2MHz, Dual-Output Buck or Boost Converter with Internal Power MOSFETs
B. Process:	B8
C. Number of Device Transistors:	
D. Fabrication Location:	USA
E. Assembly Location:	China, Malaysia, Taiwan and Thailand
F. Date of Initial Production:	October 23, 2004

III. Packaging Information

A. Package Type:	28-pin TQFN 5x5
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:	#05-9000-1145
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:	47°C/W
K. Single Layer Theta Jc:	2°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2°C/W

IV. Die Information

A. Dimensions:	128 X 121 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:	0.8 microns (as drawn)
F. Minimum Metal Spacing:	1.2 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 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 Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the B8 Process results in a FIT Rate of 0.05 @ 25C and 0.90 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The NP68-1 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM:	+/- 200V per Mil-Std 883 Method 3015.7 (lot SRJ1CQ001C, D/C 0442)
ESD-CDM:	+/- 250V per JEDEC JESD22-C101 (lot JRJ1EA016E, D/C 1230)
ESD-MM:	+/- 50V per JEDEC JESD22-A115 (lot JRJ1EA016E, D/C 1230)

Latch-Up testing has shown that this device withstands a current of +/- 100mA and overvoltage per JEDEC JESD78 (lot JRJ1EA016E, D/C 1230).

Table 1
Reliability Evaluation Test Results

MAX5073ETI+T

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	SRJ1CA005A, D/C 0604

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