

RELIABILITY REPORT
FOR
MAX15022ATI+
PLASTIC ENCAPSULATED DEVICES

June 11, 2009

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX15022AT1+ 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 MAX15022 is a dual-output, pulse-width-modulated (PWM), step-down DC-DC regulator with dual LDO controllers. The device operates from 2.5V to 5.5V and each output can be adjusted from 0.6V to the input supply (VAVIN). The MAX15022 delivers up to 4A (regulator 1) and 2A (regulator 2) of output current with two LDO controllers that can be used to drive two external PNP transistors to provide two additional outputs. This device offers the ability to adjust the switching frequency from 500kHz to 4MHz and provides the capability of optimizing the design in terms of size and performance. The MAX15022 utilizes a voltage-mode control scheme with external compensation to provide good noise immunity and maximum flexibility in selecting inductor values and capacitor types. The dual switching regulators operate 180° out-of-phase, thereby reducing the RMS input ripple current and thus the size of the input bypass capacitor significantly. The MAX15022 offers the ability to track (coincident or ratiometric) or sequence during power-up and power-down operation. When sequencing, it powers up glitch-free into a prebiased output. Additional features include an internal undervoltage lockout with hysteresis and a digital soft-start/soft-stop for glitch-free power-up and power-down. Protection features include lossless cycle-by-cycle current limit, hiccup-mode output short-circuit protection, and thermal shutdown. The MAX15022 is available in a space-saving, 5mm x 5mm, 28-pin TQFN-EP package and is specified for operation from -40°C to +125°C temperature range.

II. Manufacturing Information

A. Description/Function:	Dual, 4A/2A, 4MHz, Step-Down DC-DC Regulator with Dual LDO Controllers
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	ASAT China, UTL Thailand
F. Date of Initial Production:	April 26, 2008

III. Packaging Information

A. Package Type:	28-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (2.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
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:	2.1°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2.1°C/W

IV. Die Information

A. Dimensions:	90 X 128 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5% Cu
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 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)

$$\lambda = 22.4 \times 10^{-9}$$

$\lambda = 22.4$ 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 S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 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 NQ04-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500 V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250 mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX15022ATI+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)	Ta = 135°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