

RELIABILITY REPORT
FOR
MAX17020ETJ+
PLASTIC ENCAPSULATED DEVICES

January 5, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
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Approved by
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Quality Assurance
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Conclusion

The MAX17020ETJ+ 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.

Table of Contents

I.Device Description	V.Quality Assurance Information
II.Manufacturing Information	VI.Reliability Evaluation
III.Packaging Information	IV.Die Information
.....Attachments	

I. Device Description

A. General

The MAX17020 is a dual Quick-PWM™ step-down power-supply (SMPS) controller with synchronous rectification, intended for main 5V/3.3V or I/O 1.5V/1.05V power generation in battery-powered systems. Low-side MOSFET sensing provides a simple low-cost, highly efficient current sense for providing valley current-limit protection. Combined with the output overvoltage and undervoltage protection features, this current limit ensures robust output supplies. The 5V/3.3V or 1.5V/1.05V SMPS outputs can save power by operating in pulse-skipping mode or in ultrasonic mode to avoid audible noise. Ultrasonic mode forces the controller to maintain switching frequencies greater than 20kHz at light loads. An internal 100mA linear regulator can be used to either generate the 5V bias needed for power-up or other lower power "always-on" suspend supplies. An independent bypass input allows automatic bypassing of the linear regulator when the SMPS is active. This main controller also includes a secondary feedback input that triggers an ultrasonic pulse (DL1 turned on) if the SECFB voltage drops below its threshold voltage. This refreshes an external charge pump driven by DL1 without overcharging the output voltage. The device includes independent shutdown controls to simplify power-up and power-down sequencing. To prevent current surges at startup, the internal voltage target is slowly ramped up from zero to the final target over a 1ms period. To prevent the output from ringing below ground in shutdown, the internal voltage target is ramped down from its previous value to zero over a 1ms period. Two independent power-good outputs simplify the interface with external controllers. The MAX17020 is a pin-for-pin replacement of the MAX8778.

II. Manufacturing Information

A. Description/Function:	Dual Quick-PWM Step-Down Controller with Low-Power LDO, RTC Regulator
B. Process:	S4
C. Number of Device Transistors:	12197
D. Fabrication Location:	Texas
E. Assembly Location:	ASAT China, Hana Thailand, UTL Thailand
F. Date of Initial Production:	April 26, 2008

III. Packaging Information

A. Package Type:	32-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.0 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:	1.7°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2.7°C/W

IV. Die Information

A. Dimensions:	82 X 85 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
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

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|-----------------------------------|---|
| 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)

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

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 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 0.28 @ 25C and 4.85 @ 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 PE35 die type has been found to have all pins able to withstand a HBM transient pulse of <500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX17020ETJ+

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