

RELIABILITY REPORT
FOR
MAX1586BETM
PLASTIC ENCAPSULATED DEVICES

July 5, 2006

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
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Conclusion

The MAX1586B 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 MAX1586 power-management IC is optimized for devices using Intel X-Scale™ microprocessors, including third-generation smart cell phones, PDAs, internet appliances, and other portable devices requiring substantial computing and multimedia capability at low power.

The IC integrates seven high-performance, low-operating-current power supplies along with supervisory and management functions. Regulator outputs include three step-down DC-DC outputs, three linear regulators, and a seventh always-on output. DC-DC converter outputs power I/O, DRAM, and the CPU core. The I/O supply can be preset to 3.3V or 3.0V, or can be adjusted to other values. The DRAM supply on the MAX1586A and MAX1587A is preset for 1.8V or 2.5V, while the MAX1586B DRAM supply is preset for 3.3V or 2.5V. The DRAM supply on all parts can also be adjusted with external resistors. The CPU core supply is serial programmed for dynamic voltage management. Linear-regulated outputs are provided for SRAM, PLL, and USIM supplies.

To minimize sleep-state quiescent current, critical power supplies have bypass "sleep" LDOs that can be activated to minimize battery drain when output current is very low. Other functions include separate on/off control for all DC-DC converters, low-battery and dead-battery detection, a reset and power-OK output, a backup-battery input, and a two-wire serial interface.

All DC-DC outputs use fast, 1MHz PWM switching and small external components. They operate with fixed-frequency PWM control and automatically switch from PWM to skip-mode operation at light loads to reduce operating current and extend battery life. The core output is capable of operating in forced-PWM mode at all loads to minimize ripple and noise. A 2.6V to 5.5V input voltage range allows 1-cell lithium-ion (Li+), 3-cell NiMH, or a regulated 5V input. The MAX1586 features an additional linear regulator (V6) for VCC_USIM and low-battery and dead-battery comparators. The MAX1586 is available in a 7mm x 7mm, 48-pin thin QFN package.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
IN, IN45, IN6, MR, LBO, DBO, RSO, POK, SCL, SDA, BKBT, V7, SLP, SRAD, PWM3 to GND	-0.3V to +6V
REF, CC_, ON_, FB_, DBI, LBI, V1, V2, RAMP, BYP, MR to GND	-0.3V to (VIN + 0.3V)
PV1, PV2, PV3, SLPIN to IN	-0.3V to +0.3V
V4, V5 to GND	-0.3V to (VIN45 + 0.3V)
V6 to GND	-0.3V to (VIN6 + 0.3V)
PV1 to PG1	-0.3V to +6.0V
PV2 to PG2	-0.3V to +6.0V
PV3 to PG3	-0.3V to +6.0V
LX1 Continuous Current	-1.30A to +1.30A
LX2 Continuous Current	-0.9A to +0.9A
LX3 Continuous Current	-0.9A to +0.9A
PG1, PG2, PG3 to GND	-0.3V to +0.3V
V1, V2, V4, V5, V6 Output Short-Circuit Duration	Continuous
Continuous Power Dissipation (TA = +70°C)	
6mm x 6mm 40-Pin Thin QFN (derate 26.3mW/°C above +70°C)	2105mW
7mm x 7mm 48-Pin Thin QFN (derate 26.3mW/°C above +70°C)	2105mW
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

II. Manufacturing Information

- A. Description/Function: High-Efficiency, Low-IQ PMICs with Dynamic Core for PDAs and Smart Phones
- B. Process: B8 (Standard 0.8 micron silicon gate CMOS)
- C. Number of Device Transistors: 13,958
- D. Fabrication Location: Texas, USA
- E. Assembly Location: Thailand
- F. Date of Initial Production: November, 2003

III. Packaging Information

- A. Package Type: 48 Thin QFN 7mm x 7mm
- B. Lead Frame: Copper
- C. Lead Finish: Solder Plate or 100% Matte Tin
- D. Die Attach: Silver-filled Epoxy
- E. Bondwire: Gold (1.3 mil dia.)
- F. Mold Material: Epoxy with silica filler
- G. Assembly Diagram: # 05-9000-0682
- H. Flammability Rating: Class UL94-V0
- I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C: Level 1

IV. Die Information

- A. Dimensions: 163 x 156 mils
- B. Passivation: $\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
- C. Interconnect: Aluminum/Si (Si = 1%)
- D. Backside Metallization: None
- E. Minimum Metal Width: 0.8 microns (as drawn)
- F. Minimum Metal Spacing: 0.8 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: Jim Pedicord (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 (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 239 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

△ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 4.60 \times 10^{-9}$$

$$\lambda = 4.60 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Attached Burn-In Schematic (Spec. # 06-6211) shows the static Burn-In circuit. Maxim performs failure analysis on any lot that exceeds this reliability control level. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1N**). Current monitor data for the B8/S8 Process results in a FIT rate of 0.17 @ 25°C and 2.92 @ 55°C (eV = 0.8, UCL = 60%).

B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

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

The PN32-2 die type has been found to have all pins able to withstand a transient pulse of $\pm 1000\text{V}$, per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of $\pm 250\text{mA}$.

Table 1
Reliability Evaluation Test Results

MAX1586BETM

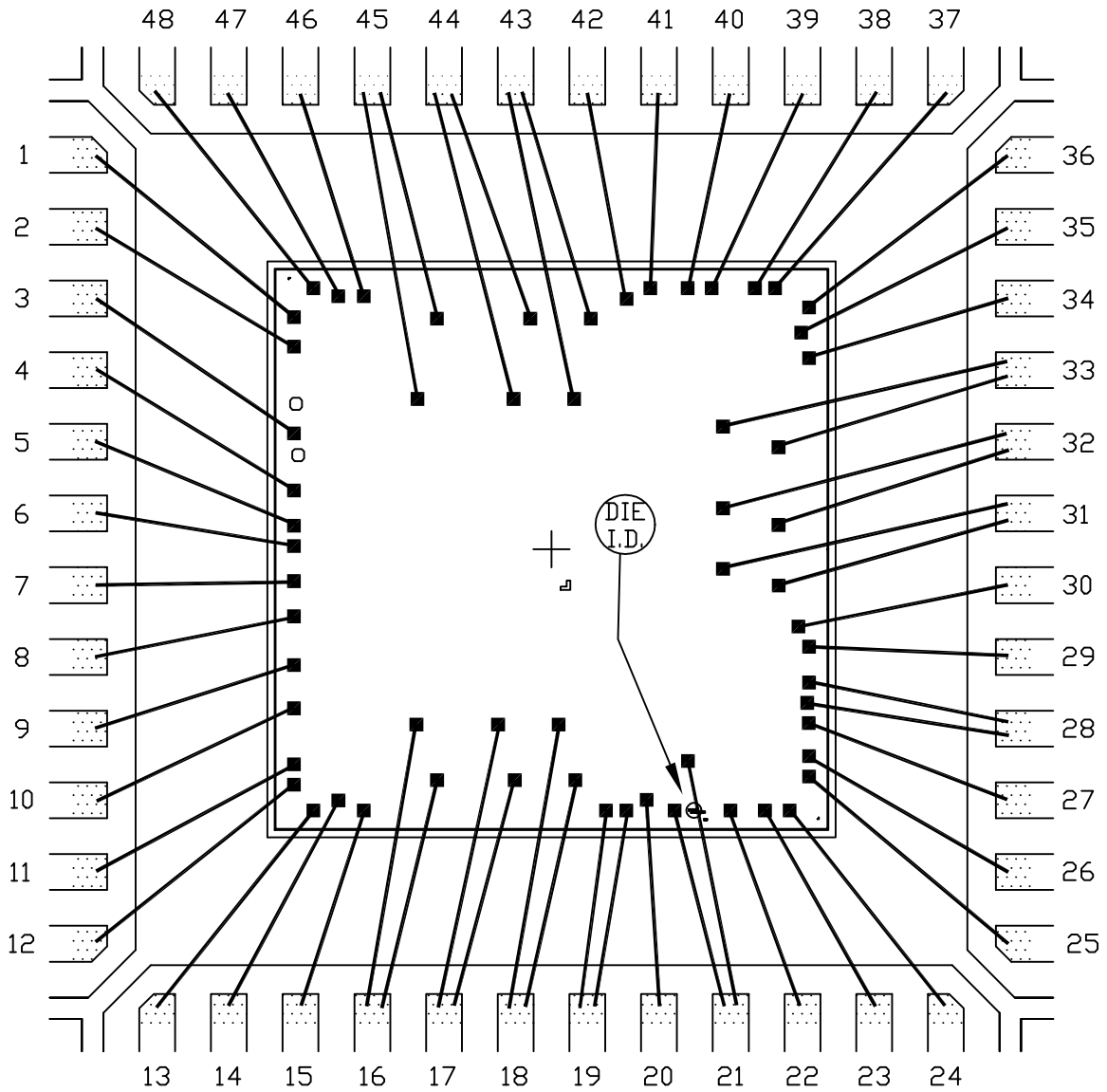
TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		239	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	uMAX SO	77 77	0 0
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

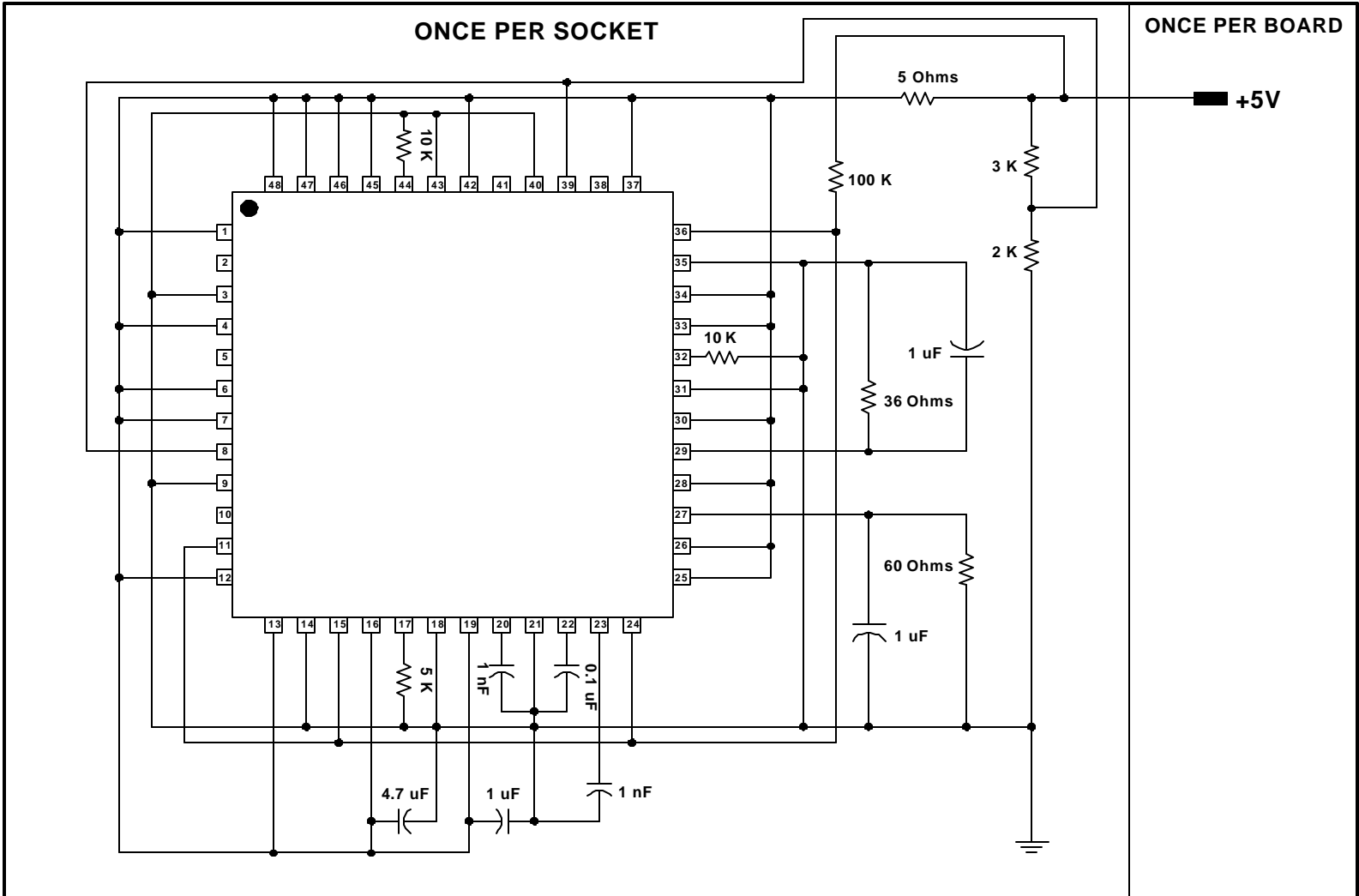
7x7x0.80mm THIN QFN PKG.

EXPOSED PAD PKG.



 BONDABLE AREA

PKG. CODE: T4877-6		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 228x228	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0682	REV: B



DEVICES: MAX1586 (PN32Z)
PACKAGE: 48-QFN 7x7 THIN
MAX. EXPECTED CURRENT = 51mA

NOTES: ALL RESISTORS RATE @ 5%, 1/4W.