

RELIABILITY REPORT
FOR
MAX1904Exx
PLASTIC ENCAPSULATED DEVICES

July 14, 2006

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Written by

Jim Pedicord
Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX1904 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 MAX1904 is a buck-topology, step-down, switch-mode, power-supply controller that generates logic-supply voltages in battery-powered systems. This high-performance, dual/triple-output device includes on-board power-up sequencing, power-good signaling with delay, digital soft-start, secondary winding control, low dropout circuitry, internal frequency-compensation networks, and automatic bootstrapping.

Up to 97% efficiency is achieved through synchronous rectification and Maxim's proprietary Idle Mode™ control scheme. Efficiency is greater than 80% over a 1000:1 load-current range, which extends battery life in system suspend or standby mode. Excellent dynamic response corrects output load transients within five clock cycles. Strong 1A on-board gate drivers ensure fast external N-channel MOSFET switching.

This device features a logic-controlled and synchronizable, fixed-frequency, pulse-width modulation (PWM) operating mode. This reduces noise and RF interference in sensitive mobile communications and pen-entry applications. Asserting the SKIP-bar pin enables fixed-frequency mode, for lowest noise under all load conditions.

The MAX1904 includes two PWM regulators, adjustable from 2.5V to 5.5V with fixed 5.0V and 3.3V modes. All these devices include secondary feedback regulation, and the MAX1902 contains a 12V/120mA linear regulator. The MAX1904 includes a secondary feedback input (SECFB), plus a control pin (STEER) that selects which PWM (3.3V or 5V) receives the secondary feedback signal. SECFB provides a method for adjusting the secondary winding voltage regulation point with an external resistor divider, and is intended to aid in creating auxiliary voltages other than fixed 12V.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
V+ to GND	-0.3V to +36V
PGND to GND	±0.3V
VL to GND	-0.3V to +6V
BST3, BST5 to GND	-0.3V to +36V
CSH3, CSH5 to GND	-0.3V to +6V
FB3 to GND	-0.3V to (CSL3 + 0.3V)
FB5 to GND	-0.3V to (CSL5 + 0.3V)
LX3 to BST3	-6V to +0.3V
LX5 to BST5	-6V to +0.3V
REF, SYNC, SEQ, STEER, SKIP, TIME/ON5, SECFB, RESET to GND	-0.3V to (VL + 0.3V)
VDD to GND	-0.3V to +20V
RUN/ON3, SHDN to GND	-0.3V to (V+ + 0.3V)
12OUT to GND	-0.3V to (VDD + 0.3V)
DL3, DL5 to PGND	-0.3V to (VL + 0.3V)
DH3 to LX3	-0.3V to (BST3 + 0.3V)
DH5 to LX5	-0.3V to (BST5 + 0.3V)
VL, REF Short to GND	Momentary
12OUT Short to GND	Continuous
REF Current	+5mA to -1mA
VL Current	+50mA
12OUT Current	+200mA
VDD Shunt Current	+15mA
Continuous Power Dissipation (TA = +70°C)	
28-Pin SSOP (derate 9.52mW/°C above +70°C)	762mW
32-Pin Thin QFN (derate 21.3mW/°C above +70°C)	1702mW
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +160°C
Lead Temperature (soldering, 10s)	+300°C

II. Manufacturing Information

- A. Description/Function: 500kHz Multi-Output, Low-Noise Power-Supply Controllers for Notebook Computers
- B. Process: B12 (Standard 1.2 micron silicon gate CMOS)
- C. Number of Device Transistors: 4886
- D. Fabrication Location: Texas or California, USA
- E. Assembly Location: USA, Taiwan, Malaysia, Philippines or Thailand
- F. Date of Initial Production: October, 2002

III. Packaging Information

- | | | |
|---|--------------------------------|--------------------------------|
| A. Package Type: | 28-pin SSOP | 32-pin Thin QFN |
| B. Lead Frame: | Copper | Copper |
| C. Lead Finish: | Solder Plate or 100% Matte Tin | Solder Plate or 100% Matte Tin |
| D. Die Attach: | Silver-filled Epoxy | Silver-filled Epoxy |
| E. Bondwire: | Gold (1 .3 mil dia.) | Gold (1.3 mil dia.) |
| F. Mold Material: | Epoxy with silica filler | Epoxy with silica filler |
| G. Assembly Diagram: | # 05-1701-0358 | # 05-9000-0333 |
| H. Flammability Rating: | Class UL94-V0 | Class UL94-V0 |
| I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C: | Level 1 | Level 1 |

IV. Die Information

- A. Dimensions: 93 x 134 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: 1.2 microns (as drawn)
- F. Minimum Metal Spacing: 1.2 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 491 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 2.24 \times 10^{-9}$$

$$\lambda = 2.24 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5116) 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 0.10 @ 25°C and 1.78 @ 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 PW57-12 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

MAX1904Exx

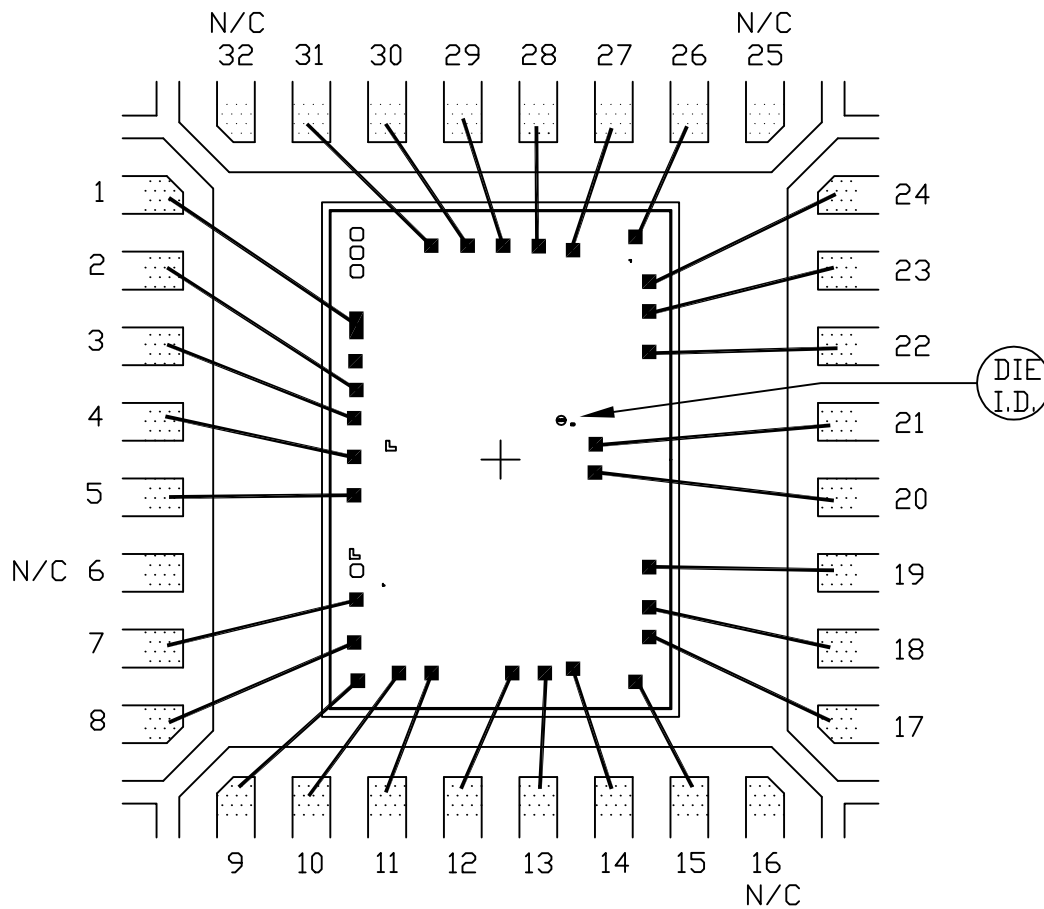
TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		491	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SSOP	77	0
			Thin QFN	77	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

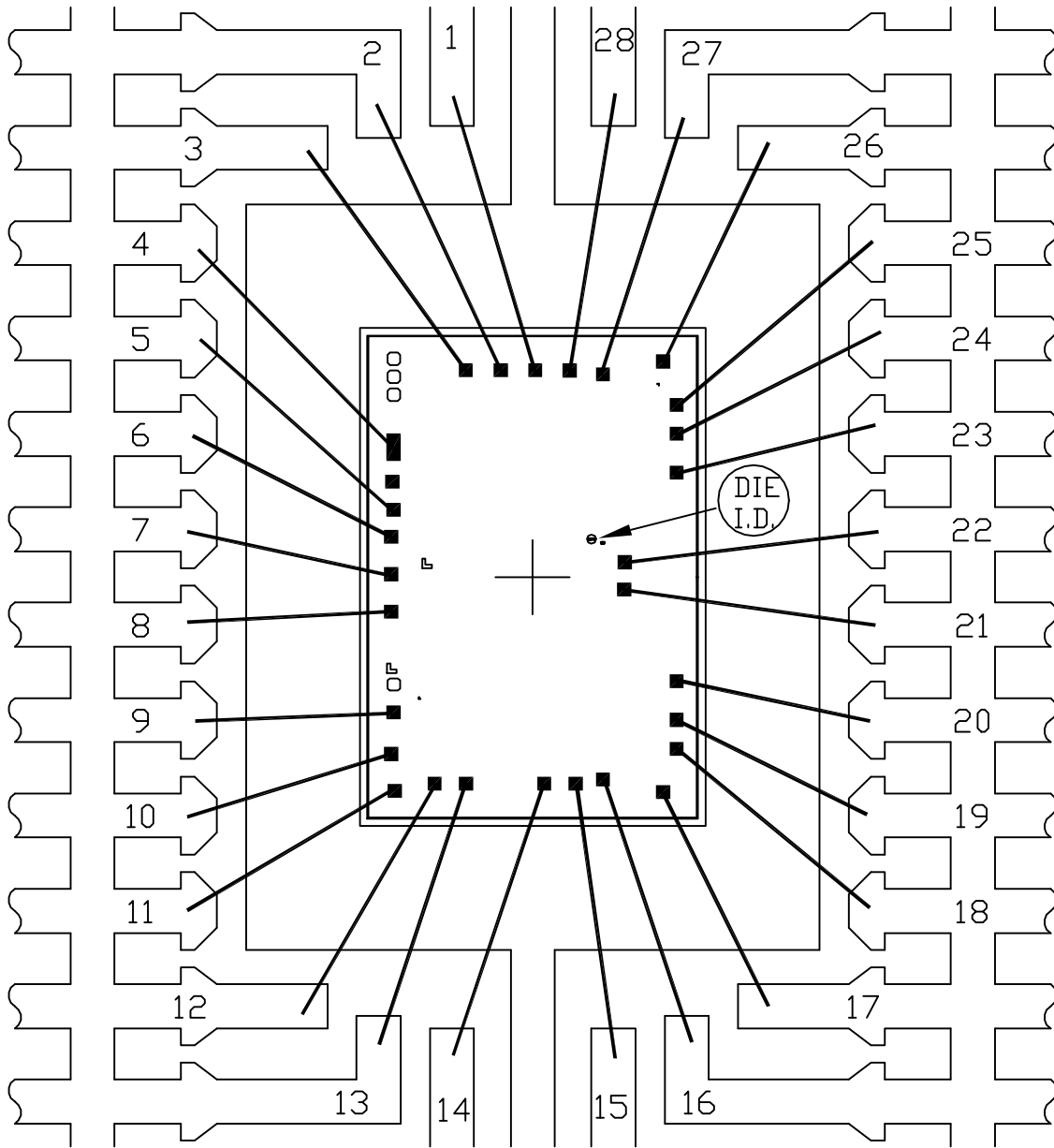
5x5x0.8mm THIN QFN PKG.

EXPOSED PAD PKG.



 BONDABLE AREA

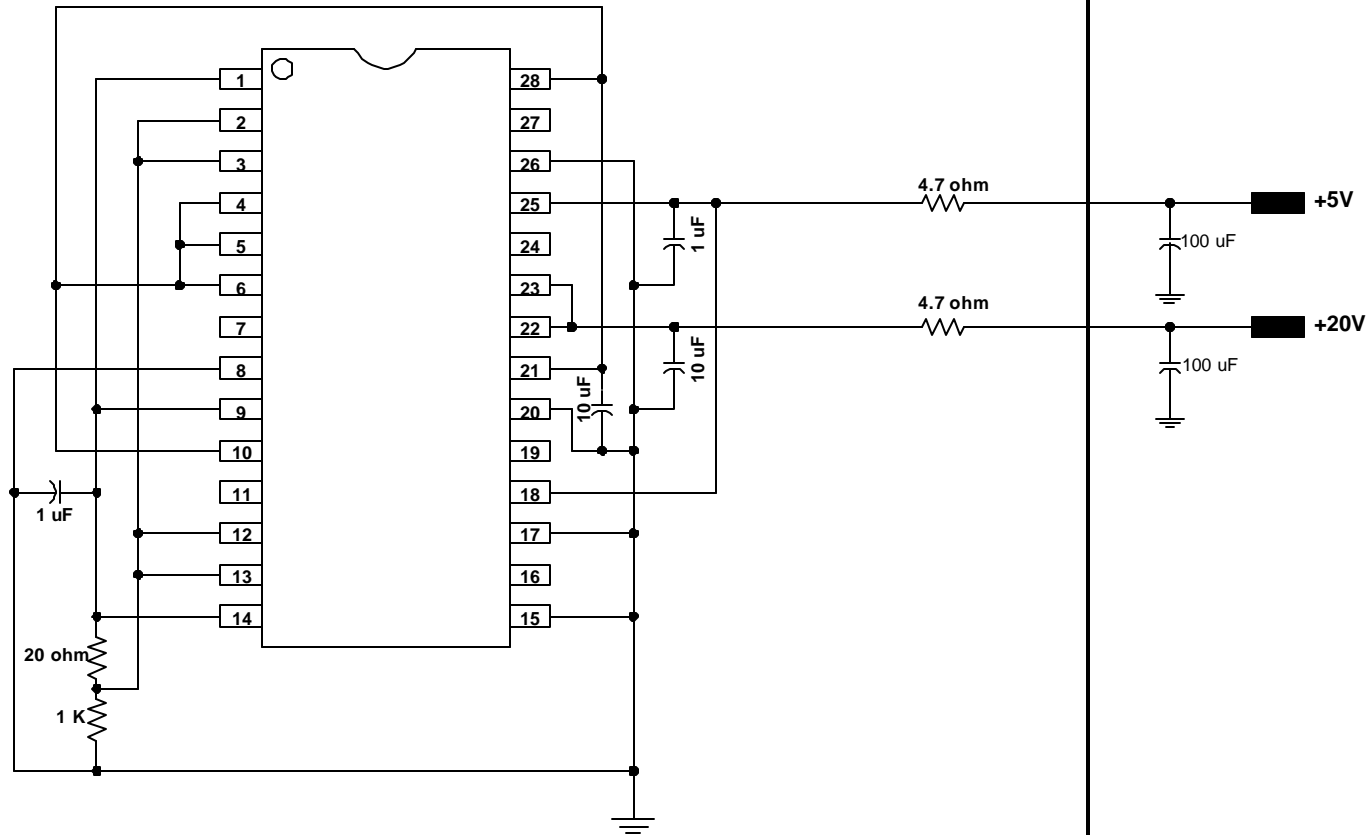
PKG. CODE: T3255-4		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 150x150	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0333	REV: B



PKG. CODE: A28-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 154X200	PKG. DESIGN			BOND DIAGRAM #: 05-1701-0358	REV: A

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 1631/1634/1901/1904
PACKAGE= 28-SSOP
MAX. EXPECTED CURRENT = 5mA

NOTES: