RELIABILITY REPORT

FOR

MAX1960EEP

PLASTIC ENCAPSULATED DEVICES

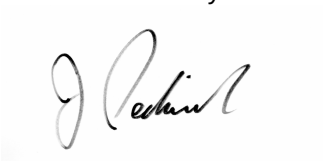
August 2, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



Jim Pedicord
Quality Assurance
Reliability Lab Manager

Reviewed by

Bryan J. Preeshl
Quality Assurance
Executive Director

Conclusion

The MAX1960 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

A. General

The MAX1960 high-current, high-efficiency voltage-mode step-down DC-DC controller operates from a 2.35V to 5.5V input and generate output voltages down to 0.8V at up to 20A. An on-chip charge pump generates a regulated 5V for MOSFET drive. Additionally, adaptive dead-time drivers allow a wide variety of MOSFETs to be used without risking shoot-through.

Fixed-frequency PWM operation and external synchronization make this controller suitable for telecom and datacom applications. The operating frequency is programmable to either 500kHz or 1MHz, or from 450kHz to 1.2MHz with an external clock. A clock output is provided to synchronize another converter for 180° out-of-phase operation. A high closed-loop bandwidth provides excellent transient response for applications with dynamic loads.

Lossless current sensing in the MAX1960 is achieved by monitoring the drain-to-source voltage of the low-side external FET. The current limit is scalable to accommodate a wide variety of MOSFETs and load currents.

The MAX1960 has an adjustable output voltage from 0.8V to 4.95V. The MAX1960 also features voltage-margining control inputs that shift the output voltage up or down by 4% for system testing.

B. Absolute Maximum Ratings

Item	Rating
VCC, CTL_, CS, FSET/SYNC, SEL, EN, OUT to GND	-0.3V to +6V
ILIM, COMP, REF, FB, CLKOUT, C- to GND	-0.3V to VAVDD + 0.3V
C+ to GND	-0.3V to higher of VVCC + 1V or VVDD + 0.3V
VDD, AVDD to GND	-0.3V to higher of VVCC - 0.3V or 6V
DL to PGND	-0.3V to VVDD + 0.3V
BST to GND	-0.3V to +12V
DH to LX	-0.3V to +6V
LX to BST	-6V to +0.3V
PGND to GND, or VDD to AVDD	-0.3V to +0.3V
Operating Temperature Range (Extended)	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
20-Pin QSOP	727mW
Derates above +70°C (Note 2)	
20-Pin QSOP	9.1mW/°C

II. Manufacturing Information

A. Description/Function: 2.35V to 5.5V, 0.5% Accurate, 1MHz PWM Step-Down Controllers with Voltage Margining

B. Process: S8 (Standard 0.8 micron silicon gate CMOS)

C. Number of Device Transistors: 4476

D. Fabrication Location: California, USA

E. Assembly Location: Malaysia, Philippines or Thailand

F. Date of Initial Production: January, 2003

III. Packaging Information

A. Package Type: **20-Pin QSOP**

B. Lead Frame: Copper

C. Lead Finish: Solder Plate

D. Die Attach: Silver-filled Epoxy

E. Bondwire: Gold (1.3 mil dia.)

.

F. Mold Material: Epoxy with silica filler

G. Assembly Diagram: # 05-3501-0023

H. Flammability Rating: Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112: Level 1

IV. Die Information

A. Dimensions: 86 x 103 mils

B. Passivation: Si_3N_4/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, Rel Operations)
Bryan Preeshl (Executive Director**)**
Kenneth Huening (Vice President)

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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 45 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 24.13 \times 10^{-9}$

$\lambda = 24.13$ 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. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-5929) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1M**).

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 PM28 die type has been found to have all pins able to withstand a transient pulse of ±1500V per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX1960EEP

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		45	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	QSOP	45	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

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except V_{PS1} 3/	All V_{PS1} pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground

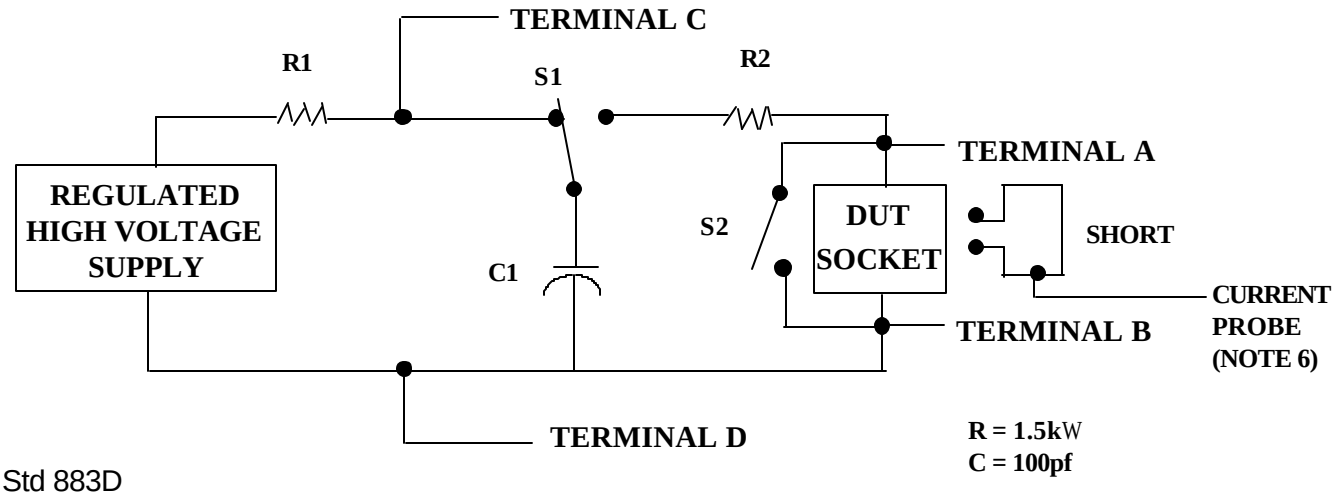
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

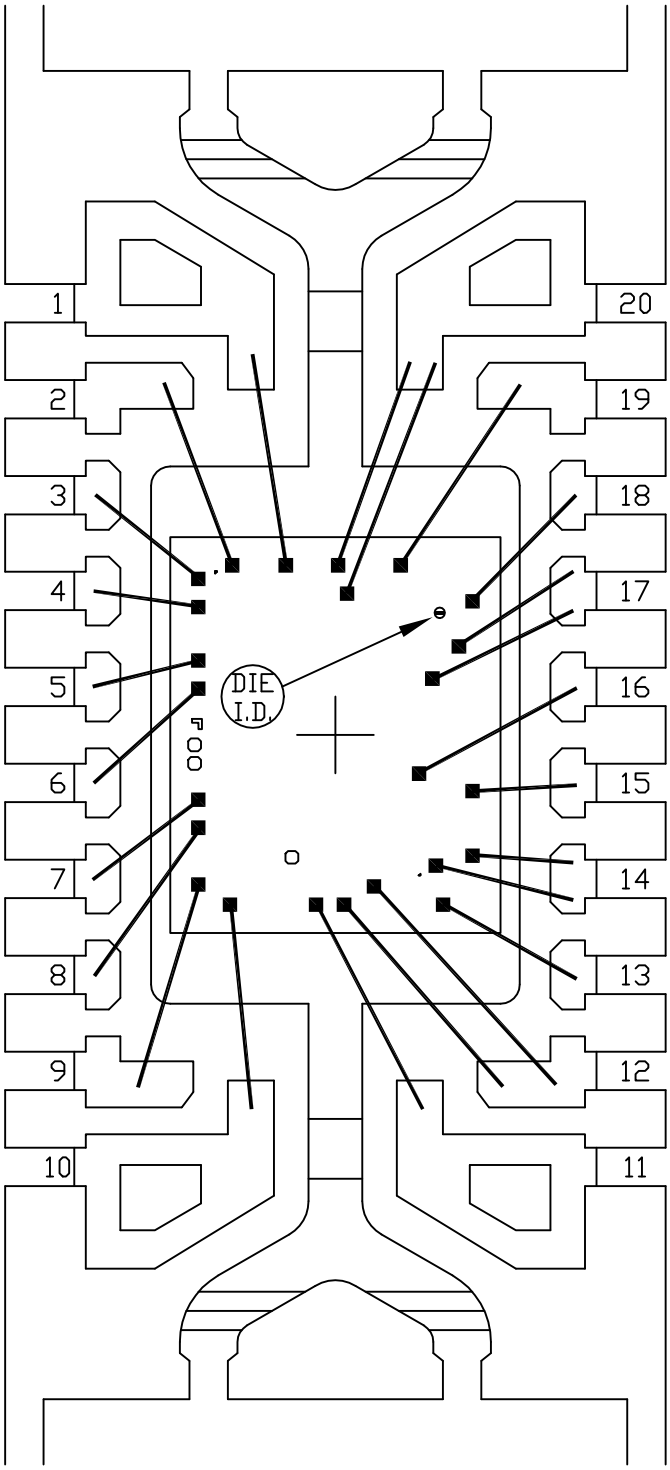
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.

c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



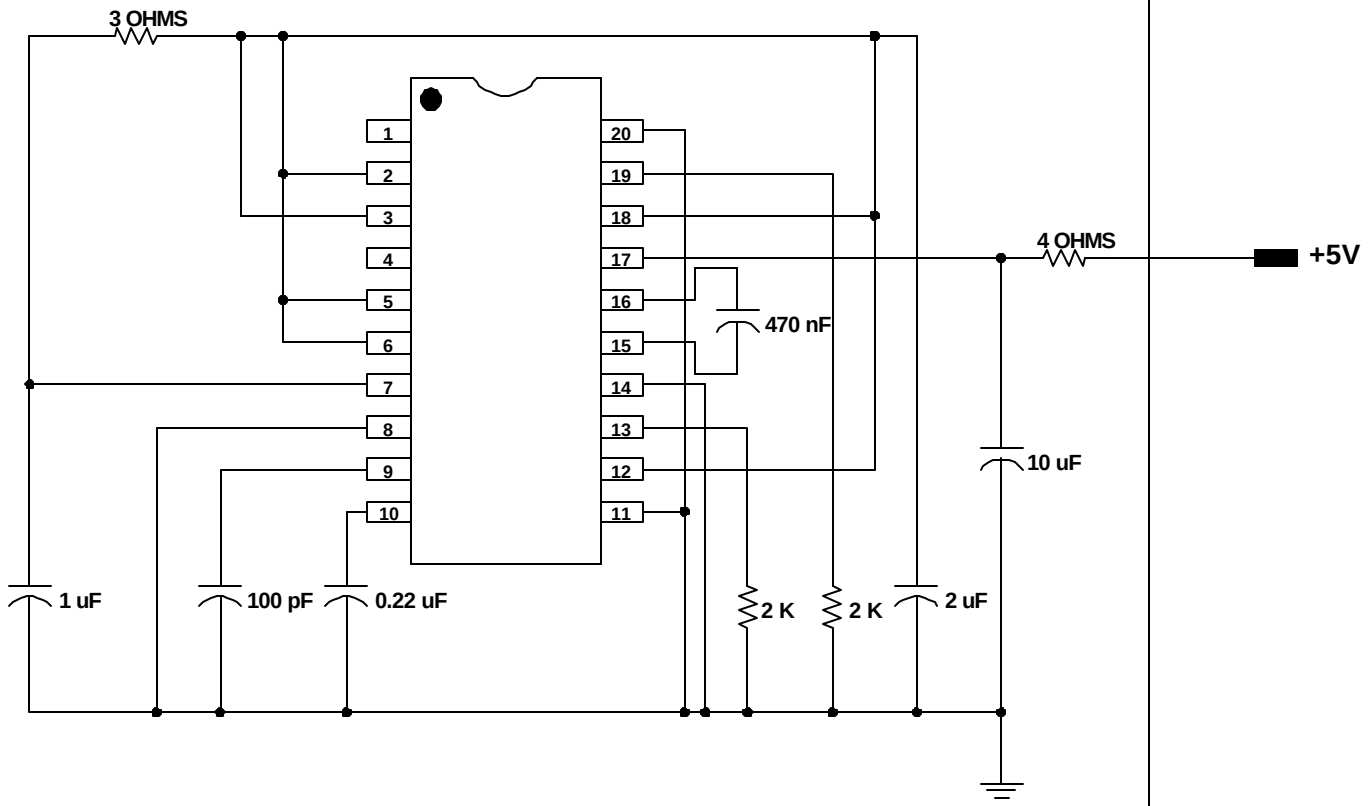
Mil Std 883D
Method 3015.7
Notice 8



PKG. CODE: E20-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 96X140	PKG.			BOND DIAGRAM #: 05-3501-0023	REV: B
	DESIGN				

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 1960/1961/1962
PACKAGE: 20-QSOP
MAX. EXPECTED CURRENT = 11mA

DRAWN BY: TEK TAN
NOTES: