RELIABILITY REPORT

FOR

MAX1563ETC

PLASTIC ENCAPSULATED DEVICES

August 8, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX1563 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

The MAX1563 single current-limited switch provides up to 4A to power up to eight USB ports. It operates from a 4V to 5.5V input supply and consumes only 40µA of quiescent current when operating and only 3µA in shutdown.

The MAX1563's autoreset features latches the switch off if the output is shorted, thereby saving system power. When the short is removed, the switch is reactivated. A fault-blanking feature enables the circuit to ignore momentary faults, such as those caused when hot swapping a capacitive load, preventing false alarms to the host system. Fault blanking also prevents fault signals from being issued when the device powers up the load.

The MAX1563 provides several safety features to protect the USB port. Built-in thermal-overload protection turns off the switch when the die temperature exceeds +160°C. Accurate internal current-limiting circuitry protects the input supply against both overload and short-circuit conditions. An open-drain fault signal (FAULT-bar) notifies the microprocessor when a thermal-overload, current-limit, undervoltage lockout (UVLO), or short-circuit fault occurs.

The MAX1563 has a selectable active-high or active-low logic-controlled enable. The current limit is programmed from 1A to 4A using a resistor..

The MAX1563 provides the same features and higher current performance in a smaller 12-pin (4mm x 4mm) QFN package. These devices operate over an extended temperature range (-40°C to +85°C).

B. Absolute Maximum Ratings

Item	Rating
IN, ON, ON, ISET, SEL, OUT to GND	-0.3V to +6V
FAULT to GND	-0.3V to (VIN + 0.3V)
IN to OUT	-0.3V to +6V
OUT Maximum Continuous Switch Current	5A
FAULT DC Current	10mA
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
Continuous Power Dissipation (TA = $+70^0$)	
12-Pin QFN (4x4)	1350mW
Derates above +70°C	
12-Pin QFN (4x4)	16.9mW/°C

II. Manufacturing Information

A. Description/Function:	Programmable 4A USB Current-Limited Switches with Autoreset and Fault Blanking
B. Process:	S8 (Standard 0.8 micron silicon gate CMOS)
C. Number of Device Transistors:	1833
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Thailand
F. Date of Initial Production:	July, 2003

III. Packaging Information

A. Package Type:	**12-Lead QFN (4 x 4)**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-filled epoxy
E. Bondwire:	Gold (2.0 mil dia)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	Buildsheet # 05-9000-0094
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity Per JEDEC standard JESD22-A112:	Level 1

IV. Die Information

A. Dimensions:	88 x 80 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Copper/Silicon
D. Backside Metallization:	None
E. Minimum Metal Width:	.8 microns (as drawn)
F. Minimum Metal Spacing:	.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	(Executive Director of QA)
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)

Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 24.13 \times 10^{-9}$ $\lambda = 24.13$ F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure the reliability of its processes. The reliability required for lots which receive a burn-in qualification 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 lots exceeding this level. The following Burn-In Schematic (Spec. #06-6059) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

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

The PM92-2 die type has been found to have all pins able to withstand a transient pulse of ±2500V, 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

MAX1563ETC

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	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		77	0

Note 1: Life Test Data may represent plastic D.I.P. qualification lots.
Note 2: Generic package/process data

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

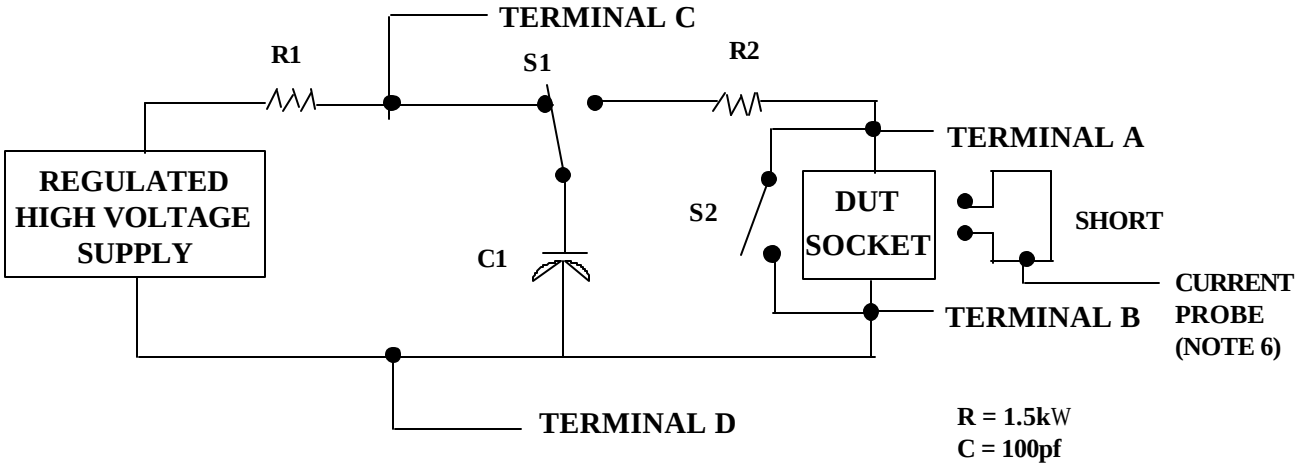
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

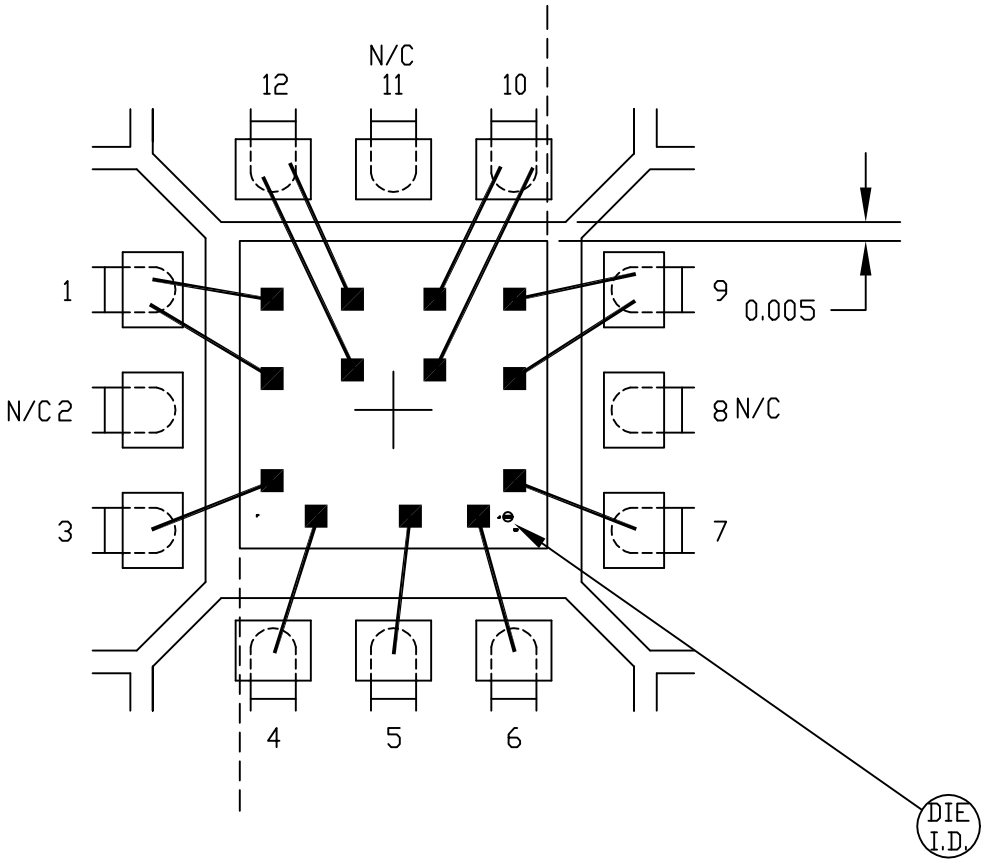
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

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.



4x4x0.8 MM QFN THIN PKG. EXPOSED PAD PKG.

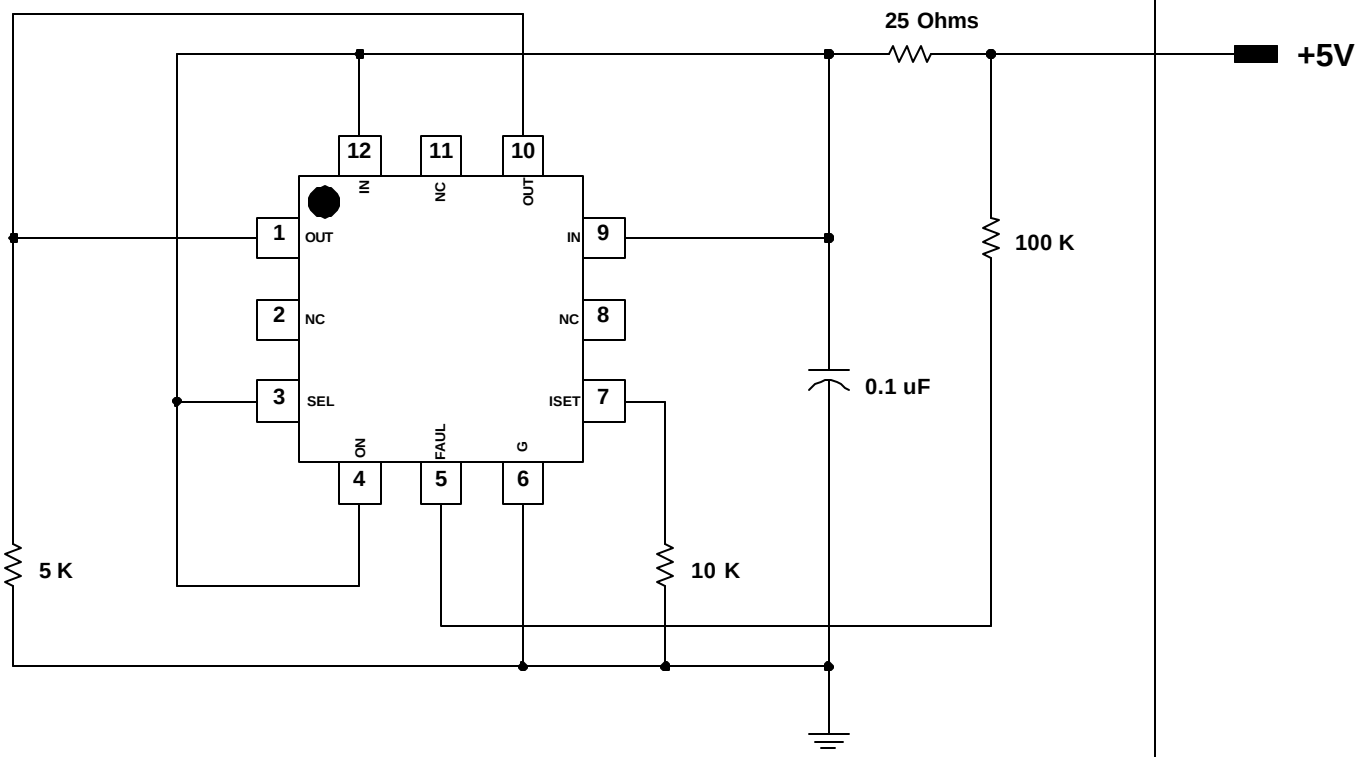


NOTE: 2.0 MIL WIRE REQUIRED.

PKG. CODE: T1244-2		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 98x98	PKG.			BOND DIAGRAM #: 05-9000-0094	REV: B
	DESIGN				

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 1563 (PM92Z)
PACKAGE: 12-QFN (4x4 THIN)
MAX. EXPECTED CURRENT = 1mA

DRAWN BY: TEK TAN
NOTES: