

RELIABILITY REPORT
FOR
MAX1673ESA
PLASTIC ENCAPSULATED DEVICES

April 3, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX1673 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 MAX1673 charge-pump inverter provides a low-cost, compact means of generating a regulated negative output from a positive input at up to 125mA. It requires only three small capacitors, and only two resistors to set its output voltage. The input range is 2V to 5.5V. The regulated output can be set from 0V to $-V_{IN}$ in Skip regulation mode or -1.5V to $-V_{IN}$ in Linear (LIN) regulation mode.

In Skip mode, the MAX1673 regulates by varying its switching frequency as a function of load current. This On-Demand™ switching gives the MAX1673 two advantages: very small capacitors and very low quiescent supply current. At heavy loads, it transfers energy from the input to the output by switching at up to 350kHz. It switches more slowly at light loads, using only 35μA quiescent supply current.

In Linear mode, the MAX1673 switches at a constant 350kHz at all loads and regulates by controlling the current-path resistance. This provides constant-frequency ripple, which is easily filtered for low-noise applications.

This device also features a 1μA logic-controlled shutdown mode and is available in a standard 8-pin SO package. For a device that delivers about 10mA and fits in a smaller package, refer to the MAX868.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
IN	-0.3V to +6V
CAP+, FB, LIN/SKIP	-0.3V to ($V_{IN} + 0.3V$)
SHDN	-0.3V to +6V
OUT, CAP-	-6V to +0.3V
Continuous Output Current	135mA
Output Short-Circuit Duration to GND (Note 1)	1sec
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +160°C
Lead Temperature (soldering, 10sec)	+300°C
Continuous Power Dissipation ($T_A = +70^\circ\text{C}$)	
8-Pin SO	450mW
Derates above +70°C	
8-Pin SO	5.88mW/°C

Note 1: Shorting OUT to IN may damage the device and should be avoided.

II. Manufacturing Information

A. Description/Function:	Regulated, 135mA-Output, Charge-Pump DC-DC Inverter
B. Process:	S3 (Standard 3 micron silicon gate CMOS)
C. Number of Device Transistors:	383
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Malaysia, Philippines or Thailand
F. Date of Initial Production:	January, 1998

III. Packaging Information

A. Package Type:	8-Pin NSO
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:	# 05-1101-0064
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1

IV. Die Information

A. Dimensions:	73 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:	3 microns (as drawn)
F. Minimum Metal Spacing:	3 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 160 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

\triangle Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 6.79 \times 10^{-9}$$

$$\lambda = 6.79 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-5319) 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 PX31 die type has been found to have all pins able to withstand a transient pulse of $\pm 3000\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 250\text{mA}$.

Table 1
Reliability Evaluation Test Results

MAX1673ESA

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		160	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	NSO	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

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} <u>3/</u>	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.

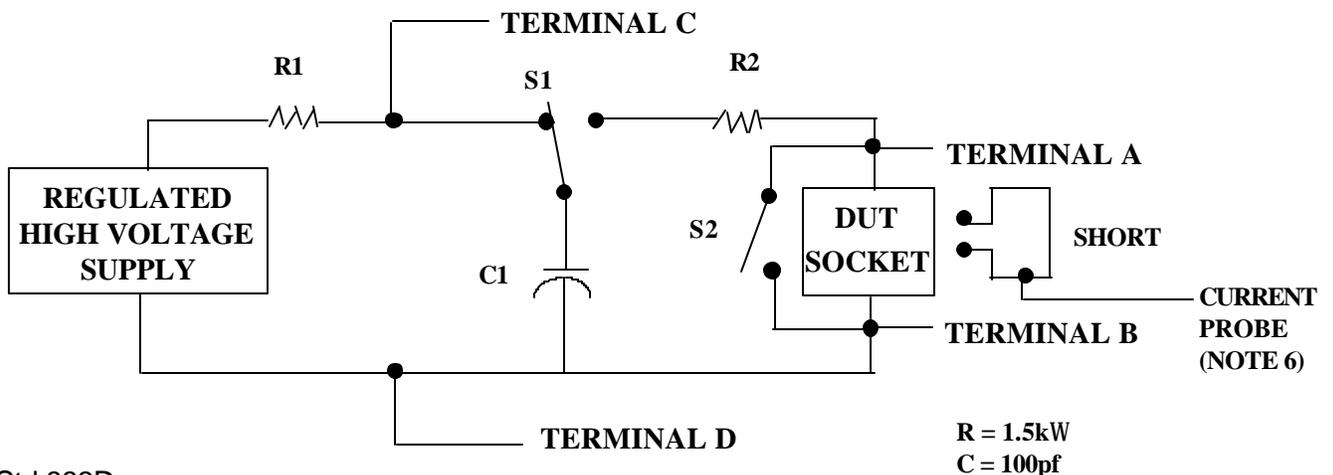
2/ No connects are not to be tested.

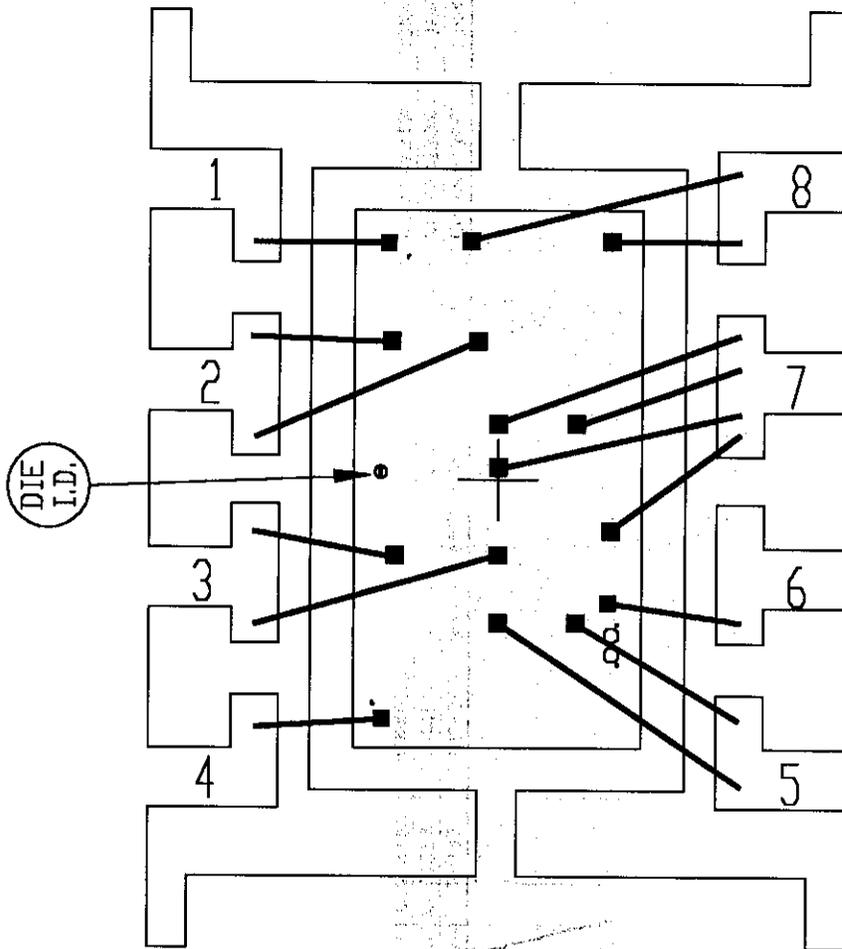
3/ Repeat pin combination 1 for each named Power supply and for ground

(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.





PKG.CODE: S8-5

APPROVALS

DATE



CAV./PAD SIZE:
95 X 155

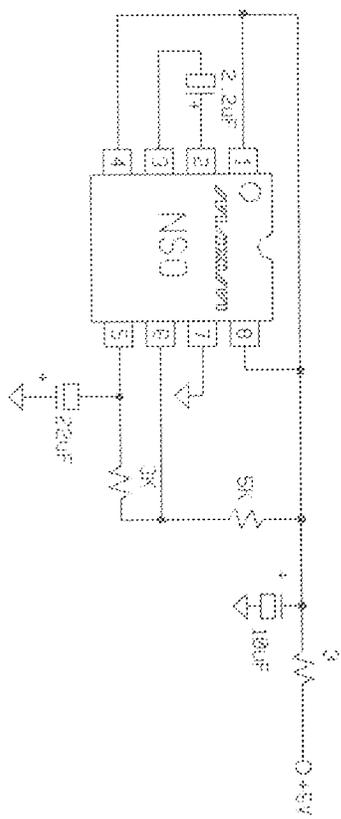
PKG.
DESIGN

BUILDSHEET NUMBER:
05-1101-0064

REV.:
A

ONCE PER BOARD

ONCE PER DEVICE



... STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1005.
 ... BURN-IN IS PER MIL-STD-883 METHOD 1015, COND. B

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND ISSBE CONTINUOUS
4. APPROVED FOR EXD COMMERCIAL
 EXD HR/003

SPEC. NO. : 08-5319 REV. A

DATE: 10/14/97

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

MAX1673

