MAX618EEE
Rev. A

RELIABILITY REPORT

FOR

**MAX618EEE**

PLASTIC ENCAPSULATED DEVICES

April 25, 2002


**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086


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**Conclusion**

The MAX618 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
II. ........Manufacturing Information
III. .......Packaging Information
IV. .......Die Information
V. ........Quality Assurance Information
VI. .......Reliability Evaluation
......Attachments


## I. Device Description

A. General

The MAX618 CMOS, PWM, step-up DC-DC converter generates output voltages up to 28V and accepts inputs from +3V to +28V. An internal 2A, 0.3 switch eliminates the need for external power MOSFETs while supplying output currents up to 500mA or more. A PWM control scheme combined with Idle Modeª operation at light loads minimizes noise and ripple while maximizing efficiency over a wide load range. No-load operating current is 500µA, which allows efficiency up to 93%.

A fast 250kHz switching frequency allows the use of small surface-mount inductors and capacitors. A shutdown mode extends battery life when the device is not in use. Adaptive slope compensation allows the MAX618 to accommodate a wide range of input and output voltages with a simple, single compensation capacitor.

The MAX618 is available in a thermally enhanced 16-pin QSOP package that is the same size as an industry-standard 8-pin SO but dissipates up to 1W. An evaluation kit (MAX618EVKIT) is available to help speed designs

B. Absolute Maximum Ratings

| Item | Rating |
|---|---|
| IN to GND | -0.3V to +30V |
| LX to VCC | -0.3V to +30V |
| VL to GND | -0.3V to +6V |
| /SHDN, COMP, FB to GND | -0.3V to (VL + 0.3V) |
| PGND to GND | +/-0.3V |
| Storage Temp. | +160°C |
| Lead Temp. (10 sec.) | +300°C |
| Continuous Power Dissipation (TA = +70°C) (Note 1) | |
| 16-Pin QSOP | 1W |
| Derates above +70°C | |
| 16-Pin QSOP | 15mW/°C |

Note 1: With part mounted on 0.9in$^2$ of copper

## II. Manufacturing Information

A. Description: 28V, PWM, Step-Up DC-DC Converters

B. Process: S12 (Standard 1.2 micron silicon gate CMOS)

C. Number of Device Transistors: 1794

D. Fabrication Location: Oregon or California, USA

E. Assembly Location: Philippines or Korea

F. Date of Initial Production: April, 1999

## III. Packaging Information

A. Package Type: **16-Lead QSOP**

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 # 05-1701-0347

H. Flammability Rating: Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1

## IV. Die Information

A. Dimensions: 85 x 145 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: 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 (Reliability Lab Manager)
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 ($\lambda$) is calculated as follows:

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

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 6.79 \times 10^{-9}$ $\lambda$ = 6.79 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 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 rejects from lots exceeding this level. The attached Burn-In Schematic (Spec. # 06-5382) 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 PW99 die type has been found to have all pins able to withstand a transient pulse of ±300V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA and/or ±20V.

**Table 1**
Reliability Evaluation Test Results

**MAX618EEE**

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | PACKAGE | SAMPLE SIZE | NUMBER OF FAILURES |
|---|---|---|---|---|---|
| **Static Life Test** (Note 1) | | | | | |
| | Ta = 135°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | | 160 | 0 |
| **Moisture Testing** (Note 2) | | | | | |
| Pressure Pot | Ta = 121°C<br>P = 15 psi.<br>RH= 100%<br>Time = 168hrs. | DC Parameters<br>& functionality | QSOP | 77 | 0 |
| 85/85 | Ta = 85°C<br>RH = 85%<br>Biased<br>Time = 1000hrs. | DC Parameters<br>& functionality | | 77 | 0 |
| **Mechanical Stress** (Note 2) | | | | | |
| Temperature Cycle | -65°C/150°C<br>1000 Cycles<br>Method 1010 | DC Parameters | | 77 | 0 |

Note 1: Life Test Data may represent plastic D.I.P. qualification lots for the Small Outline package.
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

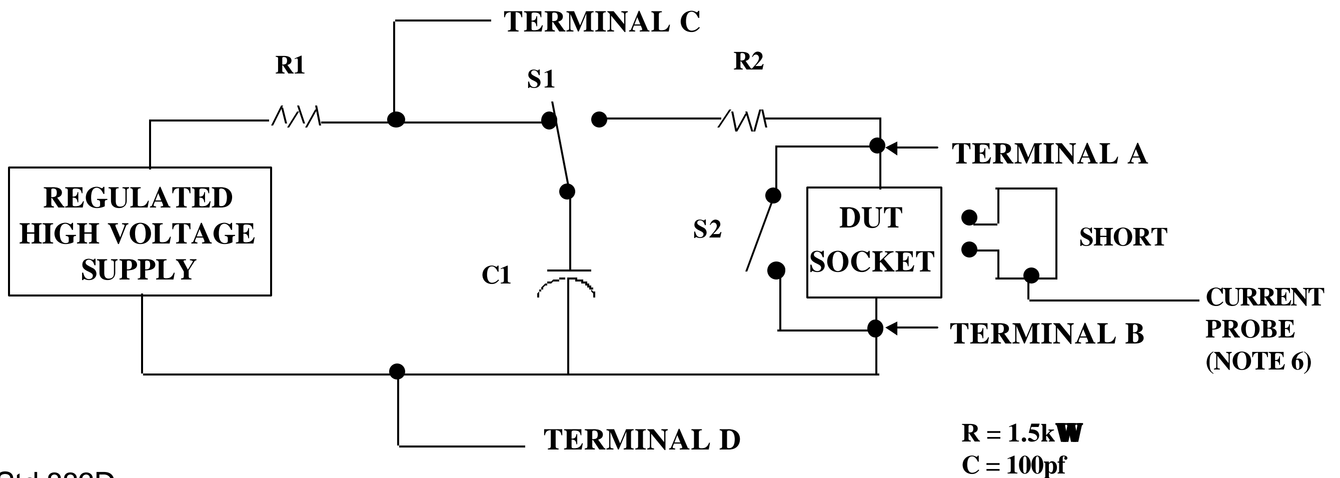
(e.g., where $V_{PS1}$ is $V_{DD}$, $V_{CC}$, $V_{SS}$, $V_{BB}$, GND, $+V_{S}$, $-V_{S}$, $V_{REF}$, etc).

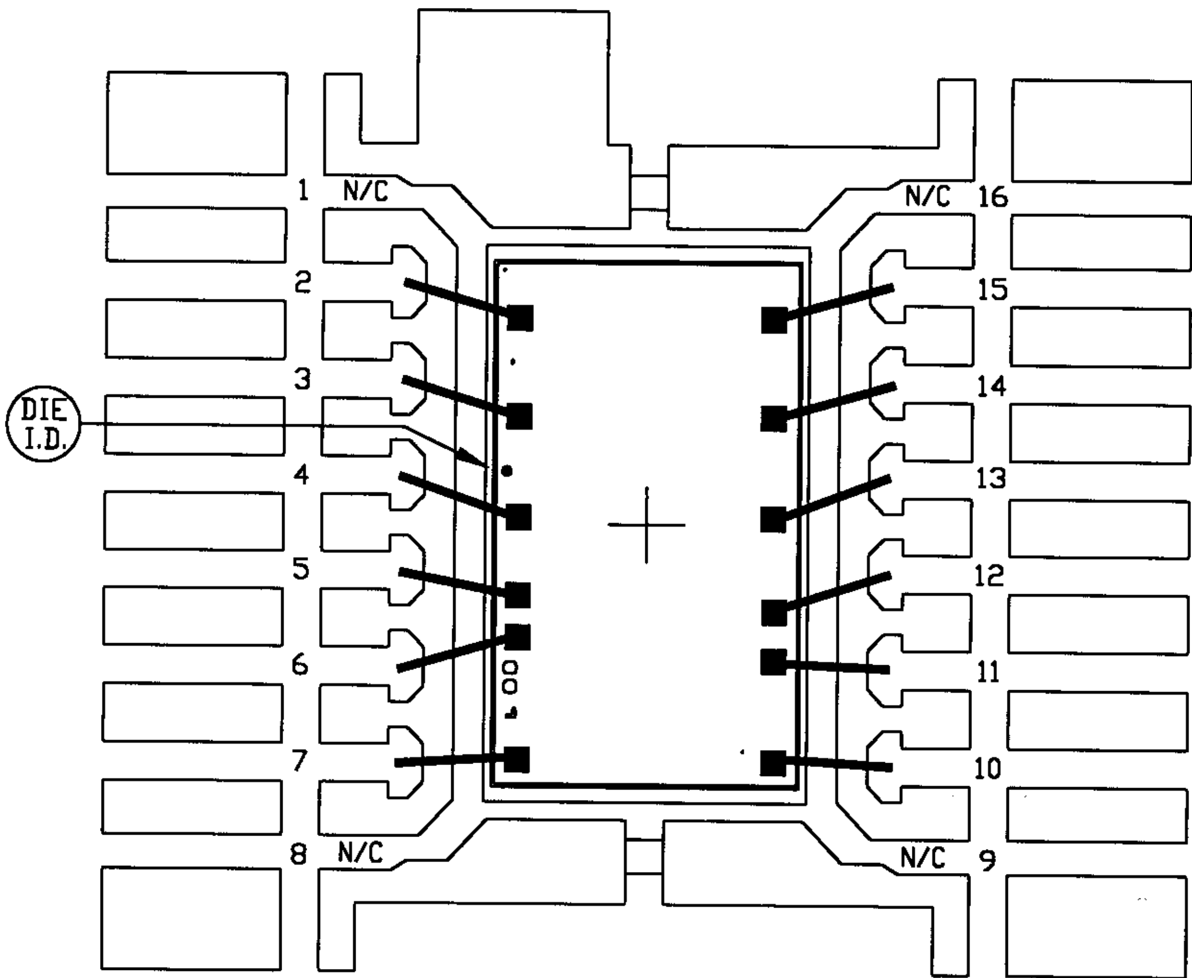
3.4 Pin combinations to be tested.

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.

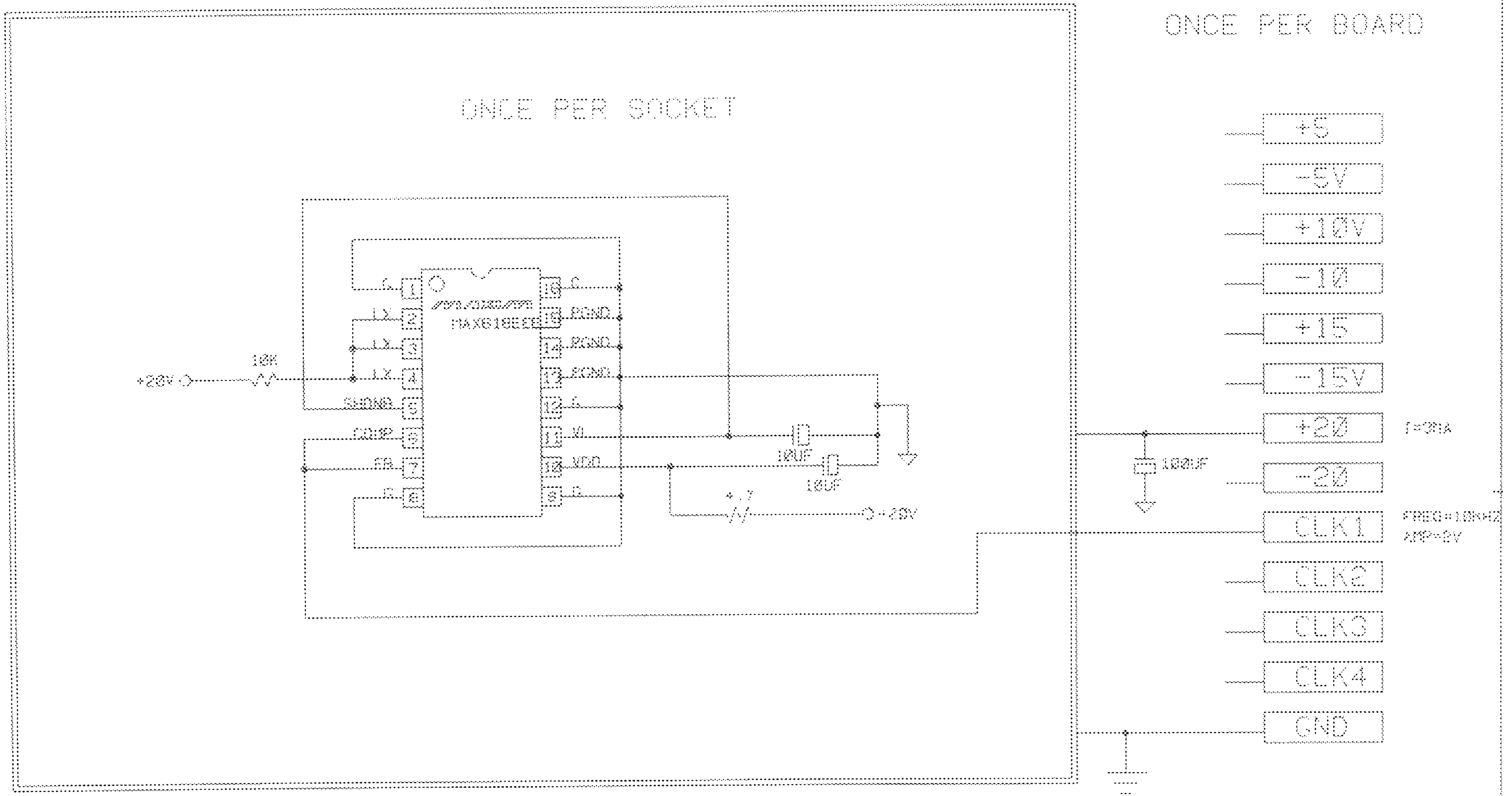
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., $V_{SS1}$, or $V_{SS2}$ or $V_{SS3}$ or $V_{CC1}$, or $V_{CC2}$) connected to terminal B. All pins except the one being tested and the power supply pin or set of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






| PKG.CODE: E16-8F | | APPROVALS | DATE | MAXIM | |
|---|---|---|---|---|---|
| CAV./PAD SIZE: 101x154 | PKG. DESIGN | | | BUILDSHEET NUMBER: 05-1701-0347 | REV.: A |




___ 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: +125oC or equivalent
2. Time: 160 hours min. or equivalent
3. All components and material must stand +150oC continuous
4. Approved for [ ] Commercial
   [ ] HR/E83

| MAXIM | CREATED: 08/15/95 | BY: JH | ENG1: JEAN REO | ENG2: - |
|---|---|---|---|---|
| | LAST SAVED: 16:26:13 02-24-99 | | SIZE B / A REVISION 00/00/00 | DWG NO. - |
| MAX618EEE | PROJECT: P029 | | | |
| | DESC.: BURN IN SCHEMATIC | | FILE: M618.DRW | SHEET 1 OF 1 |