

RELIABILITY REPORT
FOR
MAX4896EUP+
PLASTIC ENCAPSULATED DEVICES

February 29, 2012

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX4896EUP+ 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 MAX4896 8-channel relay and load driver is designed for medium voltage applications up to 50V. This device is offered in a 20-pin, 5mm x 5mm TQFN package, resulting in substantial board space savings. The MAX4896 8-channel relay driver offers built-in inductive kickback protection, drive for latching/ nonlatching or dual-coil relays, and open-load and short-circuit fault detection. The MAX4896 also protects against overcurrent conditions. Each independent open-drain output features a 3 Ohms (typ) on-resistance, and is guaranteed to sink 200mA of load current ($V_S \geq 4.5V$).

A built-in overvoltage protection clamp handles kickback- voltage transients, which are common when driving inductive loads. Thermal-shutdown circuitry shuts off all outputs (OUT_) when the junction temperature exceeds +160 deg C. The MAX4896 employs a reset input that allows the user to turn off all outputs simultaneously with a single control line.

The MAX4896 includes a 10MHz SPITM -/QSPITM - /MICROWIRETM-compatible serial interface. The serial interface is compatible with TTL-/CMOS-logic voltage levels and operates with a single +2.7V to +5.5V supply. In addition, the SPI output data can be used for diagnostics purposes including open-load and short-circuit fault detection.

The MAX4896 is offered in the extended (-40 °C to +85 °C) and automotive (-40 deg C to +125 deg C) operating temperature ranges.

II. Manufacturing Information

A. Description/Function:	Space-Saving, 8-Channel Relay/Load Driver
B. Process:	BCD88
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Taiwan
F. Date of Initial Production:	December 22, 2005

III. Packaging Information

A. Package Type:	20L TSSOP-EP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-1948 / A
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	46°C/W
K. Single Layer Theta Jc:	2°C/W
L. Multi Layer Theta Ja:	37.7°C/W
M. Multi Layer Theta Jc:	2°C/W

IV. Die Information

A. Dimensions:	108 X 140 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	3.0 microns (as drawn)
F. Minimum Metal Spacing:	3.0 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)
Don Lipps (Manager, Reliability Engineering)
Bryan Preeshl (Vice President 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 biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 47 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 23.4 \times 10^{-9}$$

$$\lambda = 23.4 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the BCD88 Process results in a FIT Rate of 0.06 @ 25C and 1.08 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot NWO0AQ001E D/C 0526)

The AS63 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX4896EUP+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	47	0	NW00AQ001B, D/C 0527

Note 1: Life Test Data may represent plastic DIP qualification lots.