

RELIABILITY REPORT FOR
MAX14838 / MAX14839
PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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Conclusion

The MAX14838 / MAX14839 successfully meet the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

Table of Contents

I.Device Description	IV.Die Information
II.Manufacturing Information	V.Quality Assurance Information
III.Packaging Information	VI.Reliability Evaluation
.....Attachments	

I. Device Description

A. General

The MAX14838/MAX14839 24V/100mA drivers are optimized for use in industrial sensors. These devices integrate all of the high-voltage (24V) circuitry commonly found in industrial sensors, including a configurable PNP/ NPN/push-pull driver and an integrated linear regulator that meets common sensor power requirements. The MAX14838/MAX14839 are pin-configurable. Logic inputs allow the driver to be configured for high-side (PNP), low-side (NPN), or push-pull operation. An additional input allows the user to select between normally- open and normally-closed logic. The MAX14838 features an onboard 5V linear regulator, while the MAX14839 features a 3.3V linear regulator. Each device includes two LED drivers for visual feedback. One LED driver reflects the output logic status and the other is a general-purpose driver that can be used to signal a fault condition. The DO output, supply (VCC), and ground (GND) pins are reverse polarity-protected and are protected against IEC ESD and surge events. The MAX14838 and MAX14839 operate from a wide supply range and are available in a 12-pin TDFN-EP package (3mm x 3mm) or a 12-bump wafer-level package (WLP) (2.1mm x 1.6mm) and operate over the -40°C to +105°C temperature range.

II. Manufacturing Information

A. Description/Function:	24V Pin-Configurable Industrial Sensor Output Drivers
B. Process:	S18
C. Number of Device Transistors:	31455
D. Fabrication Location:	Japan
E. Assembly Location:	Taiwan
F. Date of Initial Production:	December 19, 2015

III. Packaging Information

A. Package Type:	12-pin TDFN	12-bump WLP
B. Lead Frame:	Copper	N/A
C. Lead Finish:	100% matte Tin	N/A
D. Die Attach:	Conductive	None
E. Bondwire:	Au (1 mil dia.)	N/A
F. Mold Material:	Epoxy with silica filler	None
G. Assembly Diagram:	#05-9000-5830	#05-9000-5829
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1	Level 1
J. Single Layer Theta Ja:	63°C/W	N/A°C/W
K. Single Layer Theta Jc:	8.5°C/W	N/A°C/W
L. Multi Layer Theta Ja:	41°C/W	62°C/W
M. Multi Layer Theta Jc:	8.5°C/W	N/A°C/W

IV. Die Information

A. Dimensions:	62.9921 X 83.0708 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:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 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:	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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.7 \times 10^{-9}$$

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the S18 Process results in a FIT Rate of 0.05 @ 25°C and 0.93 @ 55°C (0.8 eV, 60% UCL)

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

The RV08-0 die type has been found to have all pins able to withstand an HBM transient pulse of +/-1000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX14838 / MAX14839

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C	DC Parameters & functionality	80	0	
	Biased Time = 192 hrs.				

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