

RELIABILITY REPORT
FOR
MAX22200ETJ+
MAX22200ETJ+T

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MAXIM INTEGRATED

160 RIO ROBLES
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Conclusion

The MAX22200 successfully meets 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 MAX22200 is an octal 36V serial-controlled solenoid driver. Each channel features a low impedance (200mΩ typ) push-pull output stage with sink-and-source driving capability and up to 1ARMS driving current. A serial interface (SPI) that also supports daisy-chain configurations is provided to individually control each channel.

The device half-bridges can be configured as low-side drivers or as high-side drivers. Moreover, pairs of halfbridges can be paralleled to double the driving current or can be configured as full-bridges to drive up to four latched valves (bi-stable valves) or four brushed DC motors.

Two control methods are supported: voltage drive regulation (VDR) and current drive regulation (CDR). In VDR, the device outputs a PWM voltage in which the duty cycle is programmed using SPI. For a given supply voltage and solenoid resistor, the output current is proportional to the programmed duty cycle. In CDR, an internal integrated lossless current sensing (ICS) circuit senses the output current and compares it with an internal programmable reference current.

For optimal power management in solenoid drive applications, the excitation drive level (IHIT), the hold drive level (IHOLD), and the excitation drive time (tHIT) can be individually configured for each channel.

The MAX22200 features a full set of protections and diagnostic functions. This includes overcurrent protection (OCP), thermal shutdown (TSD), undervoltage Lockout (UVLO), open-load detection (OL), and detection of plunger movement (DPM). A fault indication pin (FAULT) signals fault events and diagnostic information is stored in the FAULT register.

Due to the flexibility of use, the serial interface control, the high efficiency, and the small package, the MAX22200 is particularly well-suited for solenoid driver applications (valve control, relays control etc.) in which low power consumption and high level of integration are required.

The MAX22200 is available in a compact 5mm x 5mm, 32-pin TQFN package and operates over the temperature -40°C to +85°C range.

II. Manufacturing Information

A. Description/Function:	36V, 1A Octal Integrated Serial-Controlled Solenoid and Motor Driver
B. Process:	P90
C. Device Count:	313406
D. Fabrication Location:	Japan
E. Assembly Location:	Taiwan
F. Date of Initial Production:	December 23, 2020

III. Packaging Information

A. Package Type:	TQFN-CU
B. Lead Frame:	Cu194
C. Lead Finish:	Matte Tin
D. Die Attach:	EN4900G
E. Bondwire:	1.3 mil CuPd
F. Mold Material:	G700LA
G. Assembly Diagram:	05-101245
H. Flammability Rating:	UL-94 (V-0 Rating)
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	47 °C/W
K. Single Layer Theta Jc:	1.70 °C/W
L. Multi Layer Theta Ja:	29 °C/W
M. Multi Layer Theta Jc:	1.70 °C/W

IV. Die Information

A. Dimensions:	125.5905X100 mils
B. Passivation:	SiN/ SiO2

V. Quality Assurance Information

A. Quality Assurance Contacts:	Ryan Wall (Manager, Reliability) Michael Cairnes (Executive Director, Reliability) Bryan Preeshl (SVP 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 125C biased (static) life test are shown in Table 1. Using these results, the Failure Rate λ is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{1000 \times 2454 \times 231 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

(where 2454 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 1.61 \times 10^{-9}$$

$$\lambda = 1.61 \text{ FITs (60\% confidence level @25°C)}$$

Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <https://www.maximintegrated.com/en/support/qa-reliability/reliability/reliability-monitor-program.html>.

P90 cumulative process Fit

$$\lambda = 0.11 \text{ FITs (60\% confidence level @25°C)}$$

$$\lambda = 1.28 \text{ FITs (60\% confidence level @55°C)}$$

B. ESD and Latch-Up Testing

The MAX22200 has been found to have all pins able to withstand an HBM transient pulse of ± 2500 V per JEDEC / ESDA JS-001. Latch-Up testing has shown that this device withstands ± 250 mA current injection and supply overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results
MAX22200ETJ+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 125°C Biased Time = 1000 hrs.	DC parameters & functionality	77	0	
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Note 1: Life Test Data may represent plastic DIP qualification lots.