

RELIABILITY REPORT
FOR
DG413FEUE+T
PLASTIC ENCAPSULATED DEVICES

August 29, 2014

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Conclusion

The DG413FEUE+T 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.

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I. Device Description

A. General

The DG411F/DG412F/DG413F are quad, single-pole/single-throw (SPST), fault-protected analog switches. They are pin compatible with the industry-standard nonprotected DG411/DG412/DG413. These new switches feature fault-protected inputs and rail-to-rail signal-handling capability. All terminals are protected from overvoltage faults up to $\pm 36\text{V}$ with power on and up to $\pm 40\text{V}$ with power off. During a fault condition, the COM, NO, or NC terminal becomes an open circuit and only microamperes of leakage current flow from the source. On-resistance is $35\ \Omega$ (max) and is matched between switches to $1.5\ \Omega$ (max) at $+25^\circ\text{C}$. The DG411F has four normally closed (NC) switches. The DG412F has four normally open (NO) switches. The DG413F has two NC and two NO switches. These CMOS switches operate with dual power supplies ranging from $\pm 4.5\text{V}$ to $\pm 20\text{V}$ or a single supply between $+9\text{V}$ and $+36\text{V}$. All digital inputs have $+0.8\text{V}$ and $+2.4\text{V}$ logic thresholds, ensuring both TTL and CMOS logic compatibility when using $\pm 15\text{V}$ or a single $+12\text{V}$ supply. For supply voltages of $\pm 5\text{V}$, $+5\text{V}$, and $+3\text{V}$, refer to the MAX4711/MAX4712/MAX4713 data sheet.

II. Manufacturing Information

A. Description/Function:	Quad, Rail-to-Rail, Fault-Protected, SPST Analog Switches
B. Process:	S5
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Philippines, Thailand, or Malaysia
F. Date of Initial Production:	April 27, 2002

III. Packaging Information

A. Package Type:	16-pin TSSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-1201-0288
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	106°C/W
K. Single Layer Theta Jc:	27°C/W
L. Multi Layer Theta Ja:	90°C/W
M. Multi Layer Theta Jc:	27°C/W

IV. Die Information

A. Dimensions:	86X138 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:	5.0 microns (as drawn)
F. Minimum Metal Spacing:	5.0 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

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|-----------------------------------|---|
| 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 160 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 1.32 \times 10^{-9}$$

$$\lambda = 1.32 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S5 Process results in a FIT Rate of 0.09 @ 25C and 1.53 @ 55C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (lot NB42BU002D, D/C 0213)

The AH88-2 die type has been found to have all pins able to withstand a HBM transient pulse of +/-200V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

DG413FEUE+T

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	NRLCGA367A, D/C 0735
	Biased		80	0	NRLCGA370C, D/C 0735
	Time = 1000 hrs.				

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