



RELIABILITY REPORT  
FOR  
MAX14778ETP+T  
PLASTIC ENCAPSULATED DEVICES

March 16, 2012

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

<b>Approved by</b>
Sokhom Chum
Quality Assurance
Reliability Engineer

## Conclusion

The MAX14778ETP+T 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	IV. ....Die Information
II. ....Manufacturing Information	V. ....Quality Assurance Information
III. ....Packaging Information	VI. ....Reliability Evaluation
.....Attachments	

### I. Device Description

#### A. General

The MAX14778 dual 4:1 analog multiplexer supports analog signals up to  $\pm 25V$  with a single 3.0 to 5.5V supply. Each multiplexer has separate control inputs to allow independent switching, making the device ideal for multiplexing different communications signals with the same connector pins. Extended ESD protection of  $\pm 6kV$  (Human Body Model) enable direct interfacing to cables and connectors. The MAX14778 features a low 1.5 (max) on-resistance and 3m (typ) flatness to maximize signal integrity over the entire common-mode voltage range. Each multiplexer can carry up to 300mA of continuous current through the multiplexer in either direction. The MAX14778 supports switching of full-speed USB 1.1 signals (12Mbps) and RS-485 data rates of up to 20Mbps. The MAX14778 is available in a 20-pin (5mm x 5mm) TQFN package and is specified over the  $-40^{\circ}C$  to  $+85^{\circ}C$  extended temperature range. *This video demonstrates the MAX14778, a new idea in analog switches with the industry's first  $\pm 25V$  above- and below-the-rails multiplexer.*

## II. Manufacturing Information

A. Description/Function:	Dual $\pm 25V$ Above- and Below-the-Rails 4:1 Analog Multiplexer
B. Process:	S18
C. Number of Device Transistors:	7010
D. Fabrication Location:	California
E. Assembly Location:	China
F. Date of Initial Production:	June 23, 2011

## III. Packaging Information

A. Package Type:	20L TQFN 5x5
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:	#05-9000-4503 / 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:	48°C/W
K. Single Layer Theta Jc:	2°C/W
L. Multi Layer Theta Ja:	30°C/W
M. Multi Layer Theta Jc:	2°C/W

## IV. Die Information

A. Dimensions:	111.0236X127.9527 mils
B. Passivation:	$Si_3N_4/SiO_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.18 $\mu m$
F. Minimum Metal Spacing:	0.18 $\mu m$
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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 77 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 2.7 \times 10^{-9}$$

$$\lambda = 2.7 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S18 Process results in a FIT Rate of 0.40 @ 25C and 6.96 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot SAAN2Q001A D/C 1142)

The AK21 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 and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX14778ETP+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 1000 hrs.	DC Parameters & functionality	77	0	S1RZAQ001C, D/C 1120

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