RELIABILITY REPORT

FOR

MAX7313AEG+

PLASTIC ENCAPSULATED DEVICES

March 23, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
Director, Reliability Engineering

Conclusion

The MAX7313AEG+ 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 MAX7313 I²C-compatible serial interfaced peripheral provides microprocessors with 16 I/O ports. Each I/O port can be individually configured as either an open-drain current-sinking output rated at 50mA and 5.5V, or a logic input with transition detection. A 17th port can be used for transition detection interrupt, or as a general-purpose output. The outputs are capable of driving LEDs, or providing logic outputs with external resistive pullup up to 5.5V. PWM current drive is integrated with 8 bits of control. Four bits are global control and apply to all LED outputs to provide coarse adjustment of current from fully off to fully on with 14 intensity steps. Each output then has individual 4-bit control, which further divides the globally set current into 16 more steps. Alternatively, the current control can be configured as a single 8-bit control that sets all outputs at once. Each output has independent blink timing with two blink phases. All LEDs can be individually set to be on or off during either blink phase, or to ignore the blink control. The blink period is controlled by a register. The MAX7313 supports hot insertion. All port pins, the active-low INT output, SDA, SCL, and the slave-address inputs AD0-2 remain high impedance in power-down (V+ =0V) with up to 6V asserted upon them. The MAX7313 is controlled through the 2-wire I²C/SMBus serial interface, and can be configured to any one of 64 I²C addresses.

II. Manufacturing Information

A. Description/Function:	16-Port I/O Expander with LED Intensity Control, Interrupt, and Hot-Insertion Protection
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	Carsem Malaysia, ATP Philippines, UTL Thailand
F. Date of Initial Production:	October 25, 2003

III. Packaging Information

A. Package Type:	24-pin QSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-0795
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:	105°C/W
K. Single Layer Theta Jc:	34°C/W
L. Multi Layer Theta Ja:	88°C/W
M. Multi Layer Theta Jc:	34°C/W

IV. Die Information

A. Dimensions:	72 X 69 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Ken Wendel (Director, Reliability Engineering) Bryan Preeshl (Managing Director 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. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{1000 \times 4340 \times 48 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 4.3 \times 10^{-9}$

$\lambda = 4.3$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at http://www.maxim-ic.com/. Current monitor data for the S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The DW65 die type has been found to have all pins able to withstand a transient pulse of:

ESD HBM: +/-1000 Vper J-STD22-A114
ESD CDM: +/-750V per J-STD22-C101

Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX7313AEG+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 1000 hrs.	DC Parameters & functionality	48	0
Moisture Testing (Note 2)				
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
Mechanical Stress (Note 2)				
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data