RELIABILITY REPORT

FOR

MAX31790ATI+T

PLASTIC ENCAPSULATED DEVICES

December 23, 2016

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
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Quality Assurance
Reliability Engineer

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Conclusion

The MAX31790ATI+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 MAX31790 controls the speeds of up to six fans using six independent PWM outputs. The desired fan speeds (or PWM duty cycles) are written through the I²C interface. The outputs drive "4-wire" fans directly, or can be used to modulate the fan's power terminals using an external pass transistor. Tachometer inputs monitor fan tachometer logic outputs for precise (±1%) monitoring and control of fan RPM as well as detection of fan failure. Six pins are dedicated tachometer inputs. Any of the six PWM outputs can also be configured to serve as tachometer inputs. The PWM_START inputs select the PWM output status at startup to ensure appropriate fan drive when power is first applied. To ensure low acoustic impact of fan control, all changes in PWM duty cycle take place at a controlled, programmable rate. The MAX31790's 3.0V to 5.5V supply voltage range and I²C-compatible interface make it ideal for fan control in a wide range of cooling applications. The MAX31790 is available in a 28-pin TQFN package and operates over the -40°C to +125°C temperature range.

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II. Manufacturing Information

A. Description/Function: 6-Channel PWM-Output Fan RPM Controller
B. Process: S18
C. Fabrication Location: USA
D. Assembly Location: Taiwan
E. Date of Initial Production: December 13, 2012

III. Packaging Information

A. Package Type: 28-pin TQFN
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-MAXCIM-0697
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: 48°C/W
K. Single Layer Theta Jc: 3°C/W
L. Multi Layer Theta Ja: 35°C/W
M. Multi Layer Theta Jc: 3°C/W

IV. Die Information

A. Dimensions: 84.2519X103.937 mils
B. Passivation: Si_3N_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

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V. Quality Assurance Information

A. Quality Assurance Contacts: Eric Wright (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:

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

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

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

λ = 13.7 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 0.06@ 25C and 0.93@ 55C (0.8 eV, 60% UCL)

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

The DT05-0 die type has been found to have all pins able to withstand an 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.

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Table 1
Reliability Evaluation Test Results

MAX31790ATI+T

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

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

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