

RELIABILITY REPORT
FOR
MAX5965AEAX+
PLASTIC ENCAPSULATED DEVICES

February 5, 2010

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX5965AEAX+ 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 MAX5965A/MAX5965B are quad, monolithic, -48V power controllers designed for use in IEEE® 802.3af-compliant/pre-IEEE 802.3at-compatible power-sourcing equipment (PSE). These devices provide powered device (PD) discovery, classification, current limit, DC and AC load disconnect detections in compliance with the IEEE 802.3af standard. The MAX5965A/MAX5965B are pin compatible with the MAX5952/MAX5945/LTC4258/LTC4259A PSE controllers and provide additional features. The MAX5965A/MAX5965B feature a high-power mode that provides up to 45W per port. The MAX5965A/MAX5965B provide new Class 5 and 2-event classification (Class 6) for detection and classification of high-power PDs. The MAX5965A/MAX5965B provide instantaneous readout of each port current through the I²C interface. The MAX5965A/MAX5965B also provide high-capacitance detection for legacy PDs. These devices feature an I²C-compatible, 3-wire serial interface, and are fully software configurable and programmable. The class-overcurrent detection function enables system power management to detect if a PD draws more than the allowable current. The MAX5965A/MAX5965B's extensive programmability enhances system flexibility, enables field diagnosis, and allows for uses in other applications. The MAX5965A/MAX5965B provide four operating modes to suit different system requirements. Auto mode allows the devices to operate automatically without any software supervision. Semi-automatic mode automatically detects and classifies a device connected to a port after initial software activation, but does not power up that port until instructed to by software. Manual mode allows total software control of the device and is useful for system diagnostics. Shutdown mode terminates all activities and securely turns off power to the ports. The MAX5965A/MAX5965B provide input undervoltage lockout (UVLO), input undervoltage detection, a load-stability safety check during detection, input overvoltage lockout, overtemperature detection, output voltage slew-rate limit during startup, power-good status, and fault status. The MAX5965A/MAX5965B's programmability includes startup timeout, overcurrent timeout, and load-disconnect detection timeout. The MAX5965A/MAX5965B are available in a 36-pin SSOP package and are rated for both extended (-40°C to +85°C) and upper commercial (0°C to +85°C) temperature ranges.

II. Manufacturing Information

A. Description/Function:	High-Power, Quad, Monolithic, PSE Controllers for Power over Ethernet
B. Process:	S45
C. Number of Device Transistors:	147840
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Malaysia, Philippines
F. Date of Initial Production:	12/2/2009

III. Packaging Information

A. Package Type:	36-pin SSOP
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:	#05-9000-3250
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:	84.7457627119°C/W

IV. Die Information

A. Dimensions:	171 X 142 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:	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 in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 46 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

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

$$\lambda = 23,4 \times 10^{-9}$$

$$\lambda = 23,4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S45 Process results in a FIT Rate of 0.49 @ 25C and 8.49 @ 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 NQ19 die type has been found to have all pins able to withstand a HBM transient pulse of 2000 per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of 250.

Table 1
Reliability Evaluation Test Results

MAX5965AEAX+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	46	0
Moisture Testing (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	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