

RELIABILITY REPORT

FOR

MAX5995BETE+  
MAX5995BETE+T

PLASTIC ENCAPSULATED DEVICES

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**MAXIM INTEGRATED**

160 RIO ROBLES  
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## Conclusion

The MAX5995B 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 MAX5995A/MAX5995B/MAX5995C provide a complete interface for a powered device (PD) to comply with the IEEE® 802.3af/at/bt standard in a Power-Over-Ethernet (PoE) system. The devices provide the PD with a detection signature, classification signature, and an integrated isolation power switch with startup inrush current control. During the startup period, the devices limit the current to 135mA (typ) before switching to the higher current limit (1800mA to 2400mA, typ) when the isolation power MOSFET is fully enhanced. The devices feature Multi-Event classification, Intelligent MPS (MAX5995B/MAX5995C), Autoclass (MAX5995C), an input UVLO with wide hysteresis and long deglitch time to compensate for twistedpair cable resistive drop and to assure glitch-free transition during power-on/-off conditions. The devices can withstand a maximum voltage of 100V at the input.

The devices support a Multi-Event classification method, as specified in the IEEE 802.3bt standard, and provide a signal to indicate from Type 1 to Type 4 Power Sourcing Equipment (PSE). The devices can detect the presence of a wall adapter power source connection and allow a smooth switch-over from the PoE power source to the wall power adapter.

The devices also provide a power-good (PG) signal, two-step current limit and foldback control, overtemperature protection. A sleep mode feature in the MAX5995A/MAX5995B minimizes low power consumption while generating the Maintain Power Signature (MPS) to maintain PSE connection. An Ultra-Low-Power sleep mode feature in the MAX5995A/MAX5995B further reduces power consumption while still generating MPS current. The MAX5995B/MAX5995C provides Intelligent Maintain Power Signature (IMPS) feature to automatically enable MPS current by detecting the port current. The devices feature a LED driver that is activated during sleep mode, Ultra-Low-Power sleep mode(MAX5995A/MAX5995B), and Intelligent MPS mode(MAX5995B/MAX5995C). Multi-Event indication feature provides patterned signals to indicate power level allocated from PSE to PD in 5 different scenarios. The MAX5995C provides Autoclass feature to enable advanced applications that allow the PSE to effectively optimize power allocation to PD.

The MAX5995A/MAX5995B/MAX5995C are available in a 16-pin, 5mm x 5mm, TQFN power package. These devices are rated over the -40°C to +85°C temperature range.

**II. Manufacturing Information**

A. Description/Function:	IEEE 802.3bt-Compliant, Powered Device Interface Controllers with Integrated 91W High-Power MOSFET
B. Process:	S4
C. Device Count:	10940
D. Fabrication Location:	Japan
E. Assembly Location:	Taiwan or Thailand
F. Date of Initial Production:	October 12, 2018

**III. Packaging Information**

A. Package Type:	TQFN
B. Lead Frame:	Cu194
C. Lead Finish:	NiPdAu Preplate
D. Die Attach:	EN4900G or AB8200T
E. Bondwire:	Au (1.30 mil dia.)
F. Mold Material:	G770HJ or G770HCD
G. Assembly Diagram:	05-101040
H. Flammability Rating:	UL-94 (V-0 Rating)
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:	2.70 °C/W
L. Multi Layer Theta Ja:	35 °C/W
M. Multi Layer Theta Jc:	2.70 °C/W

**IV. Die Information**

A. Dimensions:	94X94 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub>

## V. Quality Assurance Information

A. Quality Assurance Contacts:	Norbert Gerena (Engineer, Reliability) Brian Standley (Manager, Reliability) Bryan Preeshl (SVP 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 125C biased (static) life test are shown in Table 1. Using these results, the Failure Rate  $\lambda$  is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 2454 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 2454 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 24.31 \times 10^{-9}$$

$$\lambda = 24.31 \text{ FITs (60\% confidence level @25°C)}$$

Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <https://www.maximintegrated.com/en/support/qa-reliability/reliability/reliability-monitor-program.html>.

Epson S4 Quarterly Process FIT from Q3CY18

$$\lambda = 1.9 \text{ FITs (60\% confidence level @25°C)}$$

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

The MAX5995B has been found to have all pins able to withstand an HBM transient pulse of +/- 2000 V per JEDEC / ESDA JS-001. Latch-Up testing has shown that this device withstands +/- 250 mA current injection and supply overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX5995BETE+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 125C	DC Parameters & functionality	80	0	
	Biased Time = 192 hrs.				

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