

RELIABILITY REPORT

FOR

MAX765CPA+, MAX765EPA+,
MAX765CSA+, MAX765CSA+T,
MAX765ESA+, MAX765ESA+T

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MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134


Sheena Karlyn Basinang
Engineer, Reliability


Ryan Wall
Manager, Reliability

Conclusion

The MAX765 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 MAX764/MAX765/MAX766 inverting switching regulators are highly efficient over a wide range of load currents, delivering up to 1.5W. A unique, current-limited, pulse-frequency-modulated (PFM) control scheme combines the benefits of traditional PFM converters with the benefits of pulse-width-modulated (PWM) converters. Like PWM converters, the MAX764/MAX765/MAX766 are highly efficient at heavy loads. Yet because they are PFM devices, they use less than 120 μ A of supply current (vs. 2mA to 10mA for a PWM device).

The input voltage range is 3V to 16V. The output voltage is preset at -5V (MAX764), -12V (MAX765), or -15V (MAX766); it can also be adjusted from -1V to -16V using two external resistors (Dual Mode™). The maximum operating VIN - VOUT differential is 20V.

These devices use miniature external components; their high switching frequencies (up to 300kHz) allow for less than 5mm diameter surface-mount magnetics. A standard 47 μ H inductor is ideal for most applications, so no magnetics design is necessary.

An internal power MOSFET makes the MAX764/MAX765/ MAX766 ideal for minimum component count, low- and medium-power applications. For increased output drive capability or higher output voltages, use the MAX774/MAX775/MAX776 or MAX1774, which drive an external power P-channel MOSFET for loads up to 5W.

II. Manufacturing Information

A. Description/Function:	-5V/-12V/-15V or Adjustable, High-Efficiency, Low IQ DC-DC Inverters
B. Process:	SG5
C. Device Count:	N/A
D. Fabrication Location:	USA
E. Assembly Location:	Thailand, Philippines
F. Date of Initial Production:	June 1994

III. Packaging Information

A. Package Type:	SOIC (N)	PDIP
B. Lead Frame:	Cu194	Cu194
C. Lead Finish:	Matte Tin	Matte Tin
D. Die Attach:	AB8290, AB2200D	AB8390A
E. Bondwire:	1.30 mil Au	1.30 mil Au
F. Mold Material:	G600	G600
G. Assembly Diagram:	05-1701-0130	05-1701-0129
H. Flammability Rating:	UL-94 (V-0 Rating)	UL-94 (V-0 Rating)
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1	Level 1
J. Single Layer Theta Ja:	170 °C/W	110 °C/W
K. Single Layer Theta Jc:	40 °C/W	40 °C/W
L. Multi Layer Theta Ja:	128.40 °C/W	N/A
M. Multi Layer Theta Jc:	36 °C/W	N/A

IV. Die Information

A. Dimensions:	80X145 mils
B. Passivation:	SiN / SiO2

V. Quality Assurance Information

A. Quality Assurance Contacts:	Ryan Wall (Manager, Reliability) Michael Cairnes (Executive Director, 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 λ is calculated as follows:

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

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

$$\lambda = 24.3 \times 10^{-9}$$

$$\lambda = 24.3 \text{ FITs (60\% confidence level @25°C)}$$

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>.

SG5 cumulative process Fit

$$\lambda = 0.58 \text{ FITs (60\% confidence level @25°C)}$$

$$\lambda = 6.99 \text{ FITs (60\% confidence level @55°C)}$$

B. ESD and Latch-Up Testing

The MAX765 has been found to have all pins able to withstand an HBM transient pulse of ± 2500 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
MAX765CPA

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

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