

RELIABILITY REPORT

FOR

MAX32660GTG+, MAX32660GTGBL+,
MAX32660GWE+, MAX32660GWEHL+,
MAX32660GTP+

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MAXIM INTEGRATED

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Conclusion

The MAX32660 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

In the DARWIN family, the MAX32660 is an ultra-low-power, cost-effective, highly-integrated 32-bit microcontroller designed for battery-powered devices and wireless sensors. It combines a flexible and versatile power management unit with the powerful Arm® Cortex®-M4 processor with floating point unit (FPU) in the industry's smallest form factor: 1.6mm x 1.6mm, 16-bump WLP or 4mm x 4mm, 20-pin TQFN-EP, or 3mm x 3mm, 24-pin TQFN-EP.

The MAX32660 enables designs with complex sensor processing without compromising battery life. It also offers legacy designs an easy and cost optimal upgrade path from 8- or 16-bit microcontrollers.

The device supports SPI, UART, and I2C communication while also integrating up to 256KB of flash memory and 96KB of RAM to accommodate application and sensor code. An optional bootloader through I2C, UART, or SPI is available.

II. Manufacturing Information

A. Description/Function:	Tiny, Ultra-Low-Power Arm Cortex-M4 Processor with FPU-Based Microcontroller (MCU) with 256KB Flash and 96KB SRAM
B. Process:	TS40
C. Device Count:	1625230
D. Fabrication Location:	Taiwan
E. Assembly Location:	Taiwan
F. Date of Initial Production:	September 24, 2018

III. Packaging Information

	MAX32660GTP+	MAX32660GTG+	MAX32660GWE+
A. Package Type:	20L TQFN-CU	24L TQFN-CU	WLP
B. Lead Frame:	CU194	CU194	N/A
C. Lead Finish:	Matte Tin	Matte Tin	SAC125Ni
D. Die Attach:	EN4900G	EN4900G	N/A
E. Bondwire:	0.8 mil CuPd	0.8 mil CuPd	N/A
F. Mold Material:	G700LA	G700LA	N/A
G. Assembly Diagram:	05-100815	05-100999	05-100790
H. Flammability Rating:	UL-94 (V-0 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	Level 1
J. Single Layer Theta Ja:	48 °C/W	N/A	N/A
K. Single Layer Theta Jc:	2 °C/W	N/A	N/A
L. Multi Layer Theta Ja:	33 °C/W	43.56 °C/W	66.34 °C/W
M. Multi Layer Theta Jc:	2 °C/W	4.94 °C/W	N/A

IV. Die Information

A. Dimensions:	63.1496X62.440 mils
B. Passivation:	SiO/SiN

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:

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

(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>.

TS40 cumulative process Fit

$$\lambda = 1.50 \text{ FITs (60\% confidence level @25°C)}$$

$$\lambda = 18.03 \text{ FITs (60\% confidence level @55°C)}$$

B. ESD and Latch-Up Testing

The MAX32660 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
MAX32660GTG+

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.