

RELIABILITY REPORT
FOR
MAX38650AANT+
MAX38650AANT+T

December 3, 2020

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134



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Conclusion

The MAX38650 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

MAX38650 is a nanoPower ultra-low 390nA quiescent current buck (step-down) DC-DC converter operating from 1.8V to 5.5V input voltage and supporting load currents of up to 100mA with peak efficiencies of 95%. While in shutdown, there is only 5nA of shutdown current. The device offers ultra-low quiescent current, small total solution size, and high efficiency throughout the load range. The device is ideal for battery applications where long battery life is a must. MAX38650 supports 100% Duty Cycle operation allowing seamless transition as battery discharges and falls below the target output voltage. MAX38650 utilizes a unique control scheme that allows ultra-low quiescent current and high efficiency over a wide output current range. The device is offered in a space-saving 1.58mm x 0.89mm 6-pin wafer-level package (WLP) (2 x 3 bumps, 0.4mm pitch)The part is specified for operating temperature from -40°C to +125°C.

II. Manufacturing Information

A. Description/Function:	Tiny 1.8V - 5.5V Input, 390nA IQ, 100mA nanoPower Buck Converter with 100% Duty Cycle Operation
B. Process:	S18
C. Device Count:	13331
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	September 28, 2020

III. Packaging Information

A. Package Type:	Thin WLP
B. Lead Frame:	N/A
C. Lead Finish:	SAC125Ni
D. Die Attach:	N/A
E. Bondwire:	N/A
F. Mold Material:	N/A
G. Assembly Diagram:	05-101567
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:	N/A
K. Single Layer Theta Jc:	N/A
L. Multi Layer Theta Ja:	95.15 °C/W
M. Multi Layer Theta Jc:	N/A

IV. Die Information

A. Dimensions:	63.3858X36.2205 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:

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

(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>.

S18 cumulative process Fit

$$\lambda = 0.02 \text{ FITs (60\% confidence level @25°C)}$$

$$\lambda = 0.24 \text{ FITs (60\% confidence level @55°C)}$$

B. ESD and Latch-Up Testing

The MAX38650 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
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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.