

RELIABILITY REPORT
FOR
MAX77860EWG+
MAX77860EWG+T

August 24, 2020

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134



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Conclusion

The MAX77860 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 MAX77860 is a high-performance single input switch mode charger that features USB Type-C CC detection capability in addition to reverse boost capability and a Safe out LDO.

This switched-mode battery charger with two integrated switches, provides small inductor and capacitor sizes, programmable battery charging current, and is ideally suited for portable devices such as smartphones, IoT devices, and other Li-ion battery powered electronics. The charger features a single input, which works for both USB and high voltage adapters. It supports USB Type-C CC detection under BC 1.2 specification, and the power-path switch is integrated in the chip. All MAX77860 blocks connected to the adapter/USB pin are protected from input overvoltage events up to 14V. The USB-OTG output provides true load disconnect and is protected by an adjustable output current limit. It has an input current limit up to 4.0A and can charge a single-cell battery up to 3.15A. When configured in reverse-boost mode, the IC requires no additional inductors to power USB-OTG accessories. The switching charger is designed with a special CC, CV, and die temperature regulation algorithm, as well as I2C programmable settings to accommodate a wide range of battery sizes and system loads. The on-chip ADC can help monitor the charging input voltage/current, battery voltage, charging/ discharging current, and the battery temperature.

The MAX77860 communicates through an I2C 3.0 compatible serial interface consisting of a bidirectional serial data line (SDA) and a serial clock line (SCL). The IC is available in a 3.9mm x 4.0mm, 81-bump (9 x 9 array), 0.4mm pitch, wafer-level package (WLP).

II. Manufacturing Information

| | |
|--------------------------------|--|
| A. Description/Function: | USB Type-C, 3A Switch-Mode Buck Charger with Integrated CC Detection, Reverse Boost, and ADC |
| B. Process: | S18 |
| C. Device Count: | 323273 |
| D. Fabrication Location: | USA |
| E. Assembly Location: | Taiwan |
| F. Date of Initial Production: | January 24, 2019 |

III. Packaging Information

| | |
|--|--------------------|
| A. Package Type: | WLP |
| B. Lead Frame: | W813C3+1 |
| C. Lead Finish: | SAC125Ni |
| D. Die Attach: | N/A |
| E. Bondwire: | N/A |
| F. Mold Material: | N/A |
| G. Assembly Diagram: | 05-100288 |
| 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: | 36.03 °C/W |
| M. Multi Layer Theta Jc: | N/A |

IV. Die Information

| | |
|-----------------|---------------------|
| A. Dimensions: | 157.0866X153.5 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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 2454 \times 77 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

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

$$\lambda = 25.25 \times 10^{-9}$$

$$\lambda = 25.25 \text{ FITs (60\% confidence level @25°C)}$$

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 MAX77860 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 ± 100 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 | 77 | 0 | |

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