# Process Change Notice #1611161

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| | |
|---|---|
| **PCN Issue Date:** 11/16/2016 | **Effective Date:** 2/22/2017 |
| **Title:** EFM8BB2 Datasheet update | |

**PCN Type:**

| | | |
|---|---|---|
| ☒ **Datasheet** | ☐ **Foundry** | ☐ **Packing** |
| ☐ **Product Revision** | ☐ **Assembly** | ☐ **Labeling** |
| ☐ **Discontinuance** | ☒ **Test** | ☐ **Other** |

**Last Order Date:** NA

**PCN Details**


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**Description of Change:**
Silicon Labs is pleased to announce V1.31 of the EFM8BB2 datasheet. This datasheet release corresponds to the release of the new automotive grade EFM8BB2 devices. These new EFM8BB2 devices have received full AEC-Q100 qualification and are specified for -40 °C to +125 °C operating temperature range. This datasheet release also corresponds to a change in one of the voltage regulator's calibration routines.

The calibration routines for the low dropout voltage regulator (LDO) have been updated and results in a slightly increased (1.8 V vs. 1.85 V) typical LDO output target. This calibration change occurred due to a small drop observed in the LDO output voltage when the device enters lower power modes during an extended characterization study. This LDO output supplies the core and other digital logic on the device. The new calibration method ensures this drop does not occur. No direct issues have been observed on devices using the old calibration method, and this effort is part of the continual improvement process.

Below is a list of changed power consumption specs from the datasheet. Note that some typical values were also slightly increased.

| Temperature Grade | Specification | Previous Data Sheet Value (mA) | New Data Sheet Value (mA) |
|---|---|---|---|
| G-grade devices, -40 °C to +85 °C | Normal Mode 49 MHz (Maximum) | 9.7 | 10.1 |
| | Normal Mode 24.5 MHz (Maximum) | 4.85 | 5.2 |
| | Idle Mode 49 MHz (Maximum) | 6.6 | 6.8 |
| | Idle Mode 24.5 MHz (Maximum) | 3.2 | 3.3 |
| I-grade devices, -40 °C to +125 °C | Normal Mode 49 MHz (Maximum) | 10.47 | 10.9 |
| | Normal Mode 24.5 MHz (Maximum) | 5.49 | 5.6 |
| | Idle Mode 49 MHz (Maximum) | 7.3 | 7.4 |
| | Idle Mode 24.5 MHz (Maximum) | 3.86 | 3.9 |
| G-grade devices, -40 °C to +85 °C | Normal Mode 49 MHz (Typical) | 9.1 | 9.4 |
| | Normal Mode 24.5 MHz (Typical) | 4.3 | 4.5 |
| | Idle Mode 49 MHz (Typical) | 6.15 | 6.3 |
| | Idle Mode 24.5 MHz (Typical) | 2.8 | 2.9 |
| I-grade devices, -40 °C to +125 °C | Normal Mode 49 MHz (Typical) | 9.1 | 9.4 |
| | Normal Mode 24.5 MHz (Typical) | 4.3 | 4.5 |
| | Idle Mode 49 MHz (Typical) | 6.15 | 6.3 |


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| | | | |
|---|---|---|---|
| | Idle Mode 24.5 MHz (Typical) | 2.8 | 2.9 |

The following changes were also made to the V1.30 and V1.31 datasheet
- The addition of table 4.11 “1.8V Internal Low Dropout Voltage Regulator” to outline its minimum, typical, and maximum voltages.
- The addition of automotive devices in the product selection table and ordering information.
- Addition of AEC-Q100 under the key features and specifications.
- Added thermal resistance (junction to case) for the QFN20 package.
- Added a note linking to the output low voltage and output high voltage table of the port I/Os to the performance curves.
- Added the sizes of transmit and receive FIFOs for the SMBus and I2C slave peripherals.
- Added a line in the introduction section to mention the reference manual where an individual can find more technical information on registers and blocks.
- Added a note on the comparator reference current consumption to clarify its source.

After the issue date of this PCN, the EFM8BB2 datasheet will reflect the changes listed above and all automotive (A) grade EFM8BB2 devices will adhere to the V1.31 datasheet. After the effective date of this PCN all commercial (G) and industrial (I) grade EFM8BB2 devices will adhere to the specifications in the aforementioned datasheet. For questions please contact your Silicon Labs representative.

**Reason for Change:**

1. The release of the new EFM8BB2 automotive qualified devices.
2. The release of V1.31 of the EFM8BB2 datasheet.
3. The calibration routine for the LDO has been updated and affects power consumption numbers in normal and idle mode.

**Impact on Form, Fit, Function, Quality, Reliability:**

This is considered a minor change to form, fit, function, quality, and reliability and is part of Silicon Labs’ commitment to a continual improvement process.

**Product Identification:**

Devices affected at the issue date of this PCN:
EFM8BB21F16A-C-QFN20
EFM8BB21F16A-C-QFN20R
EFM8BB22F16A-C-QFN28
EFM8BB22F16A-C-QFN28R

Devices affected at the effective date of this PCN:
EFM8BB21F16G-C-QFN20
EFM8BB21F16G-C-QFN20R
EFM8BB21F16G-C-QSOP24
EFM8BB21F16G-C-QSOP24R
EFM8BB21F16I-C-QFN20
EFM8BB21F16I-C-QFN20R
EFM8BB21F16I-C-QSOP24
EFM8BB21F16I-C-QSOP24R
EFM8BB22F16G-C-QFN28
EFM8BB22F16G-C-QFN28R
EFM8BB22F16I-C-QFN28
EFM8BB22F16I-C-QFN28R


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|---|
| **Last Date of Unchanged Product:** 2/22/2017 |
| **Qualification Samples:**<br>Available upon request. |
| **Specific conditions of acceptance of this change will be considered on a case by case basis if written notice is submitted within 30 days of this notice. To request further data or inquire about this notification, please contact your local Silicon Labs sales representative. A list of Silicon Labs sales representatives is available at www.silabs.com .**<br><br>**In some cases rejection of a change notice may impact Silicon Labs product pricing, delivery, quality, or reliability.** |
| **Customer Early Acceptance Sign Off:**<br>**Customers may approve early PCN acceptance by completing the information below:**<br>**Early Acceptance: Date: _____**<br>**Name: _____**<br>**Company: _____**<br>**Email your early Acceptance approval to: katherine.haggar@silabs.com** |
| **Qualification Data:**<br>Please see appendix. |


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Appendix

# EFM8BB2x AEC-Q100 Qualification Report

**W7101F1 - Product Qualification Report Record Rev. H**

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**EFM8BB2x Rev A2/A3/A4, HHGrace Fabrication, ASECL and UTACTH Assembly**

| Test Name | Test Condition | Qualification | Lot ID or Start | Fail/Pass or End | Notes | Summary | Status |
|---|---|---|---|---|---|---|---|
| Test Group A – Accelerated Environment Stress Tests - 20QFN - CuPd Wire ASECL | | | | | | | |
| HAST | JA110 | | Q037190 | 0/77 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q037191 | 0/80 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q037192 | 0/80 | 1 | 0/237 | |
| UHAST | JA110 | | Q037199 | 0/81 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q037200 | 0/80 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q037202 | 0/82 | 1 | 0/243 | |
| Temp Cycle | JA104 | | Q037196 | 0/80 | 1 | | |
| | Cond C: -65°C to 150°C | 3 lots, N=>77 | Q037197 | 0/80 | 1 | 3 lots | Pass |
| | 500 cycles | | Q037198 | 0/80 | 1 | 0/240 | |
| HTSL | JA103 | | Q037193 | 0/30 | 1 | | |
| | 150°C, 1000hr | 1 lot, N=>45 | Q037194 | 0/30 | 1 | 3 lots | Pass |
| | | | Q037195 | 0/30 | 1 | 0/90 | |
| Test Group A – Accelerated Environment Stress Tests - 28QFN - CuPd Wire UTACTH | | | | | | | |
| HAST | JA110 | | Q035792 | 0/80 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q035788 | 0/77 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q035789 | 0/80 | 1 | 0/237 | |
| UHAST | JA110 | | Q037163 | 0/80 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q037164 | 0/80 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q037165 | 0/80 | 1 | 0/240 | |
| Temp Cycle | JA104 | | Q037160 | 0/80 | 1 | | |
| | Cond C: -65°C to 150°C | 3 lots, N=>77 | Q037161 | 0/80 | 1 | 3 lots | Pass |
| | 500 cycles | | Q037162 | 0/80 | 1 | 0/240 | |
| HTSL | JA103 | | Q035682 | 0/30 | 1 | | |
| | 150°C, 1000hr | | Q037977 | 0/80 | 1 | | |
| | | 1 lot, N=>45 | Q037159 | 0/30 | 1 | 4 lots | Pass |
| | | | Q037806 | 0/45 | 1 | 0/185 | |
| Test Group A – Accelerated Environment Stress Tests - 24QSOP - CuPd Wire UTACTH | | | | | | | |
| HAST | JA110 | | Q036513 | 0/80 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q036515 | 0/80 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q036519 | 0/80 | 1 | 0/240 | |
| UHAST | JA110 | | Q036526 | 0/80 | 1 | | |
| | 130°C, 85%RH | 3 lots, N=>77 | Q036527 | 0/80 | 1 | 3 lots | Pass |
| | Vcc=3.6V, 96 hours | | Q036528 | 0/80 | 1 | 0/240 | |
| Temp Cycle | JA104 | | Q036523 | 0/80 | 1 | | |
| | Cond C: -65°C to 150°C | 3 lots, N=>77 | Q036524 | 0/80 | 1 | 3 lots | Pass |
| | 500 cycles | | Q036525 | 0/80 | 1 | 0/240 | |
| HTSL | JA103 | | Q036520 | 0/28 | 1 | | |
| | 150°C, 1000hr | 1 lot, N=>45 | Q036521 | 0/28 | 1 | 3 lots | Pass |
| | | | Q036522 | 0/28 | 1 | 0/84 | |

Approved by: Vincent Hidajat 1 of 3 Prepared on: 16-Aug-16


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# EFM8BB2x AEC-Q100 Qualification Report

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| EFM8BB2x Rev A2/A3/A4, HHGrace Fabrication, ASECL and UTACTH Assembly | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test Name** | **Test Condition** | **Qualification** | **Lot ID or Start** | **Fail/Pass or End** | **Notes** | **Summary** | **Status** |
| Test Group A – Accelerated Environment Stress Tests - 24QFN - CuPd Wire UTACTH | | | | | | | |
| HAST | JA110<br>130°C, 85%RH<br>Vcc=3.6V, 96 hours | 3 lots, N=>77 | Q035792<br>Q035788<br>Q035789 | 0/80<br>0/77<br>0/80 | 1<br>1<br>1 | 3 lots<br>0/237 | Pass |
| UHAST | JA110<br>130°C, 85%RH<br>Vcc=3.6V, 96 hours | 3 lots, N=>77 | Q037163<br>Q037164<br>Q037165 | 0/80<br>0/80<br>0/80 | 1<br>1<br>1 | 3 lots<br>0/240 | Pass |
| Temp Cycle | JA104<br>Cond C: -65°C to 150°C<br>500 cycles | 3 lots, N=>77 | Q038520<br>Q038521<br>Q038522 | 0/80<br>0/80<br>0/80 | 1<br>1<br>1 | 3 lots<br>0/240 | Pass |
| HTSL | JA103<br>150°C, 1000hr | 1 lot, N=>45 | Q035682<br>Q037977<br>Q037159 | 0/30<br>0/80<br>0/30 | 1<br>1<br>1 | 3 lots<br>0/140 | Pass |
| Test Group B – Accelerated Lifetime Simulation Tests | | | | | | | |
| HTOL | JA108<br>$T_J \geq 125°C$, Dynamic<br>Vcc=3.6V, 1000 hours | 3 lots, N=>77 | Q035684<br>Q035685<br>Q037250 | 0/84<br>0/84<br>0/80 | | 3 lots<br>0/248 | Pass |
| LTOL | JA108<br>-40°C, Dynamic<br>Vcc=3.6V, 1000 hours | 1 lot, N=>32 | Q036550 | 0/35 | | 1 lots<br>0/35 | Pass |
| ELFR | AEC-Q100-008<br>$T_J \geq 125°C$, Dynamic<br>Vcc=3.6V, 48 hours | 3 lots, N=>800 | Q035681<br>Q036910<br>Q037251<br>Q036509 | 0/839<br>0/839<br>0/836<br>0/840 | | 4 lots<br>0/3354 | Pass |
| Data Retention High Temp | AEC Q100-005<br>150°C, 1000hrs | 3 lots, N=>39 | Q035781<br>Q035783<br>Q037252 | 0/45<br>0/44<br>0/45 | | 3 lots<br>0/134 | Pass |
| Data Retention Low Temp | AEC Q100-005<br>25°C, 1000hrs | 3 lots, N=>38 | Q035784<br>Q035786<br>Q037253 | 0/45<br>0/45<br>0/45 | | 3 lots<br>0/135 | Pass |
| NVM P/E Cycling High Temp | AEC Q100-005<br>85°C, 24hrs | 3 lots, N=>77 | Q035787<br>Q035782<br>Q037254 | 0/84<br>0/84<br>0/84 | | 3 lots<br>0/252 | Pass |
| NVM P/E Cycling Low temp | AEC Q100-005<br>55°C, 24hrs | 3 lots, N=>77 | Q035791<br>Q035785<br>Q037255 | 0/80<br>0/80<br>0/84 | | 3 lots<br>0/244 | Pass |

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# EFM8BB2x AEC-Q100 Qualification Report

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**EFM8BB2x Rev A2/A3/A4, HHGrace Fabrication, ASECL and UTACTH Assembly**

| Test Name | Test Condition | Qualification | Lot ID or Start | Fail/Pass or End | Notes | Summary | Status |
|---|---|---|---|---|---|---|---|
| Test Group C – Package Assembly Integrity Tests | | | | | | | |
| Wire Bond Pull | M-STD-883<br>Performed post-TC | 5 units, N=>30<br>20QFN | Q037487 | 0/5 | 2 | 1 lots<br>0/5 | Pass |
| Wire Bond Pull | M-STD-883<br>Performed post-TC | 5 units, N=>30<br>28QFN | Q037489 | 0/5 | 3 | 1 lots<br>0/5 | Pass |
| Wire Bond Pull | M-STD-883<br>Performed post-TC | 5 units, N=>30<br>24QSOP | Q037707 | 0/5 | 4 | 1 lots<br>0/5 | Pass |
| Wire Bond Pull | M-STD-883<br>Performed post-TC | 5 units, N=>30<br>24QFN | Q038577 | 0/5 | 5 | 1 lots<br>0/5 | Pass |
| Test Group E – Electrical Verification | | | | | | | |
| ESD-HBM | AEC-Q100-002 | 1 lot, N=>3 | Q036561<br>Q035689<br>Q037643 | | | | 2 kV<br>2 kV<br>2 kV |
| ESD-CDM | AEC-Q100-011 | 1 lot, N=>3 | Q036705<br>Q035688<br>Q037648<br>Q036558<br>Q036512<br>Q038628 | | 2<br>3<br>3<br>3<br>4<br>5 | | 1500 V<br>1250 V<br>1250 V<br>1500 V<br>1500 V<br>1500 V |
| Latch Up | AEC-Q100-004<br>±200mA | 1 lot, N=>6 | Q037647<br>Q037674 | 125 °C<br>25 °C | | | Pass<br>Pass |
| Electromagnetic Compatibility | SAE J1752 | 1 lot, N=>1 | Q038023 | | | | Pass |

Notes:
1. Parts are Pre-conditioned at MSL2/260°C
2. 20-QFN
3. 28-QFN
4. 24-QSOP
5. 24-QFN

This report applies to the following part numbers:

| | | |
|---|---|---|
| EFM8BB21F16G-C-QSOP24 | EFM8BB21F16I-C-QSOP24 | EFM8BB21F16A-C-QFN20 |
| EFM8BB21F16G-C-QFN20 | EFM8BB21F16I-C-QFN20 | EFM8BB22F16A-C-QFN28 |
| EFM8BB22F16G-C-QFN28 | EFM8BB22F16I-C-QFN28 | |

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