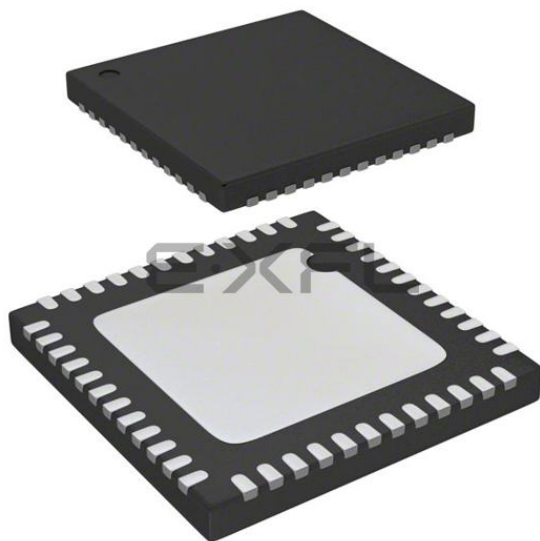




Welcome to [E-XFL.COM](https://www.e-xfl.com)

What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "[Embedded - Microcontrollers](#)"

Details

Product Status	Active
Core Processor	ARM® Cortex®-M3
Core Size	32-Bit Single-Core
Speed	40MHz
Connectivity	I ² C, IrDA, LINbus, SmartCard, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, DMA, I ² S, POR, PWM, WDT
Number of I/O	32
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	32K x 8
Voltage - Supply (Vcc/Vdd)	1.85V ~ 3.8V
Data Converters	A/D 24x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	48-VFQFN Exposed Pad
Supplier Device Package	48-QFN (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/silicon-labs/efm32jg1b200f128gm48-c0r

3.2 Power

The EFM32JG1 has an Energy Management Unit (EMU) and efficient integrated regulators to generate internal supply voltages. Only a single external supply voltage is required, from which all internal voltages are created. An optional integrated dc-dc buck regulator can be utilized to further reduce the current consumption. The dc-dc regulator requires one external inductor and one external capacitor.

AVDD and VREGVDD need to be 1.85 V or higher for the MCU to operate across all conditions; however the rest of the system will operate down to 1.62 V, including the digital supply and I/O. This means that the device is fully compatible with 1.8 V components. Running from a sufficiently high supply, the device can use the dc-dc to regulate voltage not only for itself, but also for other PCB components, supplying up to a total of 200 mA.

3.2.1 Energy Management Unit (EMU)

The Energy Management Unit manages transitions of energy modes in the device. Each energy mode defines which peripherals and features are available and the amount of current the device consumes. The EMU can also be used to turn off the power to unused RAM blocks, and it contains control registers for the DC-DC regulator and the Voltage Monitor (VMON). The VMON is used to monitor multiple supply voltages. It has multiple channels which can be programmed individually by the user to determine if a sensed supply has fallen below a chosen threshold.

3.2.2 DC-DC Converter

The DC-DC buck converter covers a wide range of load currents and provides up to 90% efficiency in energy modes EM0, EM1, EM2 and EM3, and can supply up to 200 mA to the device and surrounding PCB components. Protection features include programmable current limiting, short-circuit protection, and dead-time protection. The DC-DC converter may also enter bypass mode when the input voltage is too low for efficient operation. In bypass mode, the DC-DC input supply is internally connected directly to its output through a low resistance switch. Bypass mode also supports in-rush current limiting to prevent input supply voltage droops due to excessive output current transients.

3.3 General Purpose Input/Output (GPIO)

EFM32JG1 has up to 32 General Purpose Input/Output pins. Each GPIO pin can be individually configured as either an output or input. More advanced configurations including open-drain, open-source, and glitch-filtering can be configured for each individual GPIO pin. The GPIO pins can be overridden by peripheral connections, like SPI communication. Each peripheral connection can be routed to several GPIO pins on the device. The input value of a GPIO pin can be routed through the Peripheral Reflex System to other peripherals. The GPIO subsystem supports asynchronous external pin interrupts.

3.4 Clocking

3.4.1 Clock Management Unit (CMU)

The Clock Management Unit controls oscillators and clocks in the EFM32JG1. Individual enabling and disabling of clocks to all peripheral modules is performed by the CMU. The CMU also controls enabling and configuration of the oscillators. A high degree of flexibility allows software to optimize energy consumption in any specific application by minimizing power dissipation in unused peripherals and oscillators.

3.4.2 Internal and External Oscillators

The EFM32JG1 supports two crystal oscillators and fully integrates four RC oscillators, listed below.

- A high frequency crystal oscillator (HFXO) with integrated load capacitors, tunable in small steps, provides a precise timing reference for the MCU. Crystal frequencies in the range from 38 to 40 MHz are supported. An external clock source such as a TCXO can also be applied to the HFXO input for improved accuracy over temperature.
- A 32.768 kHz crystal oscillator (LFXO) provides an accurate timing reference for low energy modes.
- An integrated high frequency RC oscillator (HFRCO) is available for the MCU system, when crystal accuracy is not required. The HFRCO employs fast startup at minimal energy consumption combined with a wide frequency range.
- An integrated auxiliary high frequency RC oscillator (AUXHFRCO) is available for timing the general-purpose ADC and the Serial Wire debug port with a wide frequency range.
- An integrated low frequency 32.768 kHz RC oscillator (LFRCO) can be used as a timing reference in low energy modes, when crystal accuracy is not required.
- An integrated ultra-low frequency 1 kHz RC oscillator (ULFRCO) is available to provide a timing reference at the lowest energy consumption in low energy modes.

4.1.2 Operating Conditions

When assigning supply sources, the following requirements must be observed:

- VREGVDD must be the highest voltage in the system
- VREGVDD = AVDD
- DVDD $\leq$ AVDD
- IOVDD $\leq$ AVDD

4.1.2.1 General Operating Conditions

Table 4.2. General Operating Conditions

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Operating temperature range	T _{OP}	-G temperature grade, Ambient Temperature	-40	25	85	°C
		-I temperature grade, Junction Temperature	-40	25	125	°C
AVDD Supply voltage ¹	V _{AVDD}		1.85	3.3	3.8	V
VREGVDD Operating supply voltage ^{1 2}	V _{VREGVDD}	DCDC in regulation	2.4	3.3	3.8	V
		DCDC in bypass, 50mA load	1.85	3.3	3.8	V
		DCDC not in use. DVDD externally shorted to VREGVDD	1.85	3.3	3.8	V
VREGVDD Current	I _{VREGVDD}	DCDC in bypass, T _{amb} $\leq$ 85 °C	—	—	200	mA
		DCDC in bypass, T _{amb} > 85 °C	—	—	100	mA
DVDD Operating supply voltage	V _{DVDD}		1.62	—	V _{VREGVDD}	V
IOVDD Operating supply voltage	V _{IOVDD}		1.62	—	V _{VREGVDD}	V
Difference between AVDD and VREGVDD, ABS(AVDD-VREGVDD)	dV _{DD}		—	—	0.1	V
HFCLK frequency	f _{CORE}	0 wait-states (MODE = WS0) ³	—	—	26	MHz
		1 wait-states (MODE = WS1) ³	—	—	40	MHz

Note:

1. VREGVDD must be tied to AVDD. Both VREGVDD and AVDD minimum voltages must be satisfied for the part to operate.
2. The minimum voltage required in bypass mode is calculated using R_{BYP} from the DCDC specification table. Requirements for other loads can be calculated as V_{DVDD_min} + I_{LOAD} * R_{BYP_max}
3. In MSC_READCTRL register

4.1.6 Wake up times

Table 4.8. Wake up times

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Wake up from EM2 Deep Sleep	t _{EM2_WU}	Code execution from flash	—	10.7	—	μs
		Code execution from RAM	—	3	—	μs
Wakeup time from EM1 Sleep	t _{EM1_WU}	Executing from flash	—	3	—	AHB Clocks
		Executing from RAM	—	3	—	AHB Clocks
Wake up from EM3 Stop	t _{EM3_WU}	Executing from flash	—	10.7	—	μs
		Executing from RAM	—	3	—	μs
Wake up from EM4H Hiber-nate ¹	t _{EM4H_WU}	Executing from flash	—	60	—	μs
Wake up from EM4S Shut-off ¹	t _{EM4S_WU}		—	290	—	μs
Note: 1. Time from wakeup request until first instruction is executed. Wakeup results in device reset.						

4.1.7 Brown Out Detector

Table 4.9. Brown Out Detector

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DVDD BOD threshold	$V_{DVDDBOD}$	DVDD rising	—	—	1.62	V
		DVDD falling	1.35	—	—	V
DVDD BOD hysteresis	$V_{DVDDBOD_HYST}$		—	24	—	mV
DVDD response time	$t_{DVDDBOD_DELAY}$	Supply drops at 0.1V/ μs rate	—	2.4	—	μs
AVDD BOD threshold	$V_{AVddbOD}$	AVDD rising	—	—	1.85	V
		AVDD falling	1.62	—	—	V
AVDD BOD hysteresis	$V_{AVddbOD_HYST}$		—	21	—	mV
AVDD response time	$t_{AVddbOD_DELAY}$	Supply drops at 0.1V/ μs rate	—	2.4	—	μs
EM4 BOD threshold	V_{EM4BOD}	AVDD rising	—	—	1.7	V
		AVDD falling	1.45	—	—	V
EM4 BOD hysteresis	V_{EM4BOD_HYST}		—	46	—	mV
EM4 response time	t_{EM4BOD_DELAY}	Supply drops at 0.1V/ μs rate	—	300	—	μs

4.1.13 IDAC

Table 4.19. IDAC

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Number of Ranges	N _{IDAC_RANGES}		—	4	—	-
Output Current	I _{IDAC_OUT}	RANGSEL ¹ = RANGE0	0.05	—	1.6	μA
		RANGSEL ¹ = RANGE1	1.6	—	4.7	μA
		RANGSEL ¹ = RANGE2	0.5	—	16	μA
		RANGSEL ¹ = RANGE3	2	—	64	μA
Linear steps within each range	N _{IDAC_STEPS}		—	32	—	
Step size	SS _{IDAC}	RANGSEL ¹ = RANGE0	—	50	—	nA
		RANGSEL ¹ = RANGE1	—	100	—	nA
		RANGSEL ¹ = RANGE2	—	500	—	nA
		RANGSEL ¹ = RANGE3	—	2	—	μA
Total Accuracy, STEPSEL ¹ = 0x10	ACC _{IDAC}	EM0 or EM1, AVDD=3.3 V, T = 25 °C	-2	—	2	%
		EM0 or EM1	-18	—	22	%
		EM2 or EM3, Source mode, RANGSEL ¹ = RANGE0, AVDD=3.3 V, T = 25 °C	—	-2	—	%
		EM2 or EM3, Source mode, RANGSEL ¹ = RANGE1, AVDD=3.3 V, T = 25 °C	—	-1.7	—	%
		EM2 or EM3, Source mode, RANGSEL ¹ = RANGE2, AVDD=3.3 V, T = 25 °C	—	-0.8	—	%
		EM2 or EM3, Source mode, RANGSEL ¹ = RANGE3, AVDD=3.3 V, T = 25 °C	—	-0.5	—	%
		EM2 or EM3, Sink mode, RANGSEL ¹ = RANGE0, AVDD=3.3 V, T = 25 °C	—	-0.7	—	%
		EM2 or EM3, Sink mode, RANGSEL ¹ = RANGE1, AVDD=3.3 V, T = 25 °C	—	-0.6	—	%
		EM2 or EM3, Sink mode, RANGSEL ¹ = RANGE2, AVDD=3.3 V, T = 25 °C	—	-0.5	—	%
		EM2 or EM3, Sink mode, RANGSEL ¹ = RANGE3, AVDD=3.3 V, T = 25 °C	—	-0.5	—	%
Start up time	t _{IDAC_SU}	Output within 1% of steady state value	—	5	—	μs

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Settling time, (output settled within 1% of steady state value)	t_{IDAC_SETTLE}	Range setting is changed	—	5	—	μs
		Step value is changed	—	1	—	μs
Current consumption in EM0 or EM1 ²	I_{IDAC}	Source mode, excluding output current	—	8.9	13	μA
		Sink mode, excluding output current	—	12	16	μA
Current consumption in EM2 or EM3 ²	I_{IDAC}	Source mode, excluding output current, duty cycle mode, $T = 25^{\circ}C$	—	1.04	—	μA
		Sink mode, excluding output current, duty cycle mode, $T = 25^{\circ}C$	—	1.08	—	μA
		Source mode, excluding output current, duty cycle mode, $T \geq 85^{\circ}C$	—	8.9	—	μA
		Sink mode, excluding output current, duty cycle mode, $T \geq 85^{\circ}C$	—	12	—	μA
Output voltage compliance in source mode, source current change relative to current sourced at 0 V	I_{COMP_SRC}	RANGESEL1=0, output voltage = $\min(V_{IOVDD}, V_{AVDD}^2 - 100 \text{ mV})$	—	0.04	—	%
		RANGESEL1=1, output voltage = $\min(V_{IOVDD}, V_{AVDD}^2 - 100 \text{ mV})$	—	0.02	—	%
		RANGESEL1=2, output voltage = $\min(V_{IOVDD}, V_{AVDD}^2 - 150 \text{ mV})$	—	0.02	—	%
		RANGESEL1=3, output voltage = $\min(V_{IOVDD}, V_{AVDD}^2 - 250 \text{ mV})$	—	0.02	—	%
Output voltage compliance in sink mode, sink current change relative to current sunk at IOVDD	I_{COMP_SINK}	RANGESEL1=0, output voltage = 100 mV	—	0.18	—	%
		RANGESEL1=1, output voltage = 100 mV	—	0.12	—	%
		RANGESEL1=2, output voltage = 150 mV	—	0.08	—	%
		RANGESEL1=3, output voltage = 250 mV	—	0.02	—	%

Note:

1. In IDAC_CURPROG register
2. The IDAC is supplied by either AVDD, DVDD, or IOVDD based on the setting of ANASW in the EMU_PWRCTRL register and PWRSEL in the IDAC_CTRL register. Setting PWRSEL to 1 selects IOVDD. With PWRSEL cleared to 0, ANASW selects between AVDD (0) and DVDD (1).

4.1.16 USART SPI

SPI Master Timing

Table 4.24. SPI Master Timing

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
SCLK period ^{1 2}	t_{SCLK}		2 * t_{HFPERCLK}	—	—	ns
CS to MOSI ^{1 2}	$t_{\text{CS_MO}}$		0	—	8	ns
SCLK to MOSI ^{1 2}	$t_{\text{SCLK_MO}}$		3	—	20	ns
MISO setup time ^{1 2}	$t_{\text{SU_MI}}$	IOVDD = 1.62 V	56	—	—	ns
		IOVDD = 3.0 V	37	—	—	ns
MISO hold time ^{1 2}	$t_{\text{H_MI}}$		6	—	—	ns

Note:

1. Applies for both CLKPHA = 0 and CLKPHA = 1 (figure only shows CLKPHA = 0)
2. Measurement done with 8 pF output loading at 10% and 90% of V_{DD} (figure shows 50% of V_{DD})

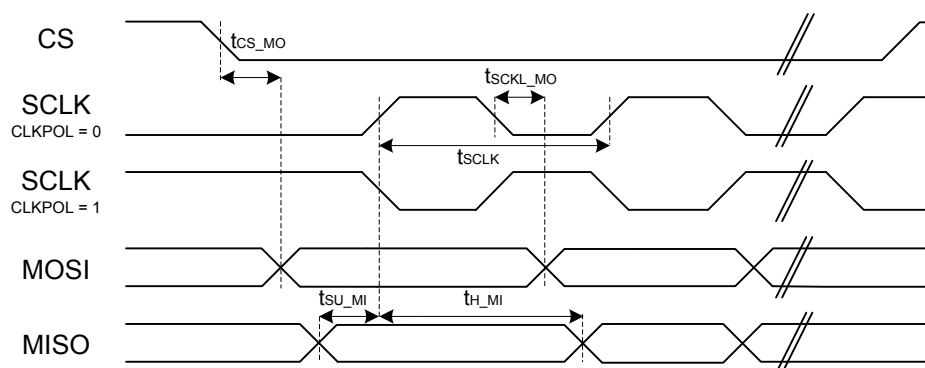


Figure 4.1. SPI Master Timing Diagram

4.2.1 Supply Current

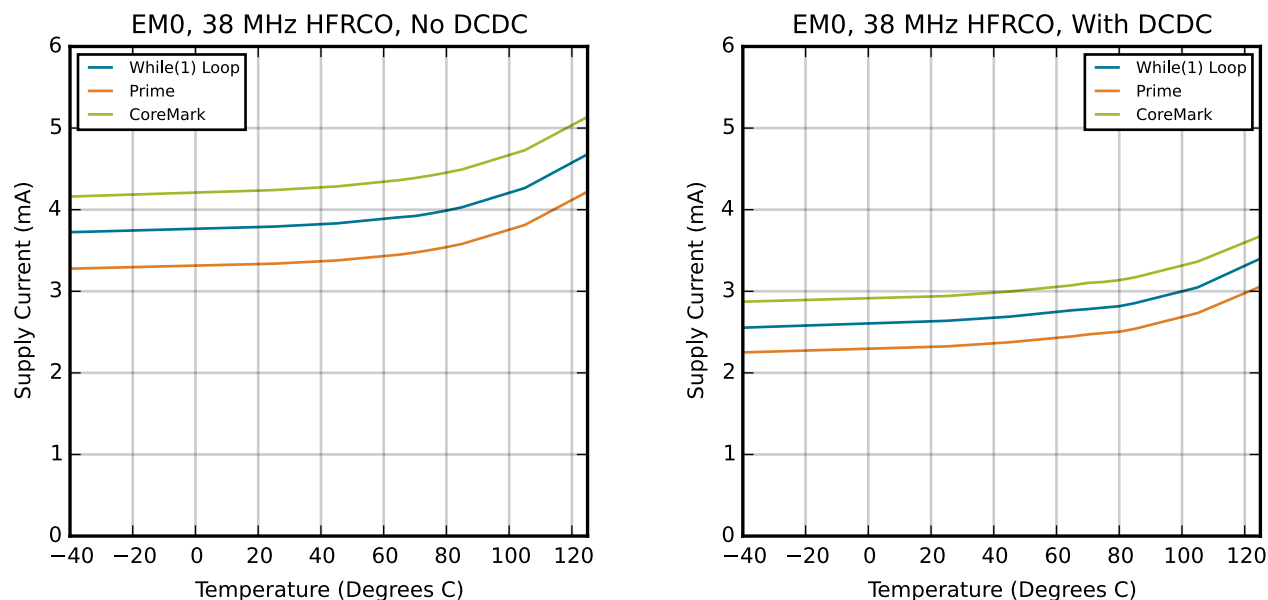


Figure 4.3. EM0 Active Mode Typical Supply Current

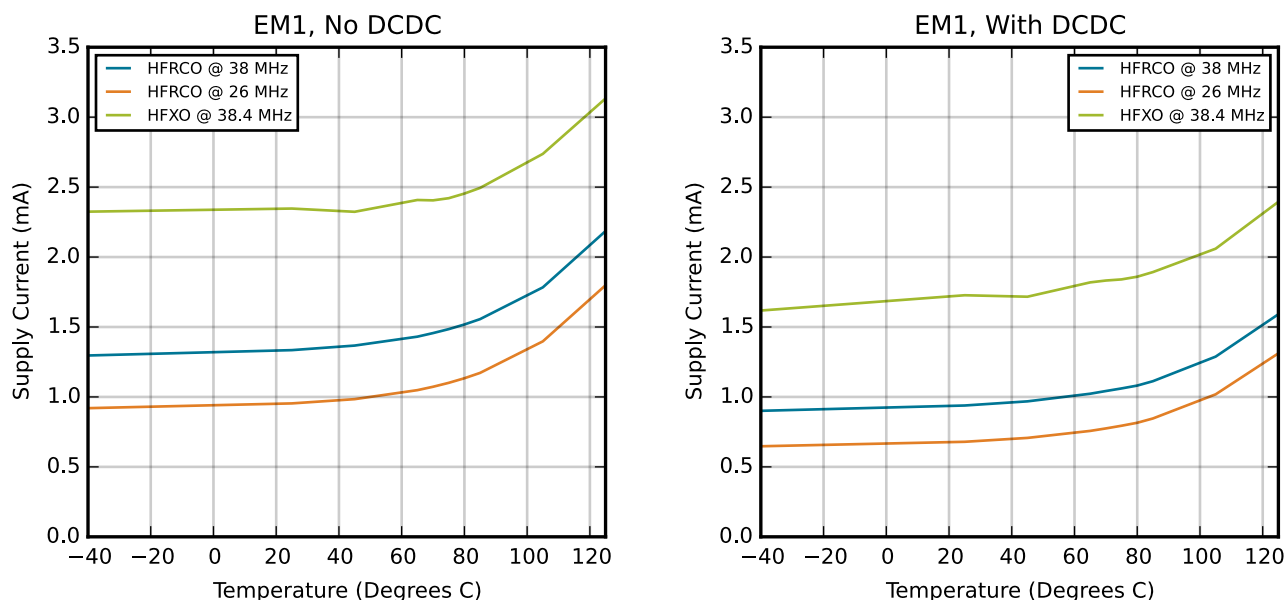


Figure 4.4. EM1 Sleep Mode Typical Supply Current

Typical supply current for EM2, EM3 and EM4H using standard software libraries from Silicon Laboratories.

4.2.2 DC-DC Converter

Default test conditions: CCM mode, LDCDC = 4.7 μ H, CDCDC = 1.0 μ F, VDCDC_I = 3.3 V, VDCDC_O = 1.8 V, FDCDC_LN = 7 MHz

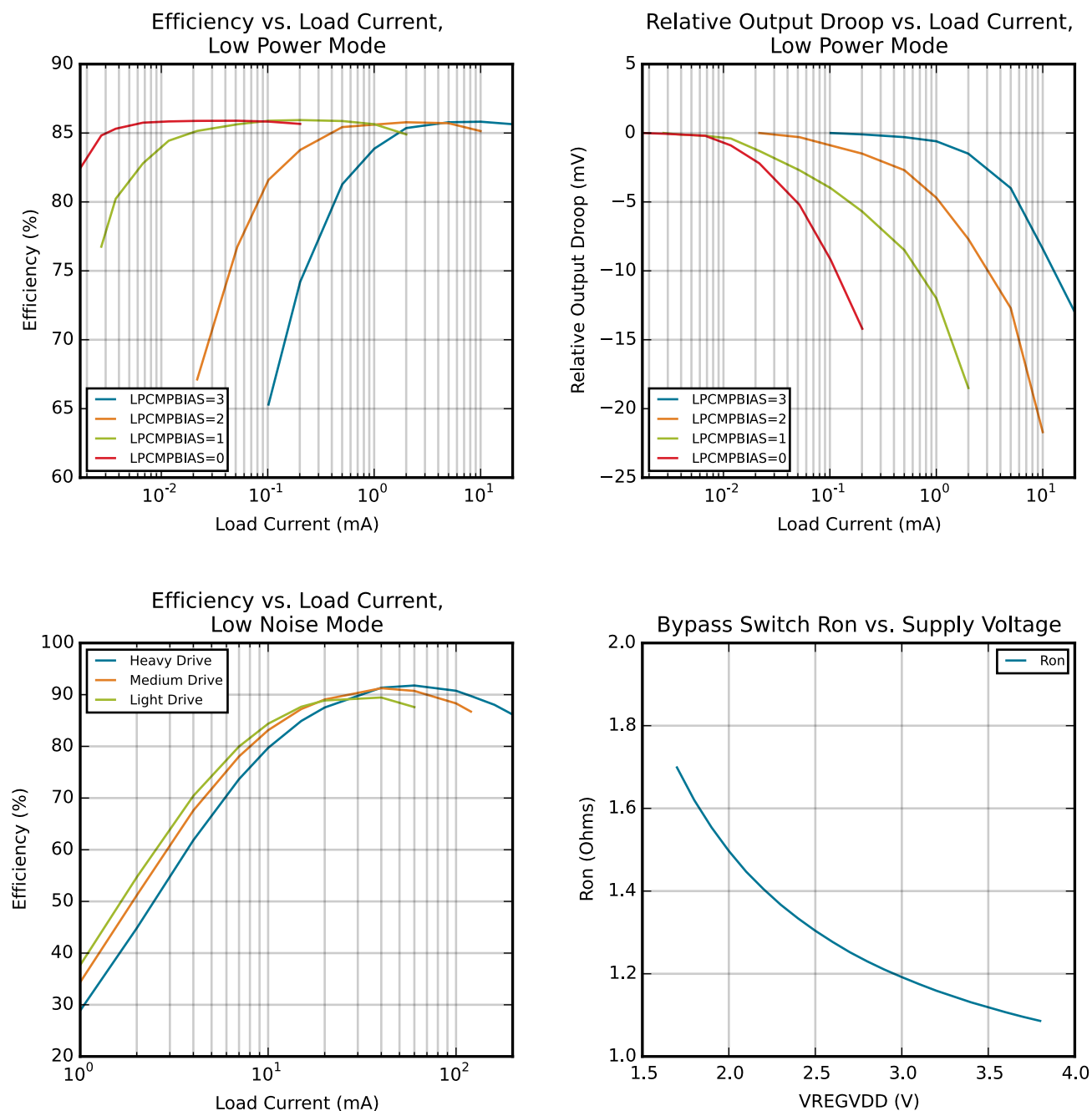


Figure 4.6. DC-DC Converter Typical Performance Characteristics

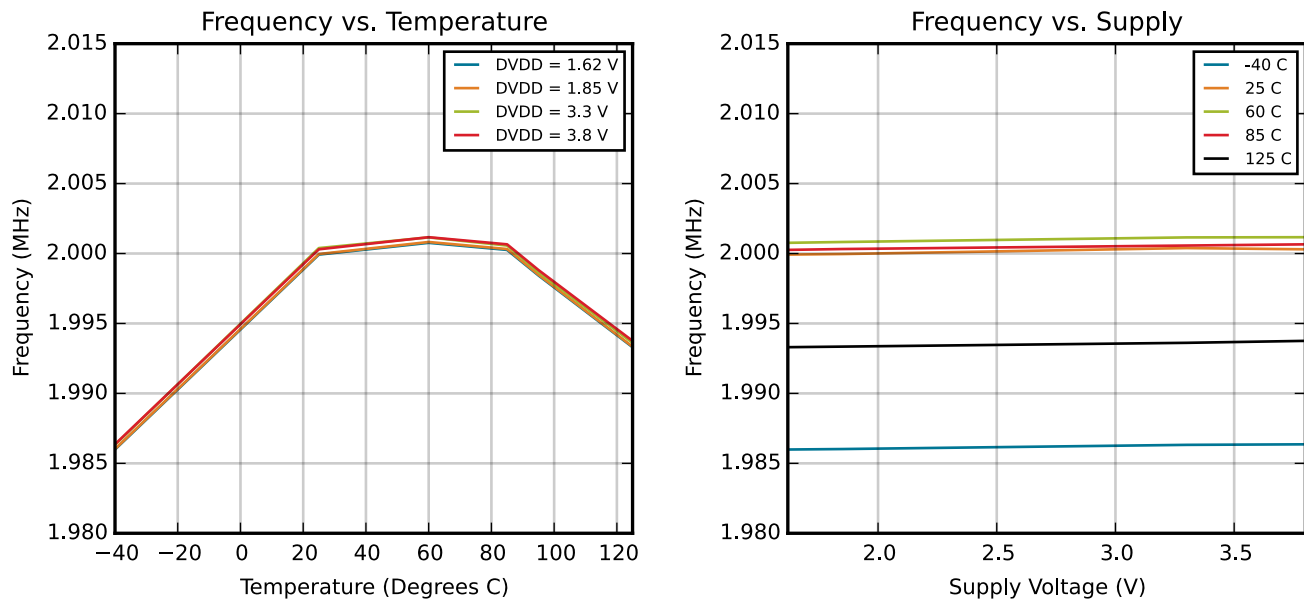


Figure 4.16. HFCO and AUXHFCO Typical Performance at 2 MHz

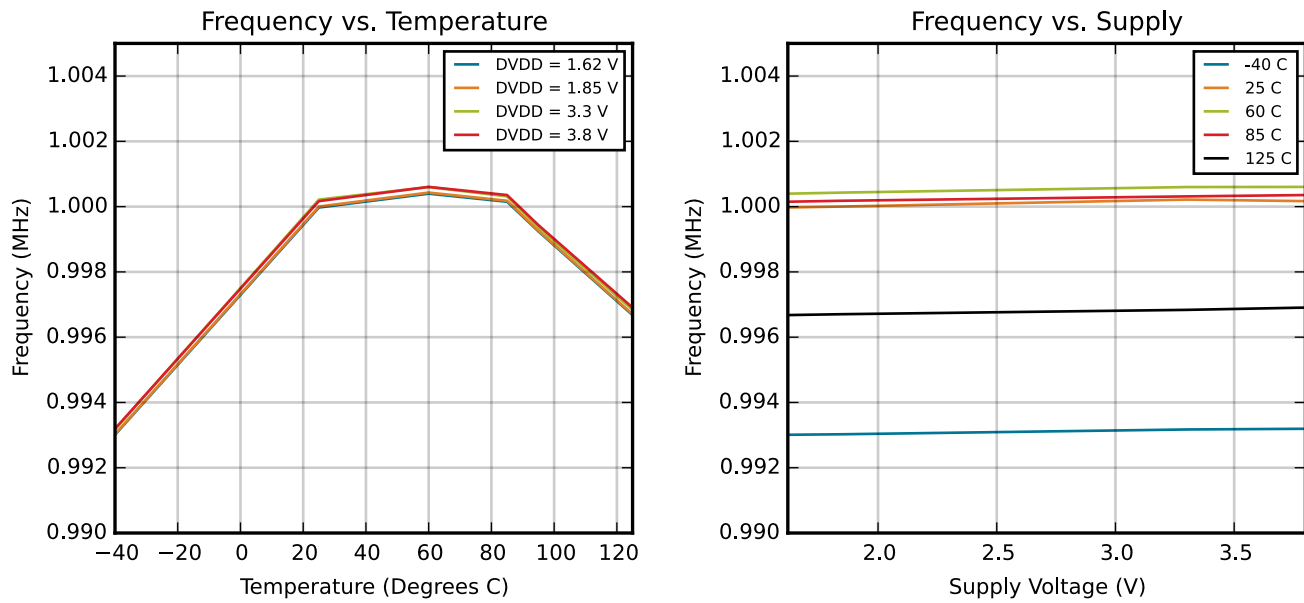


Figure 4.17. HFCO and AUXHFCO Typical Performance at 1 MHz

6. Pin Definitions

6.1 EFM32JG1 QFN48 with DC-DC Definition

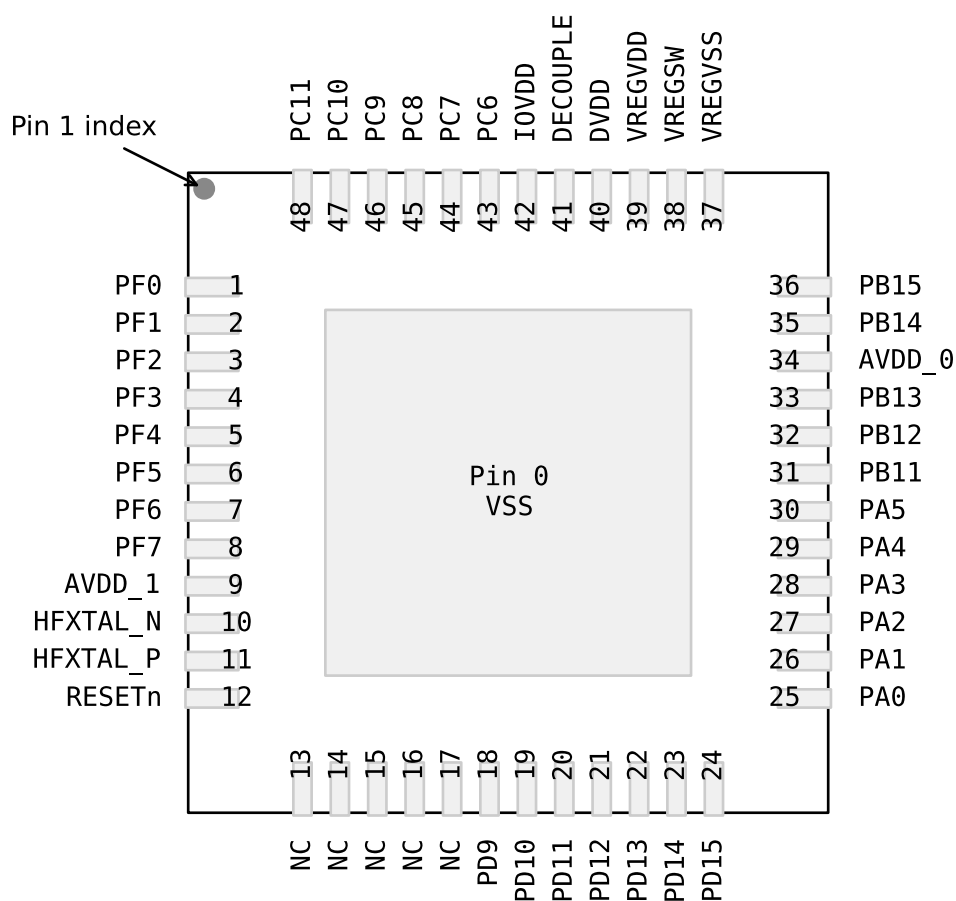


Figure 6.1. EFM32JG1 QFN48 with DC-DC Pinout

QFN48 Pin# and Name		Pin Alternate Functionality / Description			
Pin #	Pin Name	Analog	Timers	Communication	Other
24	PD15	BUSCY BUSDX	TIM0_CC0 #23 TIM0_CC1 #22 TIM0_CC2 #21 TIM0_CDTI0 #20 TIM0_CDTI1 #19 TIM0_CDTI2 #18 TIM1_CC0 #23 TIM1_CC1 #22 TIM1_CC2 #21 TIM1_CC3 #20 LE- TIM0_OUT0 #23 LE- TIM0_OUT1 #22 PCNT0_S0IN #23 PCNT0_S1IN #22	US0_TX #23 US0_RX #22 US0_CLK #21 US0_CS #20 US0_CTS #19 US0_RTS #18 US1_TX #23 US1_RX #22 US1_CLK #21 US1_CS #20 US1_CTS #19 US1_RTS #18 LEU0_TX #23 LEU0_RX #22 I2C0_SDA #23 I2C0_SCL #22	CMU_CLK1 #5 PRS_CH3 #14 PRS_CH4 #6 PRS_CH5 #5 PRS_CH6 #17 ACMP0_O #23 ACMP1_O #23 DBG_SWO #2
25	PA0	ADC0_EXTN BUSCX BUSDY	TIM0_CC0 #0 TIM0_CC1 #31 TIM0_CC2 #30 TIM0_CDTI0 #29 TIM0_CDTI1 #28 TIM0_CDTI2 #27 TIM1_CC0 #0 TIM1_CC1 #31 TIM1_CC2 #30 TIM1_CC3 #29 LE- TIM0_OUT0 #0 LE- TIM0_OUT1 #31 PCNT0_S0IN #0 PCNT0_S1IN #31	US0_TX #0 US0_RX #31 US0_CLK #30 US0_CS #29 US0_CTS #28 US0_RTS #27 US1_TX #0 US1_RX #31 US1_CLK #30 US1_CS #29 US1_CTS #28 US1_RTS #27 LEU0_TX #0 LEU0_RX #31 I2C0_SDA #0 I2C0_SCL #31	CMU_CLK1 #0 PRS_CH6 #0 PRS_CH7 #10 PRS_CH8 #9 PRS_CH9 #8 ACMP0_O #0 ACMP1_O #0
26	PA1	ADC0_EXTP BUSCY BUSDX	TIM0_CC0 #1 TIM0_CC1 #0 TIM0_CC2 #31 TIM0_CDTI0 #30 TIM0_CDTI1 #29 TIM0_CDTI2 #28 TIM1_CC0 #1 TIM1_CC1 #0 TIM1_CC2 #31 TIM1_CC3 #30 LE- TIM0_OUT0 #1 LE- TIM0_OUT1 #0 PCNT0_S0IN #1 PCNT0_S1IN #0	US0_TX #1 US0_RX #0 US0_CLK #31 US0_CS #30 US0_CTS #29 US0_RTS #28 US1_TX #1 US1_RX #0 US1_CLK #31 US1_CS #30 US1_CTS #29 US1_RTS #28 LEU0_TX #1 LEU0_RX #0 I2C0_SDA #1 I2C0_SCL #0	CMU_CLK0 #0 PRS_CH6 #1 PRS_CH7 #0 PRS_CH8 #10 PRS_CH9 #9 ACMP0_O #1 ACMP1_O #1
27	PA2	BUSCX BUSDY	TIM0_CC0 #2 TIM0_CC1 #1 TIM0_CC2 #0 TIM0_CDTI0 #31 TIM0_CDTI1 #30 TIM0_CDTI2 #29 TIM1_CC0 #2 TIM1_CC1 #1 TIM1_CC2 #0 TIM1_CC3 #31 LE- TIM0_OUT0 #2 LE- TIM0_OUT1 #1 PCNT0_S0IN #2 PCNT0_S1IN #1	US0_TX #2 US0_RX #1 US0_CLK #0 US0_CS #31 US0_CTS #30 US0_RTS #29 US1_TX #2 US1_RX #1 US1_CLK #0 US1_CS #31 US1_CTS #30 US1_RTS #29 LEU0_TX #2 LEU0_RX #1 I2C0_SDA #2 I2C0_SCL #1	PRS_CH6 #2 PRS_CH7 #1 PRS_CH8 #0 PRS_CH9 #10 ACMP0_O #2 ACMP1_O #2

QFN48 Pin# and Name		Pin Alternate Functionality / Description			
Pin #	Pin Name	Analog	Timers	Communication	Other
28	PA3	BUSCY BUSDX	TIM0_CC0 #3 TIM0_CC1 #2 TIM0_CC2 #1 TIM0_CDTI0 #0 TIM0_CDTI1 #31 TIM0_CDTI2 #30 TIM1_CC0 #3 TIM1_CC1 #2 TIM1_CC2 #1 TIM1_CC3 #0 LE- TIM0_OUT0 #3 LE- TIM0_OUT1 #2 PCNT0_S0IN #3 PCNT0_S1IN #2	US0_TX #3 US0_RX #2 US0_CLK #1 US0_CS #0 US0_CTS #31 US0_RTS #30 US1_TX #3 US1_RX #2 US1_CLK #1 US1_CS #0 US1_CTS #31 US1_RTS #30 LEU0_TX #3 LEU0_RX #2 I2C0_SDA #3 I2C0_SCL #2	PRS_CH6 #3 PRS_CH7 #2 PRS_CH8 #1 PRS_CH9 #0 ACMP0_O #3 ACMP1_O #3 GPIO_EM4WU8
29	PA4	BUSCX BUSDY	TIM0_CC0 #4 TIM0_CC1 #3 TIM0_CC2 #2 TIM0_CDTI0 #1 TIM0_CDTI1 #0 TIM0_CDTI2 #31 TIM1_CC0 #4 TIM1_CC1 #3 TIM1_CC2 #2 TIM1_CC3 #1 LE- TIM0_OUT0 #4 LE- TIM0_OUT1 #3 PCNT0_S0IN #4 PCNT0_S1IN #3	US0_TX #4 US0_RX #3 US0_CLK #2 US0_CS #1 US0_CTS #0 US0_RTS #31 US1_TX #4 US1_RX #3 US1_CLK #2 US1_CS #1 US1_CTS #0 US1_RTS #31 LEU0_TX #4 LEU0_RX #3 I2C0_SDA #4 I2C0_SCL #3	PRS_CH6 #4 PRS_CH7 #3 PRS_CH8 #2 PRS_CH9 #1 ACMP0_O #4 ACMP1_O #4
30	PA5	BUSCY BUSDX	TIM0_CC0 #5 TIM0_CC1 #4 TIM0_CC2 #3 TIM0_CDTI0 #2 TIM0_CDTI1 #1 TIM0_CDTI2 #0 TIM1_CC0 #5 TIM1_CC1 #4 TIM1_CC2 #3 TIM1_CC3 #2 LE- TIM0_OUT0 #5 LE- TIM0_OUT1 #4 PCNT0_S0IN #5 PCNT0_S1IN #4	US0_TX #5 US0_RX #4 US0_CLK #3 US0_CS #2 US0_CTS #1 US0_RTS #0 US1_TX #5 US1_RX #4 US1_CLK #3 US1_CS #2 US1_CTS #1 US1_RTS #0 LEU0_TX #5 LEU0_RX #4 I2C0_SDA #5 I2C0_SCL #4	PRS_CH6 #5 PRS_CH7 #4 PRS_CH8 #3 PRS_CH9 #2 ACMP0_O #5 ACMP1_O #5
31	PB11	BUSCY BUSDX	TIM0_CC0 #6 TIM0_CC1 #5 TIM0_CC2 #4 TIM0_CDTI0 #3 TIM0_CDTI1 #2 TIM0_CDTI2 #1 TIM1_CC0 #6 TIM1_CC1 #5 TIM1_CC2 #4 TIM1_CC3 #3 LE- TIM0_OUT0 #6 LE- TIM0_OUT1 #5 PCNT0_S0IN #6 PCNT0_S1IN #5	US0_TX #6 US0_RX #5 US0_CLK #4 US0_CS #3 US0_CTS #2 US0_RTS #1 US1_TX #6 US1_RX #5 US1_CLK #4 US1_CS #3 US1_CTS #2 US1_RTS #1 LEU0_TX #6 LEU0_RX #5 I2C0_SDA #6 I2C0_SCL #5	PRS_CH6 #6 PRS_CH7 #5 PRS_CH8 #4 PRS_CH9 #3 ACMP0_O #6 ACMP1_O #6

QFN32 Pin# and Name		Pin Alternate Functionality / Description			
Pin #	Pin Name	Analog	Timers	Communication	Other
4	PF3	BUSAY BUSBX	TIM0_CC0 #27 TIM0_CC1 #26 TIM0_CC2 #25 TIM0_CDTI0 #24 TIM0_CDTI1 #23 TIM0_CDTI2 #22 TIM1_CC0 #27 TIM1_CC1 #26 TIM1_CC2 #25 TIM1_CC3 #24 LE- TIM0_OUT0 #27 LE- TIM0_OUT1 #26 PCNT0_S0IN #27 PCNT0_S1IN #26	US0_TX #27 US0_RX #26 US0_CLK #25 US0_CS #24 US0_CTS #23 US0_RTS #22 US1_TX #27 US1_RX #26 US1_CLK #25 US1_CS #24 US1_CTS #23 US1_RTS #22 LEU0_TX #27 LEU0_RX #26 I2C0_SDA #27 I2C0_SCL #26	CMU_CLK1 #6 PRS_CH0 #3 PRS_CH1 #2 PRS_CH2 #1 PRS_CH3 #0 ACMP0_O #27 ACMP1_O #27 DBG_TDI #0
5	AVDD	Analog power supply .			
6	HFX TAL_N	High Frequency Crystal input pin.			
7	HFX TAL_P	High Frequency Crystal output pin.			
8	RESETn	Reset input, active low.To apply an external reset source to this pin, it is required to only drive this pin low during reset, and let the internal pull-up ensure that reset is released.			
9	NC	No Connect.			
10	PD9	BUSCY BUSDX	TIM0_CC0 #17 TIM0_CC1 #16 TIM0_CC2 #15 TIM0_CDTI0 #14 TIM0_CDTI1 #13 TIM0_CDTI2 #12 TIM1_CC0 #17 TIM1_CC1 #16 TIM1_CC2 #15 TIM1_CC3 #14 LE- TIM0_OUT0 #17 LE- TIM0_OUT1 #16 PCNT0_S0IN #17 PCNT0_S1IN #16	US0_TX #17 US0_RX #16 US0_CLK #15 US0_CS #14 US0_CTS #13 US0_RTS #12 US1_TX #17 US1_RX #16 US1_CLK #15 US1_CS #14 US1_CTS #13 US1_RTS #12 LEU0_TX #17 LEU0_RX #16 I2C0_SDA #17 I2C0_SCL #16	CMU_CLK0 #4 PRS_CH3 #8 PRS_CH4 #0 PRS_CH5 #6 PRS_CH6 #11 ACMP0_O #17 ACMP1_O #17
11	PD10	BUSCX BUSDY	TIM0_CC0 #18 TIM0_CC1 #17 TIM0_CC2 #16 TIM0_CDTI0 #15 TIM0_CDTI1 #14 TIM0_CDTI2 #13 TIM1_CC0 #18 TIM1_CC1 #17 TIM1_CC2 #16 TIM1_CC3 #15 LE- TIM0_OUT0 #18 LE- TIM0_OUT1 #17 PCNT0_S0IN #18 PCNT0_S1IN #17	US0_TX #18 US0_RX #17 US0_CLK #16 US0_CS #15 US0_CTS #14 US0_RTS #13 US1_TX #18 US1_RX #17 US1_CLK #16 US1_CS #15 US1_CTS #14 US1_RTS #13 LEU0_TX #18 LEU0_RX #17 I2C0_SDA #18 I2C0_SCL #17	CMU_CLK1 #4 PRS_CH3 #9 PRS_CH4 #1 PRS_CH5 #0 PRS_CH6 #12 ACMP0_O #18 ACMP1_O #18

Alternate	LOCATION								
Functionality	0 - 3	4 - 7	8 - 11	12 - 15	16 - 19	20 - 23	24 - 27	28 - 31	Description
DBG_SWDIOTMS	0: PF1								Debug-interface Serial Wire data input / output and JTAG Test Mode Select. Note that this function is enabled to the pin out of reset, and has a built-in pull up.
DBG_SWO	0: PF2 1: PB13 2: PD15 3: PC11								Debug-interface Serial Wire viewer Output. Note that this function is not enabled after reset, and must be enabled by software to be used.
DBG_TDI	0: PF3								Debug-interface JTAG Test Data In. Note that this function is enabled to pin out of reset, and has a built-in pull up.
DBG_TDO	0: PF2								Debug-interface JTAG Test Data Out. Note that this function is enabled to pin out of reset.
GPIO_EM4WU0	0: PF2								Pin can be used to wake the system up from EM4
GPIO_EM4WU1	0: PF7								Pin can be used to wake the system up from EM4
GPIO_EM4WU4	0: PD14								Pin can be used to wake the system up from EM4
GPIO_EM4WU8	0: PA3								Pin can be used to wake the system up from EM4
GPIO_EM4WU9	0: PB13								Pin can be used to wake the system up from EM4

Alternate	LOCATION								
Functionality	0 - 3	4 - 7	8 - 11	12 - 15	16 - 19	20 - 23	24 - 27	28 - 31	Description
TIM0_CC2	0: PA2 1: PA3 2: PA4 3: PA5	4: PB11 5: PB12 6: PB13 7: PB14	8: PB15 9: PC6 10: PC7 11: PC8	12: PC9 13: PC10 14: PC11 15: PD9	16: PD10 17: PD11 18: PD12 19: PD13	20: PD14 21: PD15 22: PF0 23: PF1	24: PF2 25: PF3 26: PF4 27: PF5	28: PF6 29: PF7 30: PA0 31: PA1	Timer 0 Capture Compare input / output channel 2.
TIM0_CDTI0	0: PA3 1: PA4 2: PA5 3: PB11	4: PB12 5: PB13 6: PB14 7: PB15	8: PC6 9: PC7 10: PC8 11: PC9	12: PC10 13: PC11 14: PD9 15: PD10	16: PD11 17: PD12 18: PD13 19: PD14	20: PD15 21: PF0 22: PF1 23: PF2	24: PF3 25: PF4 26: PF5 27: PF6	28: PF7 29: PA0 30: PA1 31: PA2	Timer 0 Complimentary Dead Time Insertion channel 0.
TIM0_CDTI1	0: PA4 1: PA5 2: PB11 3: PB12	4: PB13 5: PB14 6: PB15 7: PC6	8: PC7 9: PC8 10: PC9 11: PC10	12: PC11 13: PD9 14: PD10 15: PD11	16: PD12 17: PD13 18: PD14 19: PD15	20: PF0 21: PF1 22: PF2 23: PF3	24: PF4 25: PF5 26: PF6 27: PF7	28: PA0 29: PA1 30: PA2 31: PA3	Timer 0 Complimentary Dead Time Insertion channel 1.
TIM0_CDTI2	0: PA5 1: PB11 2: PB12 3: PB13	4: PB14 5: PB15 6: PC6 7: PC7	8: PC8 9: PC9 10: PC10 11: PC11	12: PD9 13: PD10 14: PD11 15: PD12	16: PD13 17: PD14 18: PD15 19: PF0	20: PF1 21: PF2 22: PF3 23: PF4	24: PF5 25: PF6 26: PF7 27: PA0	28: PA1 29: PA2 30: PA3 31: PA4	Timer 0 Complimentary Dead Time Insertion channel 2.
TIM1_CC0	0: PA0 1: PA1 2: PA2 3: PA3	4: PA4 5: PA5 6: PB11 7: PB12	8: PB13 9: PB14 10: PB15 11: PC6	12: PC7 13: PC8 14: PC9 15: PC10	16: PC11 17: PD9 18: PD10 19: PD11	20: PD12 21: PD13 22: PD14 23: PD15	24: PF0 25: PF1 26: PF2 27: PF3	28: PF4 29: PF5 30: PF6 31: PF7	Timer 1 Capture Compare input / output channel 0.
TIM1_CC1	0: PA1 1: PA2 2: PA3 3: PA4	4: PA5 5: PB11 6: PB12 7: PB13	8: PB14 9: PB15 10: PC6 11: PC7	12: PC8 13: PC9 14: PC10 15: PC11	16: PD9 17: PD10 18: PD11 19: PD12	20: PD13 21: PD14 22: PD15 23: PF0	24: PF1 25: PF2 26: PF3 27: PF4	28: PF5 29: PF6 30: PF7 31: PA0	Timer 1 Capture Compare input / output channel 1.
TIM1_CC2	0: PA2 1: PA3 2: PA4 3: PA5	4: PB11 5: PB12 6: PB13 7: PB14	8: PB15 9: PC6 10: PC7 11: PC8	12: PC9 13: PC10 14: PC11 15: PD9	16: PD10 17: PD11 18: PD12 19: PD13	20: PD14 21: PD15 22: PF0 23: PF1	24: PF2 25: PF3 26: PF4 27: PF5	28: PF6 29: PF7 30: PA0 31: PA1	Timer 1 Capture Compare input / output channel 2.
TIM1_CC3	0: PA3 1: PA4 2: PA5 3: PB11	4: PB12 5: PB13 6: PB14 7: PB15	8: PC6 9: PC7 10: PC8 11: PC9	12: PC10 13: PC11 14: PD9 15: PD10	16: PD11 17: PD12 18: PD13 19: PD14	20: PD15 21: PF0 22: PF1 23: PF2	24: PF3 25: PF4 26: PF5 27: PF6	28: PF7 29: PA0 30: PA1 31: PA2	Timer 1 Capture Compare input / output channel 3.
US0_CLK	0: PA2 1: PA3 2: PA4 3: PA5	4: PB11 5: PB12 6: PB13 7: PB14	8: PB15 9: PC6 10: PC7 11: PC8	12: PC9 13: PC10 14: PC11 15: PD9	16: PD10 17: PD11 18: PD12 19: PD13	20: PD14 21: PD15 22: PF0 23: PF1	24: PF2 25: PF3 26: PF4 27: PF5	28: PF6 29: PF7 30: PA0 31: PA1	USART0 clock input / output.
US0_CS	0: PA3 1: PA4 2: PA5 3: PB11	4: PB12 5: PB13 6: PB14 7: PB15	8: PC6 9: PC7 10: PC8 11: PC9	12: PC10 13: PC11 14: PD9 15: PD10	16: PD11 17: PD12 18: PD13 19: PD14	20: PD15 21: PF0 22: PF1 23: PF2	24: PF3 25: PF4 26: PF5 27: PF6	28: PF7 29: PA0 30: PA1 31: PA2	USART0 chip select input / output.
US0_CTS	0: PA4 1: PA5 2: PB11 3: PB12	4: PB13 5: PB14 6: PB15 7: PC6	8: PC7 9: PC8 10: PC9 11: PC10	12: PC11 13: PD9 14: PD10 15: PD11	16: PD12 17: PD13 18: PD14 19: PD15	20: PF0 21: PF1 22: PF2 23: PF3	24: PF4 25: PF5 26: PF6 27: PF7	28: PA0 29: PA1 30: PA2 31: PA3	USART0 Clear To Send hardware flow control input.
US0_RTS	0: PA5 1: PB11 2: PB12 3: PB13	4: PB14 5: PB15 6: PC6 7: PC7	8: PC8 9: PC9 10: PC10 11: PC11	12: PD9 13: PD10 14: PD11 15: PD12	16: PD13 17: PD14 18: PD15 19: PF0	20: PF1 21: PF2 22: PF3 23: PF4	24: PF5 25: PF6 26: PF7 27: PA0	28: PA1 29: PA2 30: PA3 31: PA4	USART0 Request To Send hardware flow control output.

6.5 Analog Port (APORT) Client Maps

The Analog Port (APORT) is an infrastructure used to connect chip pins with on-chip analog clients such as analog comparators, ADCs, DACs, etc. The APORT consists of a set of shared buses, switches, and control logic needed to configurably implement the signal routing. A complete description of APORT functionality can be found in the Reference Manual.

Client maps for each analog circuit using the APORT are shown in the following tables. The maps are organized by bus, and show the peripheral's port connection, the shared bus, and the connection from specific bus channel numbers to GPIO pins.

In general, enumerations for the pin selection field in an analog peripheral's register can be determined by finding the desired pin connection in the table and then combining the value in the Port column (APORT__), and the channel identifier (CH__). For example, if pin PF7 is available on port APORT2X as CH23, the register field enumeration to connect to PF7 would be APORT2XCH23. The shared bus used by this connection is indicated in the Bus column.

Table 6.8. ACMP0 Bus and Pin Mapping

APORT4Y	APORT4X	APORT3Y	APORT3X	APORT2Y	APORT2X	APORT1Y	APORT1X	Port
BUSDY	BUSDY	BUSDY	BUSDY	BUSDY	BUSDY	BUSDY	BUSDY	Bus
	PB15	PB15						CH31
PB14			PB14					CH30
	PB13	PB13						CH29
PB12			PB12					CH28
	PB11	PB11						CH27
								CH26
								CH25
								CH24
					PF7	PF7		CH23
				PF6			PF6	CH22
					PF5	PF5		CH21
				PF4			PF4	CH20
					PF3	PF3		CH19
				PF2			PF2	CH18
					PF1	PF1		CH17
				PF0			PF0	CH16
								CH15
								CH14
	PA5	PA5						CH13
PA4			PA4					CH12
	PA3	PA3			PC11	PC11		CH11
PA2			PA2	PC10			PC10	CH10
	PA1	PA1			PC9	PC9		CH9
PA0			PA0	PC8			PC8	CH8
	PD15	PD15			PC7	PC7		CH7
PD14			PD14	PC6			PC6	CH6
	PD13	PD13						CH5
PD12			PD12					CH4
	PD11	PD11						CH3
PD10			PD10					CH2
	PD9	PD9						CH1
								CH0

7.2 QFN48 PCB Land Pattern

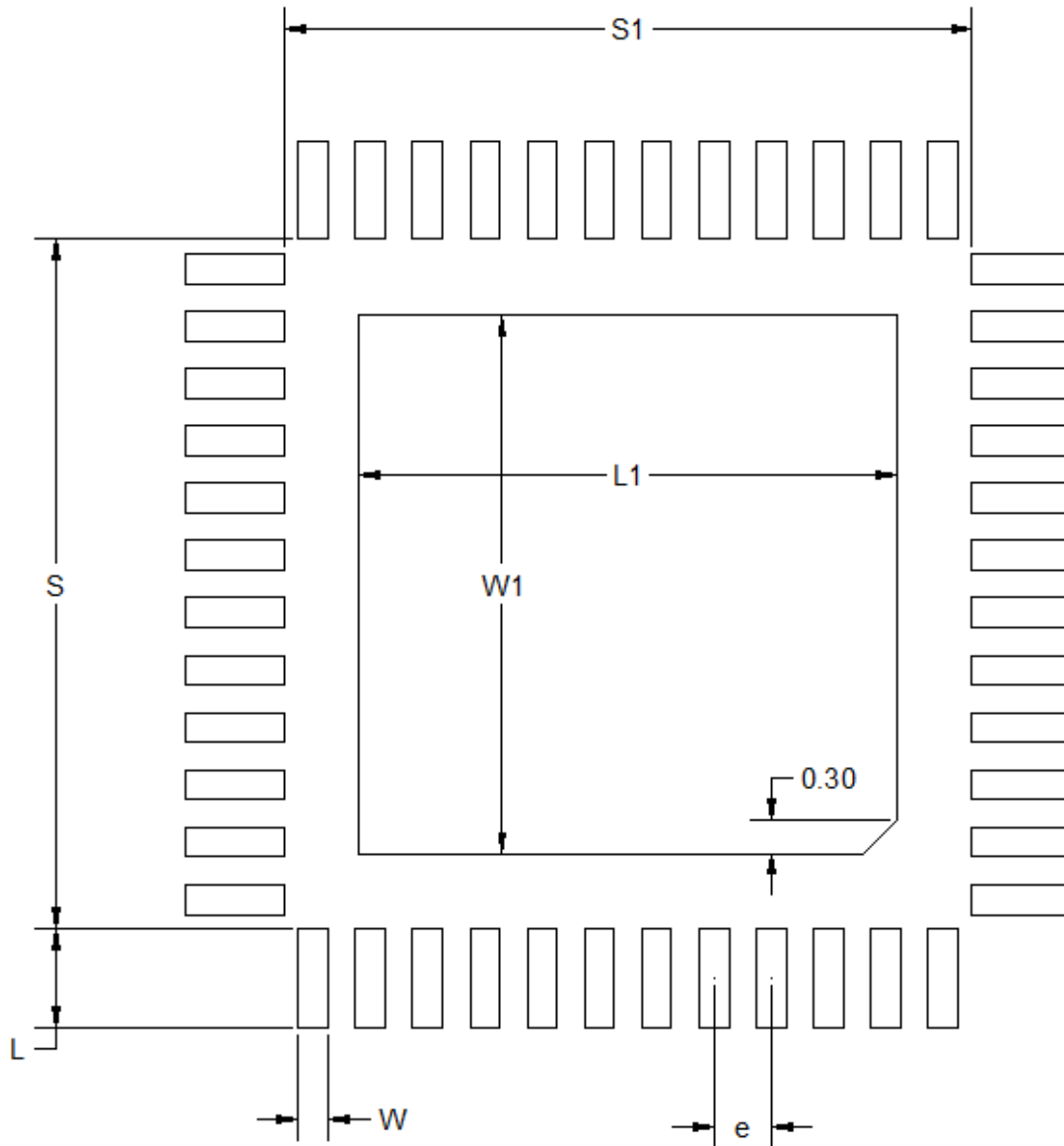


Figure 7.2. QFN48 PCB Land Pattern Drawing

8. QFN32 Package Specifications

8.1 QFN32 Package Dimensions

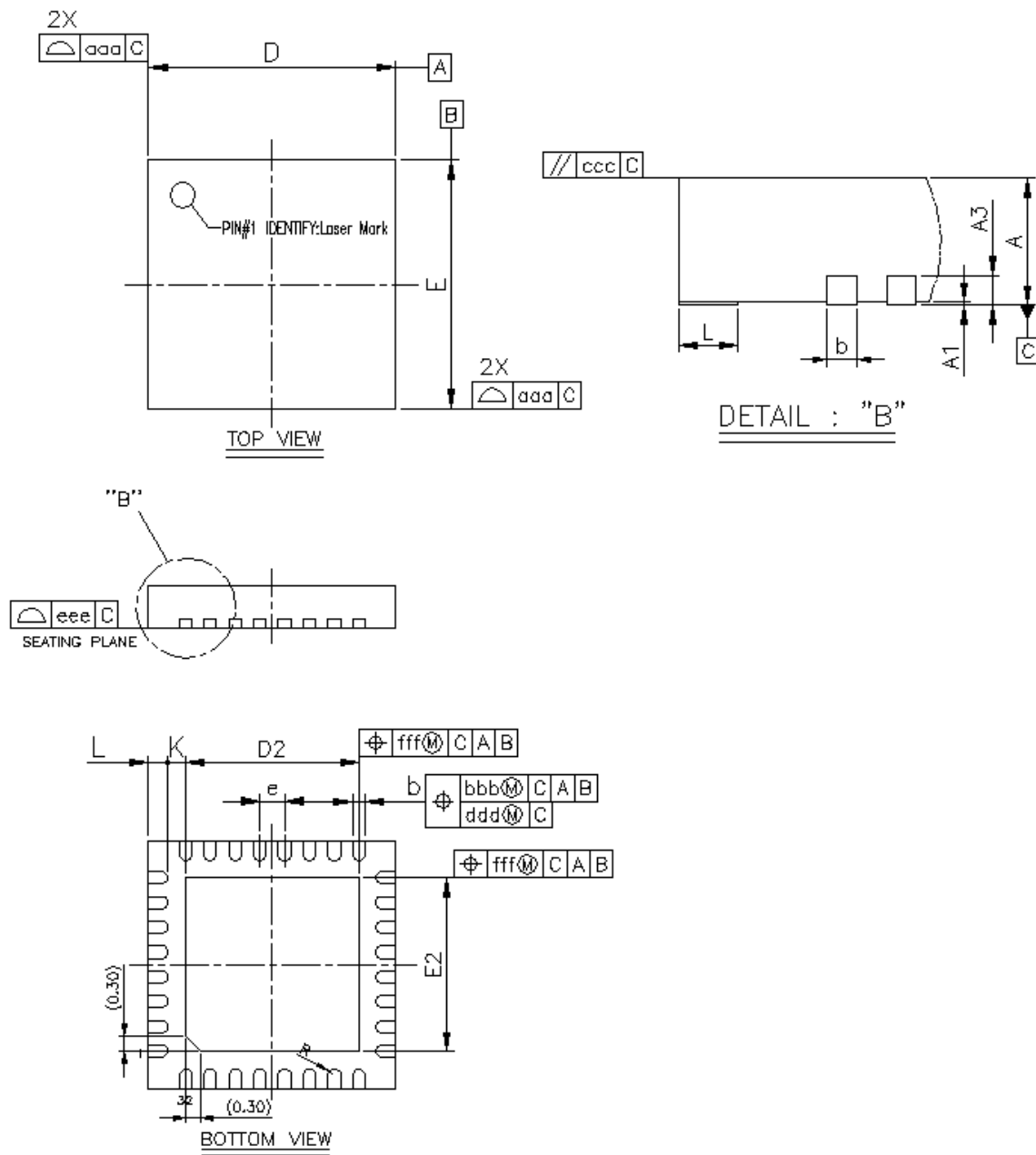


Figure 8.1. QFN32 Package Drawing

Table 8.1. QFN32 Package Dimensions

Dimension	Min	Typ	Max
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.18	0.25	0.30
D/E	4.90	5.00	5.10
D2/E2	3.40	3.50	3.60
E	0.50 BSC		
L	0.30	0.40	0.50
K	0.20	—	—
R	0.09	—	0.14
aaa	0.15		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.08		
fff	0.10		

Note:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to the JEDEC Solid State Outline MO-220, Variation VKKD-4.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

Table of Contents

1. Feature List	1
2. Ordering Information	2
3. System Overview	3
3.1 Introduction	3
3.2 Power	4
3.2.1 Energy Management Unit (EMU)	4
3.2.2 DC-DC Converter	4
3.3 General Purpose Input/Output (GPIO)	4
3.4 Clocking	4
3.4.1 Clock Management Unit (CMU)	4
3.4.2 Internal and External Oscillators	4
3.5 Counters/Timers and PWM	5
3.5.1 Timer/Counter (TIMER)	5
3.5.2 Real Time Counter and Calendar (RTCC)	5
3.5.3 Low Energy Timer (LETIMER)	5
3.5.4 Ultra Low Power Wake-up Timer (CRYOTIMER)	5
3.5.5 Pulse Counter (PCNT)	5
3.5.6 Watchdog Timer (WDOG)	5
3.6 Communications and Other Digital Peripherals	5
3.6.1 Universal Synchronous/Asynchronous Receiver/Transmitter (USART)	5
3.6.2 Low Energy Universal Asynchronous Receiver/Transmitter (LEUART)	6
3.6.3 Inter-Integrated Circuit Interface (I ² C)	6
3.6.4 Peripheral Reflex System (PRS)	6
3.7 Security Features	6
3.7.1 GPCRC (General Purpose Cyclic Redundancy Check)	6
3.7.2 Crypto Accelerator (CRYPTO)	6
3.8 Analog	6
3.8.1 Analog Port (APORT)	6
3.8.2 Analog Comparator (ACMP)	6
3.8.3 Analog to Digital Converter (ADC)	7
3.8.4 Digital to Analog Current Converter (IDAC)	7
3.9 Reset Management Unit (RMU)	7
3.10 Core and Memory	7
3.10.1 Processor Core	7
3.10.2 Memory System Controller (MSC)	7
3.10.3 Linked Direct Memory Access Controller (LDMA)	7
3.11 Memory Map	8
3.12 Configuration Summary	9
4. Electrical Specifications	10
4.1 Electrical Characteristics	10
4.1.1 Absolute Maximum Ratings	10