

## MCU with 90 V MOSFET Driver

### FEATURES AND BENEFITS

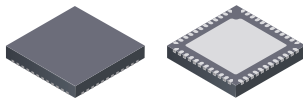
- 5.5 to 90 V supply voltage operating range
- 60 V part variant available (A89211-A)
- 32-bit ARM Cortex-M4 CPU core
  - Up to 40 MHz clock frequency
  - On-chip  $\pm 1\%$  accurate oscillator
  - Programmable clock generator
  - One clock per machine cycle architecture
  - Direct memory access (DMA)
  - 16-level interrupt handler
  - SW-DP 2-wire debug

*Continued on next page...*

### APPLICATIONS

- Optimized for 12 to 56 V battery BLDC motor modules
- Cordless power tools
- 48 V e-bike

### PACKAGE



48-pin 7 mm × 7 mm QFN with exposed thermal pad and wettable flank (suffix EV)

*Not to scale*

### DESCRIPTION

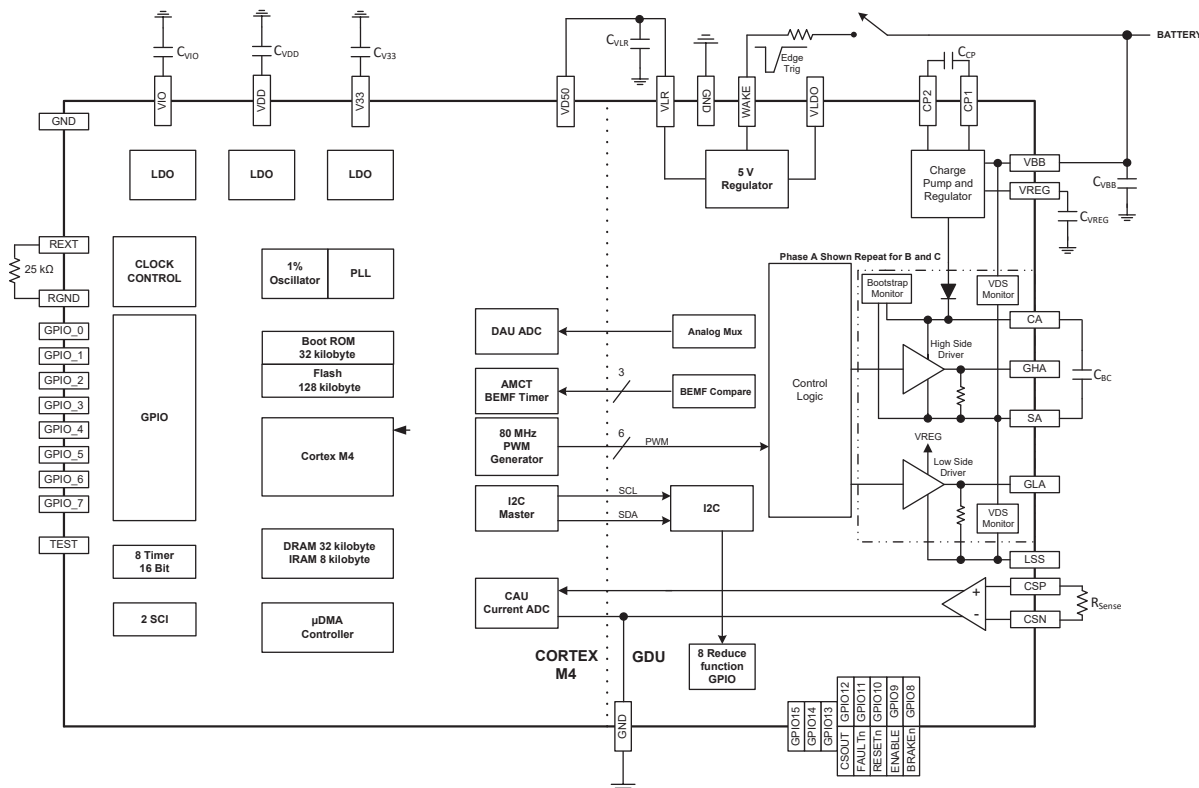
The A89211/12-A is a high-performance processor with integrated three-phase gate drive and precision current sense capability. The A89211/12-A is designed for use with advanced stand-alone three-phase BLDC and PMSM motor control applications.

The processor uses an ARM Cortex-M4 CPU core running at 40 MHz, giving up to 50 MIPS performance. The processor capability is further enhanced by peripheral functions specifically designed for motor control applications. These include a PWM generator and sense current capture systems capable of providing up to 12-bit control precision at up to 20 kHz PWM frequency.

Sixteen general purpose I/O ports provide access to programmable serial communication interfaces and analog and digital inputs and outputs.

The gate driver is an N-channel power MOSFET driver capable of controlling MOSFETs connected in a three-phase bridge arrangement and is specifically designed for power applications with high-power inductive loads, such as BLDC motors.

*Continued on next page...*



**Figure 1: A89211/12-A Block Diagram**

## FEATURES AND BENEFITS (continued)

- On-chip memory
  - Up to 252 kB flash
  - 32 kB DRAM
  - 8 kB IRAM
  - 32 kB boot ROM
- 3-phase bridge MOSFET driver with bootstrap gate drive for N-channel MOSFET bridge
- Charge pump for low supply voltage operation.
- 3.3 V or 5 V CMOS compatible logic I/O
- 80 MHz PWM generator
  - 12-bit PWM at 20 kHz
  - Programmable bemf and current sample control
- Programmable high-performance current sense amplifier
  - 3 × 11 bit, 1 μs ADC for current measurement
- 12-bit 1 μs data acquisition ADC with 16-channel mux
- 8 general purpose I/O ports (GPIO)
- 8 general purpose timers
- 2 serial communication interfaces (SCI)
- 3-phase BEMF detector
- Integrated power management
- VDS, UVLO, and thermal shutdown diagnostic
- Latched TSD with fault output

## DESCRIPTION (continued)

A unique charge pump regulator provides the supply for the MOSFET gate drive for battery voltages down to 7 V and allows the A89211/12-A to operate with a reduced gate drive voltage down to 5.5 V. A bootstrap capacitor is used to provide the above-battery supply voltage required for N-channel MOSFETs.

The power supply unit provides and manages all internal supplies from a single 5.5 to 90 V supply. The MCU section can also operate with an independent single 5 V supply.

Integrated programmable diagnostics provide indication of multiple internal faults, system faults, and power bridge faults, and can be configured to protect the power MOSFETs under most short-circuit conditions.

The A89211/12-A is supplied in a 48-lead QFN package with exposed thermal pad and wettable flank. This package is lead (Pb) free with 100% matte-tin leadframe plating.

## SELECTION GUIDE

| Part Number                  | Rated Voltage (V) | GPIO Voltage(V) | Flash Size (kB) | Package  | Packing                     |
|------------------------------|-------------------|-----------------|-----------------|--|-----------------------------|
| A89211GEVSR-A <sup>[1]</sup> | 60                | 3.3             | 128             | 7 mm × 7 mm, 0.9 mm nominal height 48-terminal QFN with exposed thermal pad and wettable flank | 4000 pieces per 13-in. reel |
| A89212GEVSR-A <sup>[1]</sup> | 90                | 3.3             | 128             |  |                             |

<sup>[1]</sup>The following variants are also offered:

| Part Number   | Rated Voltage (V) | GPIO Voltage (V) | Flash Size (kB) |
|---------------|-------------------|------------------|-----------------|
| • A89211GEVSR | 60                | 5                | 252             |
| • A89212GEVSR | 90                | 5                | 252             |

## PACKAGE OUTLINE DRAWING

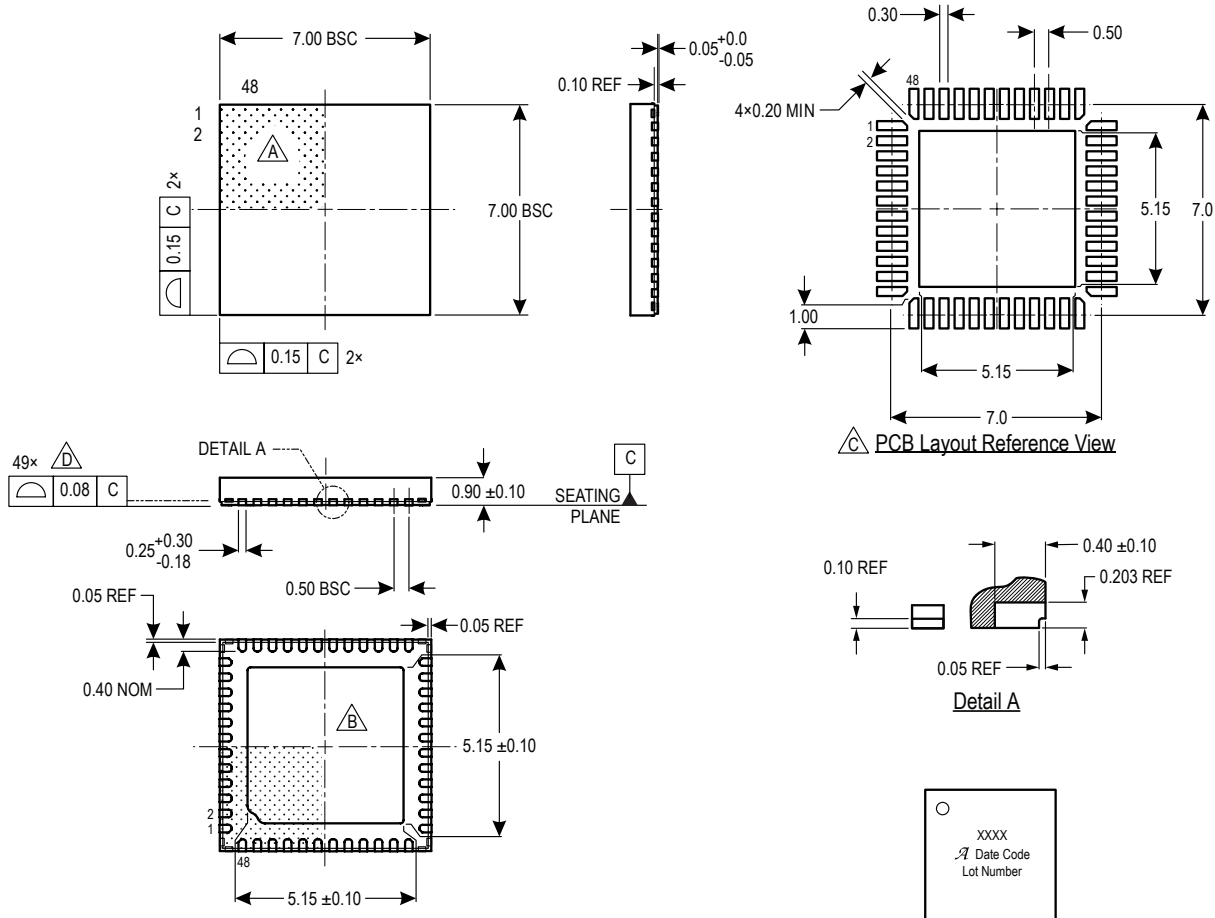
### For Reference Only – Not for Tooling Use

(Reference DWG-0000378, Rev. 3)

Dimensions in millimeters

NOT TO SCALE

Exact case and lead configuration at supplier discretion within limits shown



- A** Terminal #1 mark area
- B** Exposed thermal pad (reference only, terminal #1 identifier appearance at supplier discretion)
- C** Reference land pattern layout (reference IPC7351 QFN50P700X700X100-49M); all pads a minimum of 0.20 mm from all adjacent pads; adjust as necessary to meet application process requirements and PCB layout tolerances; when mounting on a multilayer PCB, thermal vias at the exposed thermal pad land can improve thermal dissipation (reference EIA/JEDEC Standard JESD51-5)
- D** Coplanarity includes exposed thermal pad and terminals
- E** Branding scale and appearance at supplier discretion

- E** Standard Branding Reference View  
 Line 1: Part Number  
 Line 2: Logo A, 4-digit Date Code  
 Line 3: Characters 5, 6, 7, 8 of Assembly Lot Number

**Figure 2: 48-Lead QFN With Exposed Pad (Suffix EV)**

## REVISION HISTORY

| Number | Date           | Description     |
|--------|----------------|-----------------|
| -      | March 25, 2025 | Initial release |

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