A89110 Evaluation Board User Guide

DESCRIPTION

The A89110 is an integrated N-channel power MOSFET driver designed for automotive applications with inductive loads, such as BLDC motors and stepper motors.

A unique charge pump regulator provides the supply for full gate drive from to 4.5 to 40 V. Gate drive voltage and strength are programmable to help reduce EMC issues.

Integrated 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.

Full control is provided over all six power MOSFETs in the 3-phase bridge, allowing motors to be driven with block commutation or sinusoidal excitation. The power MOSFETs are protected from shoot-through by integrated crossover control and programmable dead time. Detailed diagnostic information can be read through the serial interface.

The A89110 is supplied in a 28-contact wettable flank QFN (suffix ET), with exposed pad for enhanced thermal dissipation. Consult the A89110 datasheet for further information than what is contained in this user guide.
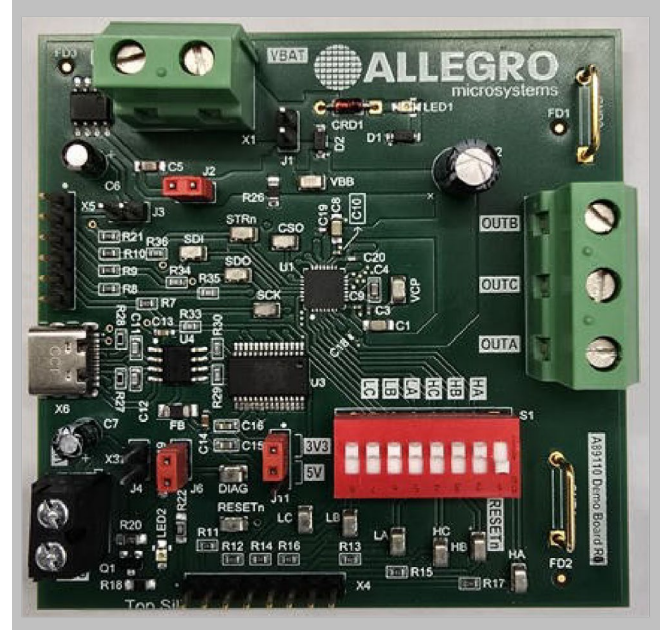

Figure 1: A89110 Evaluation Board

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Table 1: A89110 Evaluation Board Configurations

Configuration Name	Part Number	I/O Logic	Fitted Jumper Links
APEK89110KET-03-T	A89110KETSR-3 (optional)	3.3 V	J6, J11. J11 on 3.3 V
APEK89110KET-05-T	A89110KETSR-5 (default)	5 V	J2, J6, J11. J11 on 5 V

Table 2: General Specifications

Specification	Min	Nom	Max	Units
Supply Voltage	4.5	12	40	V
RMS Phase Current	–	–	1.5 [1]	A
Logic Voltage Range	−0.3	–	5.5	V
Operating Ambient Temperature Range	−40	–	125	°C
Operating Junction Temperature Range	−40	–	150	°C
Motor PWM Frequency	–	24	–	kHz

[1] Power dissipation and thermal limits must be observed

FEATURES

- 3-phase integrated MOSFET driver
- Cross-conduction protection with adjustable dead time
- Charge pump for low supply voltage operation
- 4.5 to 40 V supply voltage operating range
- Integrated logic supply
- 2 MHz 16-bit SPI-compatible serial interface
- Multiple control interface options
  - □ 6× PWM control interface
  - □ 3× PWM control interface
- Programmable gate drive
- Current sense amplifier
- Programmable diagnostics
- Automotive AEC-Q100 qualified
- ASIL Compliant: ASIL B safety element out-of-context (SEooC) developed in accordance with ISO 26262, when used as specified in the safety manual.

A2 SiL ISO 26262 ASIL Compliant

EVALUATION BOARD CONTENTS

- APEK89110 Evaluation Board

USING THE EVALUATION BOARD

The following sections explain what equipment is needed to use the evaluation board, as well as step-by-step instructions for initial setup and power-up and power-down instructions.

Equipment Required

- DC Motor (assumed load of 3 × 18R on a heat sink with a star point flying lead)

- Power Supply Unit, PSU (4 A capable). A second PSU will only be needed for a APEK89110KET-03-T configuration board, at 3.3 V to supply VL

- Meter, VDC, Digital Voltage Multi Meter (DMMV)

- Meter, IDC, Digital Ammeter Multi Meter (DMMA)

- A89110 GUI

- FTDI cable TL-232R or USB-C cable (not included)

- Personal computer for USB control

Setup

This guide assumes a default APEK89110KET-05-T board configuration. For an APEK89110KET-03-T configuration, ensure J2 is not fitted and apply 3.3 V to the VL connector from a second PSU.

1. Place DMMA (1 A fused) inline from PSU (for VBB) positive terminal to X1 VBB lead.

2. To configure for for APEK89110KET-05-T, fit jumpers J2, J6 and J11. Fit J11 on 5 V. For APEK89110KET-03-T, fit jumpers J6 and J11. Fit J11 on 3.3 V.

3. Set all S1 switches OFF.

4. Set the PSU supply limit to 4 A.

5. Set the PSU voltage, motor voltage VBB, to 13.5 V. Ensure PSU remains off.

6. Connect meter to VL found on J4

7. Connect FTDI cable or USB C cable.

8. Connect the motor to X2 and star point flying lead connected to negative PSU terminal.

Caution: Do not connect or disconnect the motor, unless the outputs are either disabled or the VBB voltage is OFF. Doing so risks permanent damage to the A89110 part and the evaluation board and could cause it to malfunction.

Power-up

1. Switch 13.5 V PSU on (DMMA reads approximately 2 to 3 mA).

2. Switch RESETn on (DMMA reads approximately 15 to 20 mA).

3. Open the GUI and clear any fault flags

4. Ensure the voltage at J4 is approximately 5 V.

5. The motor draws approximately 400 mA

Power-down

1. Set all S1 switches OFF.

2. Switch PSU OFF.

3. Disconnect the PSU and the motor.

HARDWARE

The following sections shows the hardware and connections of the the evaluation board, jumper locations, and other related information.
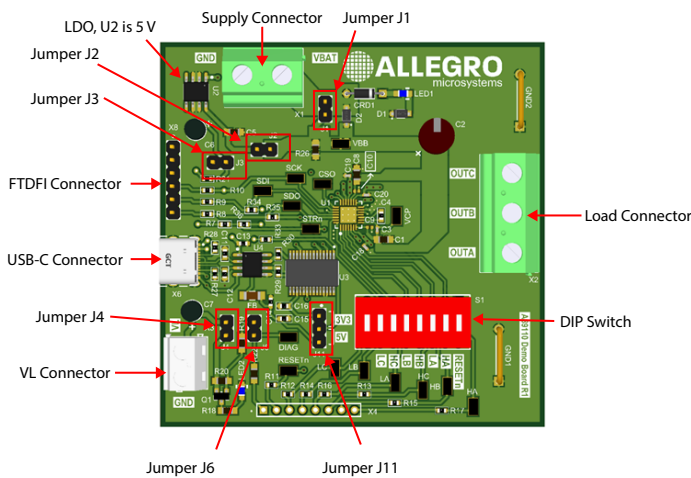

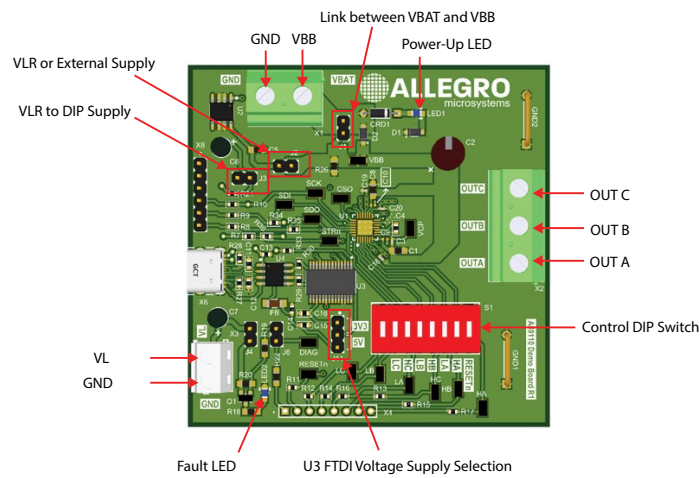**Figure 2: Evaluation board Input and Output part A**

Figure 3: Evaluation board Input and Output part B

Table 3: Jumper Default Settings

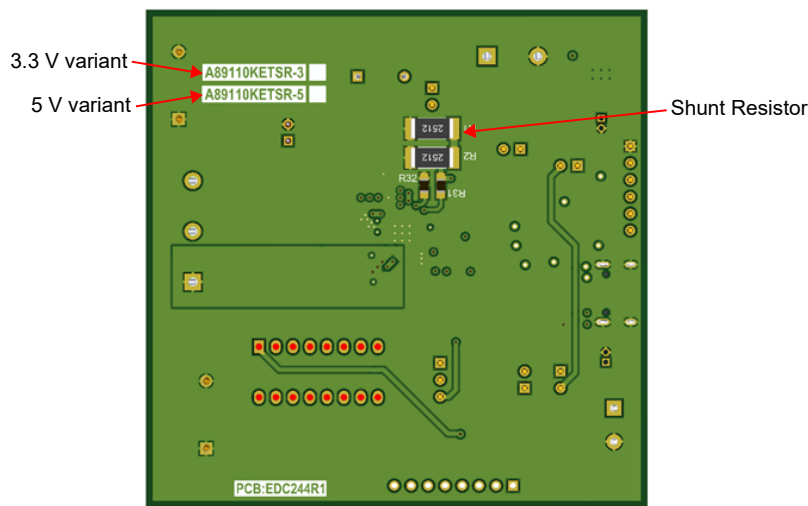| Jumper	Terminal Detail	Default Setting
J1	Provide link between VBAT and VBB pin	OFF
J2	Provide link between VBB and U2 (External regulator)	ON
J3	For DIP-based control of xHI, xLO and RESETn	OFF
J4	For external logic voltage supply (VL)	OFF
J6	For Fault LED	ON
J11	FTDI chip supply through FTDI cable or USB-C	FTDI chip supply

Figure 4: Shunt resistor connection

SCHEMATIC

The following figure shows the A89110 evaluation board schematic.

Figure 5: A89110 evaluation board schematic

LAYOUT

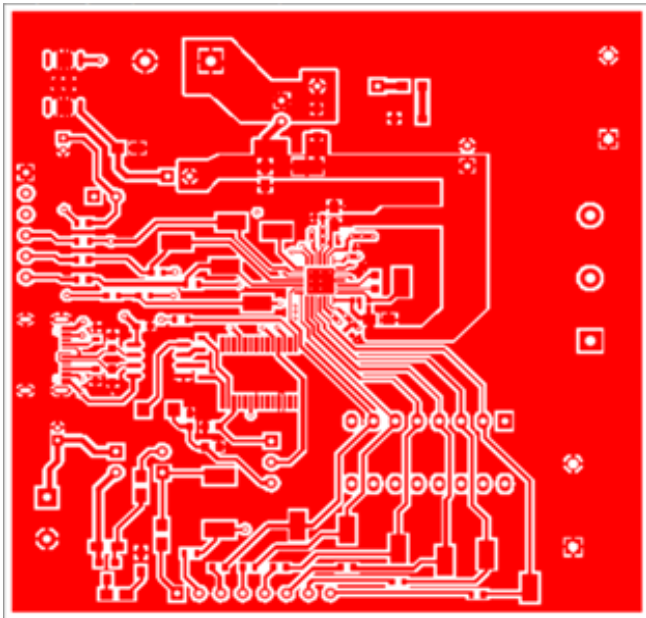The following figures show the A89110 evaluation board PCB layout.

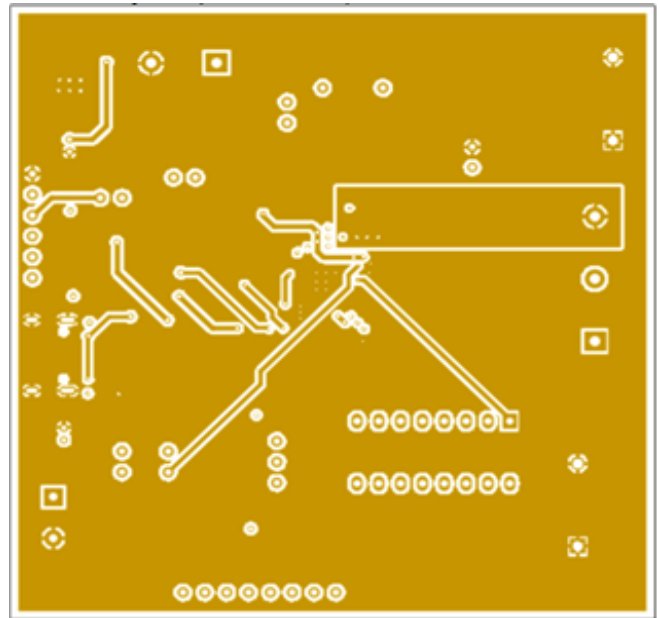**Figure 6: A89110 evaluation board PCB top layer**

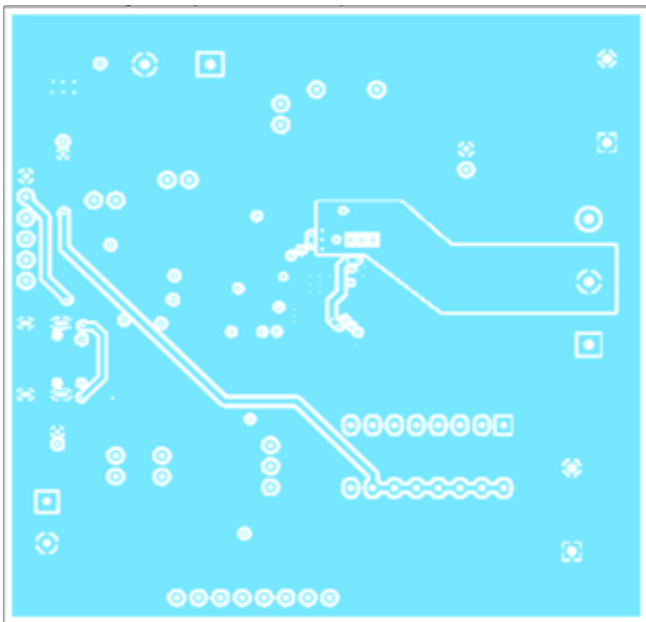**Figure 7: A89110 evaluation board PCB middle layer 1**
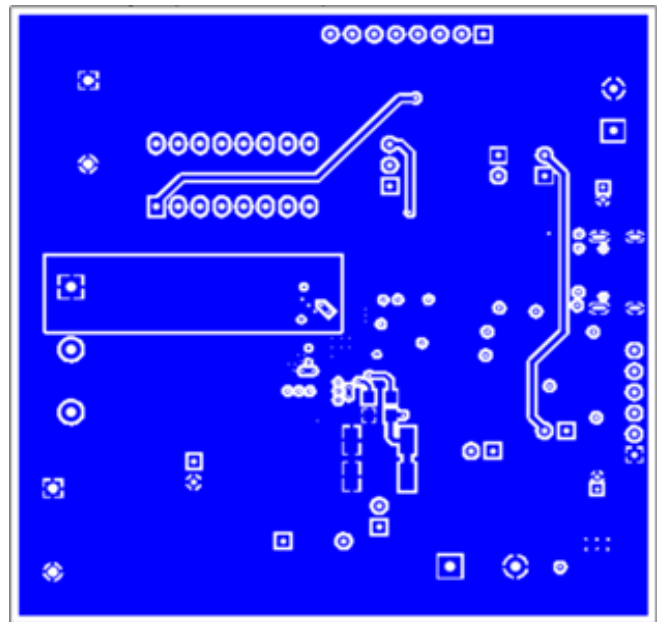

Figure 8: A89110 evaluation board PCB middle layer 2

Figure 9: A89110 evaluation board PCB bottom layer

BILL OF MATERIALS

Table 4: A89110 Evaluation Board Bill of Materials

ELECTRICAL COMPONENTS						
Designator	**Quantity**	**Value**	**Description**	**Manufacturer**	**Manufacturer Part Number**	**Footprint**
C1, C8	2	1 µF	Capacitor: Ceramic Chip	Murata	GRM21BR71H105KA12L	0805
C2	1	10 µF	Capacitor: Alu Electrolytic Radial	Rubycon	100YXF10MEFC6.3X11	CAP 4 mm Dia_1.5 mm PS
C3	1	1 µF	Capacitor: Ceramic chip, 1 µF, 16 V, X5R	Murata	GRM155R61C105KA12D	0402
C4	1	470 nF	Capacitor: Ceramic, Multilayer, 25 V	Tayo Yuden	TMK107B7474KA-TR	0603
C5	1	100 nF	Capacitor: Ceramic Chip	KEMET	C0805C104K5RACTU	0805
C6	1	10 µF	Capacitor: Electrolytic Radial, 10 µF, 16 V	Panasonic	EEA-GA1C100	CAP 4mm Dia_1.5mm PS
C7	1	10 µF	Capacitor: Alu Electrolytic Radial	Multicomp	MCMHR16V106M4X7	CAP 4mm Dia_1.5mm PS
C9, C10	2	10 nF	Capacitor: Ceramic Multilayer, 50V, X7R	KEMET	C0402C103J5RECAUTO	0402
C11, C12	2	47 pF	Capacitor: Ceramic, Multilayer	Kyocera AVX	06035C470J4T2A	0603
C13	1	10 nF	Capacitor: Ceramic Chip	KEMET	C0603C103K2RACTU	0603
C14	1	4.7 µF	Capacitor: Ceramic, Multilayer, 16 V, X5R	Murata	GRT188R61C475KE13D	0603
C15, C16	2	100 nF	Capacitor: Ceramic, 100 V, X7R	Murata	GCJ188R72A104KA01D	0603
C18, C19, C20	3	100 pF	Capacitor: Ceramic, 50 V, COG/NPO	Walsin Technologies	MT15N101J500CT	0402
C11, C12	2	47 pF	Capacitor: Ceramic, Multilayer	Kyocera AVX	06035C470J4T2A	0603
CRD1	1	–	Diode: Current Regulation, 100V, 2mA	Semitec	E-202	DIA_0.5 mm
CSO, DIAG, HA, HB, HC, LA, LB, LC, RESETn, SCK, SDI, SDO, STRn, VBB, VCP	15	–	Test Point: SMT 2.0 mm high	Harwin	S1751-46R	0.128" L × 0.064" W (3.25 mm × 1.63 mm)
D1, D2	2	–	Diode: 100 V, 0.15 A	Diodes	1N4148W-7-F	SOD123
FB	1	–	Ferrite Bead: Chip Impeder	Laird	HZ1206E601R-10	1206
GND1, GND2	2	–	Jumper: (Busbar), shorting link/pin	Harwin	D3082-05	Dia_2.54 mm PS
J1, J2, J3, J4, J6	5	–	Jumper: Header, Male 2-pin	Harwin	M20-9990246	Dia_2.54 mm PS
J11	1	–	Jumper: Header, Male 3-pin	Harwin	M20-9993645	Dia_2.54 mm PS
LED1, LED2	2		LED: 2-pin, Red, 2 mA	Kingbright	KPTD-2012LVSURCK	0805
Q1	1	–	Transistor: PNP, 45 V, 0.5 A	Nexperia	BC807-25,215	SOT23
R1, R2	2	0.1	Resistor: SMD Current Sense	Vishay Dale	WSL2512R1000FEA	2512
R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R21	12	1k	Resistor: SMD Chip Resistor, 0.1 W, 1000 Ω, 50 V	TE Connectivity	CRG0603F1K0	0603
R18	1	1.6k	Resistor: Ceramic Chip	Vishay	CRCW08051K60FKEA	0805
R19, R20	2	27k	Resistor: Ceramic Chip	TE Connectivity	CRG0805F27K	0805
R22	1	1k	Resistor: Ceramic Chip	TT Welwyn	ASC0805-1K0FT5	0805
R26	1	20k	Resistor: Ceramic Chip	Vishay	CRCW080520K0FKEA	0805

Table 3: A89110 Evaluation Board Bill of Materials (continued)

R27, R28	2	5.1k	Resistor: Thick Film 1% 1/10 W SMD	Panasonic	ERJ-3EKF5101V	0603
R29, R30, R33, R34, R35, R36	6	–	Resistor: Ceramic Chip	Multicomp	MCWR06X000 PTL	0603
R31, R32	2	–	Resistor: Ceramic Chip	Multicomp	MC0805S8F0000T5E	0805
S1	1	–	Switch: DIL16, 8-way, Raised Actuator	Grayhill	78B08ST	S1
U1	1	–	Device: 3-phase integrated MOSFET driver	Allegro MicroSystems	A89110KETTR-3-J, A89110KETTR-5-J	eQFN28
U2	1	–	Device : Voltage Regulator 5 V (V_{IN} <60 V)	TI National Semiconductor	LM2936HVMA-5.0/NOPB	SOIC8
U3	1	–	Device: USB Interface IC USB Full Speed to Serial UART IC	FTDI	FT232RNL-TUBE	SSOP-28
U4	1	–	Device : USB Port Protection	STMicroelectonics	USB6B1RL	SOIC8

OTHER COMPONENTS

Designator	Quantity	Value	Description	Manufacturer	Manufacturer Part Number	Footprint
X1	1	–	Connector: Screw Terminal, 2-way, 30 A	Phoenix Contact	1731721	2-pin screw down connector
X2	1	–	Connector: Screw Terminal, 3-way, 30 A	Phoenix Contact	1731734	2-pin screw down connector
X3	1	–	Connector: Screw Terminal, 2-way, 20 A	Weidmuller	PM5.08/2/90BLK	2-pin screw down connector
X4	1	–	Connector: 8-way Header Unshrouded	Molex	90120-0768	Dia 2.54 mm PS
X5	1	–	Connector: 6-way Header Unshrouded	Molex	90120-0766	Dia 2.54 mm PS
X6	1	–	Connector: USB 2.0 Type C	Global Connector Technology	USB4105-GF-A	–
X8	1	–	Connector: 6-way Header Unshrouded	Molex	90120-0766	–

RELATED LINKS

The GUI is available from the Allegro Software Portal. Registration for the A89110 is required.

To register for, or login to the Allegro software portal, visit: https://registration.allegromicro.com/login.

For access to the GUI interface, download the A89110 GUI.

APPLICATION SUPPORT

For application support, go to https://www.allegromicro.com/en/about-allegro/contact-us/technical-assistance and navigate to the appropriate page.

Revision History

Number	Date	Description
–	Dcember 2, 2025	Initial release