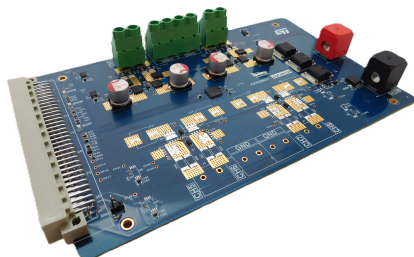


Configurable quad half-bridge or dual H-bridge DC motor driver board based on L99MH94



Features

- **L99MH94** quad half-bridge or dual H-bridge predriver for DC motors in automotive applications
- Independent channel driver up to 4 high-side or 4 low-side MOSFETs
- 15 A motor drive per single channel in half-bridge mode
- 30 A at $v_{bat} = 14\text{ V}$ motor drive per double channel in full bridge mode
- Adaptive MOSFET gate control
 - Three-step gate control of external high-side or low-side MOSFETs
 - Optimized electromagnetic interference (EMI)
 - Programmable gate current up to 120 mA
 - Reduced switching losses in PWM level mode
- Protection and diagnostic features:
 - Watchdog timeout by MCU control board
 - Drain-source monitoring for short-circuit detection
 - Undervoltage lockout
 - Reverse battery protection dedicated circuit
 - Overtemperature warning and shutdown
 - Detailed off-state diagnostic via SPI
 - Programmable diagnostic load on all channels
- Load channel direct current measurement via shunt resistors from 1.5 to 50 A
- Standardized 96-pin plug-and-play automotive unified connector to plug MCU boards (for example, **AEK-MCU-C4M3** belonging to the **AEK-MCU-C4MLIT3** evaluation kit)
- Compact size: 112 x 180 mm
- Included in the **AutoDevKit** ecosystem

Description

The key objective of the **AEK-MOT-4DCMH94** evaluation board is to drive brushed DC motors for a wide range of body control and convenience applications, such as seat control, steering column adjustment, gas pedal adjustment, sunroof, sliding doors, window lift, and washer pump.

The board also supports safety applications, including seatbelt pretensioners and central door lock (crash unlock), as well as chassis and powertrain applications, such as engine vibration compensation systems.

The **AEK-MOT-4DCMH94** is based on the **L99MH94** quad half-bridge predriver for brushed DC motor control applications. It is designed to drive four configurable channels in half-bridge or two channels in full-bridge mode. It manages up to 30 A per channel in H-bridge configuration and 15 A per channel in half-bridge configuration.

In this application, the **AEK-MOT-4DCMH94** can drive two motors simultaneously. As the **L99MH94** integrates the control of four external half-bridges in an independent and configurable way, it can also be used in several other application scenarios.

The board can drive a resistive load. This includes devices like a heater or a fan. It can also control a motor by using an H-bridge.

Product summary	
Configurable quad half-bridge or dual H-bridge DC motor driver board based on L99MH94	AEK-MOT-4DCMH94
Automotive quad and dual half-bridge pre-driver	L99MH94Q7-TR
Cost-optimized and compact size MCU discovery kit for SPC58EC80E5 Chorus 4M automotive microcontroller with CAN-FD and unified automotive connector	AEK-MCU-C4MLIT3
AutoDevKit Studio for 32-bit power architecture MCUs	STSW-AUTODEVKIT
Applications	Automotive motor control Body and convenience Chassis and safety

The **AEK-MOT-4DCMH94** supports two types of current measurement systems: the classical method, which is based on current measurement through a sensing resistor connected in series between the power source and the load, and an innovative indirect current measurement based on the measurement of the $R_{DS(ON)}$ of MOSFETs external to **L99MH94**.

The control board manages the **L99MH94** through a 24-bit serial peripheral interface (SPI).

The SPI status registers provide important diagnostic information. This information includes monitoring supply voltage, charge pump voltage, temperature warnings, and overtemperature shutdown.

Each gate driver monitors its external MOSFET drain-source voltage for fault conditions.

The innovative and efficient three-stage gate current drives the external MOSFETs and optimizes electromagnetic interference (EMI).

The **L99MH94** has several protection features. These features include drain-source monitoring for short-circuit detection. It also provides overtemperature warnings and shutdowns. A timeout watchdog controls the microcontroller. Additionally, it offers detailed off-state diagnostics via SPI. These features ensure that the device complies with ASIL-B according to the ISO 26262 standard.

The **AEK-MOT-4DCMH94** uses the **L99MH94** off-state diagnostic feature. It offers three diagnostic functions on the load output. These functions detect potential short-to-ground, short-to-battery, and open-load conditions when the **L99MH94** is off.

The off-state diagnostic can be performed for loads that are infrequently activated. Thus, MOSFET short-circuit conditions are detected without the stress inherent to on-state diagnostic mode. For example, the microcontroller can perform an off-state diagnostic immediately before the activation request of the load. Upon detection of a fault condition, the application software can report the failure and inhibit load activation, preventing any stress to the MOSFETs.

In case of failures, the **L99MH94** switches the gate drivers off to protect the device or application. The DIAG pin changes the logic level output immediately. It warns the external microcontroller unit (MCU). The MCU reads the necessary registers. This action ensures prompt intervention in various conditions. These conditions include open load, short to ground, short to battery, thermal warning, overtemperature shutdown, undervoltage, and overcurrent protection.

To provide robust protection and prevent damage due to power supply polarity inversion, reverse polarity protection is implemented. For systems requiring a higher safety level, a watchdog with a configurable time window can be enabled.

The **AEK-MOT-4DCMH94** can be connected to a microcontroller board, such as the AEK-MCU-C4M3 included in the **AEK-MCU-C4MLIT3** evaluation kit, using its 96-pin automotive unified connector for SPI communication and current sensing.

Finally, the board is a functional block of the AutoDevKit ecosystem. Release 2.9 (available at [STSW-AUTODEVKIT](#)) includes a dedicated demo to simplify board configuration and usage.

This demo shows how to control two motors by using the **L99MH94** predriver in full-bridge configuration on channels 1 and 2 for bidirectional motor control or in half-bridge configuration on channel 3 for unidirectional motor control.

The demo changes the motor speed by adjusting the PWM duty cycle every 1.5 seconds.

Every 9 seconds, the direction of the full-bridge motor on channels 1 and 2 is reversed.

The demo also measures currents and voltages for all active channels. All data measured can be visualized via a serial terminal, such as PuTTY, termite, etc.

1 System requirements, HW and SW resources

Figure 1. AEK-MOT-4DCMH94 connected to AEK-MCU-C4M3 MCU board: 2-bidirectional DC motors application diagram

MCU board (e.g. AEK-MCU-C4M3)

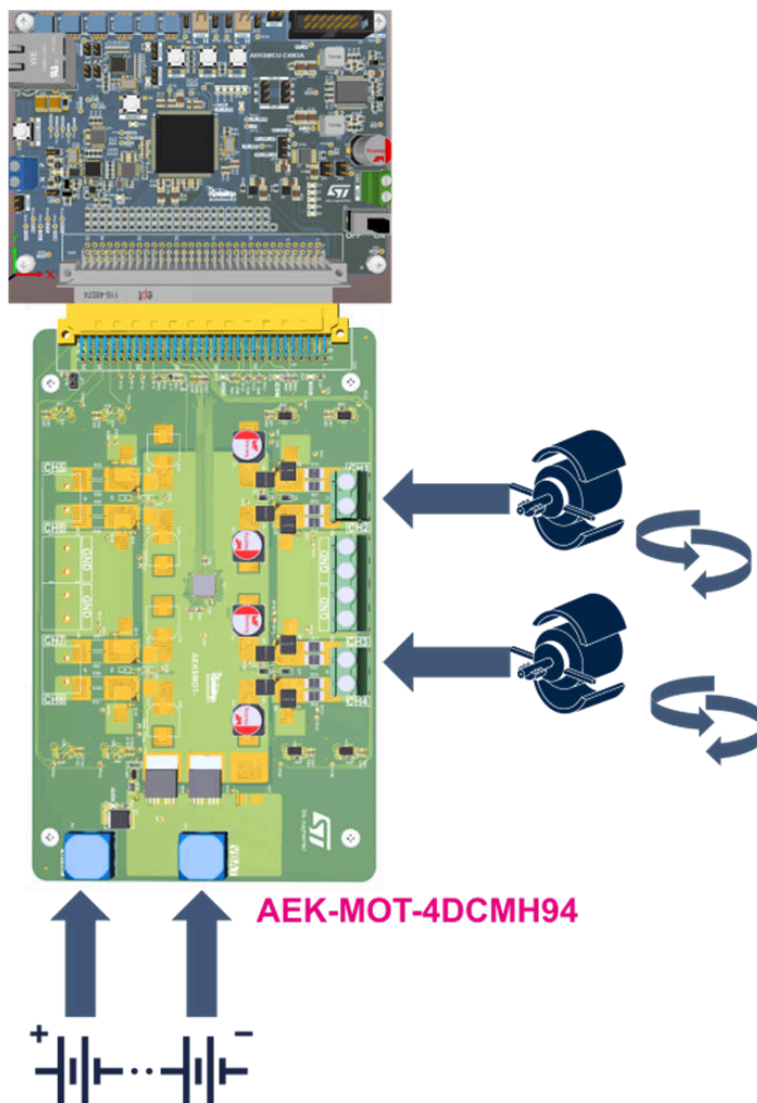
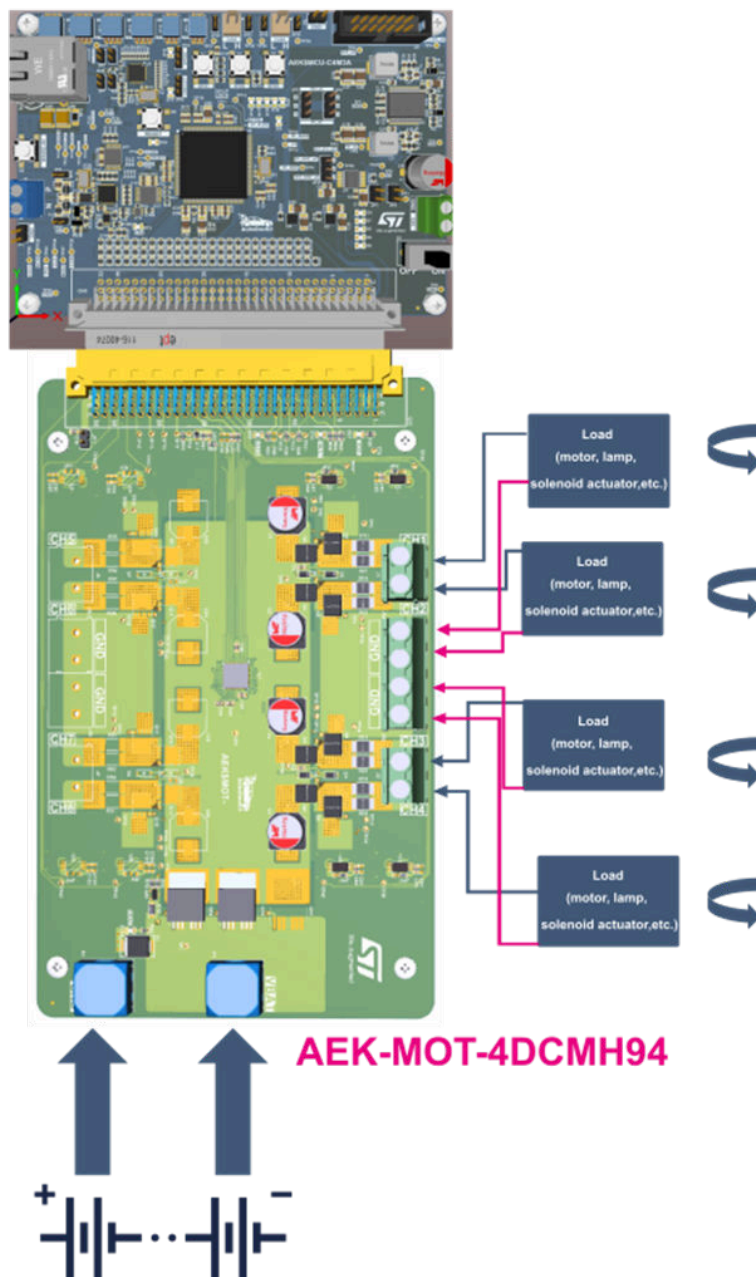


Figure 2. AEK-MOT-4DCMH94 connected to AEK-MCU-C4M3 MCU board: 4-unidirectional DC motors application diagram

MCU board (e.g. AEK-MCU-C4M3)



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Figure 3. AEK-MOT-4DCMH94 circuit schematic (1 of 4)

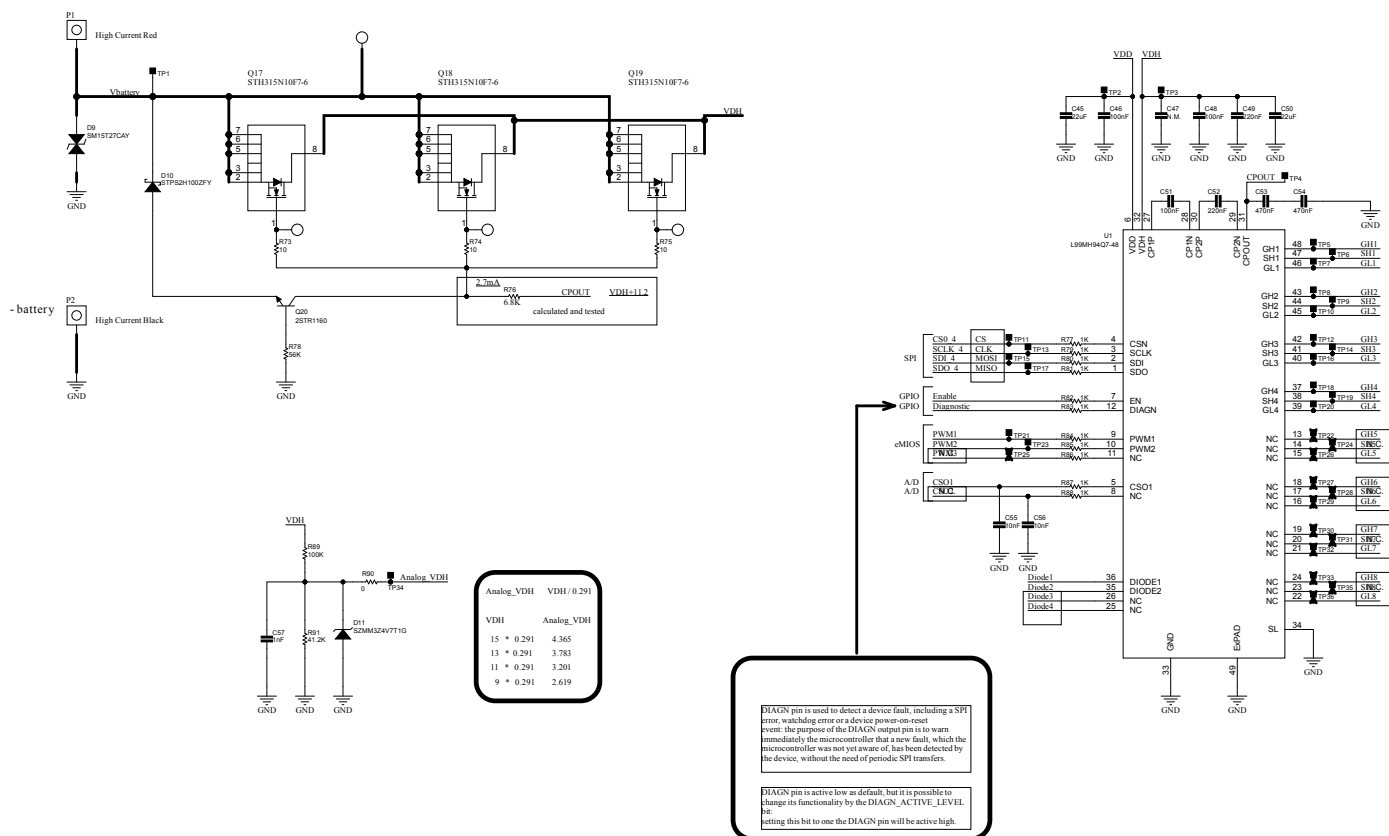
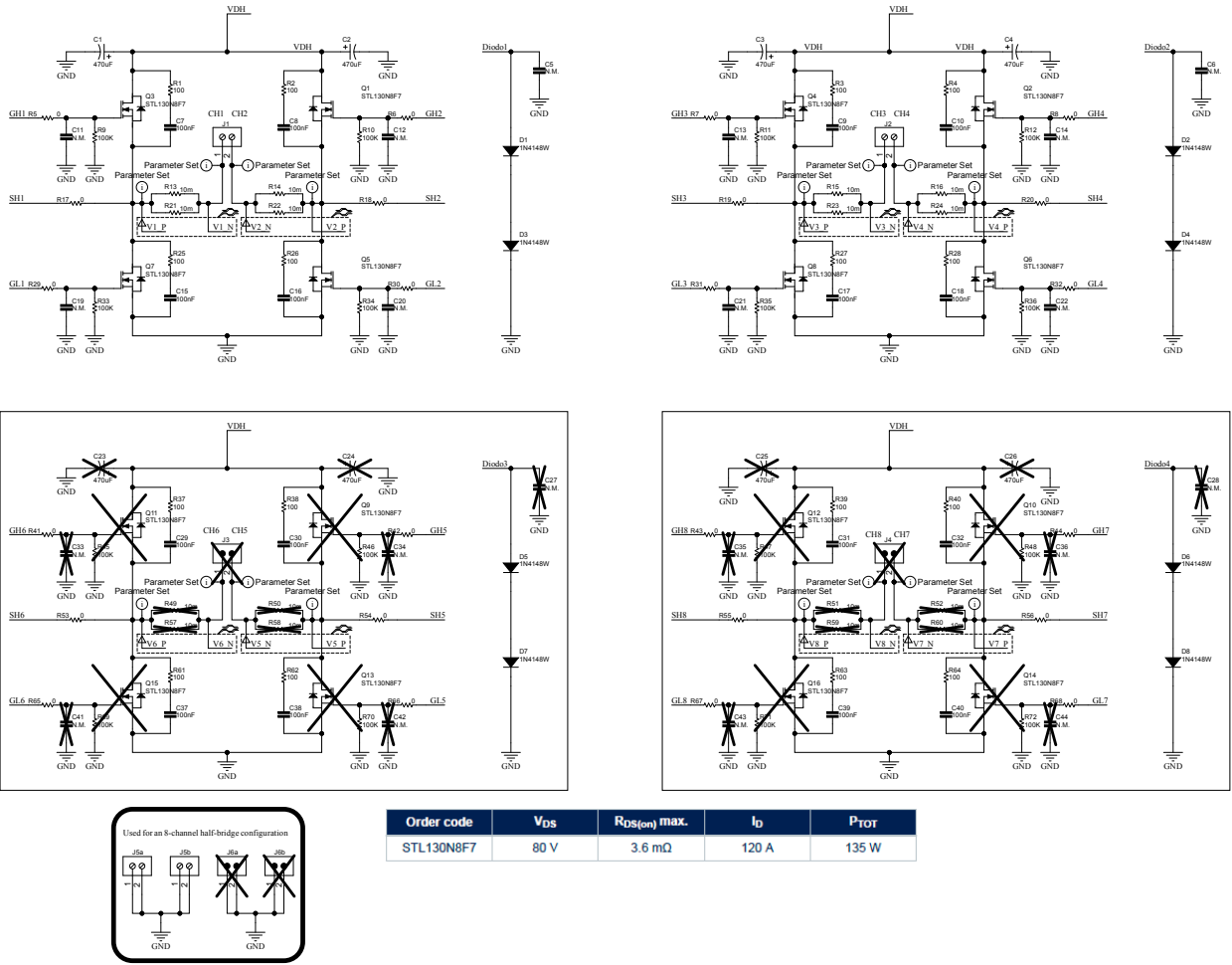
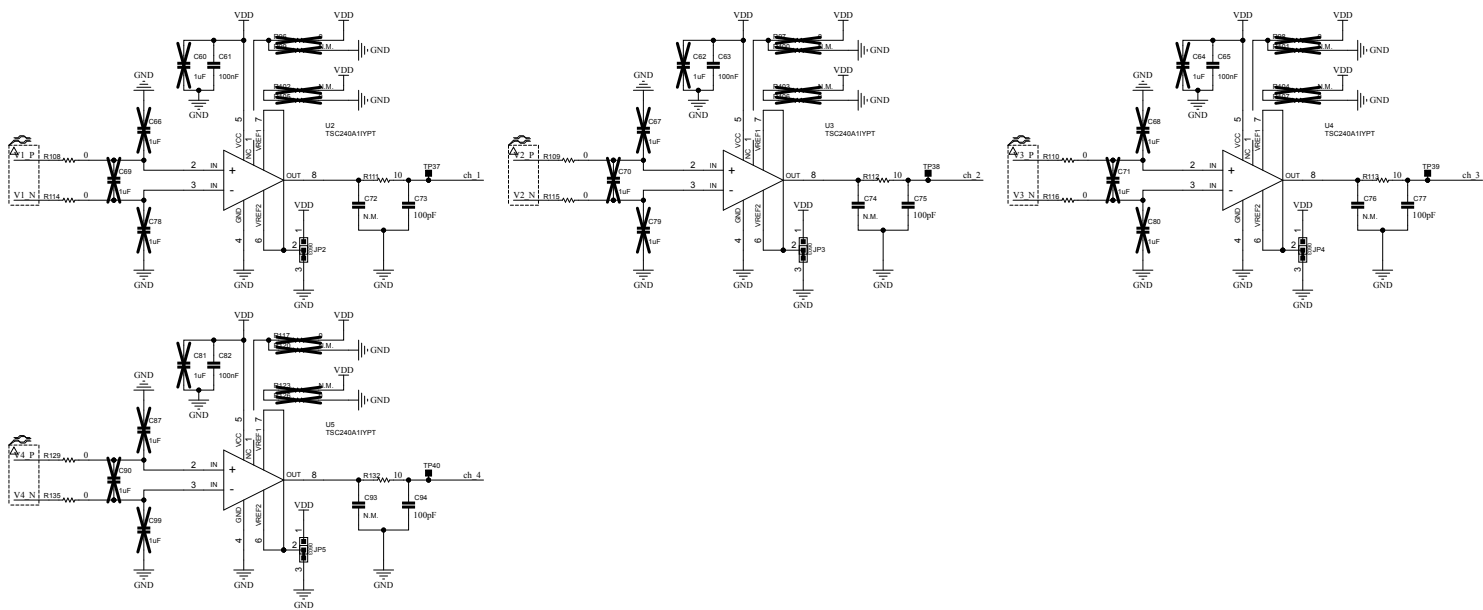


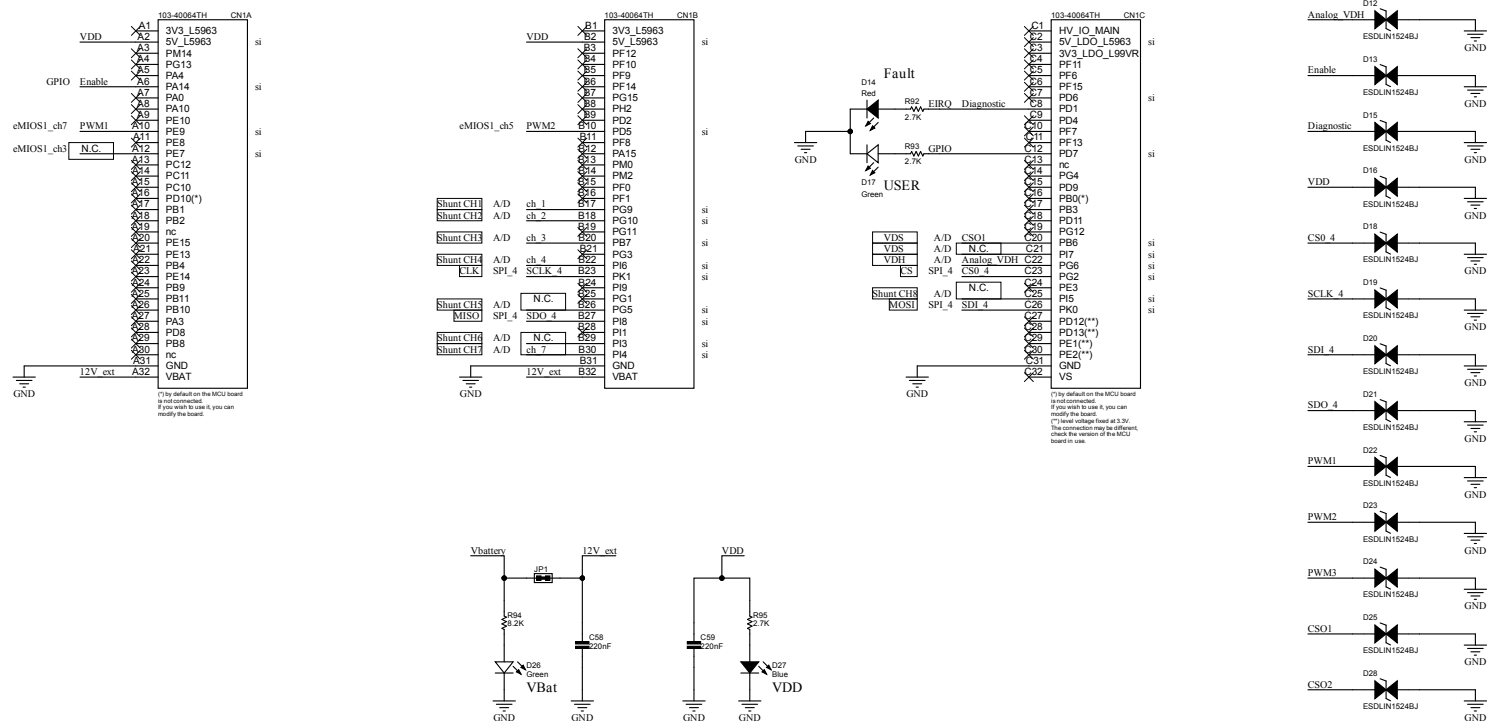
Figure 4. AEK-MOT-4DCMH94 circuit schematic (2 of 4)



AEK-MOT-4DCMH94

Schematic diagrams







3 Board versions

Table 1. AEK-MOT-4DCMH94 versions

Finished good	Schematic diagrams	Bill of materials
AEK\$MOT-4DCMH94A ⁽¹⁾	AEK\$MOT-4DCMH94A schematic diagrams	AEK\$MOT-4DCMH94A bill of materials

1. This code identifies the AEK-MOT-4DCMH94 evaluation board first version.

Revision history

Table 2. Document revision history

Date	Revision	Changes
03-Jul-2026	1	Initial release.

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