AMT49101

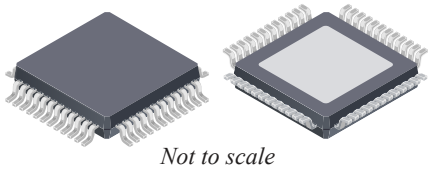
80 V Automotive Three-Phase MOSFET Driver

FEATURES AND BENEFITS

- 3-phase bridge MOSFET driver
- Bootstrap gate drive for N-channel MOSFET bridge
- Cross-conduction protection with adjustable dead time
- Fixed-frequency buck converter
- Operation at any PWM duty cycle up to and including 100%
- Programmable gate drive strength
- 10 to 80 V supply voltage operating range
- Programmable logic supply regulator controller
- Programmable 3.3 or 5 V CMOS compatible logic I/O
- Two programmable current sense amplifiers
- SPI-compatible serial interface
- Bridge control by direct logic inputs or serial interface
- Programmable control input logic sense
- Extensive programmable diagnostics
- Diagnostic verification
- Safety-assist features
- Automotive AEC-Q100 qualified
- A²-SIL™ product—device features for safety-critical systems*

PACKAGE:

48-pin LQFP with exposed thermal pad (suffix JP)



Not to scale

*The AMT49101 was developed in accordance with ISO 26262:2011 as a hardware safety element out of context with ASIL D capability (pending assessment) for use in automotive safety-related systems when integrated and used in the manner prescribed in the applicable safety application note and datasheet.

DESCRIPTION

The AMT49101 is an N-channel power MOSFET driver capable of controlling MOSFETs connected in a 3-phase bridge arrangement and is specifically designed for 48 V automotive power applications with high-power inductive loads, such as BLDC motors.

A fixed-frequency buck converter provides a regulated gate drive and bootstrap charge voltage over the full supply voltage range from 10 to 80 V. A bootstrap capacitor is used to provide the above-battery supply voltage required for N-channel MOSFETs. The bootstrap charge is maintained by an additional charge pump providing 0-100% PWM with no duty cycle restriction. The AMT49101 also provides a low voltage regulated output suitable for controller or sensor circuits power supply.

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

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. For safety-critical systems, the integrated diagnostic operation can be verified under control of the serial interface.

Configuration settings can be set, and detailed diagnostic information can be read through the serial interface.

The AMT49101 is supplied in a 48-pin QFP package (suffix JP) with exposed thermal pad. The package is lead (Pb) free with 100% matte-tin leadframe plating.

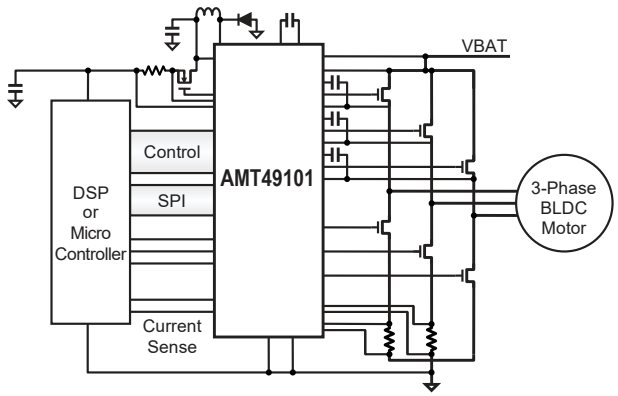


Figure 1: Typical Application

SELECTION GUIDE

Part Number	Buck Regulator	V_{IO} (V)	Packing	Package
AMT49101KJPTR-A-3	Enabled	3.3	1500 pieces per 13-inch reel	7 mm × 7 mm, 1.6 mm nominal height 48-terminal LQFP with exposed thermal pad
AMT49101KJPTR-A-5	Enabled	5		
AMT49101KJPTR-B-3	Disabled	3.3		
AMT49101KJPTR-B-5	Disabled	5		

Table of Contents

Allegro MicroSystems
955 Perimeter Road
Manchester, NH 03103-3353 U.S.A.
www.allegromicro.com

ABSOLUTE MAXIMUM RATINGS [1][2]

Characteristic	Symbol	Notes	Rating	Unit
Supply Voltage	V_{BB}		–0.3 to 80	V
Between Ground Terminals		Connect GND terminals together at package	–0.1 to 0.1	V
Logic Regulator Control Terminals	V_{LR}, V_{LL}	VLR, VLL	–0.3 to 6	V
Logic Regulator Gate Drive Terminal	V_{LG}	VLG	–0.3 to 6	V
Drive Regulator Terminal	V_{REG}	VREG	–0.3 to 16	V
Buck Switch Terminal	V_{LX}	LX	–1 to 80	V
Bootstrap Pump Capacitor Terminal	V_{CP1}	CP1	–0.3 to V_{BRG} + 0.3	V
Bootstrap Pump Capacitor Terminal	V_{CP2}	CP2	V_{CP1} – 0.3 to V_{BRG} + 12	V
Battery-Compliant Logic Input Terminals	V_{IB}	HA, HB, HC, LA, LB, LC, ENABLE, RESETn	–0.3 to 80	V
Logic Input Terminals	V_I	STRn, SCK, SDI	–0.3 to 6	V
Logic Output Terminals	V_O	SDO, SAL, SBL, SCL	–0.3 to 6	V
Diagnostic Output Terminal	V_{DIAG}	DIAG	–0.3 to 80	V
Sense Amplifier Inputs	V_{CSI}	CSxP, CSxM	–4 to 6.5	V
Sense Amplifier Output	V_{CSO}	CSxO	–0.3 to 6	V
Bridge Drain Monitor Terminal	V_{BRG}	VBRG	–5 to 85	V
Bootstrap Supply Terminals	V_{Cx}	CA, CB, CC	–0.3 to V_{REG} + 80	V
High-Side Gate Drive Outputs	V_{GHx}	GHA, GHB, GHC	V_{Cx} – 16 to V_{Cx} + 0.3	V
		GHA, GHB, GHC (transient) [3]	–18 to V_{Cx} + 0.3	V
Motor Phase Terminals	V_{Sx}	SA, SB, SC	V_{Cx} – 16 to V_{Cx} + 0.3	V
		SA, SB, SC (transient) [3]	–18 to V_{Cx} + 0.3	V
Low-Side Gate Drive Outputs	V_{GLx}	GLA, GLB, GLC	V_{REG} – 16 to 18	V
		GLA, GLB, GLC (transient) [3]	–8 to 18	V
Bridge Low-Side Source Terminals	V_{LSS}	LSSA, LSSB, LSSC	V_{REG} – 16 to 18	V
		LSSA, LSSB, LSSC (transient) [3]	–8 to 18	V
NVM Maximum Programming Junction Temperature	T_{NVM}	Guaranteed by design characterization	85	°C
Ambient Operating Temperature Range	T_A	Limited by power dissipation	–40 to 150	°C
Maximum Continuous Junction Temperature	$T_{J(max)}$		165	°C
Transient Junction Temperature	T_{Jt}	Over temperature event not exceeding 10 seconds, lifetime duration not exceeding 10 hours, guaranteed by design characterization.	180	°C
Storage Temperature Range	T_{stg}		–55 to 150	°C

[1] With respect to GND. Ratings apply when no other circuit operating constraints are present.
[2] Lowercase “x” in terminal names and symbols indicates a variable sequence character.
[3] Not tested in production. Confirmed by design and characterization. Duration less than 1 µs.

THERMAL CHARACTERISTICS: May require derating at maximum conditions

Characteristic	Symbol	Test Conditions [4]	Value	Unit
JP Package Thermal Resistance	$R_{\theta JA}$	4-layer PCB based on JEDEC standard	23	°C/W
		2-layer PCB with 3.8 in.^{2} of copper area each side	44	°C/W
	$R_{\theta JP}$		2	°C/W

[4] Additional thermal information available on the Allegro website.

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