MLX90418

No-Hall 1-coil motor driver for high speed fans

Product Abstract

General description

Features & benefits

- Sensorless 1-coil No-Hall technology
- Open and closed loop speed control:
  - Up to 40k mRPM (for 2 pole-pair motors)
  - ±1.5 % closed loop speed accuracy
  - Soft-switching
  - Lead angle control
- Configurable motor start & stop options:
  - Forward windmilling
  - Reverse windmilling
  - (Universal windmilling)
- Integrated bridge driver
  - 135 mOhm (HS+LS)
  - Programmable current limit up to 4.0 A
  - 8.0 A braking current
  - Integrated supply clamp
- Operating range:
  - Supply voltage range from 6.7 V to 18 V
  - Junction temperature from -40 °C to 150 °C
- Extensive programmability (MTP)
  - Sleep mode option
  - 8-point configurable speed curves
  - Synthesized FG output for easy retrofitting of legacy 3-phase solutions
- Protections & Diagnostics
  - LRP / UVP / OCP / TSD
  - Hot unplug handling with power loss brake option
  - AC-power loss management
- Package RoHS compliant
  - DFN10 3.5x3 mm2 with exposed pad

Applications examples

- High speed server cooling fans
- General 12V fans & pumps up to 30W

Available support & tools

- www.melexis.com/technical-inquiry
- www.melexis.com/FandriverEVB2
- www.melexis.com/FanDriverProgrammerB

Description

The MLX90418 is a member of the No-Hall sensorless 1-coil BLDC motor driver IC's. It can be configured for a wide range of applications and supports replacing legacy sensorless 3-phase motors. Furthermore, it includes dedicated features for high speed server fan applications.

The device drives 12 V 1-coil motors, typically without the need for an external TVS for protection. It integrates two half bridges with very low RDSon, supporting 8 A braking current and a programmable current limit up to 4 A.

The MLX90418 is controlled via a PWM input, and provides speed feedback through a programmable FG output. Extensive speed curve fitting is available with 8 configuration points, up to 40k mRPM (for 2 pole-pair motors).

The non-volatile memory can be programmed through I2C and is "Multiple Times Programmable"

The IC features a wide range of protections, including: "Locked Rotor Protection", "Under Voltage Protection" with hot unplug handling, "Thermal Shut Down" and "Over Current Protection".

Plug-and-play prototyping: a motor parameter extraction tool is available for fast validation.

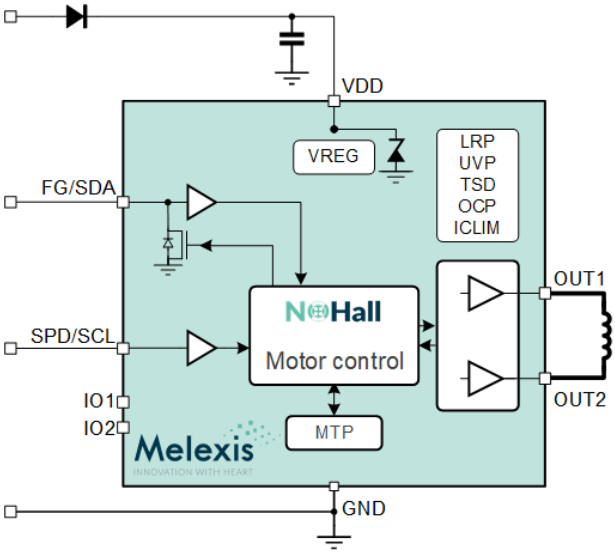


Figure 1 – Functional diagram

Ordering information

Product order code	Temperature	Package	IC version code	$CLIM_{MAX}$	Packing
MLX90418KLD-AAA-004-RE	-40 to 150 °C	DFN10	AAA-00	4.0 A	Reel
MLX90418KLD-AAA-002-RE	-40 to 150 °C	DFN10	AAA-00	2.8 A	Reel

Table 1 – Product codes

1 Conditions and specifications

1.1 Absolute Maximum Ratings (AMR)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	V_{DDcont}	-0.3		20	V	Externally applied
Peak motor braking current	I_{PHASE_brk}			I_{OCP_min}	A	During initial braking[1], <500 ms
FG, IO1 output voltage	V_{FG}	-0.3		20	V	
SPD, IO2 voltage	V_{PWM}	-0.3		V_{DD} + 0.3	V	
OUT1, OUT2 voltage	V_{OUT}	-1		V_{DD} + 1.0	V	During PWM switching dead time
OTP write temperature	$T_{OTPWrite}$			50	°C	3x OTP pages
Maximum ambient temperature	T_{AMB}	-40		125	°C	[1]
Maximum junction temperature	T_J	-40		150	°C	[1]
Storage temperature range	T_s	-55		165	°C	
ESD Sensitivity – HBM	V_{HBM}			4000	V	HBM according to JS-001
ESD Sensitivity – CDM	V_{CDM}			1000	V	CDM according to JS-001

Table 2 – Absolute Maximum Ratings

Exceeding the absolute maximum ratings may cause permanent damage.
Exposure to absolute maximum-rated conditions for extended periods may affect the device reliability.

1.2 Electrical operating conditions & specifications

Unless otherwise specified, the electrical specifications are valid at T_J 25 °C, and a supply voltage range from 6.7 to 12 V. All absolute timings, except for closed loop speed control are subject to RCO tolerances.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
VDD operating range	V_{DD}	6.7	12	18	V	
VDD degraded operating range	V_{DD_DEGR}	5.7		6.7	V	
VDD digital register preserved	V_{POR}		3.55	4.5	V	

Table 3 – Electrical operating conditions

[1] Maximum junction operating temperature should not be exceeded.

2 Pins description for DFN10 package

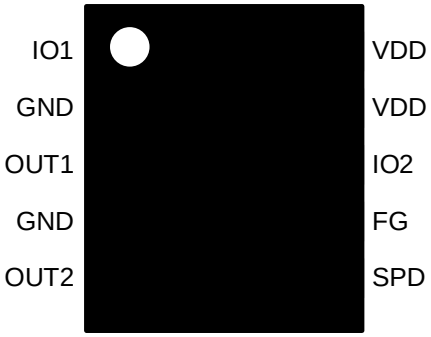


Figure 2 - DFN10 package pinout

Pin #	Name	I/O	Description
1	IO1	I/O	IO1
2	GND	Ground	Ground connection
3	OUT1	Output	Motor coil connection 1
4	GND	Ground	Ground connection
5	OUT2	Output	Motor coil connection 2
6	SPD	Input	▪ PWM input ▪ SCL input for the I_2C interface
7	FG	I/O	▪ FG output ▪ SDA input/output for the I_2C interface
8	IO2	I/O	IO2
9	VDD	Supply	Power supply input voltage
10	VDD	Supply	Power supply input voltage
EP	EP	Ground	Exposed pad to be connected to GND

Table 4 – DFN10 package pins description

3 Recommended application diagram

A decoupling capacitor should be placed as close as possible to the MLX90418 VDD and GND pins.

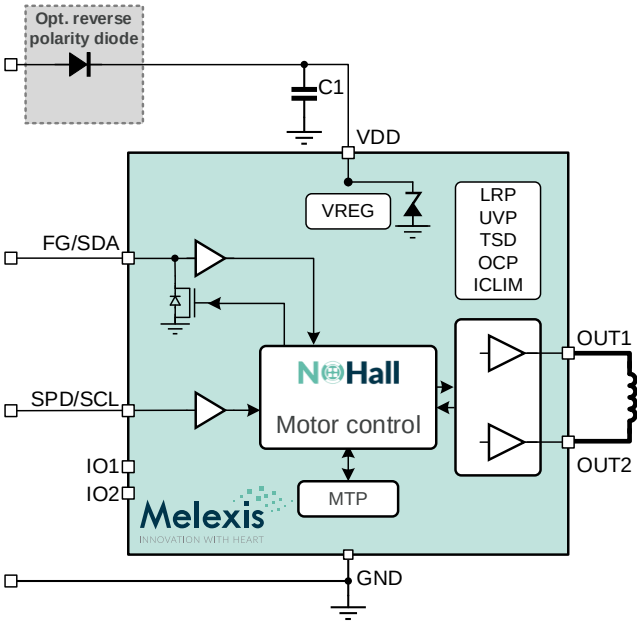


Figure 3 – Recommended application diagram

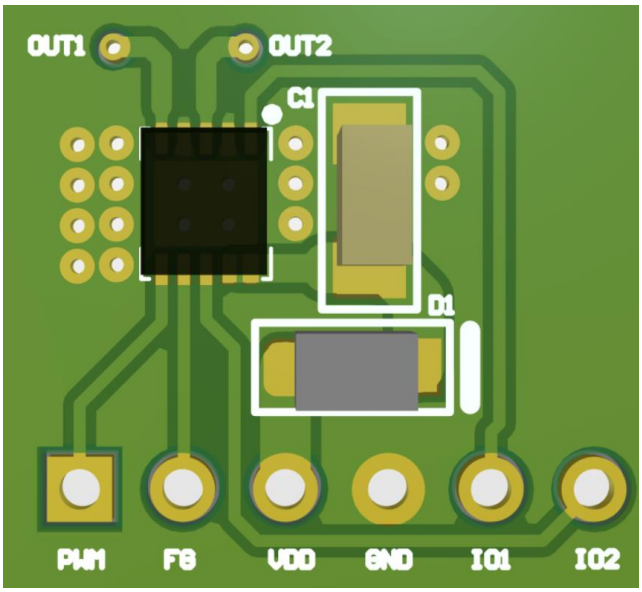


Figure 4 – Reference layout

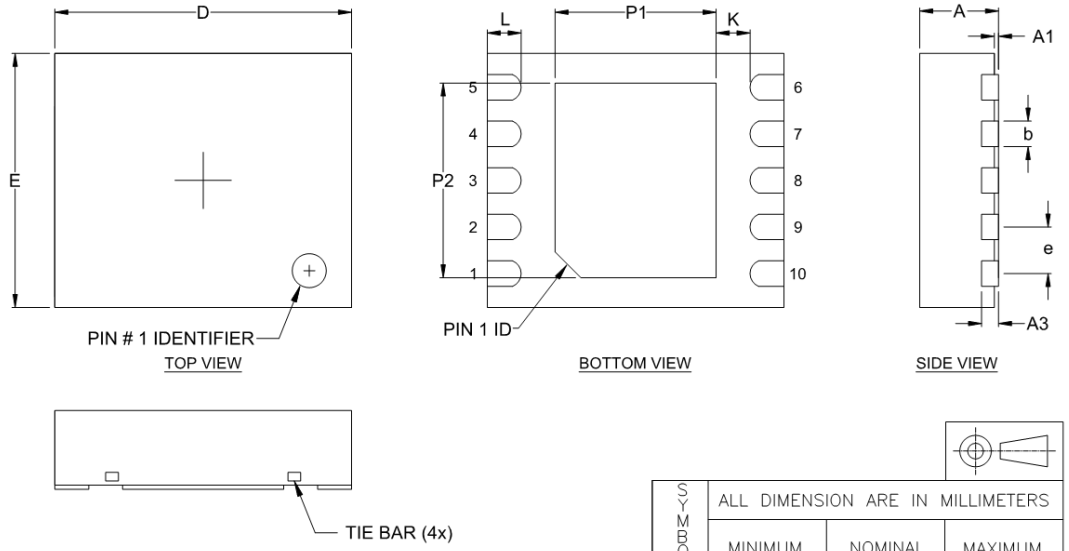
Component	Symbol	Value	Condition
Decoupling capacitor	C1	10 µF	
Optional reverse polarity diode	D1		• Optional component, in case reverse polarity protection is not guaranteed by polarity of the connector • Component to be selected acc. to application voltage and current requirements

Table 5 – External components specifications for recommended application diagram

4 Package, IC handling and assembly

4.1 Package information

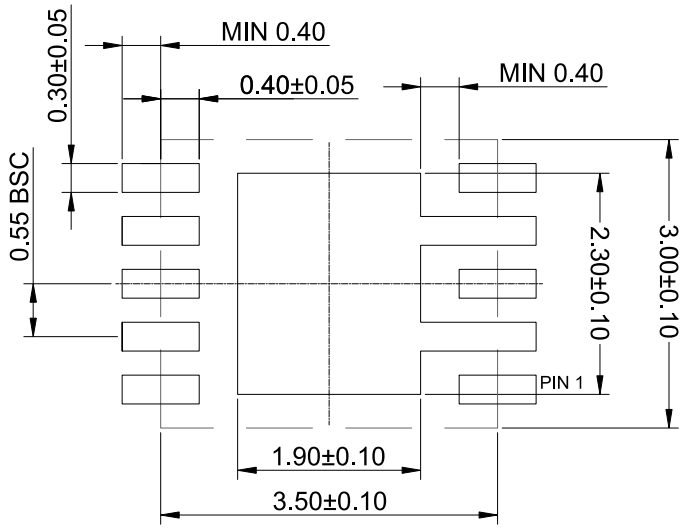
4.1.1 Package DFN10 dimensions



NOTE :
1. ALL DIMENSIONS ARE IN MILLIMETERS (mm)
2. EXPOSED TIE BAR SHOULD BE KEPT FREE FROM SOLDER.

SYMBOL	ALL DIMENSION ARE IN MILLIMETERS		
	MINIMUM	NOMINAL	MAXIMUM
A	0.80	0.85	1.00
A1	0	0.02	0.05
A3		0.20 REF	
D	3.40	3.50	3.60
E	2.90	3.00	3.10
P1	1.80	1.90	2.00
P2	2.20	2.30	2.40
L	0.35	0.40	0.45
K		0.40 REF	
b	0.25	0.30	0.35
e		0.55 BSC	

Figure 5 – Package outline dimensions



NOTE :
1. ALL DIMENSIONS IN MILLIMETERS (mm) UNLESS NOTED OTHERWISE
2. PIN 2 AND PIN 4 (ELECTRICAL GROUND) NEED TO BE CONNECTED TO EXPOSED PAD.

Figure 6 – Recommended land pattern

5 Revision history

Revision	Date	Change history
1.0	25-Jun-2024	▪ First release

Table 6 – Revision history

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