

Bi-direction Relay Driver, 5 V to 40 V**1 Introduction**

The AL669 is a bi-direction relay driver IC designed to control bi-direction relays. It features high output current capability and low quiescent power consumption, making it suitable for a wide range of applications including smart electricity meters and other related industries.

The AL669 is available in SOT-23-6 .

2 Features

- Wide supply voltage range: 5V to 40 V
- Peak current limit protection: 2.5 A
- Continuous current: 750mA
- Standby mode current: 0.75 μ A
- Low MOSFET on-resistance: $R_{DS(on)}$ = 0.7 Ω , $R_{DS(on)}$ = 0.4 Ω
- Anti-back-EMF protection
- Shutdown state prevents mains interference
- Compatible with a wide range of MCU control logic
- Input logic hysteresis
- Over-current and over-temperature shutdown

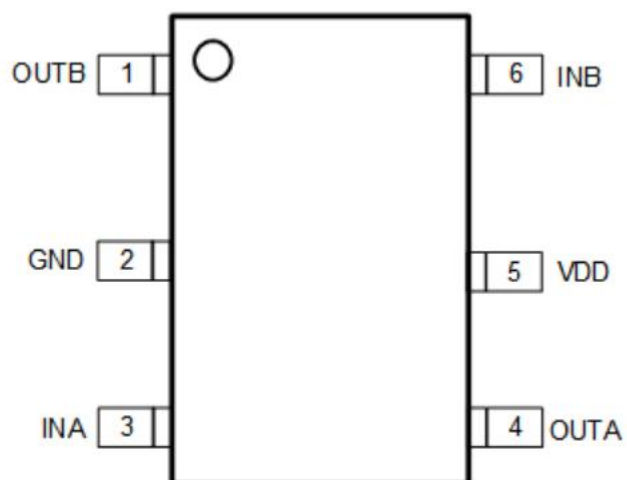
3 Applications

- Smart Meter

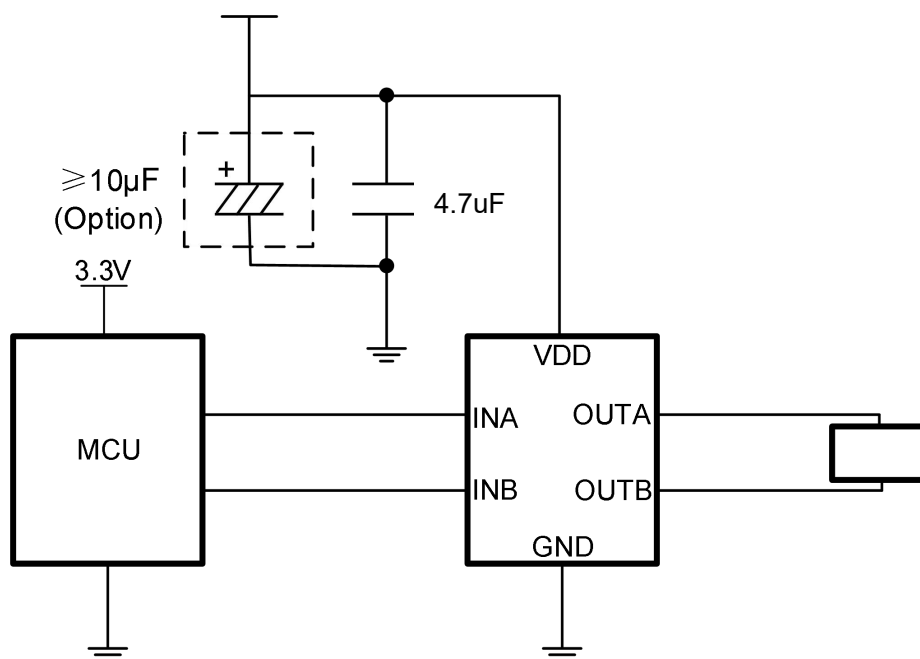
4 Ordering Information

Product No	Marking*
AL669	AL669

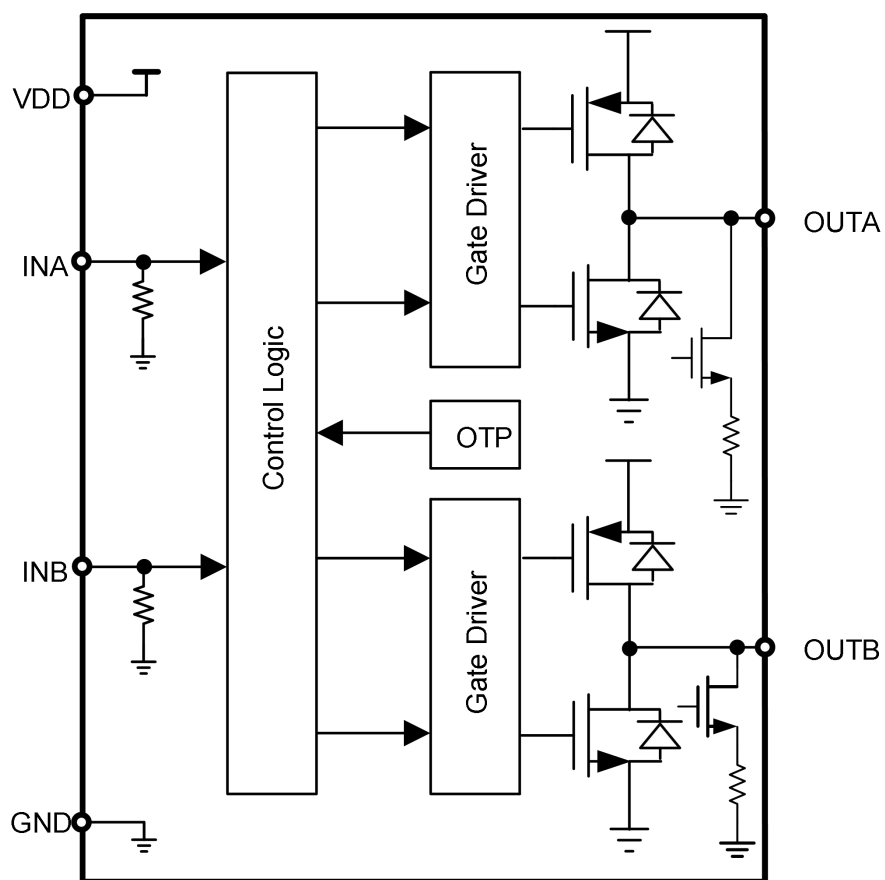
5 Pinout



6 Typical Application



7 Block Diagram



8 Logic Function Table

INA	INB	OUTA	OUTB
0	0	L	L
0	1	L	H
1	0	H	L
1	1	L	L

9 Pin Descriptions

AL669	Name	
1	OUTB	Output.
2	GND	GND.
3	INA	Logic input.
4	OUTA	Output.
5	VDD	Power supply.
6	INB	Logic input.

10 Specifications

10.1 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
VDD Supply Voltage Range	V _{DD}	-0.4~45	V
Input Pin Voltage Range	V _{INX}	-0.4~6.0	V
Output Pin Voltage Range	V _{OUTX}	-0.4~45	V
Storage Temperature Range	T _{STG}	-55~150	°C
Lead Temperature	T _{LEAD}	260 (soldering,10s)	°C

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the “Recommended Operating Conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are referenced to the ground terminal.

10.2 ESD Ratings

Discharge mode	Standard	Value	Units
HBM	JEDECJS-001-2023	±6000	V
CDM	JEDECJS-002-2022	±2000	V

10.3 Recommended Operating Range

Parameter	Symbol	Condition	Min.	Max.
VDD Voltage Range	V _{DD}		5V	40V
Logic input voltage	V _{INx}		0V	6V
Input Capacitor	C _{IN}	4.7		uF
Operating Temperature	T _A *		-40°C	85°C

*Note: The maximum ambient temperature is calculated based on the specific thermal resistance.

10.4 Thermal Information

Parameter	Package	Value	Unit
θ _{JA}	SOT23-6	120	°C/W

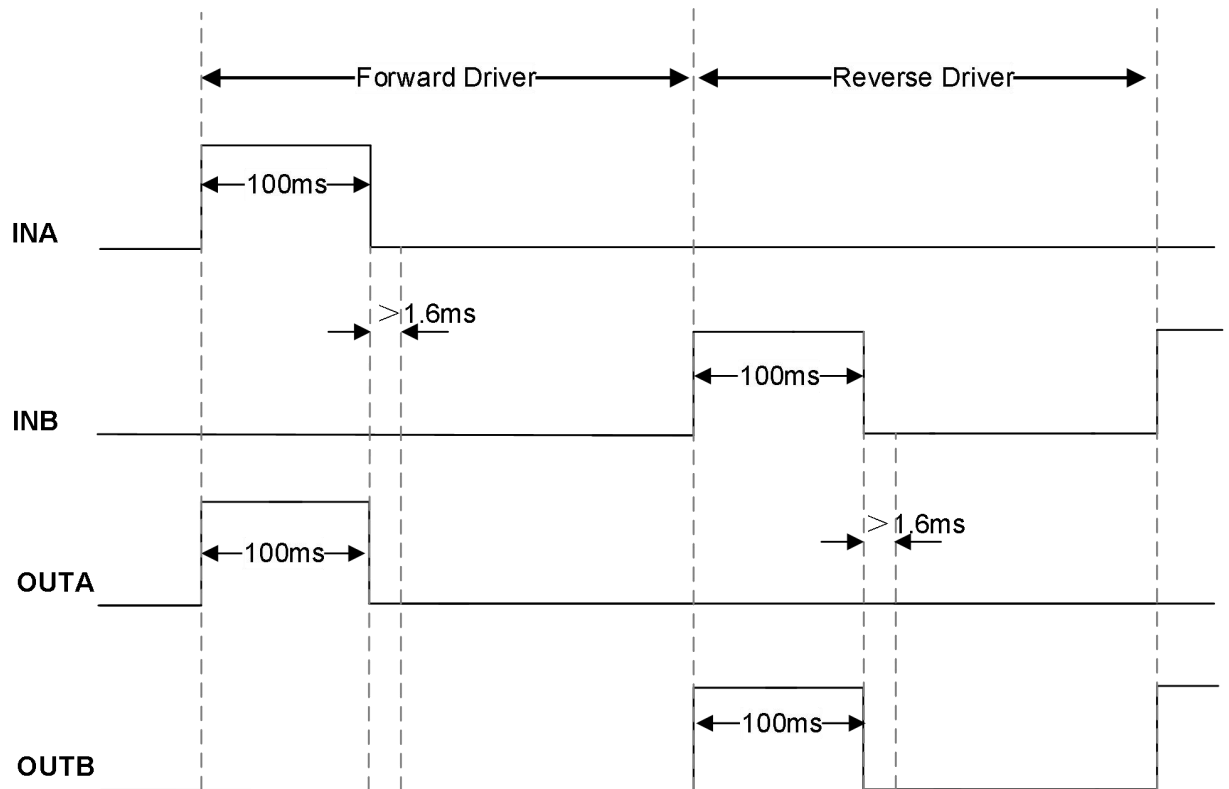
11 Electrical Characteristics

Test conditions: TA = 25°C, VDD = 12V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Supply						
Standby Mode Supply Current	Iq0	INA=INB=0V		0.75		μA
Operating Supply Current	Iq1			250		μA
Output Enable Time	T1	VDD > VUVLO and INA or INB input high		10		us
Logic Level Input						
Input High Voltage	VIH		1.2			V
Input Low Voltage	VIL				0.4	V
Input Logic Hysteresis	V _{IN HYS}			0.15		V
Input High-Level Current	I _{INH}	INA or INB=5V		10		μA
Input Low-Level Current	I _{INL}	INA or INB=0V		0	1	μA
Input Pull-down Resistor	RIN		0.35	0.5	0.65	MΩ
Output						
HS On-Resistance	R _{hs}	ILOAD=300mA		0.7		Ω
LS On-Resistance	R _{ls}	ILOAD=300mA		0.4		Ω
Output pull-down resistor	R _{OUTX}			20		KΩ
Body Diode Forward Voltage	V _D	IOUT=1A		0.8		V
Dead Time	T _{dead}			200		ns
ZCD shutdown time	T _{ZCD}	INA or INB from 10-00, time from OUTA、OUTB current less than ZCD current to output shutdown		1.4		ms
Protection Circuits						
VDD Undervoltage Reset Voltage	V _{UVLO_R}		3.6	4	4.4	V
VDD Undervoltage Lockout Voltage	V _{UVLO_F}		3.45	3.85	4.25	
VDD Undervoltage Protection Hysteresis	V _{UVLO_H}			0.15		V
Overcurrent Protection	OCP			2.5		A
Overcurrent Protection Filter Time	T _{OCP}			1.5		μs
Overcurrent Protection Retry Time	T _{RETRY}			1.4		ms
Thermal Shutdown Threshold	OTP			160		°C
Thermal Protection Hysteresis	T _{HYS}			30		°C

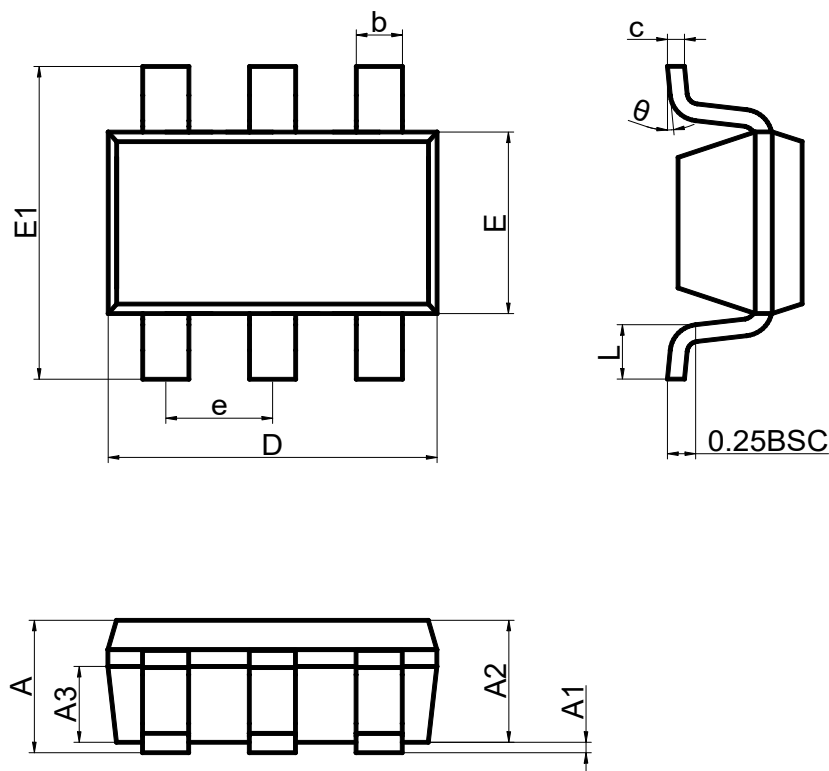
12 Anti-Back-EMF Protection

To prevent destructive effects caused by back-EMF, the AL669 incorporates an anti-back-EMF function. Through internal logic configuration, before the INA/INB enter the "00" pull-down state, the internal logic adds an extra "11" state. This allows the residual inductive current in the relay coil to be discharged to ground through two NMOS transistors, effectively reducing device damage due to back-EMF.



12 Package

SOT23-6



标注 \ 尺寸	最小 (mm)	标准 (mm)	最大 (mm)
A	1.05	1.15	1.25
A2	1.00	1.10	1.20
b	0.30	0.40	0.50
c	0.10	0.152	0.20
D	2.82	2.92	3.02
E	1.51	1.61	1.7
E1	2.65	2.80	2.95
e	-	0.95	-
L	0.30	0.42	0.57