LV8548

Motor Driver, Forward/Reverse
Low Saturation Voltage 28V

GENERAL DESCRIPTION

The LV8548 is a 2-channel low saturation voltage forward/reverse motor driver IC. It is optimal for motor drive in 12V and 24V system products and can drive either two DC motors, one DC motor using parallel connection, or it can drive a stepper motor in Full-step and Half-step.

The output driver block of each H-bridge consists of N-channel power MOSFETs configured as an H-bridge to drive the motor windings. Each H-bridge includes circuitry to regulate or limit the winding current.

Internal shutdown functions are provided for under-voltage lockout, and over temperature. A low-power sleep mode is also provided.

The LV8548 is available in a compact SOIC-10 package.

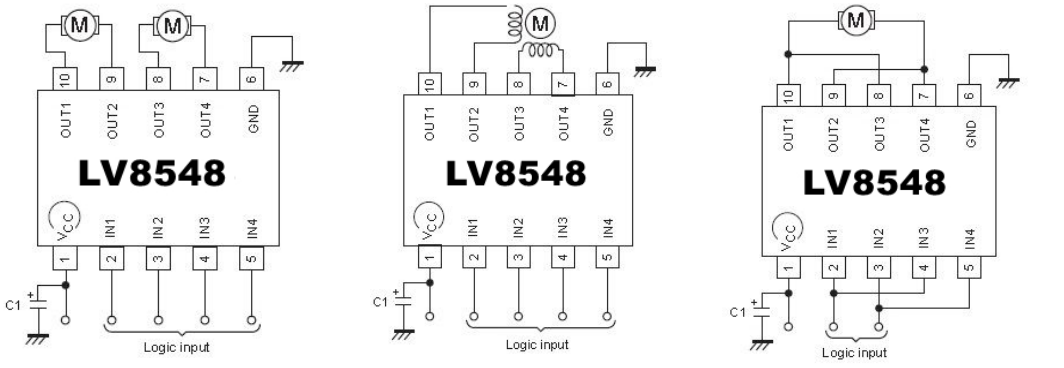
FEATURES

- DMOS output transistor adoption (upper and lower total Rdson = 0.65 Ω Typ.).
- V_{CC} Max = 28V, I_O Max = 1.2A, I_O RMS = 0.8A.
- 4V to 28V operating supply voltage range (The control system power supply is unnecessary.).
- The compact package (SOIC-10) is adopted.
- Current consumption 0 when standby mode.
- It is possible to connect in parallel (parallel connection of drive channel).
- Built-in brake function.

TYPICAL APPLICATIONS

- Refrigerator
- Flatbed Scanner, Document Scanner
- POS Printer, Label Printer
- PoE Point of Sales Terminal
- Clothes Dryer
- Vacuum Cleaner
- Time Recorder

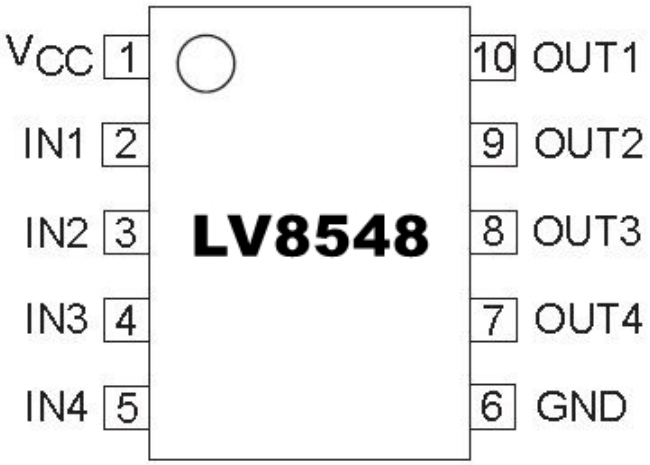
TYPICAL APPLICATION CIRCUIT



Two DC Motors | One Stepper Motor | One DC Motor by Parallel Connection

Figure 1 Typical Application Circuit

PIN CONFIGURATION

Package	Pin Configuration (Top View)
SOIC-10	

PIN DESCRIPTION

No.	Pin	Description
1	V_{CC}	Power-supply voltage pin. A 10-uF (minimum) ceramic bypass capacitor to GND is recommended.
2	IN1	Logic input pin of OUT1 and OUT2. Internal pull-down.
3	IN2	Logic input pin of OUT1 and OUT2. Internal pull-down.
4	IN3	Logic input pin of OUT3 and OUT4. Internal pull-down.
5	IN4	Logic input pin of OUT3 and OUT4. Internal pull-down.
6	GND	Device ground.
7	OUT4	Driving output pin. Motor coil is connected between terminal OUT3 (pin8).
8	OUT3	Driving output pin. Motor coil is connected between terminal OUT4 (pin7).
9	OUT2	Driving output pin. Motor coil is connected between terminal OUT1 (pin10).
10	OUT1	Driving output pin. Motor coil is connected between terminal OUT2 (pin9).

ORDERING INFORMATION

Industrial Range: -40°C to +125°C

Order Part No.	Package	QTY
LV8548CC-13GTR	SOIC-10, Pb-Free	4000/Reel
LV8548CC-GT	SOIC-10, Pb-Free	100/Tube

FUNCTIONAL BLOCK DIAGRAM

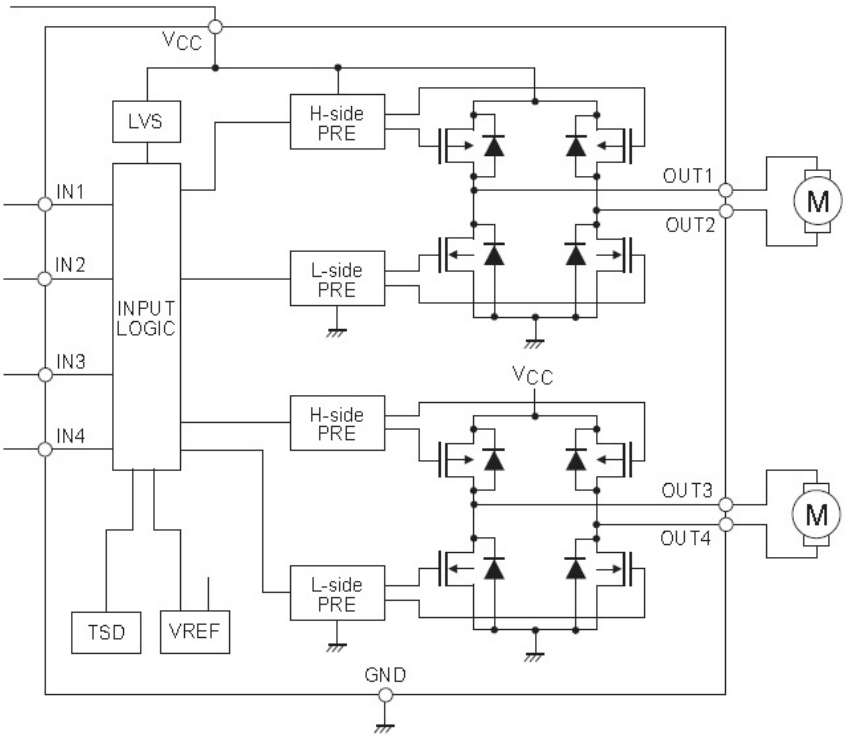


Figure 2 Two DC Motors Drive

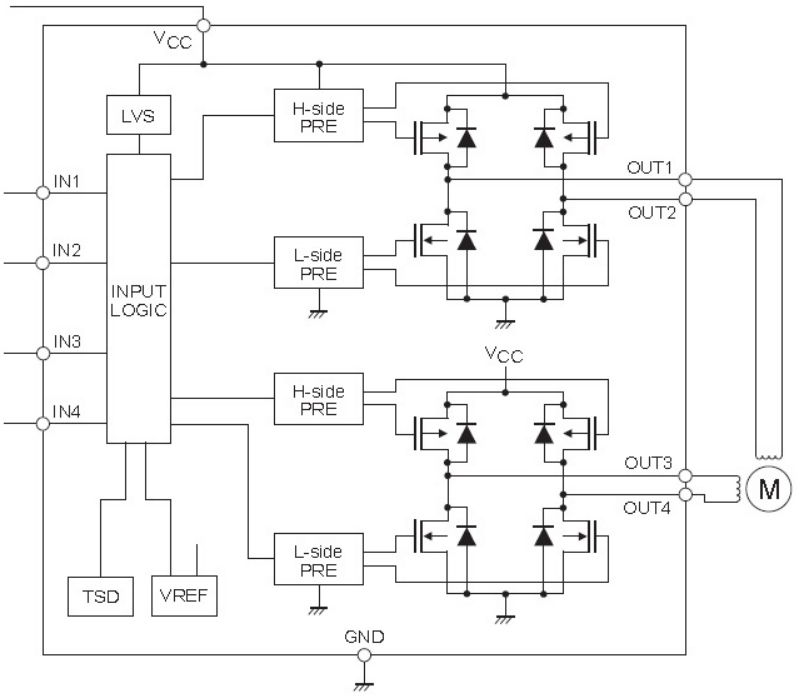


Figure 3 One Stepper Motor Drive

ABSOLUTE MAXIMUM RATINGS

Symbol	Definition		Min.	Max.	Units
V_{CC} Max	Maximum power supply voltage (V_{CC})		-0.3	+30	V
V_{OUT}	Output voltage (OUT1, OUT2, OUT3, OUT4)		-0.3	+30	
V_{IN}	Input voltage (IN1, IN2, IN3, IN4)		-0.3	+6	
I_{GND}	Maximum GND pin sink/source current.		---	+1.2	A
P_D	Package power dissipation @ $T_A \leqslant$ +25°C	SOIC-10	---	1.0	W
Rth_{JA}	Thermal resistance, junction to ambient	SOIC-10	---	80	°C/W
T_J	Junction temperature		---	150	°C
T_S	Storage temperature		-55	150	
T_L	Lead temperature (soldering, 10 seconds)		---	300	

Note:
Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

RECOMMENDED OPERATION CONDITIONS

Symbol	Definition	Min.	Max.	Units
V_{CC}	Power supply voltage (V_{CC})	4.0	28	V
V_{IH}	Logic “1” input voltage (IN1, IN2, IN3, IN4)	1.8	5.5	
V_{IL}	Logic “0” input voltage (IN1, IN2, IN3, IN4)	-0.3	+0.7	
V_{LO}	Low-side output voltage	0	V_{CC}	
T_A	Ambient temperature	- 40	125	°C

Note:
The input/output logic timing diagram is shown in Fig. 1. For proper operation the device should be used within the recommended conditions. The V_S offset rating is tested with all supplies biased at a 15 V differential.

DYNAMIC ELECTRICAL CHARACTERISTICS

V_{CC} = 12 V and T_A = 25°C unless otherwise specified.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
t_{on}	Turn-on propagation delay	V_{CC} = 12 / 24 V	170	200	230	ns
t_{off}	Turn-off propagation delay	V_{CC} = 12 / 24 V	80	100	120	
t_r	Turn-on rise time	V_{CC} = 12 / 24 V, 16Ω to GND, 10% to 90% V_{CC}	160	200	240	
t_f	Turn-off fall time	V_{CC} = 12 / 24 V, 16Ω to GND, 90% to 10% V_{CC}	220	260	300	
DT	Deadtime, LS turn-off to HS turn-on & HS turn-on to LS turn-off	V_{CC} = 12 / 24 V	220	270	320	

STATIC ELECTRICAL CHARACTERISTICS

V_{CC} = 12 V and T_A = 25°C unless otherwise specified.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{CC}	Power supply voltage		4.0	---	28	V
V_{CCUV+}	V_{CC} supply undervoltage positive going threshold	V_{CC} = 12 / 24 V	3.5	3.7	3.95	V
V_{CCUV-}	V_{CC} supply undervoltage negative going threshold		3.1	3.3	3.6	
V_{IH}	Logic “1” input voltage		1.8	---	---	
V_{IL}	Logic “0” input voltage		---	---	0.7	
I_{CC0}	Quiescent current (standby mode)	V_{CC} = 12 / 24 V, IN1=IN2=IN3=IN4=”0”	---	---	1	µA
I_{CC1}	Operating current (no load)	V_{CC} = 12 / 24 V, IN1+IN2+IN3+IN4=”1”	---	1.5	2.3	mA
I_{IN}	Input current	V_{CC} = 12 / 24 V, $V_{IN1/IN2/IN3/IN4}$ = 5V	40	56	65	µA
T_{SD}	Thermal shutdown temperature		150	160	170	°C
T_{SD_HYS}	Thermal shutdown hysteresis			25		°C
R_{DSON}	Output ON resistance (high-side and low-side total)	I_{OUT} = 0.8A	550	650	900	mΩ
I_{OLEAK}	Output leakage current	V_O = 30V	---	---	10	µA
V_D	Diode forward voltage	I_D = 0.8A	---	1.0	1.2	V

APPLICATION INFORMATION

DCM Output Control Logic

Input				Output				Remarks	
IN1	IN2	IN3	IN4	OUT1	OUT2	OUT3	OUT4		
L	L	L	L	OFF	OFF	OFF	OFF	Stand-by	
L	L			OFF	OFF			1CH	Stand-by
H	L			H	L			1CH	Forward
L	H			L	H			1CH	Reverse
H	H			L	L			1CH	Brake
		L	L			OFF	OFF	2CH	Stand-by
		H	L			H	L	2CH	Forward
		L	H			L	H	2CH	Reverse
		H	H			L	L	2CH	Brake

Timing

About the switch time from the stand-by state to the state of operation, when IN1, IN2, IN3, IN4 are logic “0”, the LV8548 has completely stopped operating. After the time of reset of about 7μs of and internal setting, it shifts to a prescribed output status corresponding to the state of the input when the signal enters the input terminal.

Reset of about 7μs doesn’t hang even if the motor is driven from the stand-by state when either CH drives and the output becomes an output status corresponding to the state of the input. As for full power TR between the reset time, turning off is maintained.

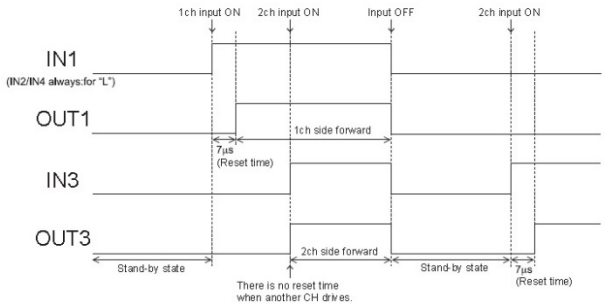


Figure 4 Control Timing

Current Waveforms

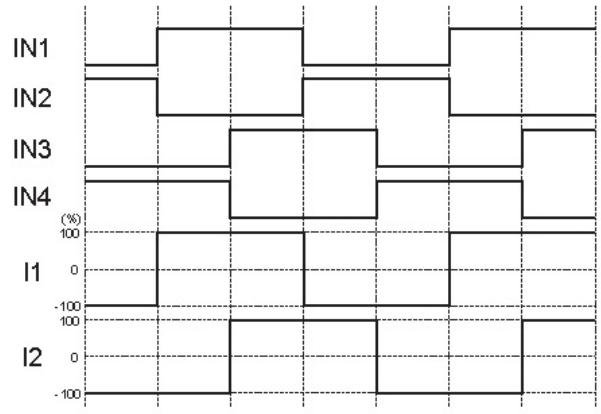


Figure 5 Full-step Mode

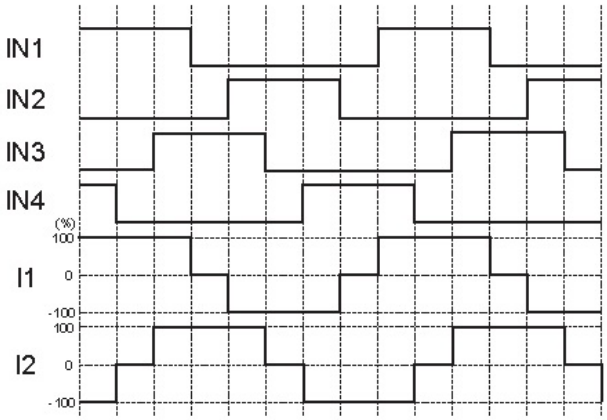


Figure 6 Half-step Mode

Thermal Shutdown

The thermal shutdown circuit is incorporated and the output is turned off when junction temperature exceeds 160°C. As the temperature falls by hysteresis, the output turned on again.

The thermal shutdown circuit doesn’t guarantee the protection of the final product because it operates when the temperature exceed the junction temperature of T_{jmax}=150°C.

T_{SD} = 160°C (TYP)

T_{SD_HYS} = 25°C (TYP)

CLASSIFICATION REFLOW PROFILES

Profile Feature	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	150°C 200°C 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3°C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	217°C 60-150 seconds
Peak package body temperature (Tp)*	Max 260°C
Time (tp)** within 5°C of the specified classification temperature (Tc)	Max 30 seconds
Average ramp-down rate (Tp to Tsmax)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

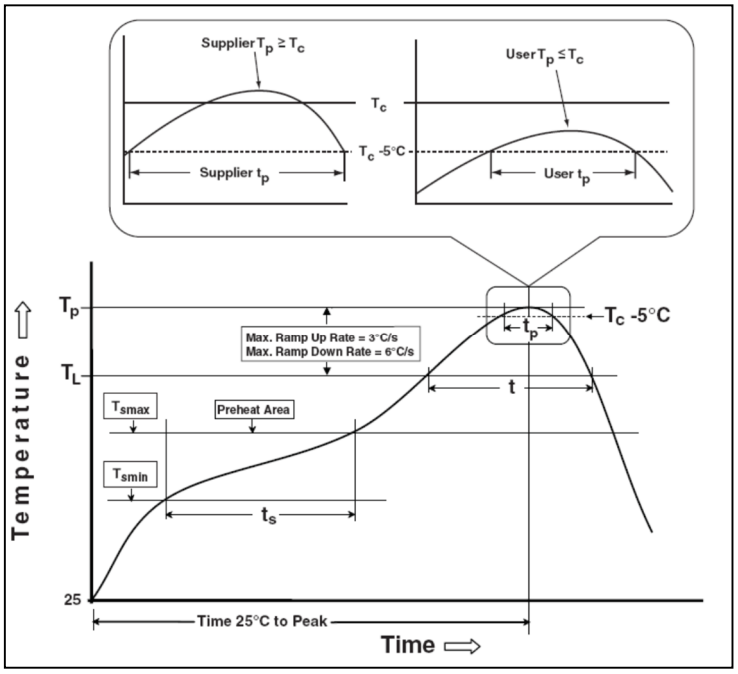
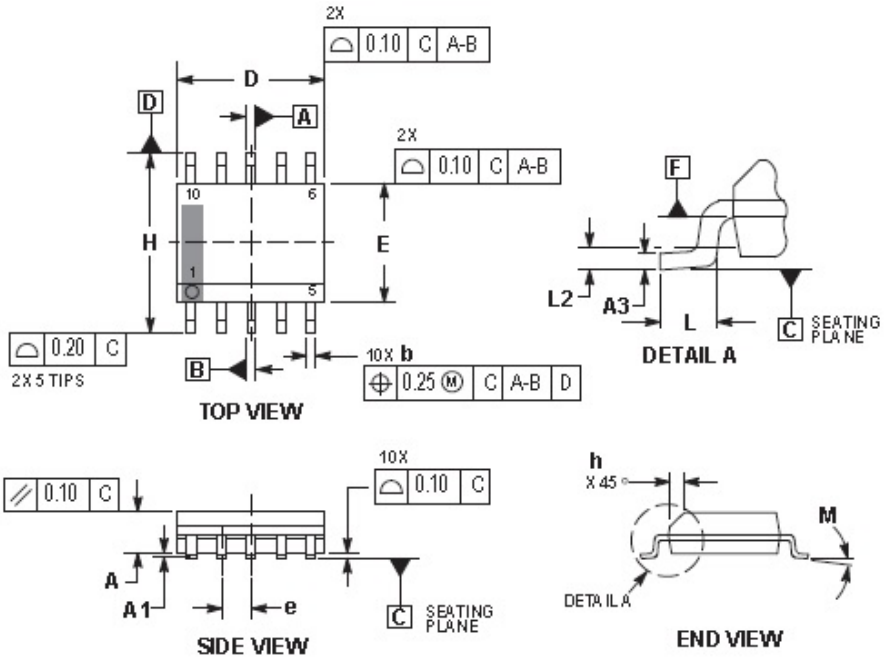


Figure 2 Classification Profile

PACKAGE CASE OUTLINES



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10mm TOTAL IN EXCESS OF 'b' AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.
5. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS MIN	MAX
A	1.25	1.75
A1	0.10	0.25
A3	0.17	0.25
b	0.31	0.51
D	4.80	5.00
E	3.80	4.00
e	1.00 BSC	
H	5.80	6.20
h	0.37 REF	
L	0.40	1.27
L2	0.25 BSC	
M	0°	8°

RECOMMENDED SOLDERING FOOTPRINT