20V Low Saturation Voltage Stepper Motor Driver

FEATURES

- V_{CC} max=24V, I_O max=1A
- 4V to 20V Operating supply voltage range
- The control system power supply is unnecessary.
- DMOS output transistor adoption
- Upper and lower total R_{ON}<1Ω typical
- The compact package (SSOP10) is adopted.
- Pin compatible with LV8549MC
- Current consumption 0 when standby mode

APPLICATIONS

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

GENERAL DESCRIPTION

The TMI8549 is a 2-channel output low saturation voltage motor driver IC. It is optimal for motor drive in 12V system products. it can drive a stepper motor.

TYPICAL APPILCATION

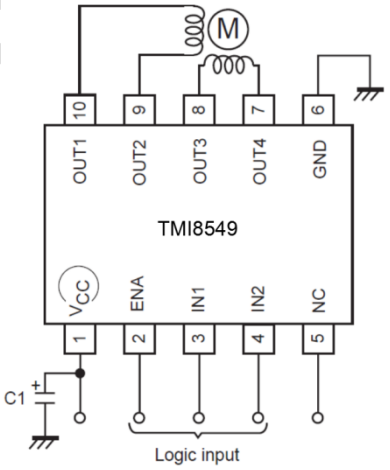

Figure 1. Example of application circuit when one stepper motor driving

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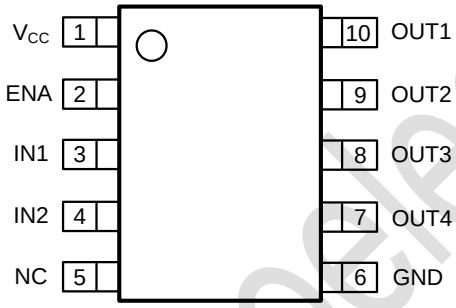
ABSOLUTE MAXIMUM RATINGS (Note1)

Items	Symbol	Value	Unit
Maximum power supply voltage	V_{CC} max	-0.3~24	V
Output impression voltage	V_{OUT1}, V_{OUT2}, V_{OUT3}, V_{OUT4}	-0.3~24	V
Input impression voltage	V_{IN1}, V_{IN2}, V_{ENA}	-0.3~6	V
GND pin outflow current per channel	I_{GND}	1.0	A
Allowable Power dissipation	P_D max	1.0	W
Junction Temperature (Note2)	T_J	-40~150	°C
Storage Temperature	T_{STG}	-40~165	°C

PACKAGE/ORDER INFORMATION



SSOP10

Top Mark: T8549/YYXXX (T8549: Device Code, YYXXX: Inside Code)

Part Number	Package	Top mark	Quantity/ Reel
TMI8549	SSOP10	T8549 YYXXX	2500

TMI8549 devices are Pb-free and RoHS compliant.

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PIN FUNCTIONS

Pin	Name	Function
1	V_{CC}	Power-supply voltage pin. The capacitor is connected for stabilization for GND pin.
2	ENA	Motor drive control input pin. When ENA input is “L” level, the device is in stand-by mode. The circuits current can be adjusted to 0A. When ENA input is pulled “H” level from “L” level, the device shifts from the stand-by state to a prescribed output operation mode. For the digital input, range of the "L" level is 0V to 0.4V, range of the "H" level is from 1.5V to 5.5V. PWM can be input. Pull-down resistance 100kΩ is built into in the pin.
3	IN1	Motor drive control input pin. Driving control input pin of OUT1 (10pin) and OUT2 (9pin). PWM can be input. With built-in pull-down 100kΩ resistance.
4	IN2	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). PWM can be input. With built-in pull-down 100kΩ resistance.
5	NC	No Connection
6	GND	Ground pin.
7	OUT4	OUT4 Driving output pin. The motor coil is connected between this pin and OUT3 (8pin).
8	OUT3	OUT3 Driving output pin. The motor coil is connected between this pin and OUT4 (7pin).
9	OUT2	OUT2 Driving output pin. The motor coil is connected between this pin and OUT1 (10pin).
10	OUT1	OUT1 Driving output pin. The motor coil is connected between this pin and OUT2 (9pin).

ESD RATING

Items	Description	Value	Unit
V_{ESD}	Human Body Model for all pins	±2000	V

JEDEC specification JS-001

RECOMMENDED OPERATING CONDITIONS

Items	Description	Condition	Value	Unit
V_{CC}	Power supply voltage	V_{cc}	4~20	V
V_{INH}	Input “H” level voltage	V_{IN1}, V_{IN2}, V_{ENA}	1.5~5.5	V
V_{INL}	Input “L” level voltage		0~0.4	V

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ELECTRICAL CHARACTERISTICS

(V_{CC}=12V, TA = 25°C, unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Power Supply Voltage	I_{CC0}	Standby mode ENA="LOW"			1	μA
	I_{CC1}	ENA="HIGH"		1.1	1.52	mA
Input current	I_{IN}	V_{IN}=5V	40	50	64	μA
Thermal shutdown operating temperature	T_{tsd}	Design certification		160		°C
Width of temperature hysteria	$\triangle T_{tsd}$	Design certification		40		°C
Low voltage protection function operation voltage	$V_{th}V_{CC}$		3.75	3.79	3.83	V
Release voltage	V_{thret}		3.51	3.54	3.58	V
Output ON resistance (Upper and lower total)	R_{DSON}	I_{OUT}=1.0A	0.7	0.83	0.96	Ω
Output leak current	I_{O_leak}	V_O=20V	0		10	μA
Diode forward voltage	V_D	ID=1.0A			1.1	V
IN1/IN2/IN3/IN4 high level voltage threshold	IN_{xH}		1.5		5.5	V
IN1/IN2/IN3/IN4 low level voltage threshold	IN_{xL}				0.4	V
Thermal Shutdown Threshold (Note 3)				160		°C
Thermal Shutdown Hysteresis (Note 3)				30		°C

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula: $T_J = T_A + P_D \times \theta_{JA}$. The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_{D\,(MAX)} = (T_{J(MAX)}-T_A)/\theta_{JA}$.

Note 3: Thermal shutdown threshold and hysteresis are guaranteed by design.

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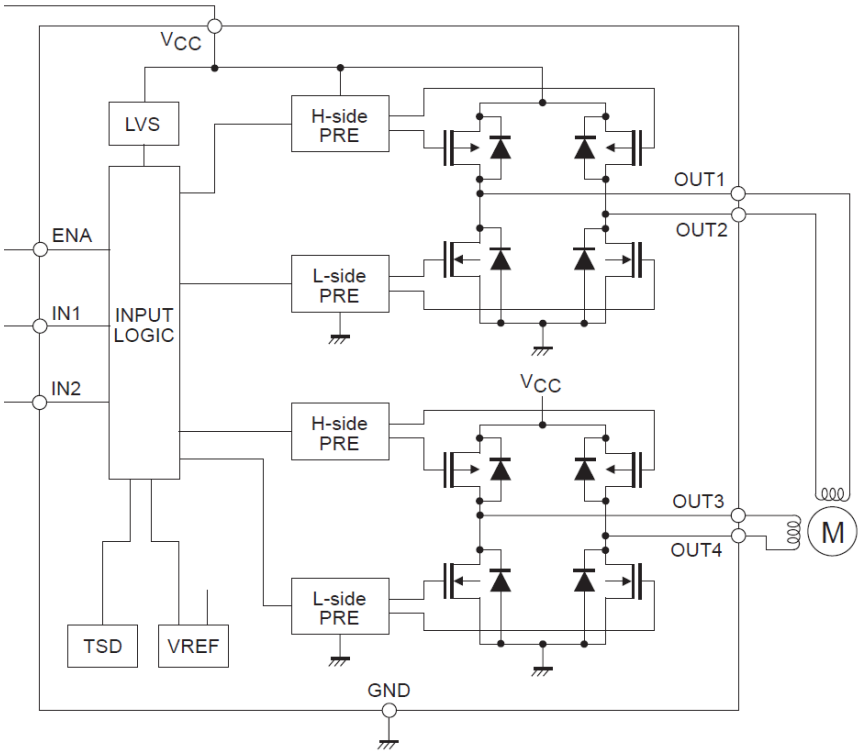
BLOCK DIAGRAM



FUNCTION DESCRIPTION

1. DCM output control logic

Input			Output				State
ENA	IN2	IN3	OUT1	OUT2	OUT3	OUT4	
L	-	-	OFF	OFF	OFF	OFF	Stand-by
H	L	L	H	L	H	L	Step 1
	H	L	L	H	H	L	Step 2
	H	H	L	H	L	H	Step 3
	L	H	H	L	L	H	Step 4

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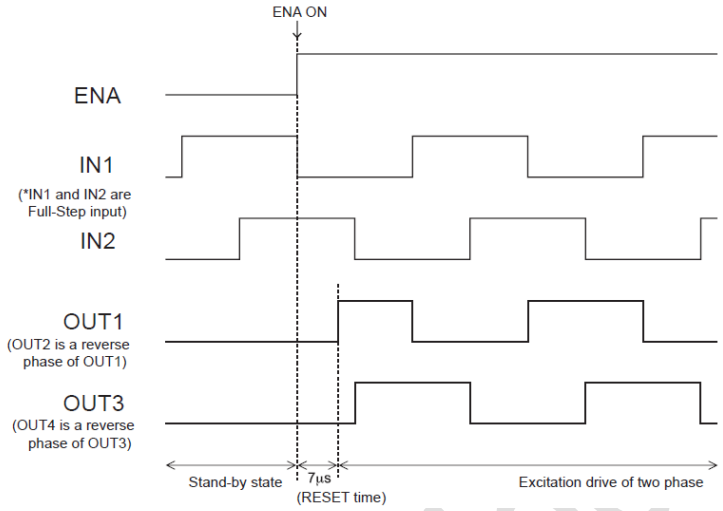
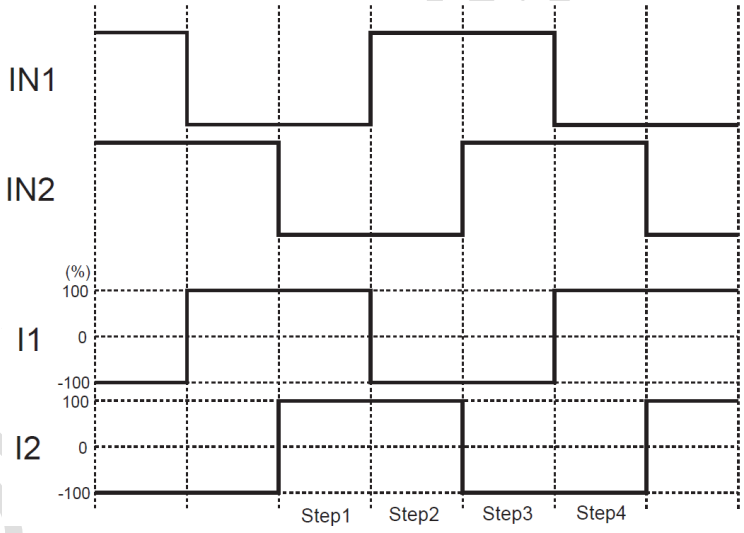
2. The switch time from the stand-by state to the state of operation

When ENA pin is "L", this IC has completely stopped operating. After the time of reset of about 7μs of an internal setting, it shifts to a prescribed output status corresponding to the state of the input when the signal enters the ENA pin.



3. Example of current waveform at full-step mode.



4. Thermal shutdown function

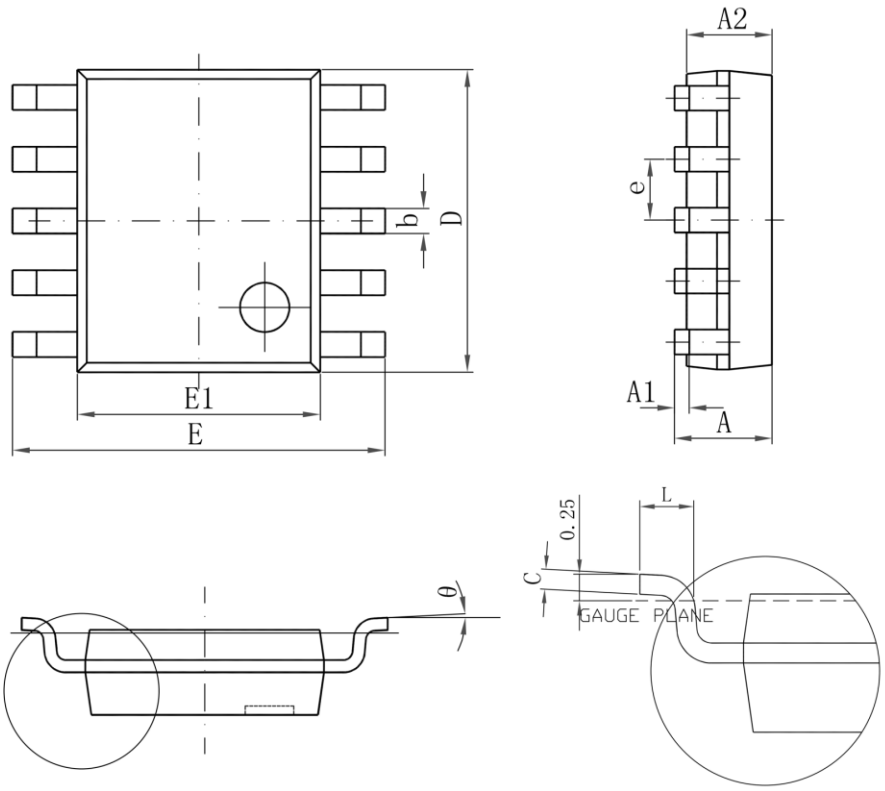
The thermal shutdown circuit is incorporated and the output of the device is turned off when junction temperature T_j exceeds 160°C. As the temperature falls by hysteresis, the output of the device is turned on again (automatic restoration). The thermal shutdown circuit does not guarantee the protection of the final product because it operates when the temperature exceeds the junction temperature of T_{j_max}=150°C.

T_{SD} = 160°C (typ)

$\triangle T_{SD}$ = 30°C (typ)

PACKAGE INFORMATION

SSOP10



Unit: mm

Symbol	Dimensions In Millimeters			Symbol	Dimensions In Millimeters		
	Min	Nom	Max		Min	Nom	Max
A	-	-	1.75	E	5.80	6.00	6.20
A1	0.10	-	0.225	E1	3.80	3.90	4.00
A2	1.30	1.40	1.50	e	1.00 BSC		
A3	0.60	0.65	0.70	h	0.25	-	0.50
b	0.39	-	0.47	L	0.50	-	0.80
c	0.20	-	0.24	L1	1.05 REF		
D	4.80	4.90	5.00	θ	0°	-	8°

Note:

1) All dimensions are in millimeters.

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