

12V Low Saturation Voltage Stepper Motor Driver

FEATURES

- V_{CC} max=20V, I_o max=1A
- 4V to 16V Operating Supply Voltage Range
- DMOS Output Transistor Adoption (Upper and lower total $R_{ON}<1\Omega$ typ.)
- 0 Current Consumption @ Standby Mode
- Built-in Over-current Protection
- Built-in Over-temperature Protection
- Built-in Under Voltage Lockout
- Small Package is Adopted: SSOP10

GENERAL DESCRIPTION

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

With the internal inverters, TMI8549 can drive a step motor with only two square waves. Moreover, the integrated over current protection and over temperature protection help the system work safely.

The package form of TMI8549 is SSOP10.

APPLICATIONS

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

TYPICAL APPLICATION

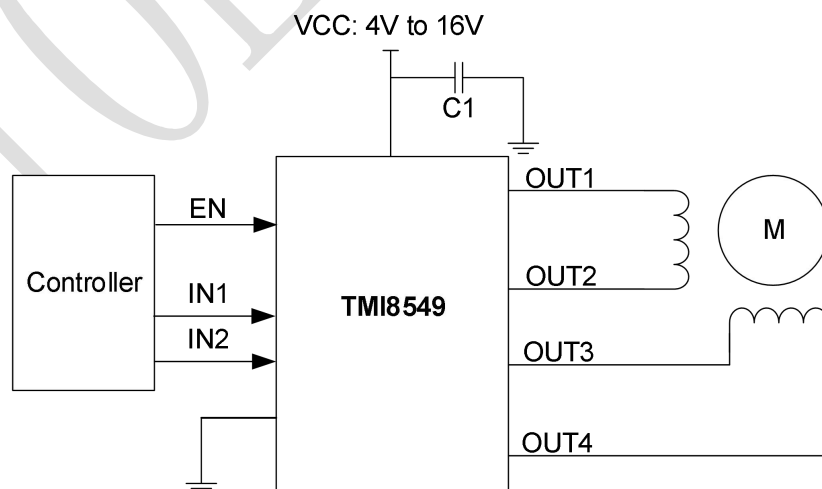
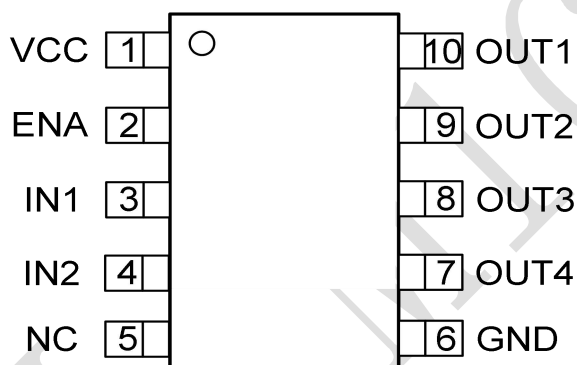


Figure 1. Example of application circuit when one stepper motor driving

ABSOLUTE MAXIMUM RATINGS

Items	Symbol	Value	Unit
Maximum power supply voltage	V_{CC} max	-0.3~20	V
Output impression voltage	V_{OUT1} , V_{OUT2} , V_{OUT3} , V_{OUT4}	-0.3~20	V
Control input impression voltage	V_{IN1} , V_{IN2} , V_{ENA}	-0.3~6	V
GND pin outflow current per channel	IGND	1.0	A
Allowable Power dissipation	P_D max	1.0	W
Operating temperature	Topr	-40~85	°C
Storage temperature	Tstg	-40~165	°C

PACKAGE/ORDER INFORMATION



SSOP10 (TMI8549)

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

Part Number	Package	Top mark	Quantity/ Reel
TMI8549	SSOP10	T8549 XXXXX	4000

TMI8549 device is Pb-free and RoHS compliant.

PINFUNCTION

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 and OUT2. PWM can be input. With built-in pull-down 100kΩ resistance.
4	IN2	Motor drive control input pin. Driving control input pin of OUT3 and OUT4. PWM can be input. With built-in pull-down 100kΩ resistance.
5	NC	Not connected.
6	GND	Ground pin.
7	OUT4	OUT4 Driving output pin. The motor coil is connected between this pin and OUT3.
8	OUT3	OUT3 Driving output pin. The motor coil is connected between this pin and OUT4.
9	OUT2	OUT2 Driving output pin. The motor coil is connected between this pin and OUT1.
10	OUT1	OUT1 Driving output pin. The motor coil is connected between this pin and OUT2.

ESD RATING

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

JEDEC specification JS-001

RECOMMENDED OPERATING CONDITIONS

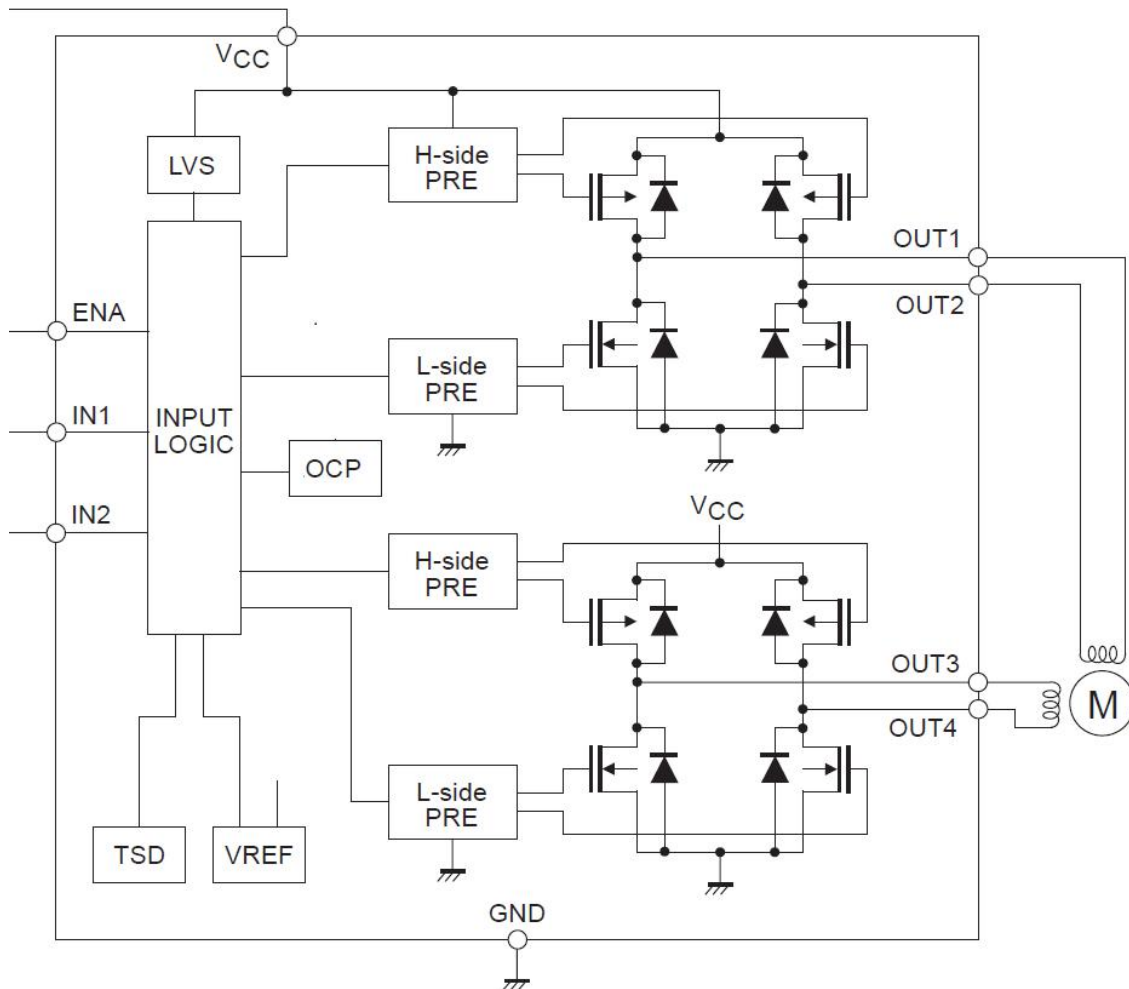
Items	Description	Condition	Value	Unit
V _{CC}	Power supply voltage	V _{CC}	4~16	V
V _{INH}	Input "H" level voltage	V _{ENA} , V _{IN1} , V _{IN2}	1.5~5.5	V
V _{INL}	Input "L" level voltage		0~0.4	V

ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Power Supply Voltage	I _{CC0}	Standby mode ENA=L			1	μA
	I _{CC1}	ENA=H		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	ΔT _{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 _{DS(ON)}	I _{OUT} =1.0A	0.7	0.83	0.96	Ω
Output Leak Current	I _{oleak}	V _O =16V	0		10	μA
Over-current Protection	I _{OCp}			1.6		A
Diode Forward Voltage	V _D	I _D =1.0A			1.1	V
IN1/IN2 and ENA High Level Voltage Threshold	IN _{xH} ENA _H		1.5		5.5	V
IN1/IN2 and ENA Low Level Voltage Threshold	IN _{xL} ENA _L				0.4	V

BLOCK DIAGRAM



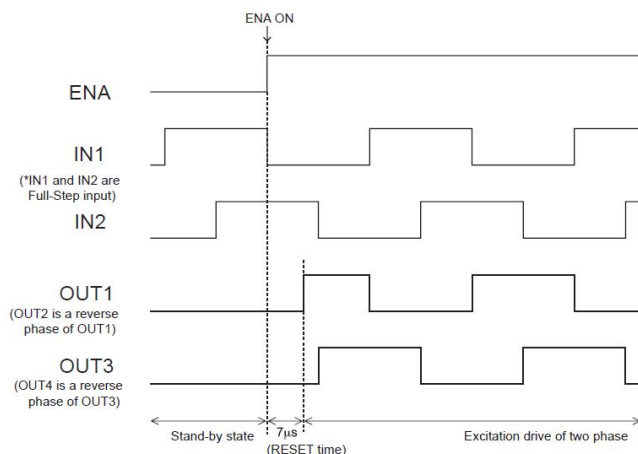
FUNCTION DESCRIPTION

1. DCM output control logic

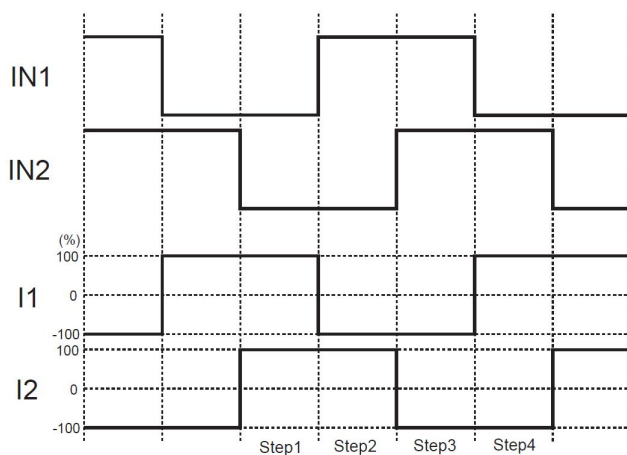
Input			Output				State
ENA	IN1	IN2	OUT1	OUT2	OUT3	OUT4	
L	-	-	OFF	OFF	OFF	OFF	Stand-by
H	L	L	H	L	H	L	Step 1
	H	L	L	H	H	L	Step 2
	H	H	L	H	L	H	Step 3
	L	H	H	L	L	H	Step 4

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

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

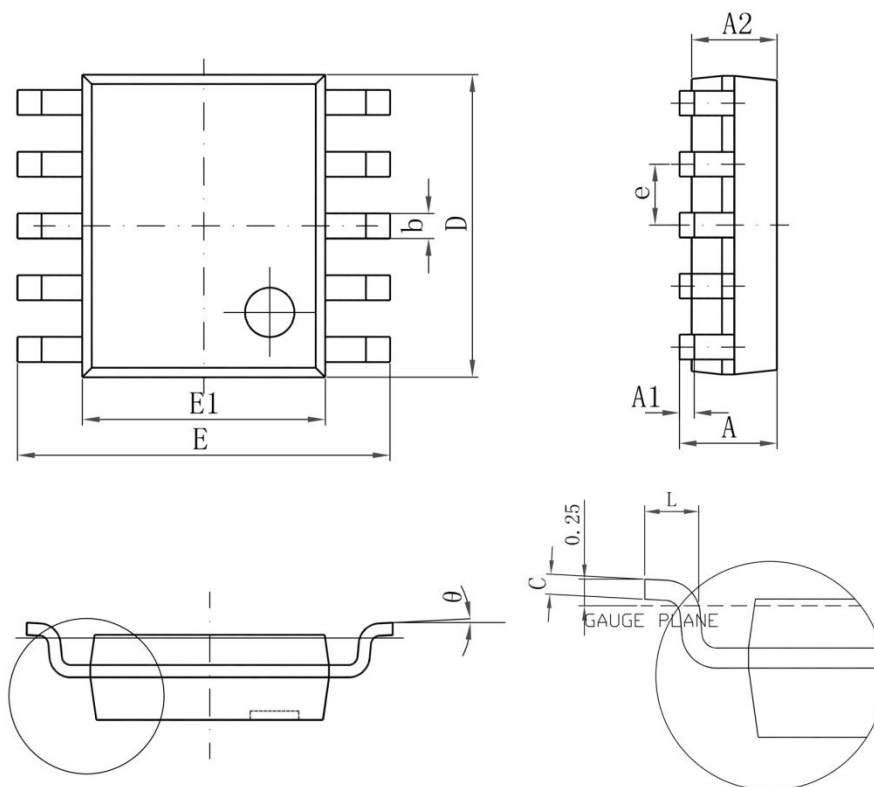
The thermal shutdown circuit is incorporated and the output of the device is turned off when junction temperature T_j exceeds 160°C . As the temperature falls by hysteresis, the output of the device is turned on again (automatic restoration). The thermal shutdown circuit does not guarantee the protection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

TSD = 160°C (typ)

$\Delta\text{TSD} = 40^{\circ}\text{C}$ (typ)

PACKAGE INFORMATION

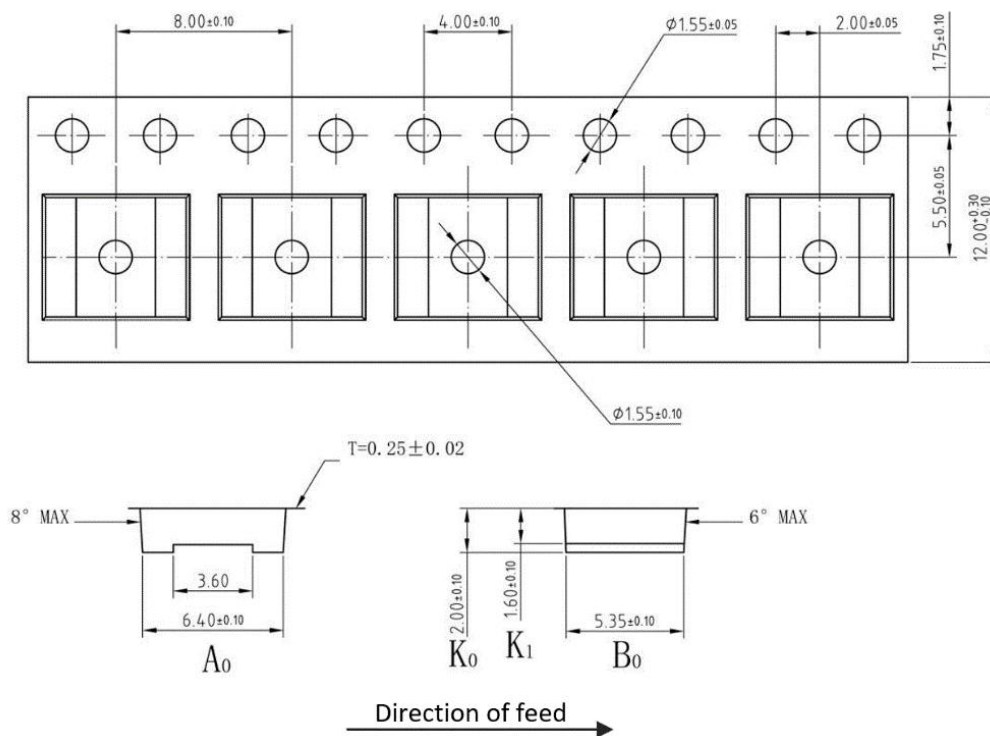
SSOP10



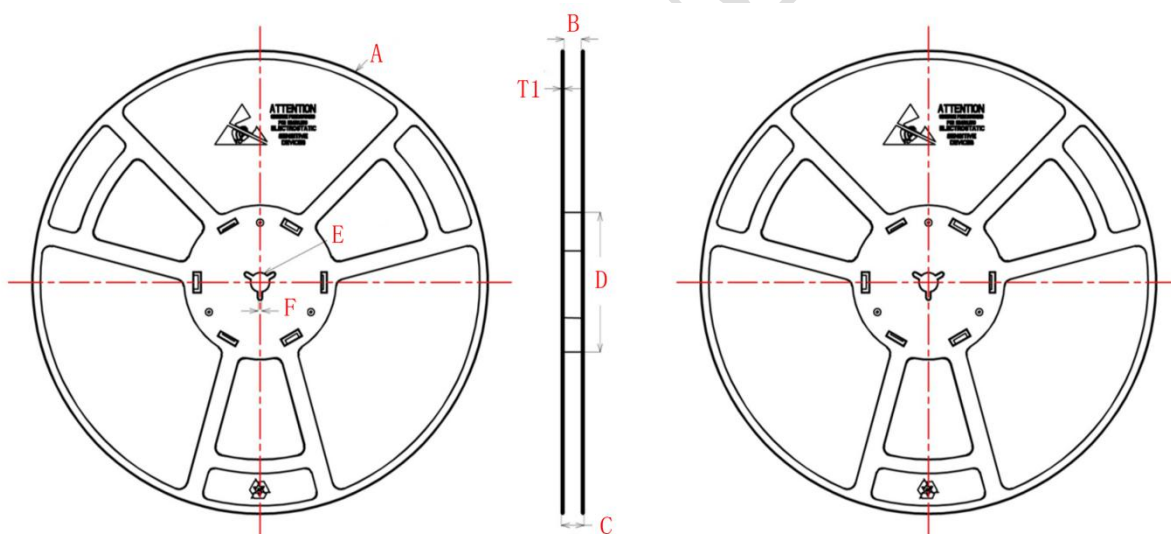
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.300	0.450	0.012	0.018
C	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.000 (TYP)		0.039 (TYP)	
L	0.400	1.270	0.016	0.005
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

TAPE DIMENSIONS: SSOP10



REEL DIMENSIONS: SSOP10



Unit: mm

A	B	C	D	E	F	T1
Ø 330±1.0	12.4 ^{+1.0} / _{-0.0}	17.6 ^{+1.0} / _{-0.0}	Ø 100.0±0.5	Ø 13.0±0.2	1.9±0.4	1.9±0.2

Note:

- 1) All Dimensions are in Millimeter
- 2) Quantity of Units per Reel is 4000
- 3) MSL level is level 3.