12V 2-Channel Low Saturation Voltage Motor Driver with Forward/Reverse and Brake function

FEATURES

- VCC max=20V, IO max=1A
- 4-16V Operating Supply Voltage Range
- The Control System Power Supply is Unnecessary.
- DMOS Output Transistor Adoption
- Upper and Lower Total RON<1Ω Typical
- 0 Current Consumption @ Standby Mode
- It is Possible to Connect in Parallel
- Parallel Connection of Drive Channel
- Built-in Over-current Protection
- Built-in Over-temperature Protection
- Built-in Under Voltage Lockout
- Small Package is Adopted：SSOP10

APPLICATIONS

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

GENERAL DESCRIPTION

The TMI8548 is a 2-channel output low saturation voltage forward/reverse motor driver IC. It is optimal for motor drive in 12V 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.

APPILCATION

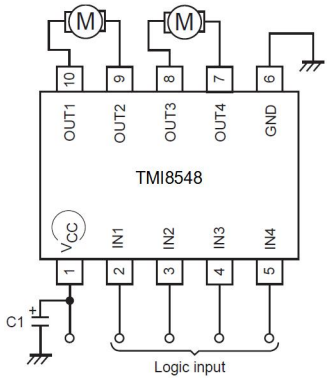


Figure 1. Example of application circuit when two DC motor driving

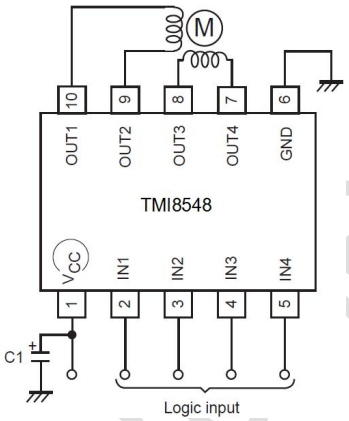


Figure 2. Example of application circuit when one stepper motor driving

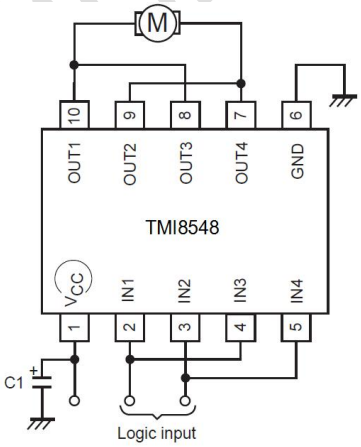
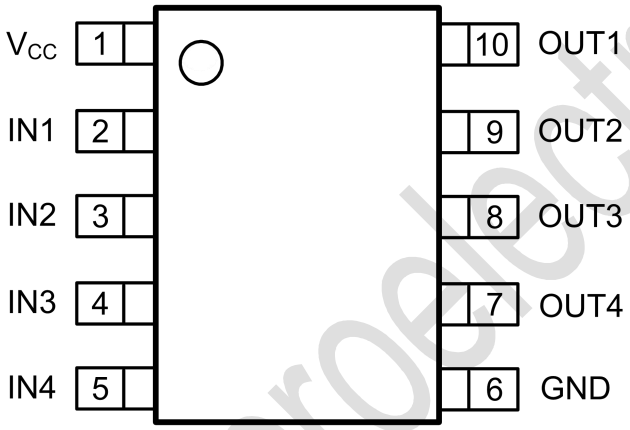


Figure 3. Example of application circuit when connecting it in parallel

ABSOLUTE MAXIMUM RATINGS (Note1)

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
Input impression voltage	V_{IN1}, V_{IN2}, V_{IN3}, V_{IN4}	-0.3~6	V
GND pin outflow current per channel	I_{GND}	1.0	A
Allowable Power dissipation	P_D max	1.0	W
Operating temperature	Topr	-40~85	°C
Storage Temperature	T_{STG}	-40~165	°C

PACKAGE/ORDER INFORMATION



SSOP10

Top Mark: T8548/YYXXX (T8548: Device Code, YYXXX: Inside Code)

Part Number	Package	Top mark	Quantity/ Reel
TMI8548	SSOP10	T8548 YYXXX	4000

TMI8548 devices are Pb-free and RoHS compliant.

PIN FUNCTIONS

Pin	Name	Function
1	V_{CC}	Power-supply voltage pin. The capacitor is connected for stabilization for GND pin.
2	IN1	Motor drive control input pin. Driving control input pin of OUT1 (10pin) and OUT2 (9pin). It is used in combination with IN2 pin (3pin). For the digital input, range of the "L" level is 0 to 0.4(V), range of the "H" level is 1.5 to 5.5(V). PWM can be input. Pull-down resistance 100kΩ is built into the pin. It becomes a standby mode when all IN1, IN2, IN3, and IN4 pins are made "L", and the circuit current can be adjusted to 0.
3	IN2	Motor drive control input pin. Driving control input pin of OUT1 (10pin) and OUT2 (9pin). It is used in combination with IN1 pin (2pin). PWM can be input. With built-in pull-down 100kΩ resistance.
4	IN3	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It is used in combination with IN4 pin (5pin). PWM can be input. With built-in pull-down 100kΩ resistance.
5	IN4	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It is used in combination with IN3 pin (4pin). PWM can be input. With built-in pull-down 100kΩ resistance.
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}	4~16	V
V_{INH}	Input “H” level voltage	V_{IN1}, V_{IN2}, V_{IN3}, V_{IN4}	1.5~5.5	V
V_{INL}	Input “L” level voltage		0~0.4	V

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 IN1=IN2=IN3=IN4=Low		0.1	1	μA
	I_{CC1}	It is High from IN1 as for either of IN4. Load opening		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
Over-current Protection	I_{OCP}			1.6		A
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.

APPLICATION INFORMATION

Application information

The TMI8548 device is typically used to drive one step motor as below:

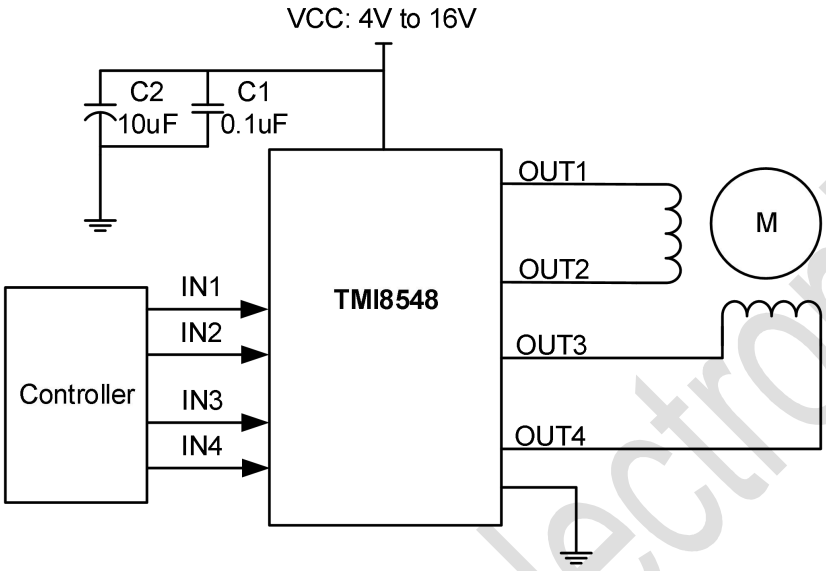


Figure 4. TMI8548 Typical Application

BLOCK DIAGRAM

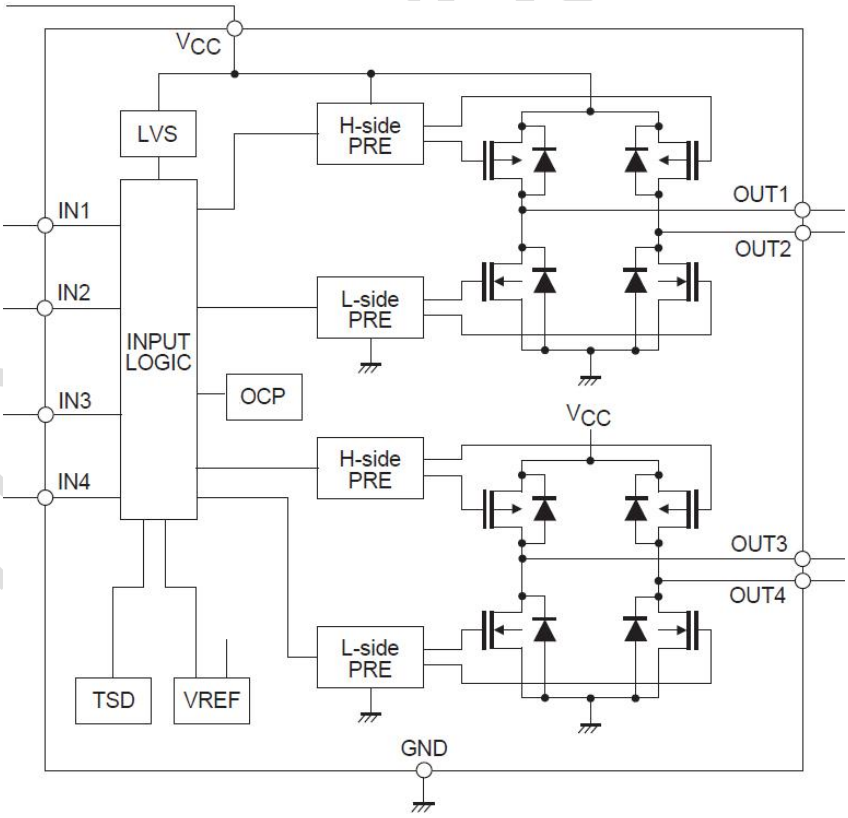


Figure 5. TMI8548 Block Diagram

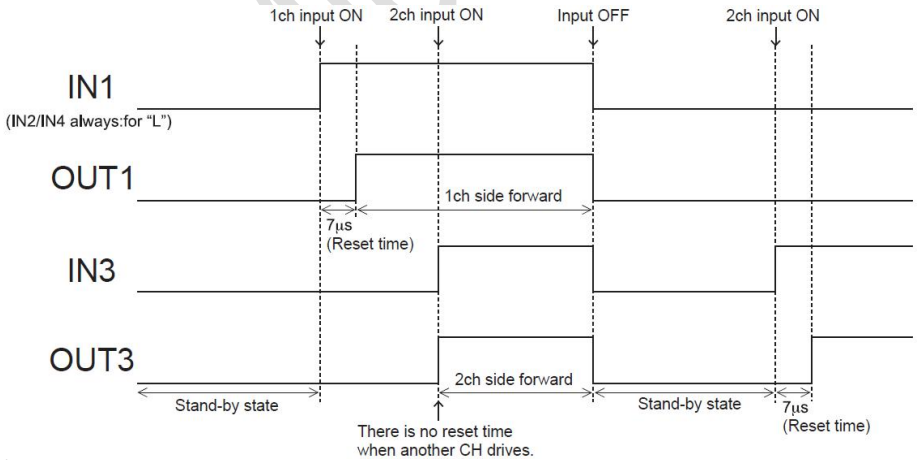
FUNCTION DESCRIPTION

1. 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				Forward
L	H			L	H				Reverse
H	H			L	L				Brake
		L	L			OFF	OFF	2CH	Stand-by
		H	L			H	L		Forward
		L	H			L	H		Reverse
		H	H			L	L		Brake

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

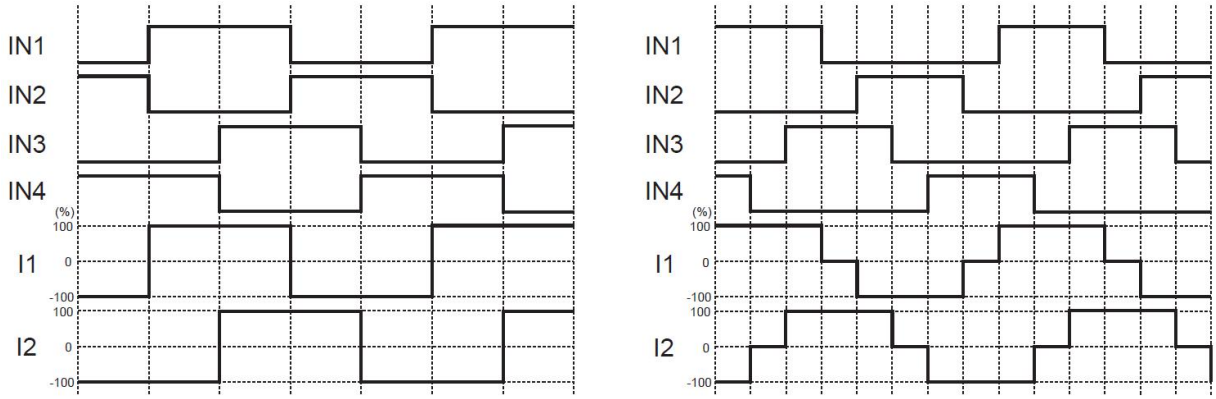
When IN1, IN2, IN3, IN4 are all "L", this IC has completely stopped operating. After the time of reset of about 7μs of an internal setting, it shifts to a prescribed output status corresponding to the state of the input when the signal enters the input terminal. Reset of about 7μs doesn't hang even if the motor is driven from the stand-by state when either CH drives or the output becomes an output status corresponding to the state of the input. As for full power TR between the reset times, turning off is maintained.



3. Example of current waveform type in each excitation mode when stepper motor parallel input is controlled.

Full-step mode

Half-step mode



4. Thermal shutdown function

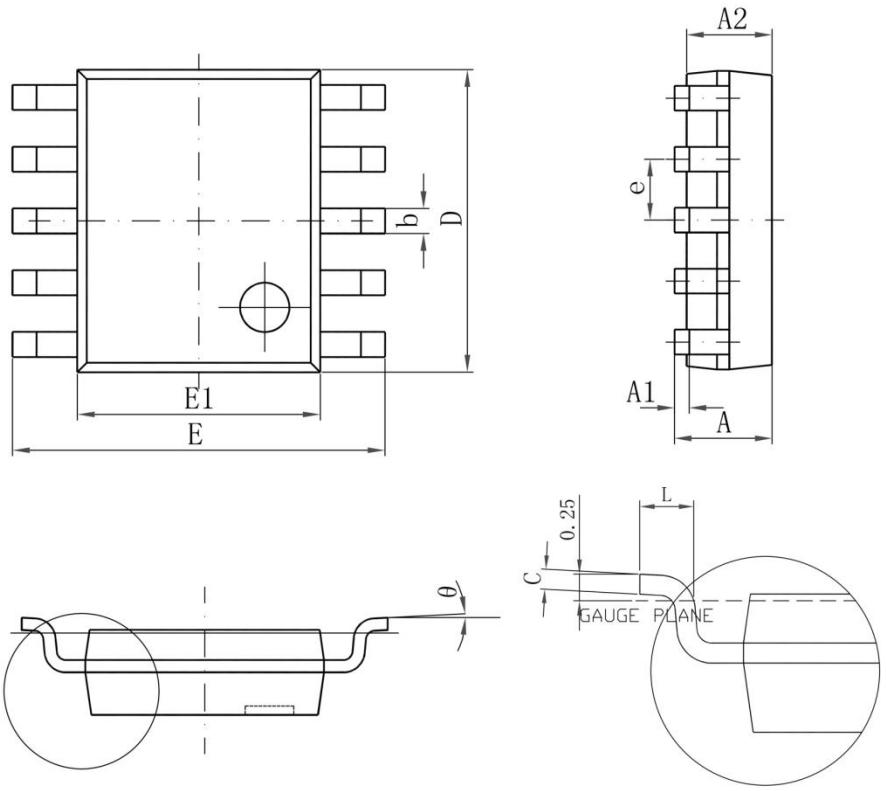
The thermal shutdown circuit is incorporated and the output of the device is turned off when junction temperature T_j exceeds 160°C. As the temperature falls by hysteresis, the output of the device is turned on again (automatic restoration). The thermal shutdown circuit does not guarantee the protection 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

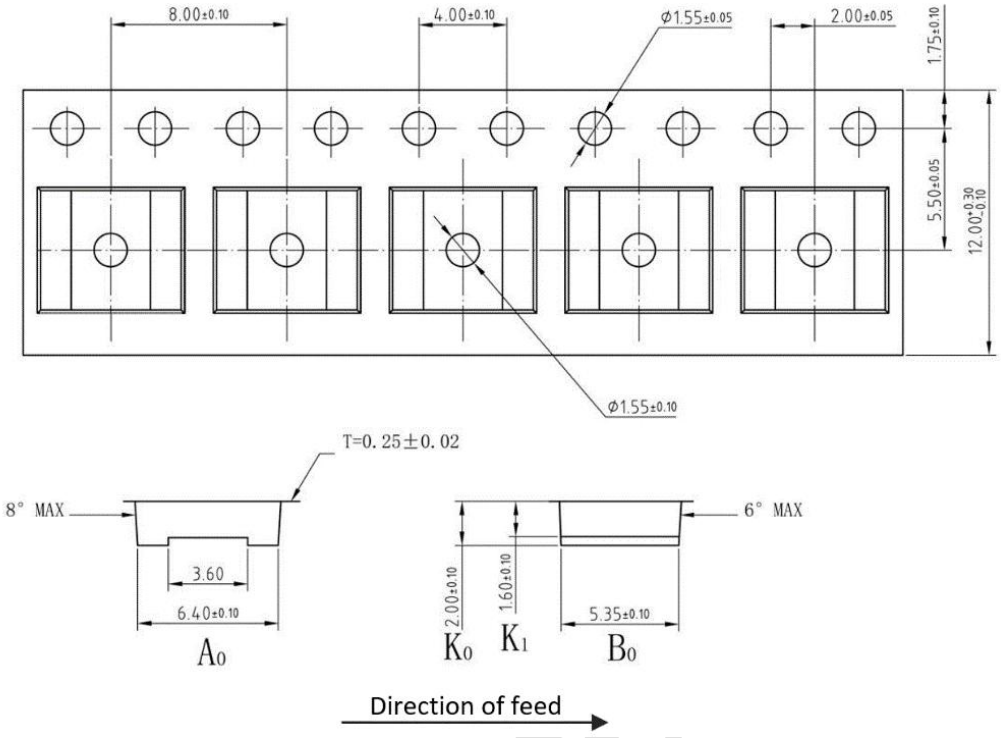
SSOP10



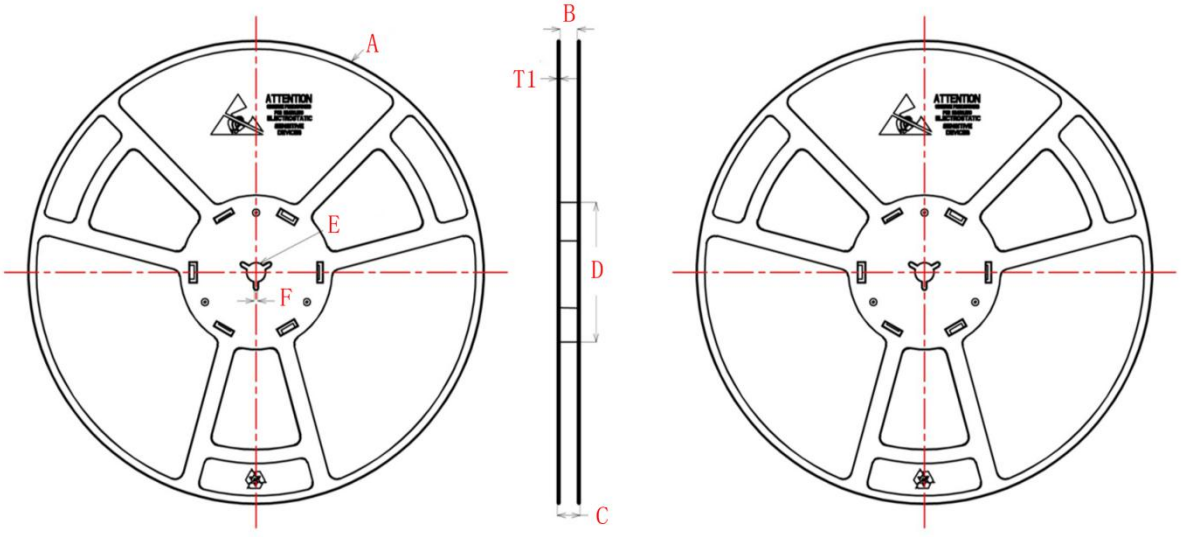
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.300	0.450	0.012	0.018
C	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.000（TYP）		0.039（TYP）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