

# 1-Channel 2.8A Mid-voltage H-Bridge DC Motor Driver

## FEATURES

- Support the input voltage range:
- Motor power: 1.8V~11V
- Control power supply: 1.8V~7V
- LDMOS RDS(ON) (HS+LS): 285mΩ (typical)
- Ultra-low power sleep mode:
- 5nA (typical) VCC sleep mode current
- Maximum 2.8A current output capacity
- Built-in UVLO Protection
- Built-in Over Temperature Protection
- Built-in Short Circuit Protection
- Built-in Over Current Protection
- Built-in Charge Pump
- Package and Footprint
- TMI8230: DFN2x2-8 package
- TMI8230S: SOP8 package

## GENERAL DESCRIPTION

TMI8230 and TMI8230S are low voltage DC motor driver IC. Internal integration 285mΩ (HS+LS typical) H-bridge NMOS switch, which can support the 1.8V~11V input voltage range. The maximum current capacity is up to 2.8A. The devices support for ultra-low power sleep mode; built-in UVLO, Thermal Shutdown, OCP protection circuit. TMI8230 and TMI8230S can be used in camera, smart lock and consumer products.

The package of TMI8230 is DFN2x2-8, and TMI8230S adopts SOP8 package.

## APPLICATIONS

- Cameras
- Smart Lock
- Consumer Products
- Robotics
- DC Motor Driver

## TYPICAL APPLICATION

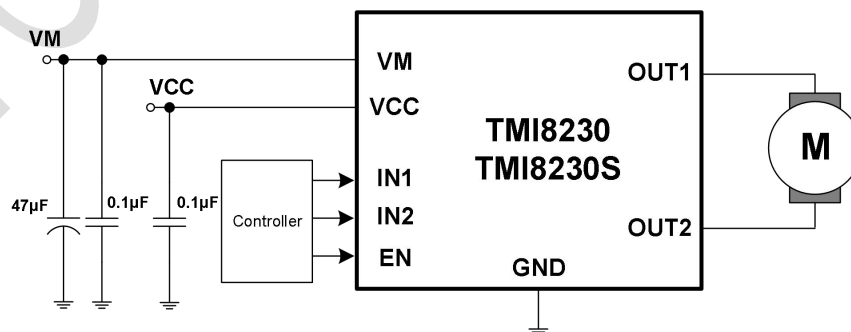
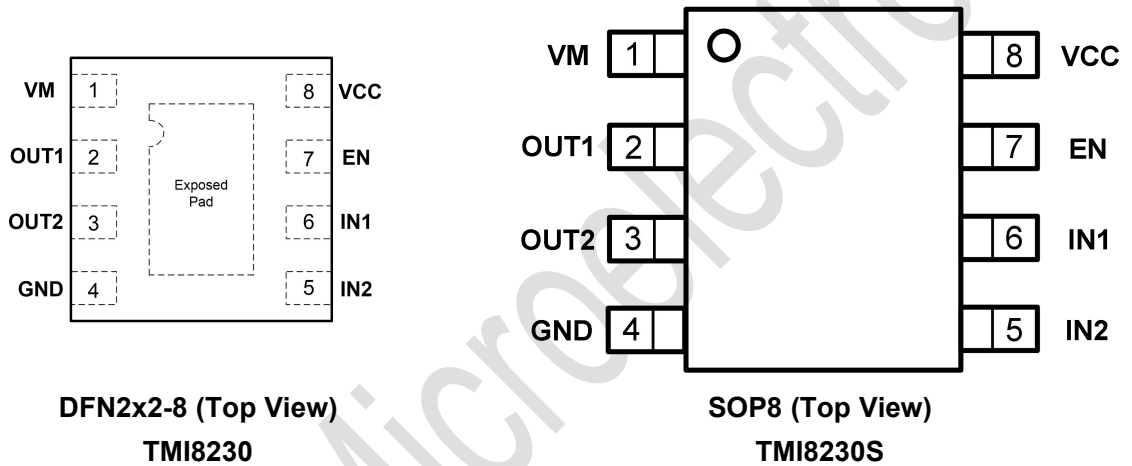


Figure 1. Basic Application Circuit

## ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Unit
VM Voltage Range	-0.3	12	V
VCC, IN1, IN2, EN Voltages Range	-0.3	7	V
OUT1, OUT2 Voltage Range	-0.3	V <sub>M</sub> +0.3	V
Storage Temperature Range	-50	150	°C
Junction Temperature	-40	150	°C
Allowable Power Dissipation (DFN2x2-8)	-	1.5	W
Allowable Power Dissipation (SOP8)	-	1.5	W
Lead Temperature (Soldering, 10s)	-	260	°C

## PACKAGE/ORDER INFORMATION



**Top Mark: TMI8/XXX (TMI8: Device Code, XXX: Inside Code) for TMI8230**

**Top Mark: TMI8230S/XXXXX (TMI8230S: Device Code, XXXXX: Inside Code) for TMI8230S**

Part Number	Package	Top Mark	Quantity/ Reel
TMI8230	DFN2x2-8	TMI8 XXX	3000
TMI8230S	SOP8	TMI8230S XXXXX	3000

TMI8230 and TMI8230S devices are Pb-free and RoHS compliant.

## PIN FUNCTIONS

Pin	Name	Function
1	VM	Power Supply for Driver. Connect a 0.1 $\mu$ F bypass ceramic capacitor and a 47 $\mu$ F bulk capacitor to GND.
2	OUT1	Motor Driver output 1
3	OUT2	Motor Driver output 2
4	GND	Ground pin
5	IN2	Control Logic input2. Internal pulldown.
6	IN1	Control Logic input1. Internal pulldown.
7	EN	Chip Enable Input Pin. When this pin is in logic low, the device enters low-power sleep mode. The device operates normally when this pin is logic high. The pin has an internal pull-down resistor to GND.
8	VCC	Power Supply for Logic Input. Connect a 0.1 $\mu$ F bypass ceramic capacitor to GND

## ESD RATING

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

JEDEC specification JS-001

## RECOMMENDED OPERATING CONDITIONS

Items	Description	Min	Max	Unit
VM Voltage Range	$V_M$	1.8	11	V
VCC Voltage Range	$V_{CC}$	1.8	7	V
$T_J$	Operating Junction Temperature Range	-40	125	$^{\circ}$ C

## THERMAL RESISTANCE (Note 3)

Items	Description	Value	Unit
$\theta_{JA}$	Junction-to-ambient thermal resistance of DFN2x2-8	70	$^{\circ}$ C/W
	Junction-to-ambient thermal resistance of SOP8	90	$^{\circ}$ C/W

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C, unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Power Suppliers (VM and VCC)</b>						
VM Voltage Range	V <sub>M</sub>		1.8		11	V
VM Supply Current	I <sub>VM</sub>	V <sub>M</sub> =5V, V <sub>CC</sub> =3V No PWM		67		μA
		V <sub>M</sub> =5V, V <sub>CC</sub> =3V 50kHz PWM		0.43		mA
VM Sleep Current	I <sub>VMQ</sub>	V <sub>M</sub> =5V, V <sub>CC</sub> =3V EN=0V		30	85	nA
VCC Voltage Range	V <sub>CC</sub>		1.8		7	V
VCC Supply Current	I <sub>VCC</sub>	V <sub>M</sub> =5V, V <sub>CC</sub> =3V No PWM		105		μA
		V <sub>M</sub> =5V, V <sub>CC</sub> =3V 50kHz PWM		0.28		mA
VCC sleep mode supply current	I <sub>VCCQ</sub>	V <sub>M</sub> =5V, V <sub>CC</sub> =3V Sleep Mode (EN=0)		5		nA
<b>Control Logic Input (IN1, IN2 and EN)</b>						
Input Logic Low Voltage	V <sub>IL</sub>		0.25x V <sub>CC</sub>	0.4x V <sub>CC</sub>		V
Input Logic High Voltage	V <sub>IH</sub>			0.5x V <sub>CC</sub>	0.6x V <sub>CC</sub>	V
Input logic Hysteresis	V <sub>HYS</sub>			0.1x V <sub>CC</sub>		V
Input Logic Low Current	I <sub>IL</sub>		-5		5	μA
Input Logic High Current	I <sub>IH</sub>				50	μA
Input Pull Down Resistor	R <sub>IN</sub>			100		kΩ
<b>Motor Driver Outputs (OUT1 and OUT2)</b>						
Output Switch On-Resistance (HS+LS)	R <sub>ON</sub>	V <sub>M</sub> =5V, V <sub>CC</sub> =3V I <sub>load</sub> =800mA		0.285		Ω
Output Switch Leakage Current	I <sub>LEAK</sub>		-200		200	nA
<b>Protection Functions</b>						
VCC UVLO Voltage	V <sub>UVLO</sub>		1.75			V
UVLO Hysteresis	V <sub>UVLO_HY</sub>			100		mV
Over Current Protection	I <sub>OCP</sub>			4.5		A
Over Current Retry Time	T <sub>OCP_RT</sub>			1.5		ms
Thermal Shutdown Threshold (Note 4)	T <sub>SDN</sub>			180		°C

Thermal Shutdown Hysteresis (Note 4)	$T_{SDN\_HY}$			30		°C
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## ELECTRICAL CHARACTERISTICS (continued)

( $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Timing Requirements</b>						
Output Enable time	$T_1$			180		ns
Output Disable time	$T_2$			70		ns
Delay Time IN1 low to OUT2 high IN2 low to OUT1 high	$T_3$			140		ns
Delay Time IN2 high to OUT1 low IN1 high to OUT2 low	$T_4$			160		ns
Output rise time	$T_5$			60		ns
Output fall time	$T_6$			40		ns

**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 PD according to the following formula:  $T_J = T_A + (PD) \times \theta_{JA}$ .

**Note 3:** Measured on JESD51-7, 4-layer PCB.

**Note 4:** Guaranteed by design.

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**FUNCTIONAL BLOCK DIAGRAM**

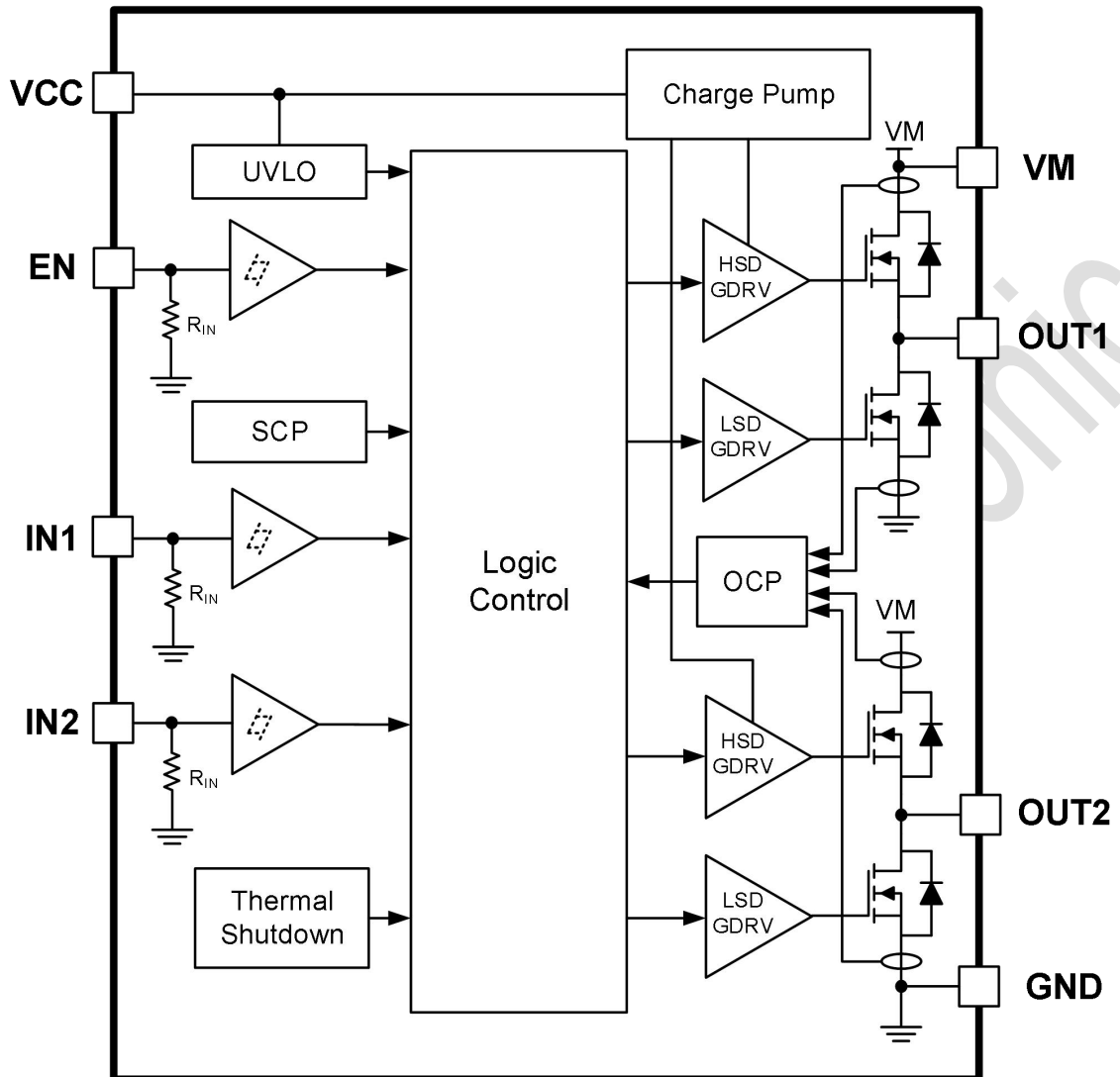
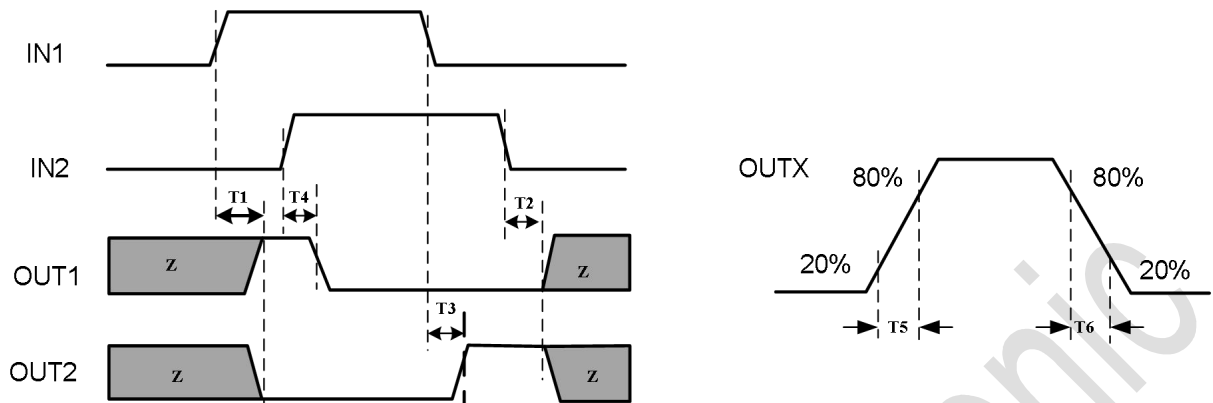


Figure 2. TMI8230/S Block Diagram

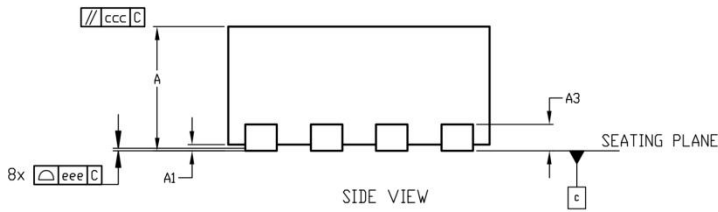
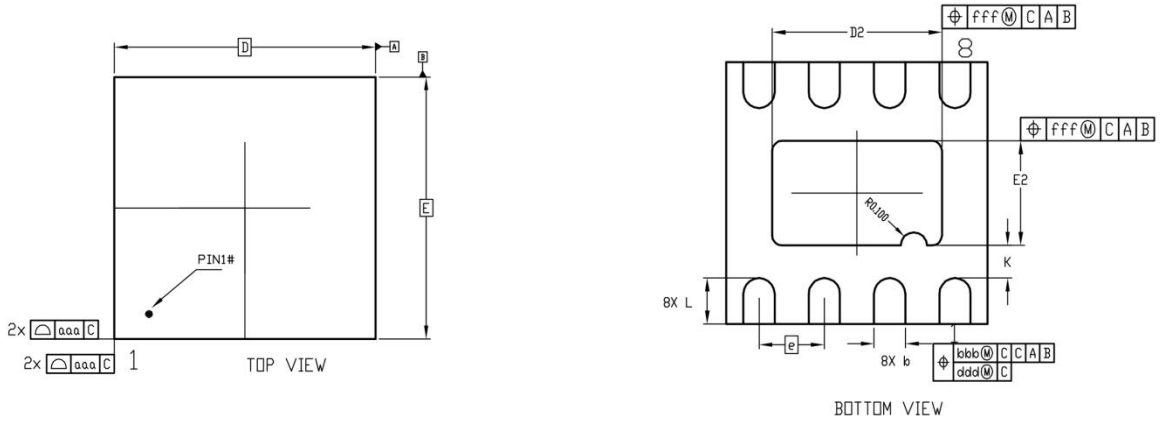
## INPUT OUTPUT LOGIC



EN	IN1	IN2	OUT1	OUT2	Function
0	X	X	Z	Z	Coast
1	0	0	Z	Z	Coast
1	1	0	H	L	Forward
1	0	1	L	H	Reverse
1	1	1	L	L	Brake

**PACKAGE INFORMATION**

**DFN2x2-8**



Unit: mm

Symbol	Dimensions In Millimeters			Symbol	Dimensions In Millimeters		
	Min	Typ	Max		Min	Typ	Max
A	0.70	0.75	0.80	L	0.30	0.35	0.40
A1	0	0.02	0.05	K	0.20	-	-
A3	-	0.20 REF	-	aaa	-	0.15	-
b	0.19	0.24	0.29	bbb	-	0.10	-
D	2.00 BSC			ccc	-	0.10	-
E	2.00 BSC			ddd	-	0.05	-
D2	1.25	1.30	1.35	eee	-	0.08	-
E2	0.75	0.80	0.85	fff	-	0.10	-
e	0.50 BSC						

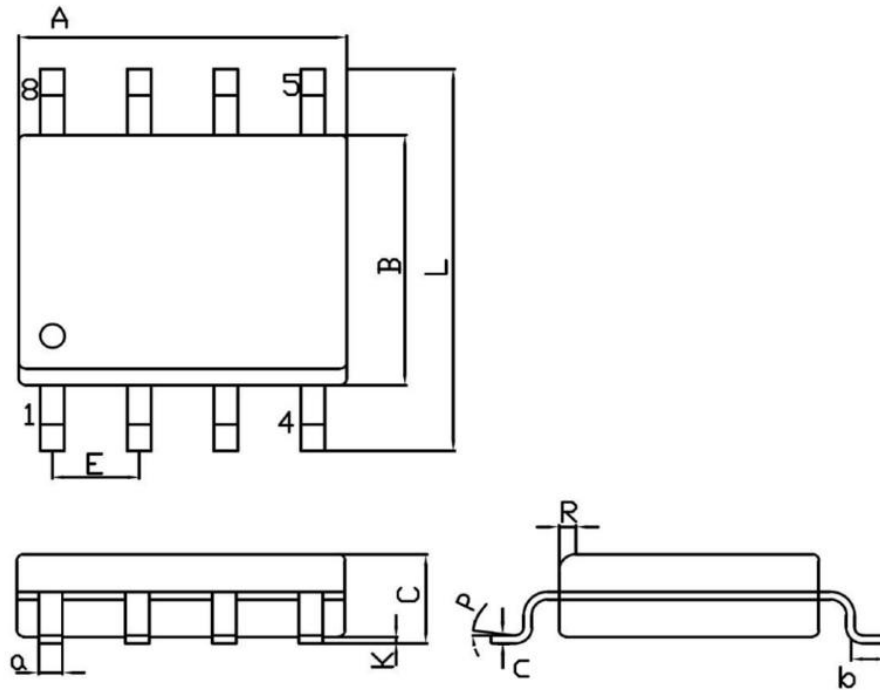
**Note:**

- 1) All dimensions are in millimeters.



## PACKAGE INFORMATION

### SOP8



Unit: mm

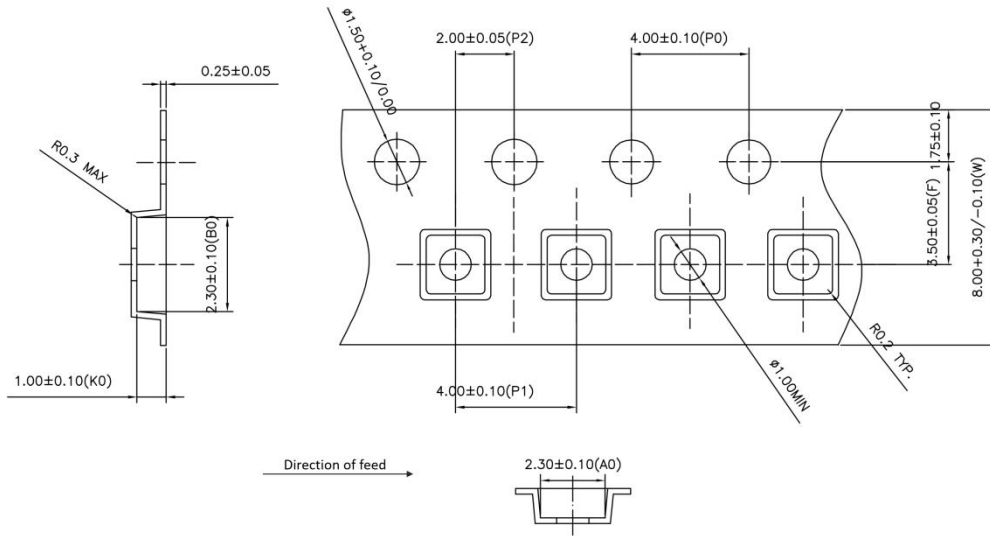
Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
A	4.70	5.10	C	1.35	1.75
B	3.70	4.10	a	0.35	0.49
L	6.00	6.40	R	0.30	0.60
E	1.27 BSC		P	0°	7°
K	0.12	0.22	b	0.40	1.25
			c	0.203	0.243

**Note:**

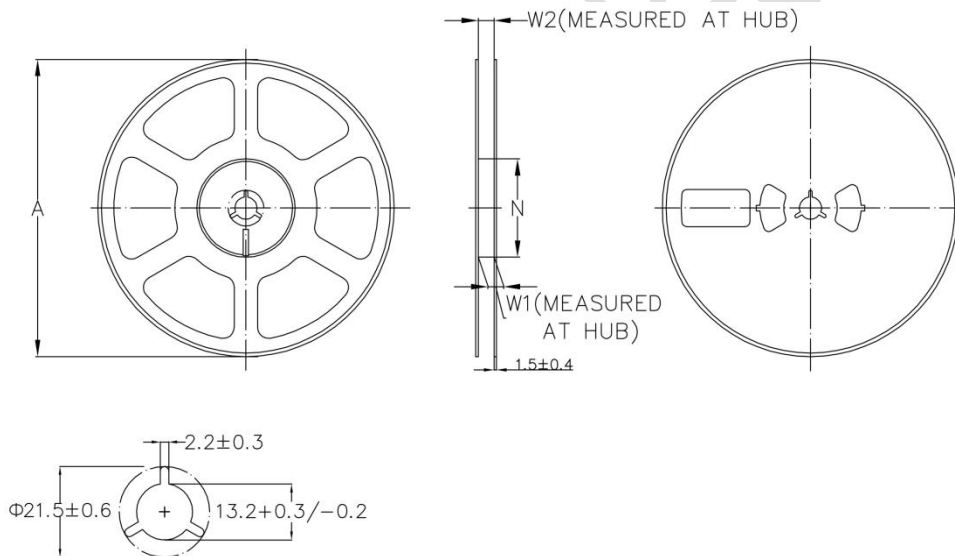
- 1) All dimensions are in millimeters.
- 2) Package length does not include mold flash, protrusion or gate burr.
- 3) Package width does not include inter lead flash or protrusion.
- 4) Lead popularity (bottom of leads after forming) shall be 0.10 millimeters max.
- 5) Pin 1 is lower left pin when reading top mark from left to right.

## TAPE AND REEL INFORMATION

### TAPE DIMENSIONS: DFN2x2-8



### REEL DIMENSIONS: DFN2x2-8



Unit: mm

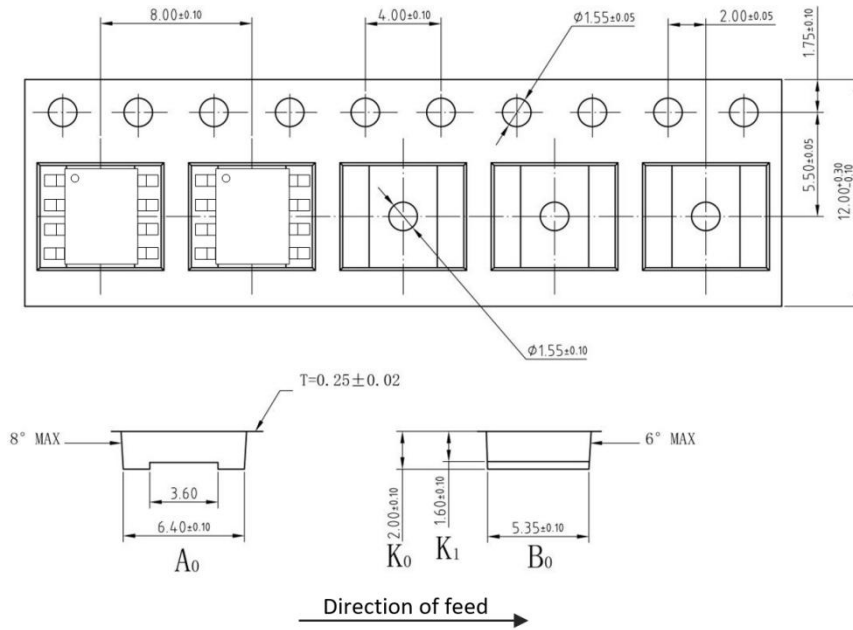
TAPE WIDTH	$\phi A (\pm 1.0)$	$\phi N (\pm 2.0)$	W1 (+1.5/-0)	W2 (Max)
8MM	178	54	8.4	14.4

#### Note:

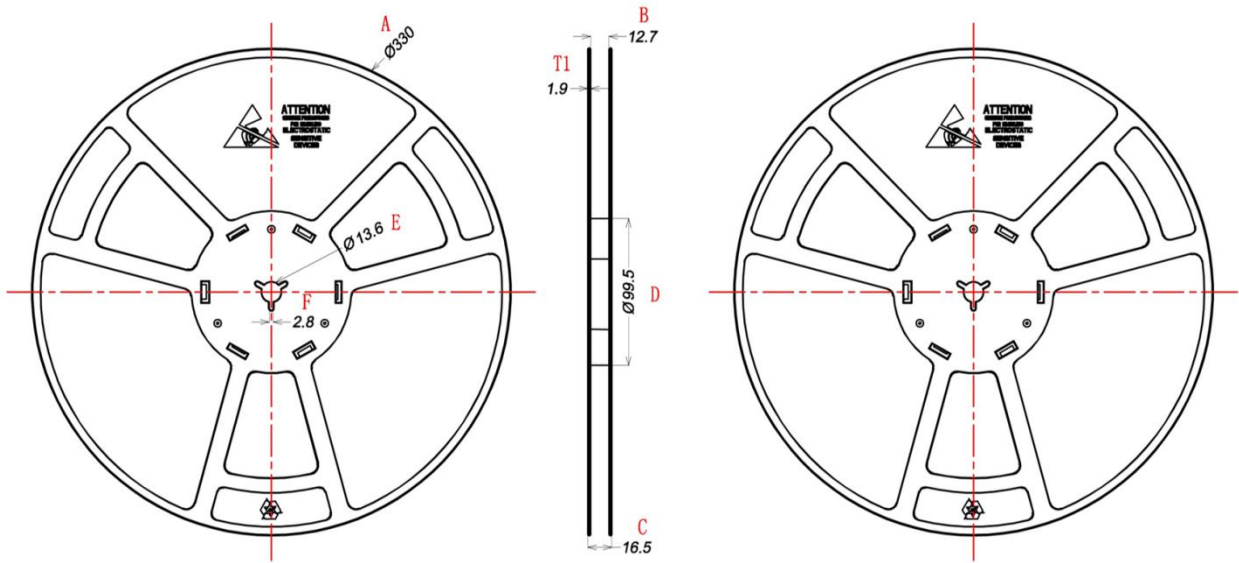
- 1) All Dimensions are in Millimeter
- 2) Quantity of Units per Reel is 3000
- 3) MSL level is level 3.

### TAPE AND REEL INFORMATION

#### TAPE DIMENSIONS:



#### REEL DIMENSIONS:



Unit: mm

A	B	C	D	E	F	T1
$\phi 330 \pm 1$	$12.7 \pm 0.5$	$16.5 \pm 0.3$	$\phi 99.5 \pm 0.5$	$\phi 13.6 \pm 0.2$	$2.8 \pm 0.2$	$1.9 \pm 0.2$

**Note:**

- 1) All Dimensions are in Millimeter
- 2) Quantity of Units per Reel is 3000
- 3) MSL level is level 3.