

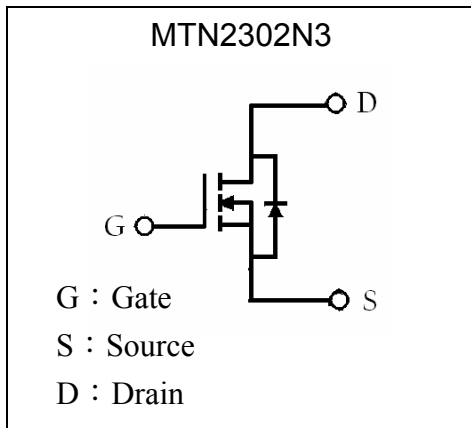
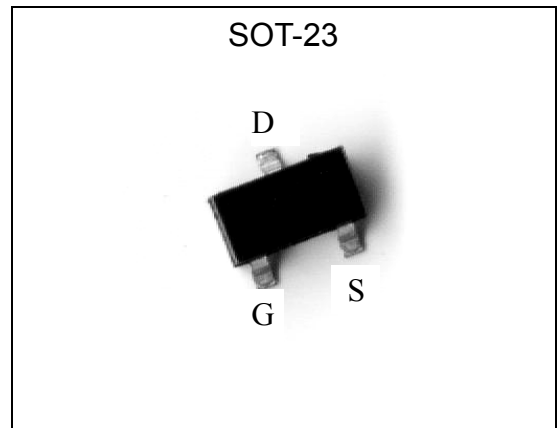
**20V N-CHANNEL Enhancement Mode MOSFET**

# MTN2302N3

$BV_{DSS}$	20V
$I_D$	3.6A
$R_{DSON(MAX)}@V_{GS}=4.5V, I_D=3.6A$	29m $\Omega$ (typ.)
$R_{DSON(MAX)}@V_{GS}=2.5V, I_D=3.1A$	39m $\Omega$ (typ.)

**Features**

- Simple drive requirement
- Small package outline
- Capable of 2.5V gate drive
- Pb-free lead plating and halogen-free package

**Symbol**

**Outline**

**Absolute Maximum Ratings** ( $T_a=25^\circ\text{C}$ )

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current @ $V_{GS}=4.5V, T_A=25^\circ\text{C}$ (Note 3)	$I_D$	3.6	A
Continuous Drain Current @ $V_{GS}=4.5V, T_A=70^\circ\text{C}$ (Note 3)		2.9	A
Pulsed Drain Current (Notes 1, 2)	$I_{DM}$	10	A
Maximum Power Dissipation @ $T_A=25^\circ\text{C}$	$P_D$	1.38 (Note 3)	W
Linear Derating Factor		0.01	W/ $^\circ\text{C}$
Operating Junction and Storage Temperature	$T_j, T_{stg}$	-55~+150	$^\circ\text{C}$

Note : 1. Pulse width limited by maximum junction temperature.

2. Pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .

3. Surface mounted on 1 in<sup>2</sup> copper pad of FR-4 board,  $t \leq 5\text{s}$ ; 270 $^\circ\text{C}/\text{W}$  when mounted on minimum copper pad.



## Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance, Junction-to-Ambient, max	R $\theta$ JA	90	°C/W
Thermal Resistance, Junction-to-Case, max	R $\theta$ JC	80	°C/W

Note : Surface mounted on 1 in<sup>2</sup> copper pad of FR-4 board, t $\le$ 5s; 270°C/W when mounted on minimum copper pad.

## Electrical Characteristics (T $_j$ =25°C, unless otherwise noted)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV $_{DSS}$	20	-	-	V	V $_{GS}$ =0, I $_D$ =250 $\mu$ A
$\Delta$ BV $_{DSS}/\Delta$ T $_j$	-	0.1	-	V/°C	Reference to 25°C, I $_D$ =1mA
V $_{GS(th)}$	0.5	0.7	1.2	V	V $_{DS}$ =V $_{GS}$ , I $_D$ =250 $\mu$ A
I $_{GSS}$	-	-	$\pm$ 100	nA	V $_{GS}$ = $\pm$ 12V, V $_{DS}$ =0
I $_{DSS}$	-	-	1	$\mu$ A	V $_{DS}$ =20V, V $_{GS}$ =0
	-	-	10	$\mu$ A	V $_{DS}$ =20V, V $_{GS}$ =0 (T $_j$ =70°C)
*R $_{DS(ON)}$	-	29	55	m $\Omega$	I $_D$ =3.6A, V $_{GS}$ =4.5V
	-	39	70		I $_D$ =3.1A, V $_{GS}$ =2.5V
*G $_{FS}$	-	7.5	-	S	V $_{DS}$ =5V, I $_D$ =3.6A
<b>Dynamic</b>					
C $_{iss}$	-	440	-	pF	V $_{DS}$ =10V, V $_{GS}$ =0, f=1MHz
C $_{oss}$	-	61	-		
C $_{rss}$	-	59	-		
t $_{d(ON)}$	-	4.5	-	ns	V $_{DS}$ =10V, I $_D$ =3.6A, V $_{GS}$ =5V R $_G$ =6 $\Omega$ , R $_D$ =2.8 $\Omega$
t $_r$	-	7.4	-		
t $_{d(OFF)}$	-	19	-		
t $_f$	-	7.2	-		
Q $_g$	-	4.4	-	nC	V $_{DS}$ =10V, I $_D$ =3.6A, V $_{GS}$ =4.5V
Q $_gs$	-	0.7	-		
Q $_gd$	-	1.7	-		
<b>Source-Drain Diode</b>					
*V $_{SD}$	-	0.8	1.2	V	V $_{GS}$ =0V, I $_S$ =1.6A
I $_S$	-	-	1	A	V $_D$ =V $_G$ =0V, V $_S$ =1.2V
I $_{SM}$	-	-	10		

\*Pulse Test : Pulse Width  $\leq$ 300 $\mu$ s, Duty Cycle  $\leq$ 2%

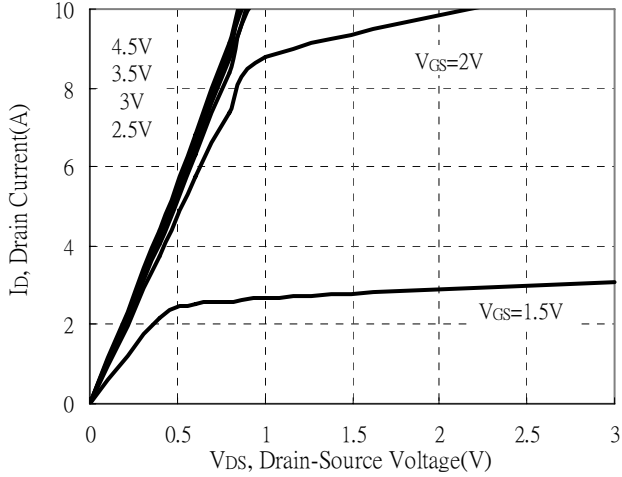
## Ordering Information

Device	Package	Shipping
MTN2302N3-0-T1-G	SOT-23 (Pb-free lead plating and halogen-free package)	3000 pcs / Tape & Reel

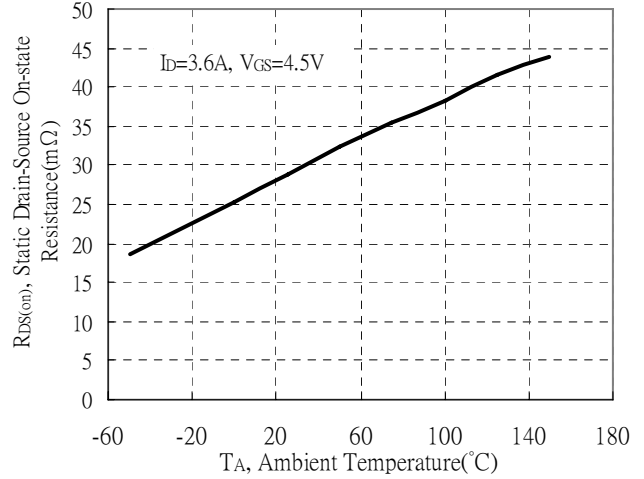


### Typical Characteristics

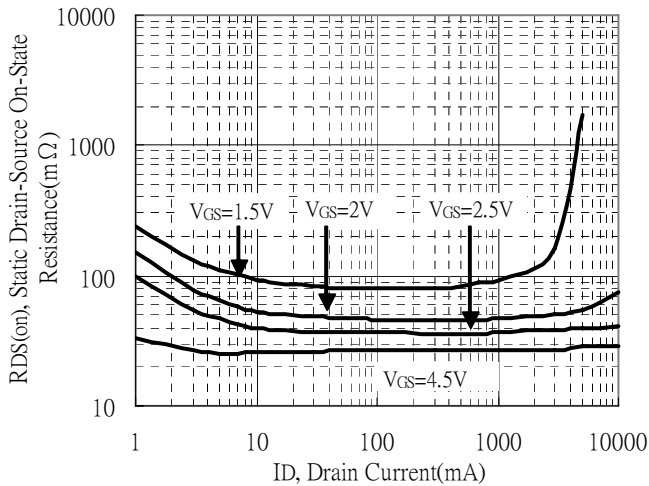
Typical Output Characteristics



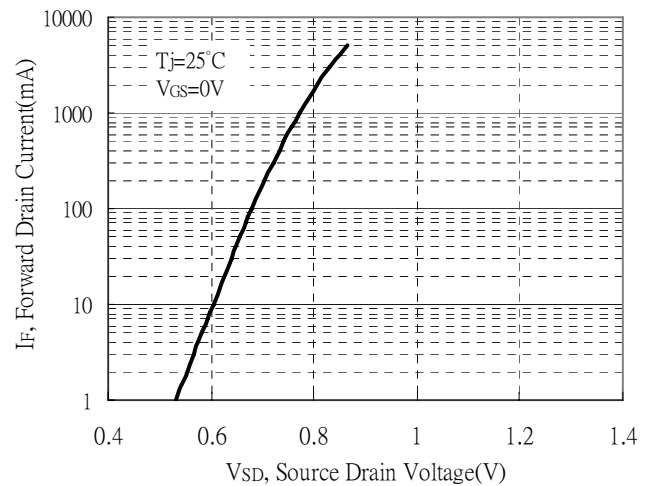
Static Drain-Source On-resistance vs Ambient Temperature



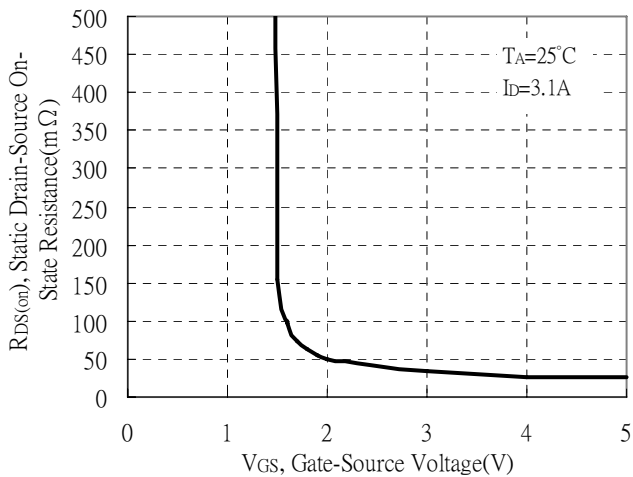
Static Drain-Source On-State resistance vs Drain Current



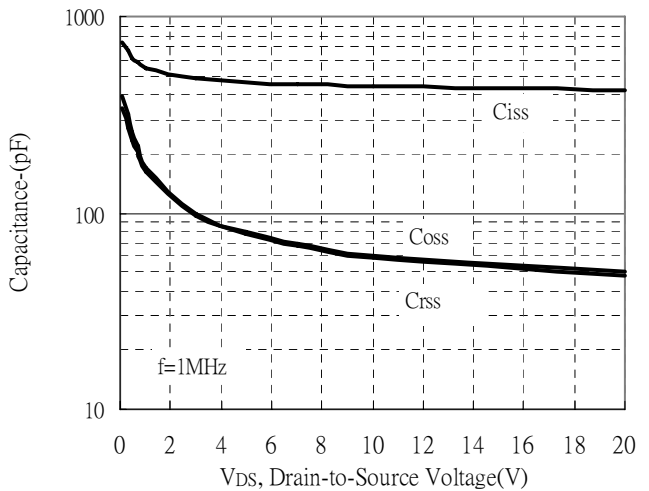
Forward Drain Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

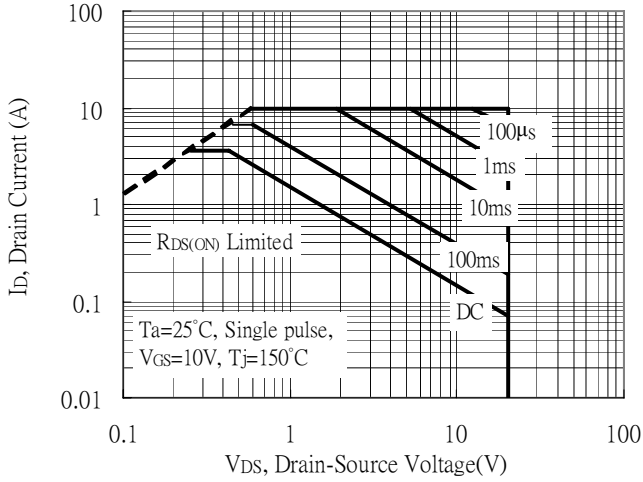


Capacitance vs Reverse Voltage

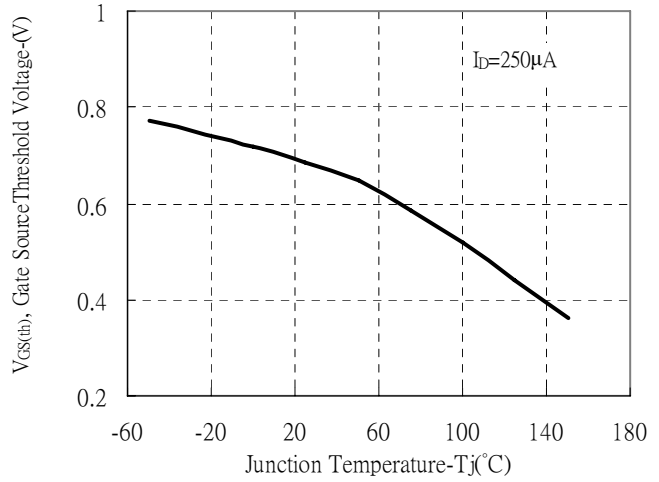


**Typical Characteristics(Cont.)**

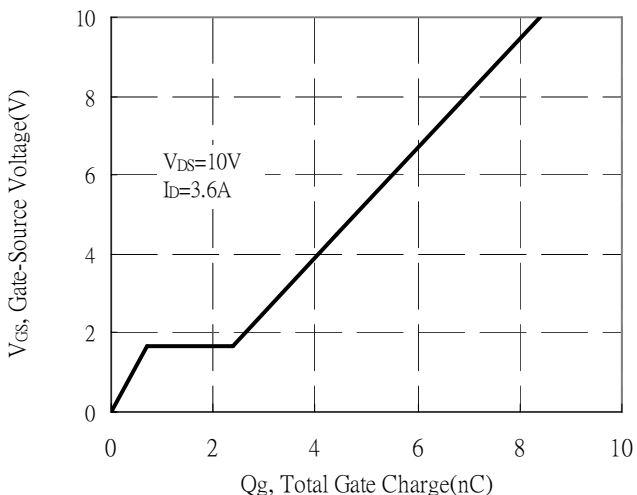
Maximum Safe Operating Area



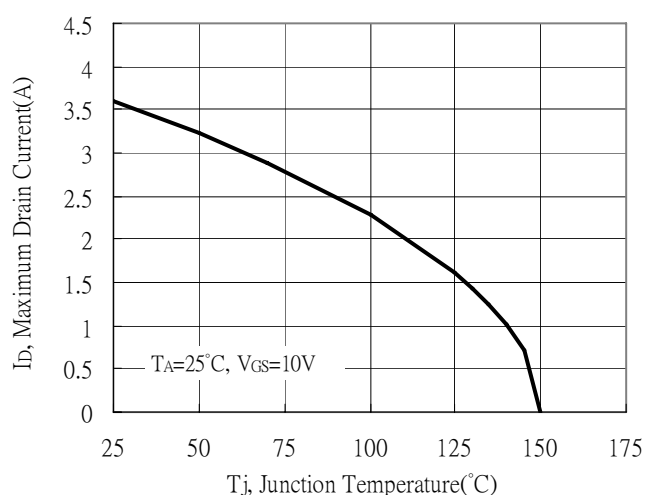
Gate Threshold Voltage vs Ambient Temperature



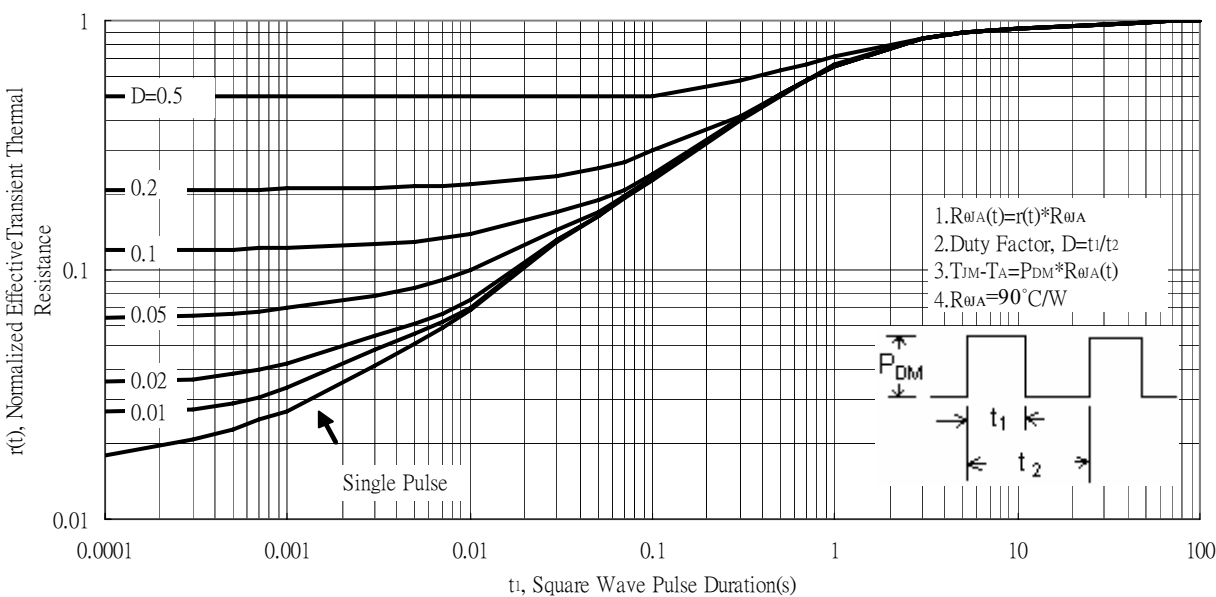
Gate Charge Characteristics



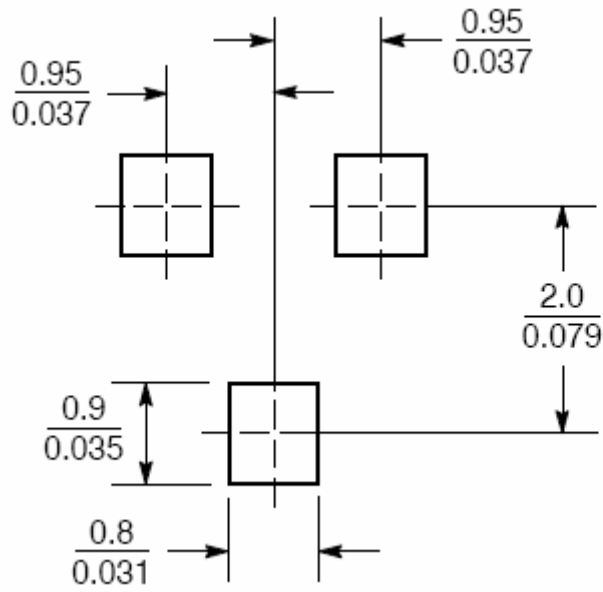
Maximum Drain Current vs Junction Temperature



Transient Thermal Response Curves

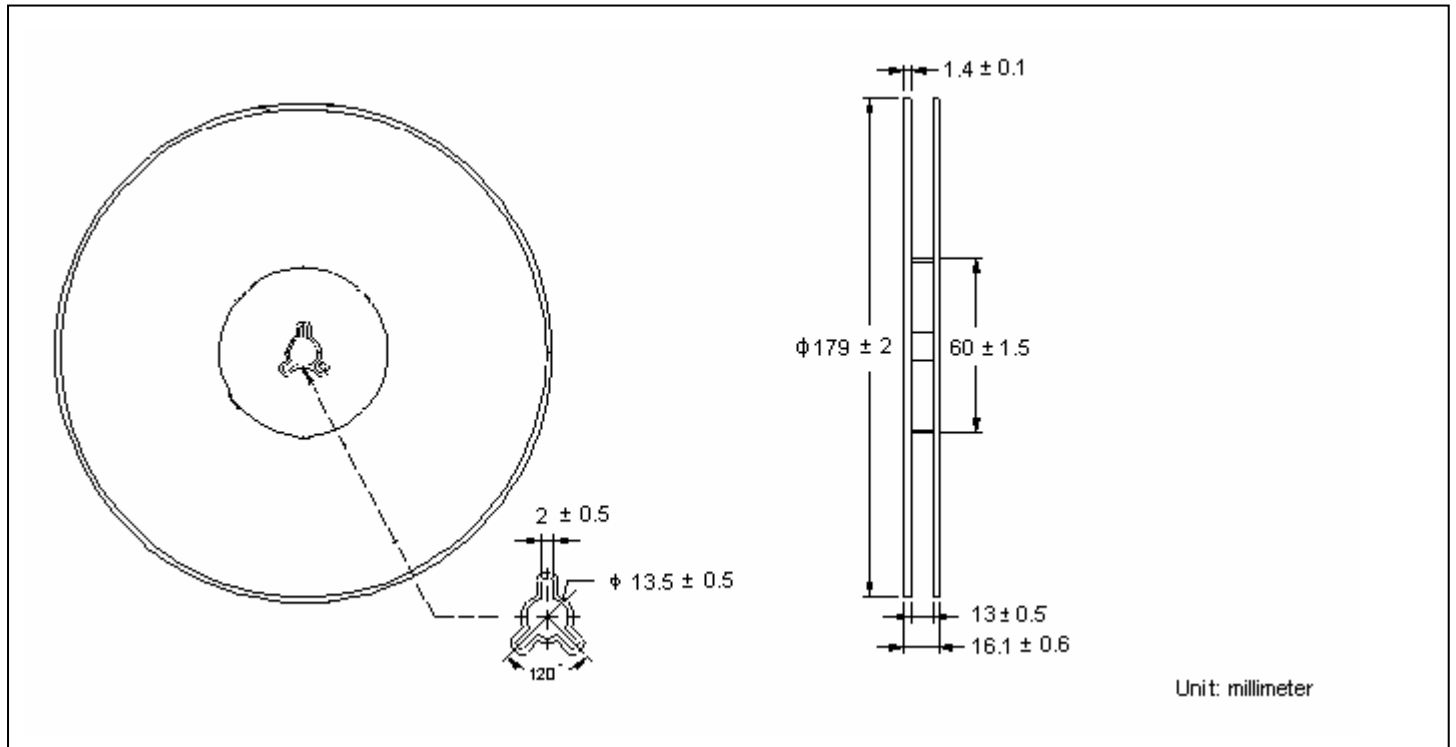


### Recommended Soldering Footprint

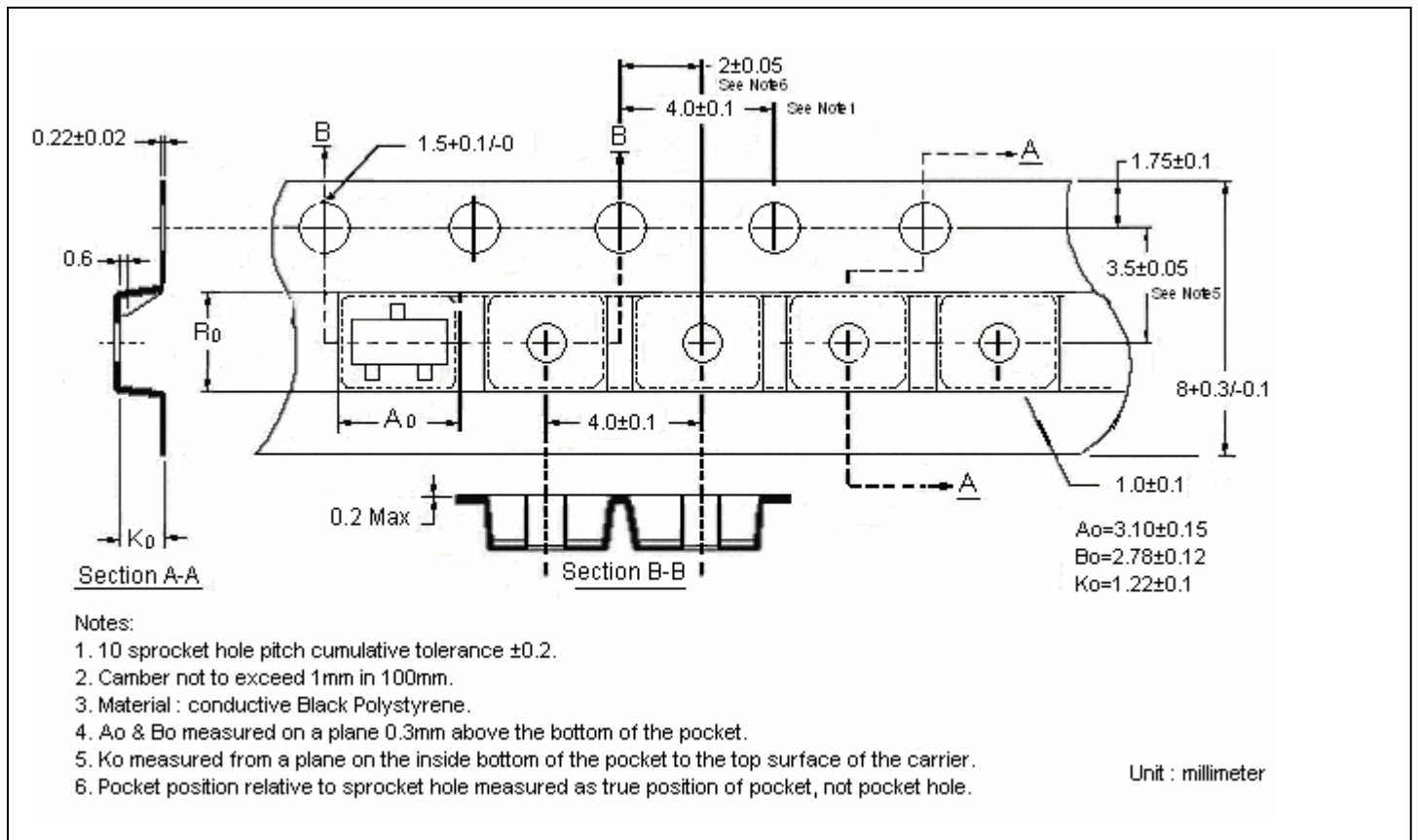


Unit :  $\frac{\text{mm}}{\text{inches}}$

**Reel Dimension**



**Carrier Tape Dimension**



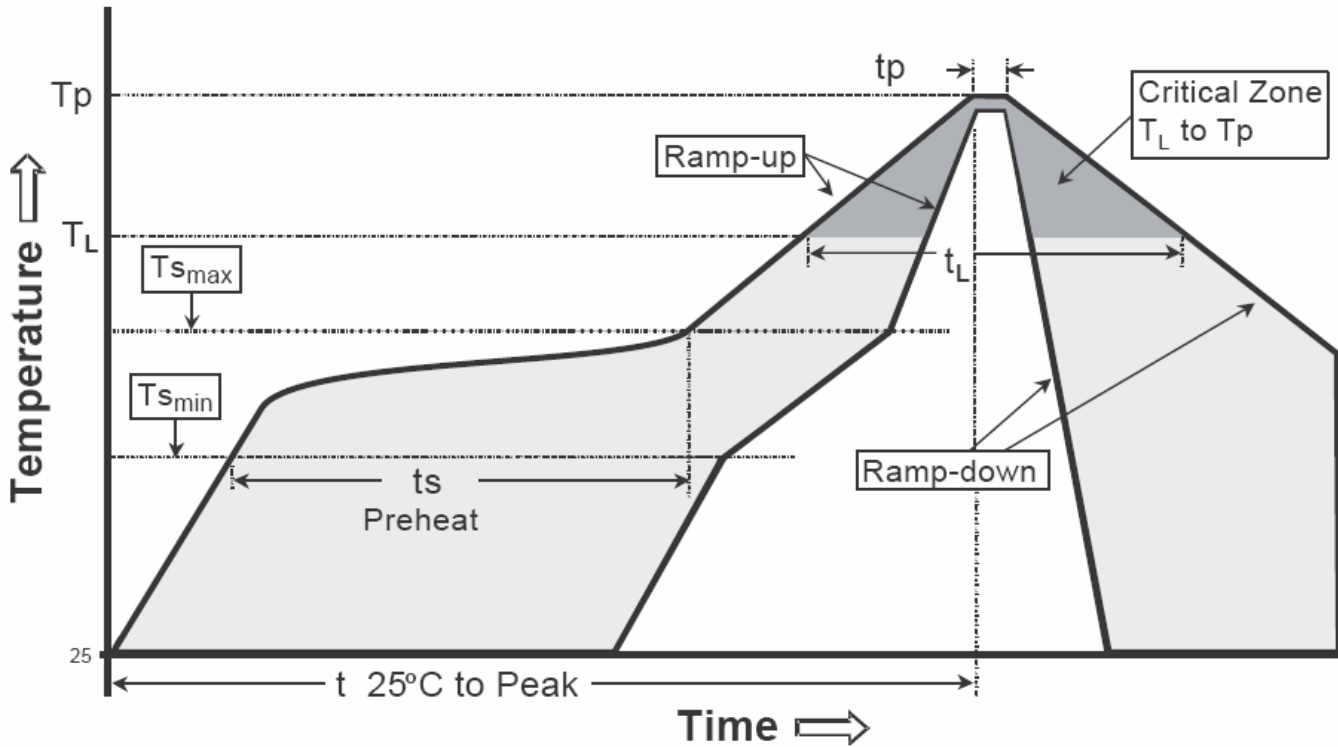
**Notes:**

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
2. Camber not to exceed 1mm in 100mm.
3. Material : conductive Black Polystyrene.
4.  $A_o$  &  $B_o$  measured on a plane 0.3mm above the bottom of the pocket.
5.  $K_o$  measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

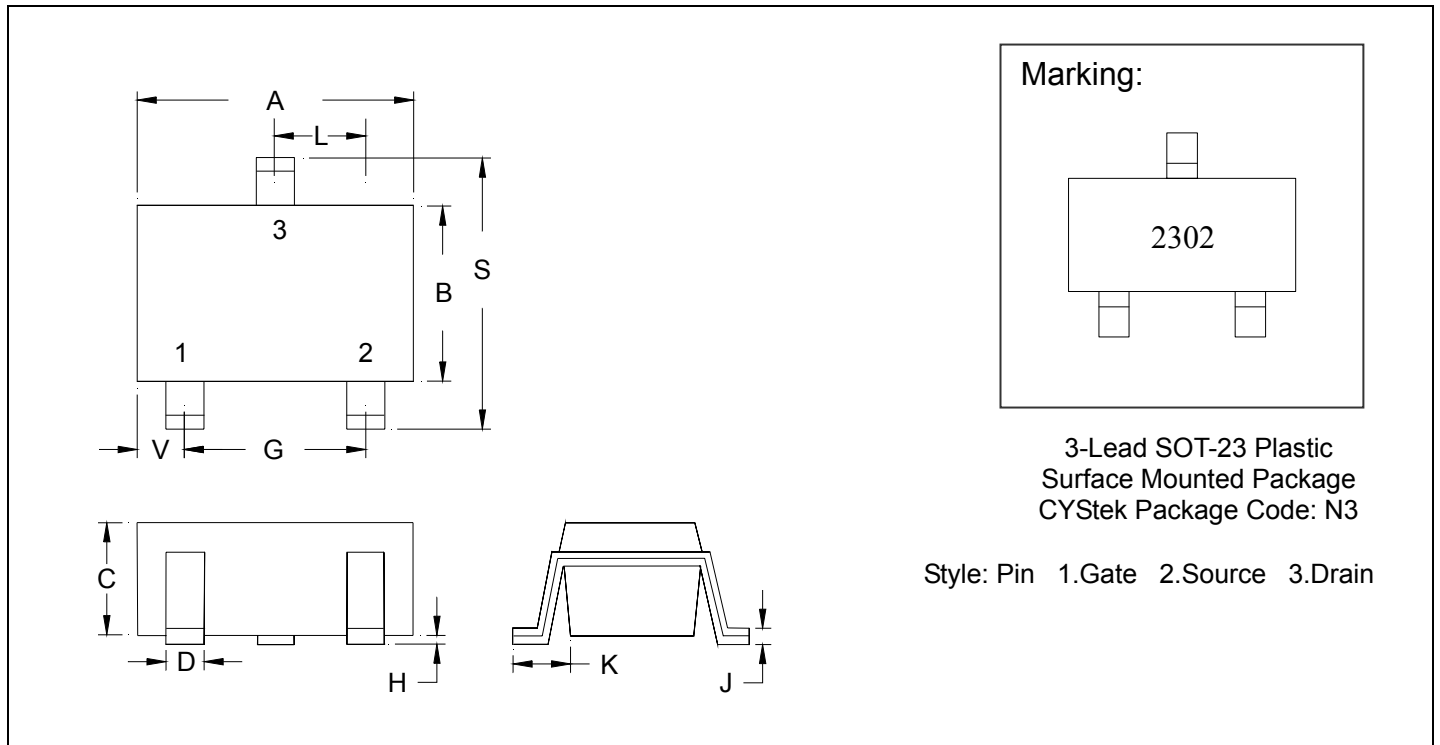
**Recommended temperature profile for IR reflow**



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T <sub>s min</sub> )	100°C	150°C
-Temperature Max(T <sub>s max</sub> )	150°C	200°C
-Time(t <sub>s min</sub> to t <sub>s max</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak Temperature(T <sub>P</sub> )	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

**SOT-23 Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1102	0.1204	2.80	3.04	J	0.0032	0.0079	0.08	0.20
B	0.0472	0.0669	1.20	1.70	K	0.0118	0.0266	0.30	0.67
C	0.0335	0.0512	0.89	1.30	L	0.0335	0.0453	0.85	1.15
D	0.0118	0.0197	0.30	0.50	S	0.0830	0.1161	2.10	2.95
G	0.0669	0.0910	1.70	2.30	V	0.0098	0.0256	0.25	0.65
H	0.0000	0.0040	0.00	0.10					

- Notes:**
- Controlling dimension: millimeters.
  - Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
  - If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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