
**Pin Definition:**

1. Gate
2. Drain
3. Source

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
600	5 @ $V_{GS}=10V$	1

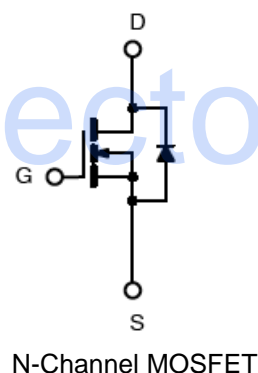
### General Description

The TSM2N60 is used an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain- to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

### Features

- Robust high voltage termination
- Avalanche energy specified
- Diode is characterized for use in bridge circuits
- Source to Drain diode recovery time comparable to a discrete fast recovery diode.

### Block Diagram



### Ordering Information

Part No.	Package	Packing
TSM2N60CP RO	TO-252	2.5Kpcs/ 13" Reel
TSM2N60CP ROG	TO-252	2.5Kpcs/ 13" Reel
TSM2N60CH C5	TO-251	75pcs / Tube
TSM2N60CH C5G	TO-251	75pcs / Tube
TSM2N60CZ C0	TO-220	50pcs / Tube

**Note:** "G" denotes for Halogen Free

### Absolute Maximum Rating ( $T_a = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	600	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	2	A
Pulsed Drain Current	$I_{DM}$	9	A
Continuous Source Current (Diode Conduction) <sup>a,b</sup>	$I_S$	1	A
Single Pulse Drain to Source Avalanche Energy ( $V_{DD} = 50V, I_{AS}=1.8A, L=68mH, R_G=25\Omega$ )	EAS	120	mJ
Maximum Power Dissipation @ $T_c = 25^\circ C$	TO-251 / TO-252	70	W
	TO-220	70	
Operating Junction Temperature	$T_J$	+150	$^\circ C$
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ C$

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	TO-251 / TO-252	2.87	°C/W
	TO-220	2.32	
Thermal Resistance - Junction to Ambient	TO-251 / TO-252	110	°C/W
	TO-220	62.5	

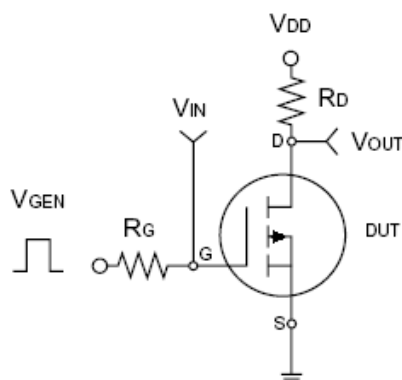
Notes: Surface mounted on FR4 board  $t \leq 10\text{sec}$

### Electrical Specifications (Ta = 25°C unless otherwise noted)

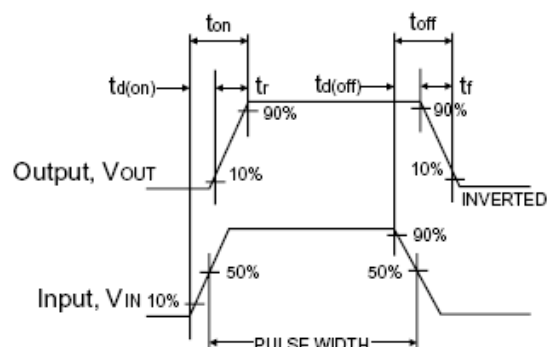
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	600	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 1A$	$R_{DS(ON)}$	--	--	5	$\Omega$
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2.0	--	4.0	V
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	$I_{DSS}$	--	--	10	$\mu A$
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance	$V_{DS} = 40V, I_D = 1A$	$g_{fs}$	--	5	--	S
Diode Forward Voltage	$I_S = 2A, V_{GS} = 0V$	$V_{SD}$	--	--	1.6	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$V_{DS} = 400V, I_D = 2A, V_{GS} = 10V$	$Q_g$	--	13	22	nC
Gate-Source Charge		$Q_{gs}$	--	2	--	
Gate-Drain Charge		$Q_{gd}$	--	6	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{MHz}$	$C_{iss}$	--	435	--	pF
Output Capacitance		$C_{oss}$	--	56	--	
Reverse Transfer Capacitance		$C_{rss}$	--	9.2	--	
<b>Switching<sup>c</sup></b>						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 2A, V_{DD} = 300V, R_G = 18\Omega$	$t_{d(on)}$	--	12	--	ns
Turn-On Rise Time		$t_r$	--	21	--	
Turn-Off Delay Time		$t_{d(off)}$	--	30	--	
Turn-Off Fall Time		$t_f$	--	24	--	

#### Notes:

- Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- For design reference only, not subject to production testing.
- Switching time is essentially independent of operating temperature.



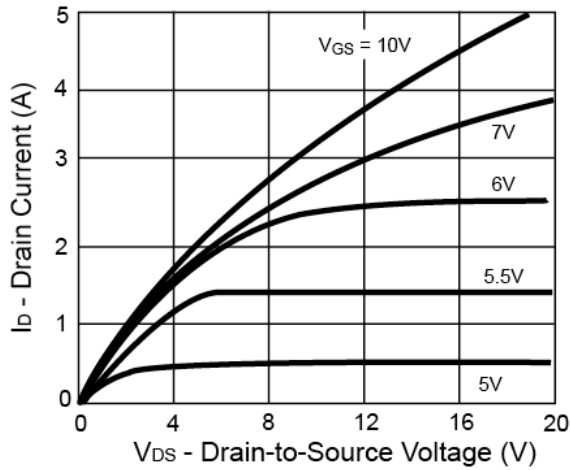
Switching Test Circuit



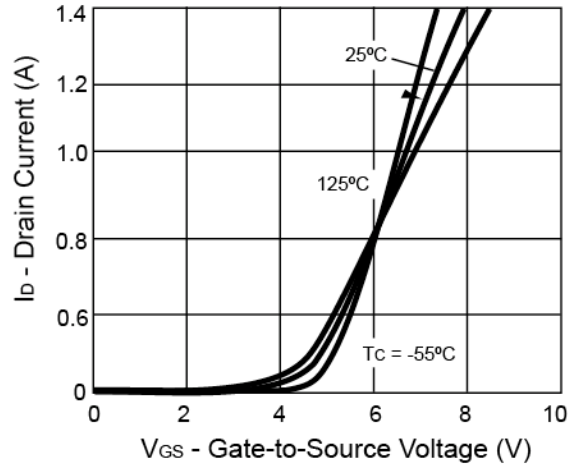
Switchin Waveforms

**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

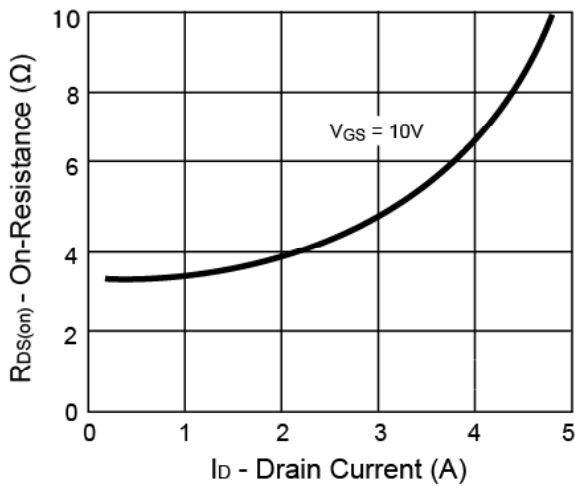
**Output Characteristics**



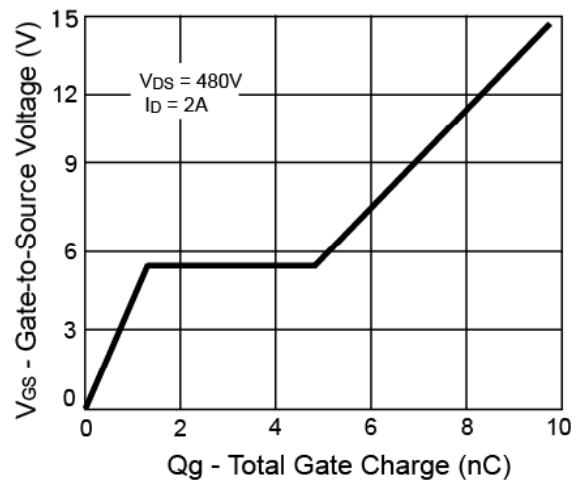
**Transfer Characteristics**



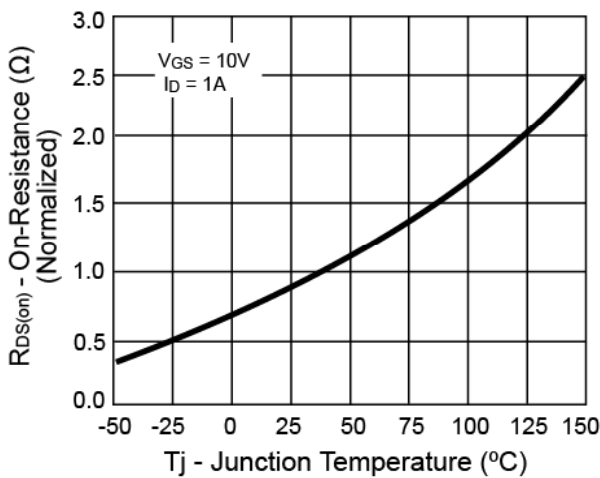
**On-Resistance vs. Drain Current**



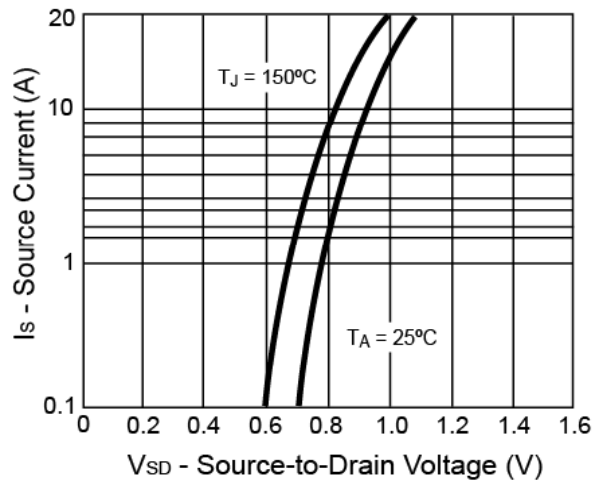
**Gate Charge**



**On-Resistance vs. Junction Temperature**

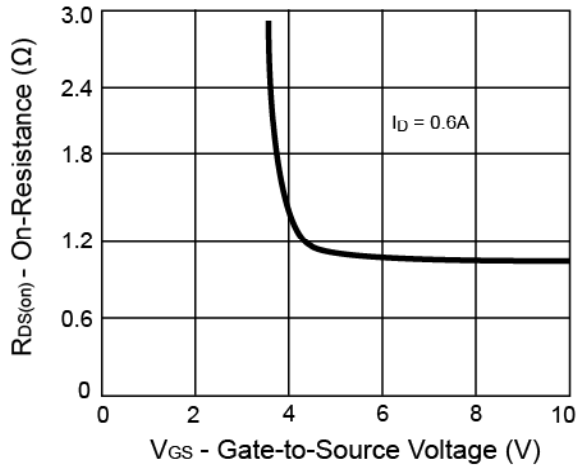


**Source-Drain Diode Forward Voltage**

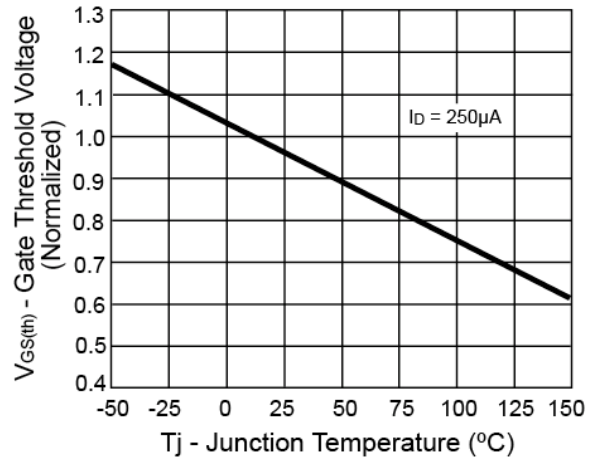


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

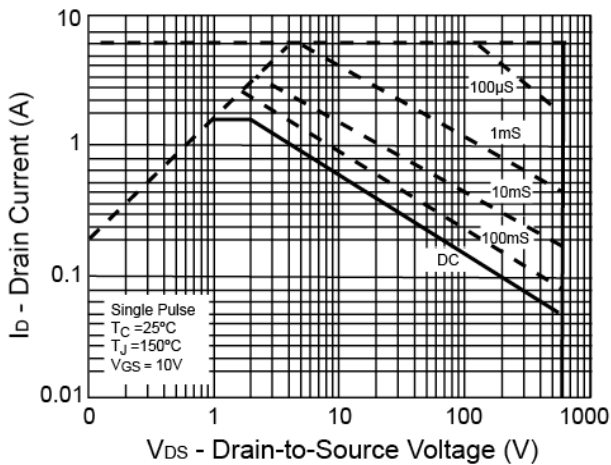
**On-Resistance vs. Gate-Source Voltage**



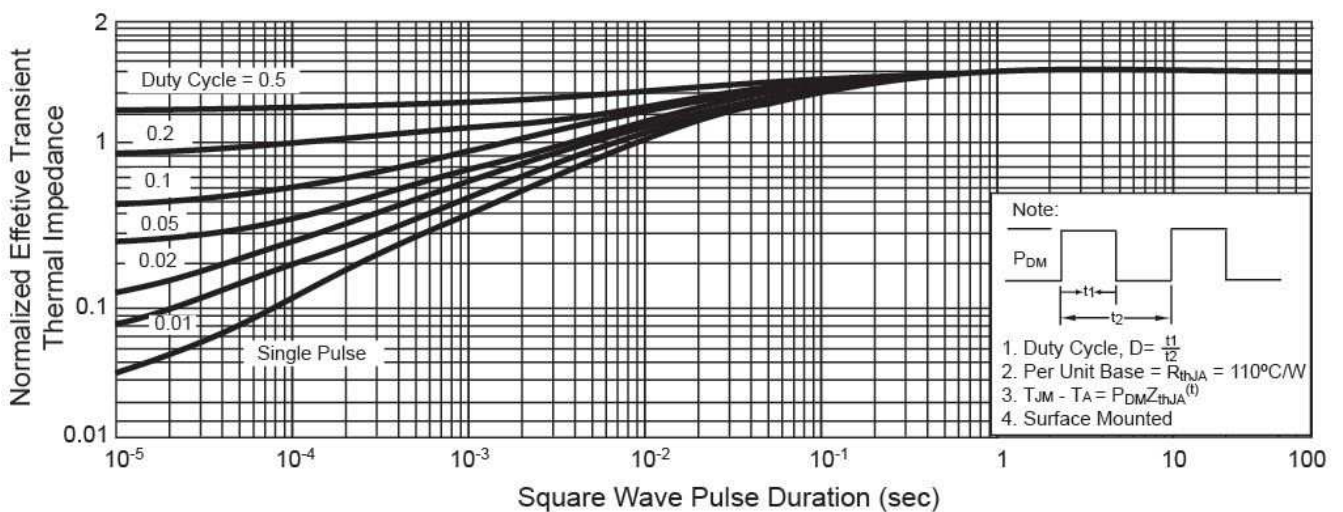
**Threshold Voltage**



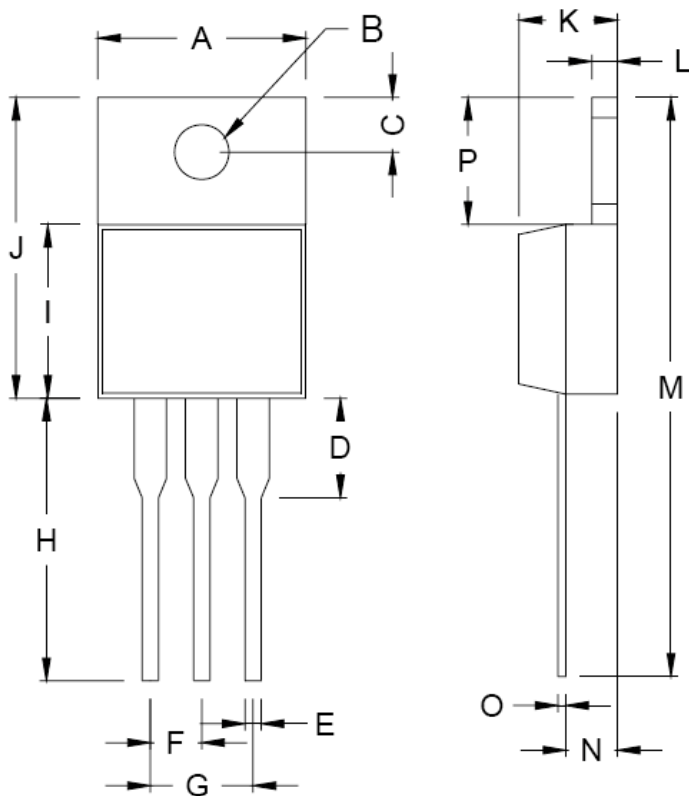
**Maximum Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

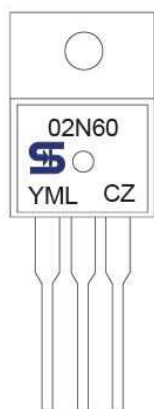


### TO-220 Mechanical Drawing



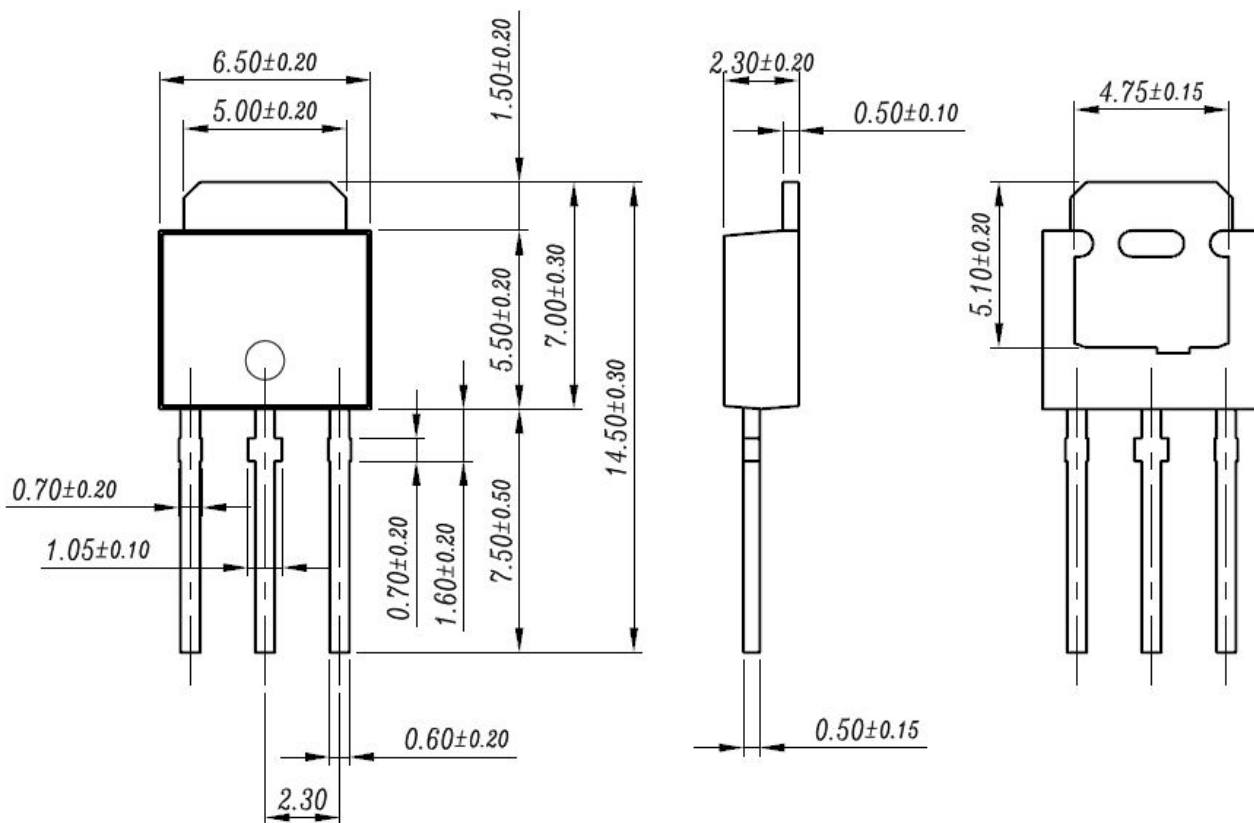
DIM	TO-220 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.000	10.500	0.394	0.413
B	3.740	3.910	0.147	0.154
C	2.440	2.940	0.096	0.116
D	-	6.350	-	0.250
E	0.381	1.106	0.015	0.040
F	2.345	2.715	0.092	0.058
G	4.690	5.430	0.092	0.107
H	12.700	14.732	0.500	0.581
J	14.224	16.510	0.560	0.650
K	3.556	4.826	0.140	0.190
L	0.508	1.397	0.020	0.055
M	27.700	29.620	1.060	1.230
N	2.032	2.921	0.080	0.115
O	0.255	0.610	0.010	0.024
P	5.842	6.858	0.230	0.270

### Marking Diagram



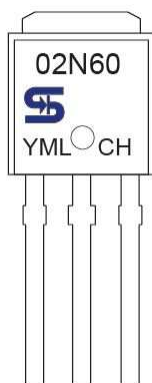
- Y = Year Code
- M = Month Code
- (A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L = Lot Code

**TO-251 Mechanical Drawing**



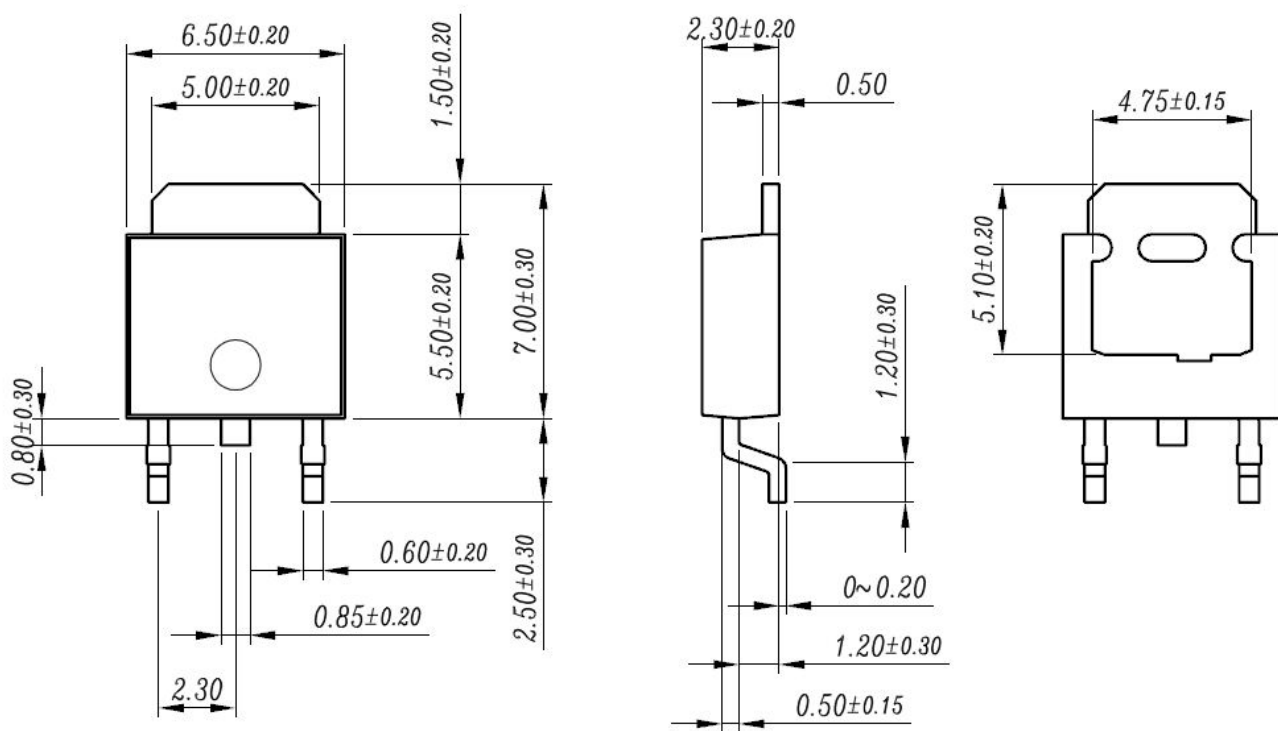
Unit: Millimeters

**Marking Diagram**



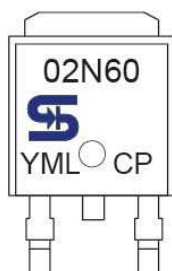
- Y** = Year Code
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(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- = Month Code for Halogen Free Product  
(O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
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**TO-252 Mechanical Drawing**



Unit: Millimeters

**Marking Diagram**



- Y** = Year Code
- M** = Month Code
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