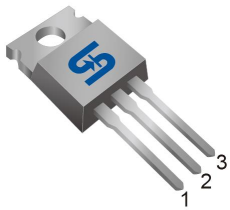
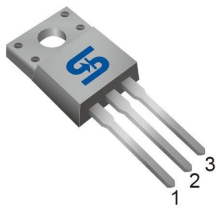




TO-220



ITO-220



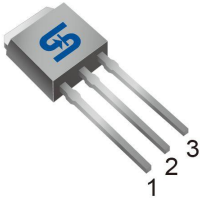
**Pin Definition:**

1. Gate
2. Drain
3. Source

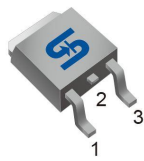
**Key Parameter Performance**

Parameter	Value	Unit
$V_{DS}$	500	V
$R_{DS(on)}$ (max)	1.5	
$Q_g$	14	nC

TO-251 (IPAK)



TO-252 (DPAK)



**Application**

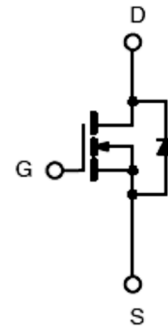
Power Supply.  
Lighting

**Ordering Information**

Part No.	Package	Packing
TSM5NB50CZ C0G	TO-220	50pcs / Tube
TSM5NB50CI C0G	ITO-220	50pcs / Tube
TSM5NB50CH C5G	TO-251	75pcs / Tube
TSM5NB50CP ROG	TO-252	2.5kpcs / 13+Reel

**Note:** %G+denotes for Halogen- and Antimony-free as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

**Block Diagram**



N-Channel MOSFET

**Absolute Maximum Ratings** ( $T_C = 25^\circ C$  unless otherwise noted)

Parameter	Symbol	Limit			Unit
		IPAK/DPAK	ITO-220	TO-220	
Drain-Source Voltage	$V_{DS}$	500			V
Gate-Source Voltage	$V_{GS}$	±30			V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	$T_C = 25^\circ C$			A
		$T_C = 100^\circ C$			A
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	20			A
Single Pulse Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	100			mJ
Total Power Dissipation @ $T_C = 25^\circ C$	$P_{TOT}$	54	33	70	W
Operating Junction Temperature	$T_J$	-55 to +150			$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to +150			$^\circ C$

### Thermal Performance

Parameter	Symbol	Limit			Unit
		IPAK/DPAK	ITO-220	TO-220	
Thermal Resistance - Junction to Case	$R_{JC}$	2.3	3.8	1.78	$^{\circ}\text{C}/\text{W}$
Thermal Resistance - Junction to Ambient	$R_{JA}$	83	62.5	62.5	$^{\circ}\text{C}/\text{W}$

### Electrical Specifications ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

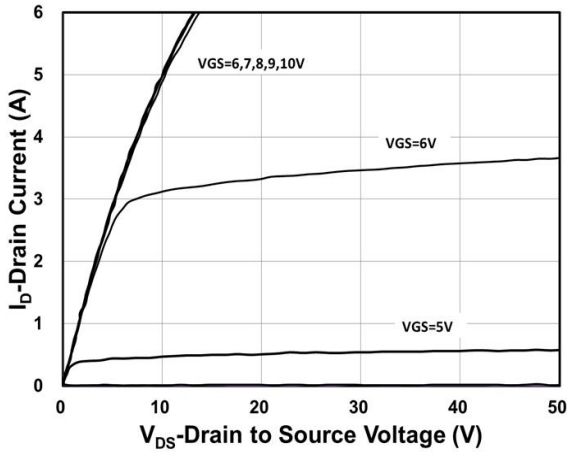
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	500	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 2.5\text{A}$	$R_{DS(ON)}$	--	1.3	1.5	
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2.5	3.5	4.5	V
Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Gate Body Leakage	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transfer Conductance	$V_{DS} = 10\text{V}, I_D = 2.5\text{A}$	$g_{fs}$	--	3.5	--	S
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = 300\text{V}, I_D = 5\text{A},$ $V_{GS} = 10\text{V}$	$Q_g$	--	14	--	nC
Gate-Source Charge		$Q_{gs}$	--	4.5	--	
Gate-Drain Charge		$Q_{gd}$	--	5.5	--	
Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	$C_{iss}$	--	552	--	pF
Output Capacitance		$C_{oss}$	--	83	--	
Reverse Transfer Capacitance		$C_{rss}$	--	18	--	
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{GS} = 10\text{V}, I_D = 5\text{A},$ $V_{DD} = 300\text{V}, R_G = 25$	$t_{d(on)}$	--	12	--	ns
Turn-On Rise Time		$t_r$	--	22	--	
Turn-Off Delay Time		$t_{d(off)}$	--	33	--	
Turn-Off Fall Time		$t_f$	--	21	--	
<b>Source-Drain Diode Ratings and Characteristic</b> (Note 4)						
Source Current	Integral reverse diode in the MOSFET	$I_S$	--	--	5	A
Source Current (Pulse)		$I_{SM}$	--	--	20	A
Diode Forward Voltage	$I_S = 5\text{A}, V_{GS} = 0\text{V}$	$V_{SD}$	--	0.9	1.5	V

#### Notes:

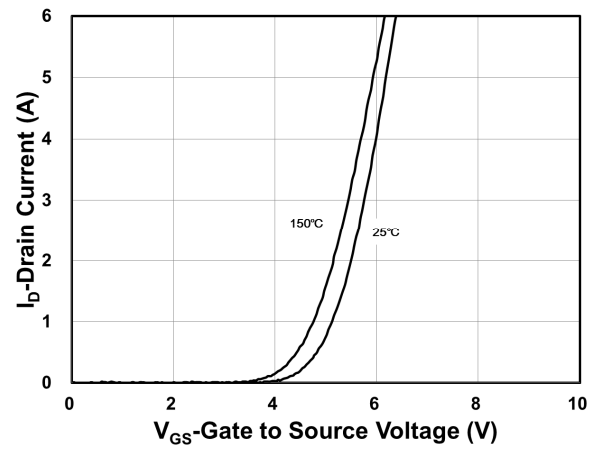
- Current limited by package
- Pulse width limited by the maximum junction temperature
- $L = 40\text{mH}, I_{AS} = 2.2\text{A}, V_{DD} = 50\text{V}, R_G = 25$  , Starting  $T_J = 25^{\circ}\text{C}$
- Pulse test: PW  $300\mu\text{s}$ , duty cycle  $2\%$
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curves

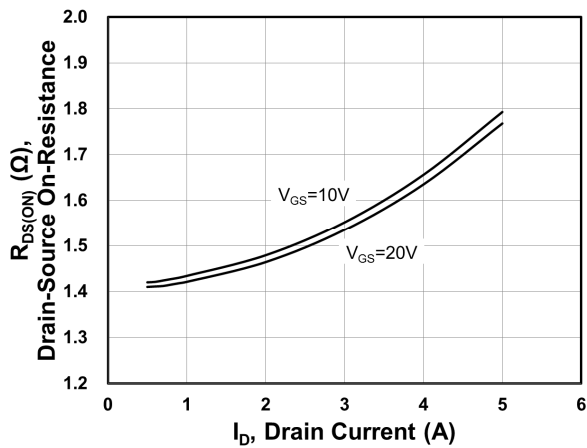
**Output Characteristics**



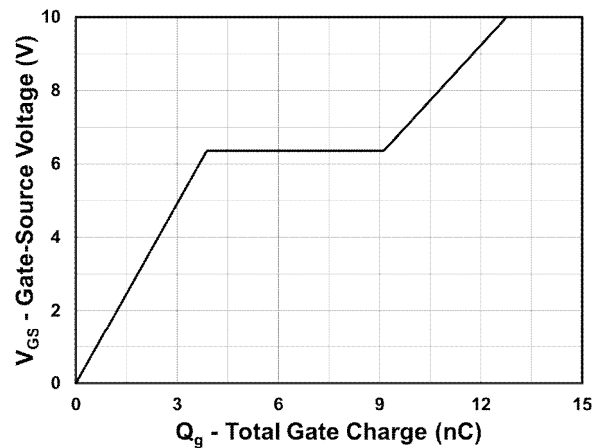
**Transfer Characteristics**



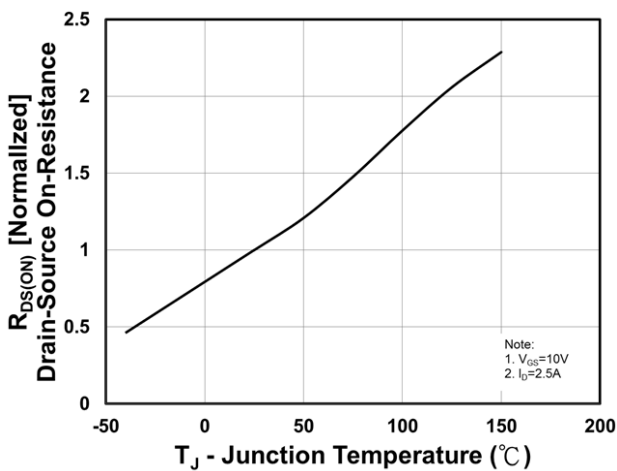
**On-Resistance vs. Drain Current**



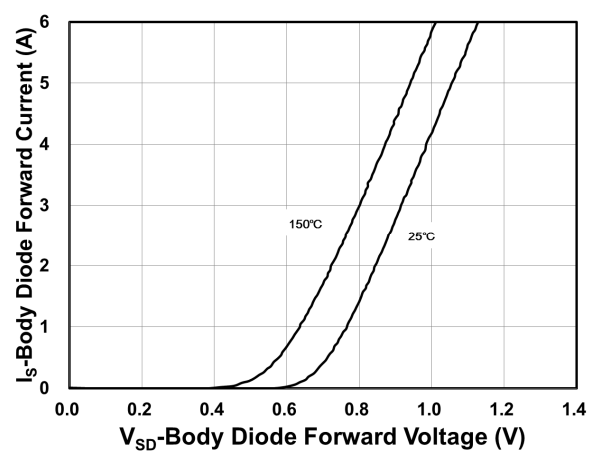
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**

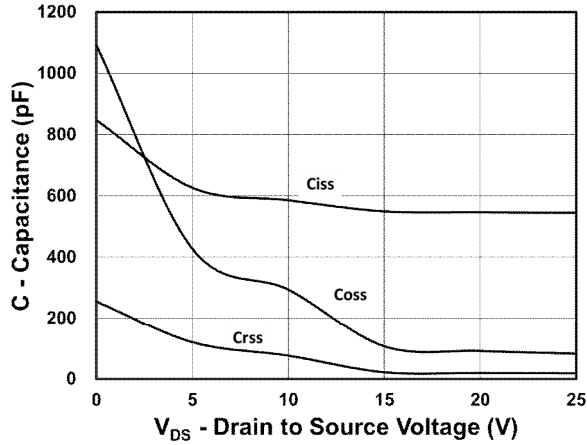


**Source-Drain Diode Forward Current vs. Voltage**

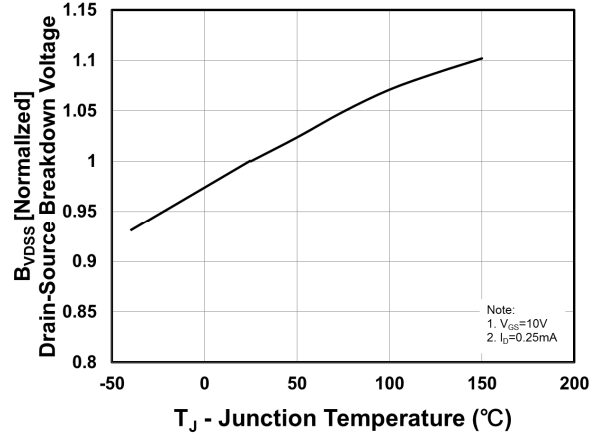


### Electrical Characteristics Curves

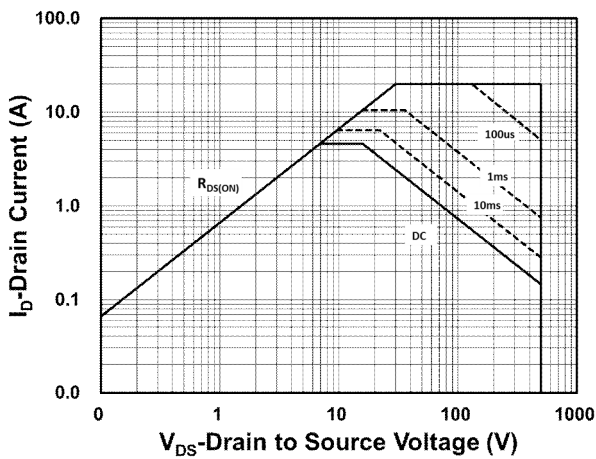
**Capacitance vs. Drain-Source Voltage**



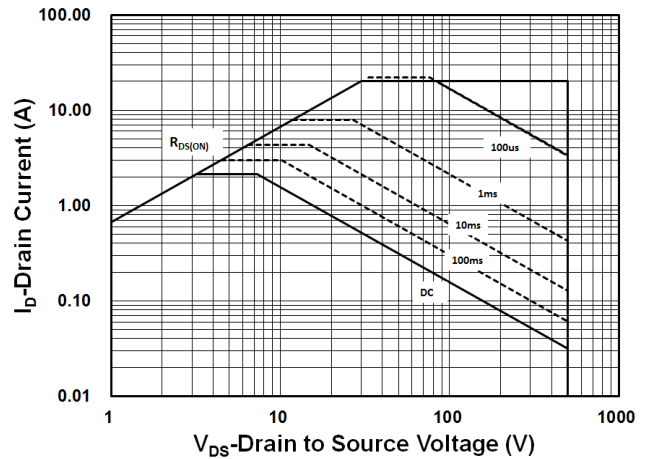
**BV<sub>DSS</sub> vs. Junction Temperature**



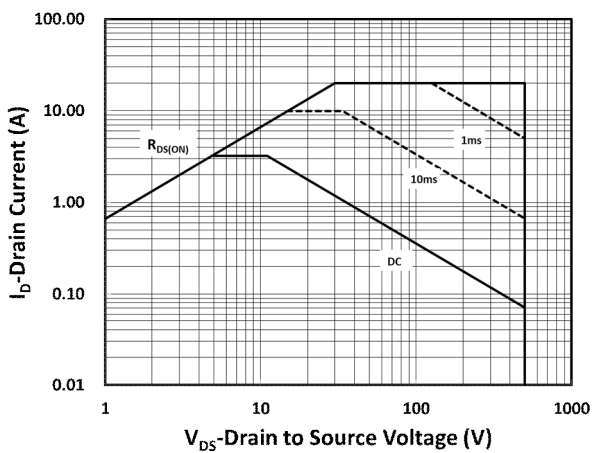
**Maximum Safe Operating Area (TO-220)**



**Maximum Safe Operating Area (ITO-220)**

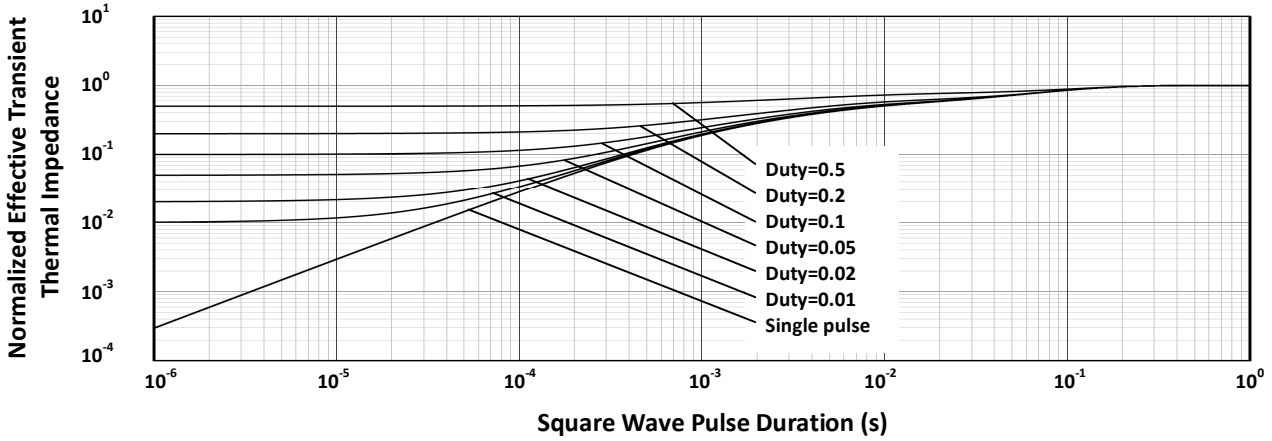


**Maximum Safe Operating Area (DPAK/IPAK)**

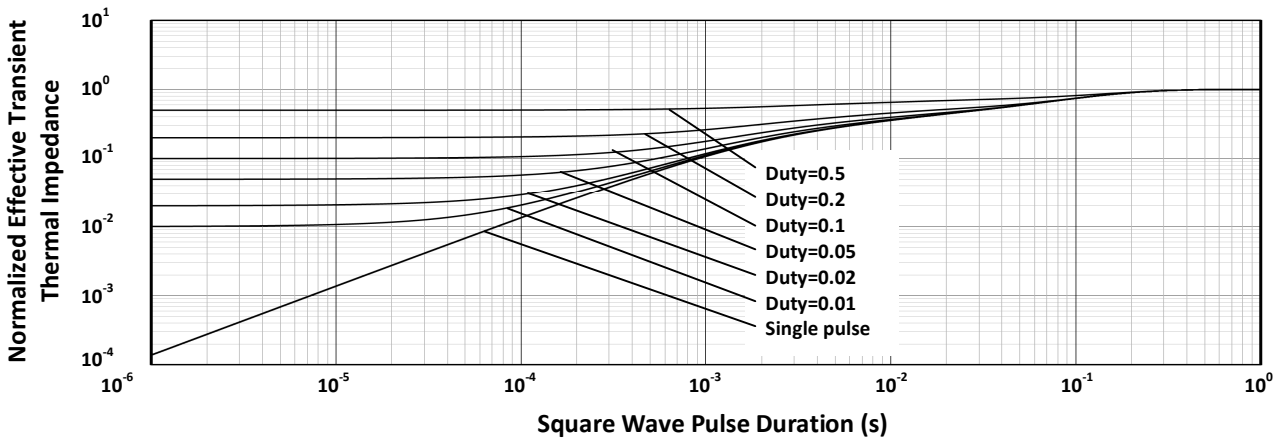


**Electrical Characteristics Curves**

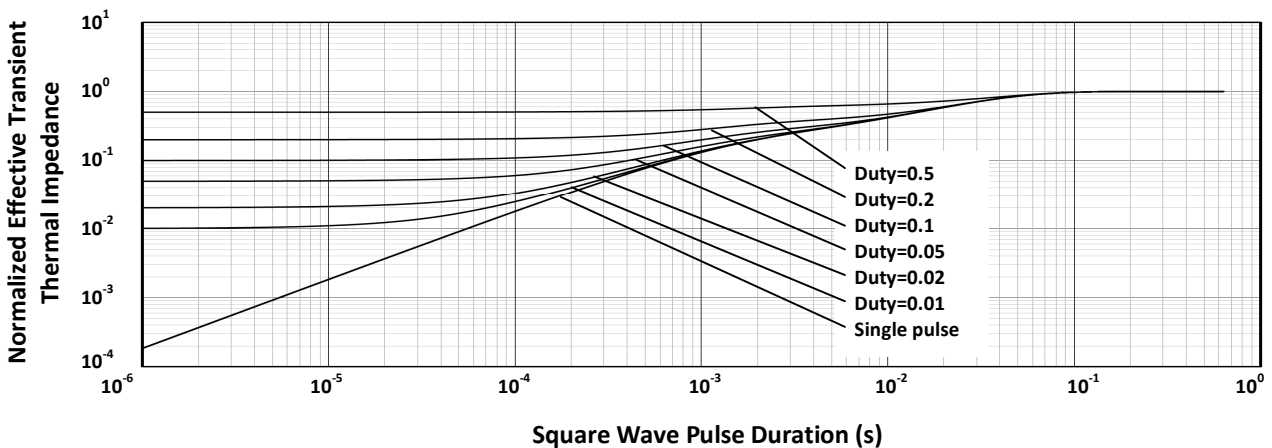
**Normalized Thermal Transient Impedance, Junction-to-Case (TO-220)**



**Normalized Thermal Transient Impedance, Junction-to-Case (ITO-220)**

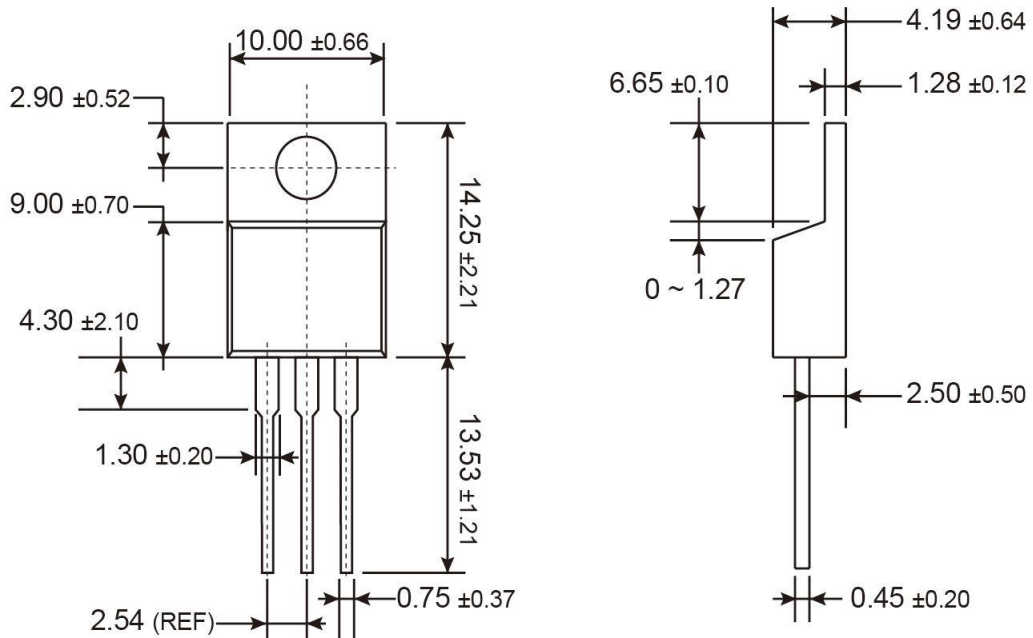


**Normalized Thermal Transient Impedance, Junction-to-Case (DPAK/IPAK)**



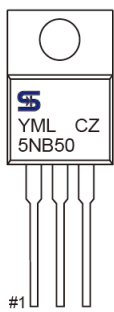


**TO-220 Mechanical Drawing**



Unit: Millimeters

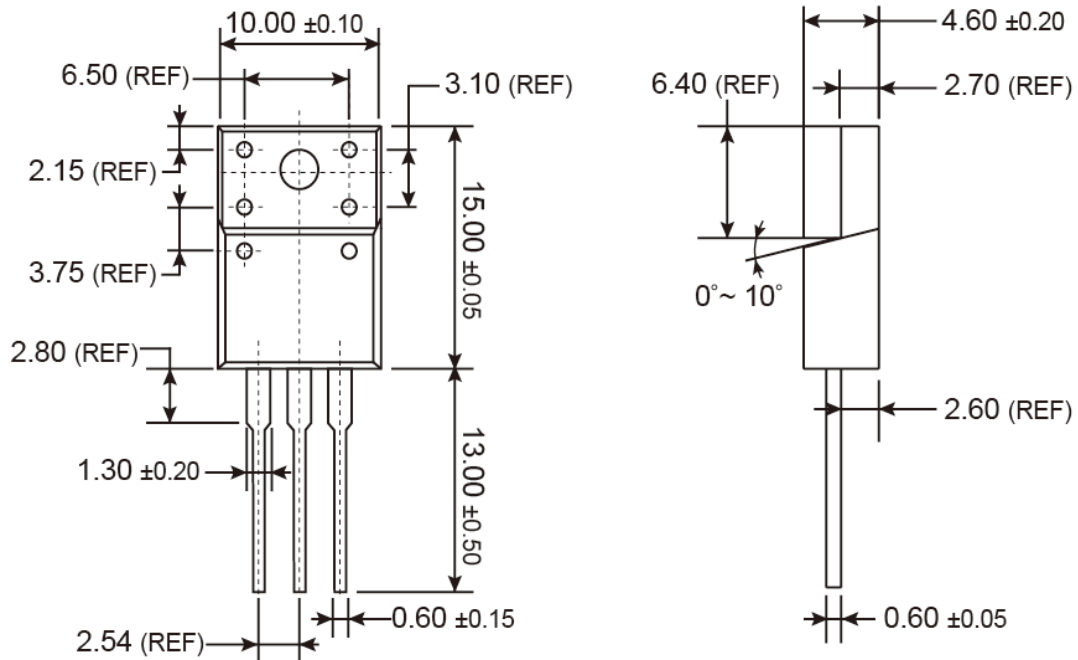
**Marking Diagram**



- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apr, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
- L** = Lot Code

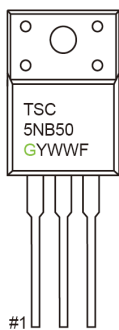


**ITO-220 Mechanical Drawing**



Unit: Millimeters

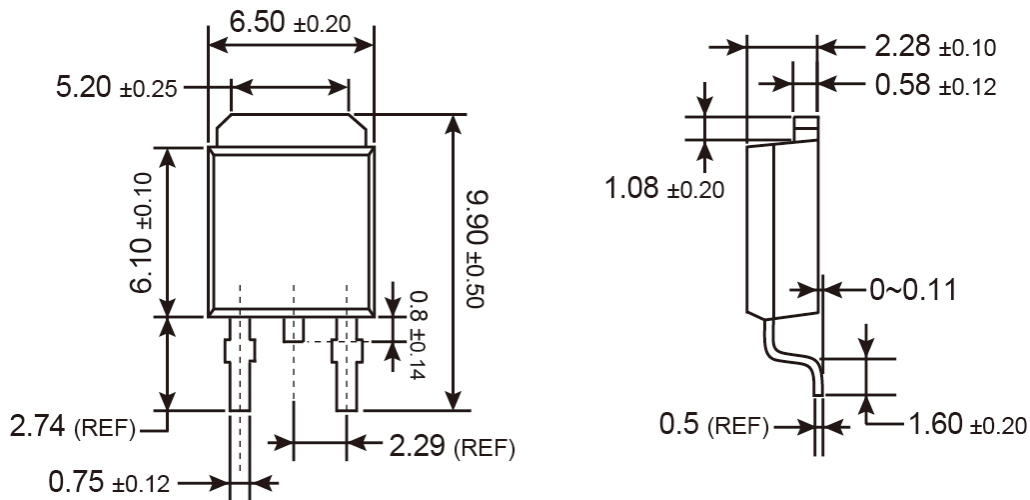
**Marking Diagram**



- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

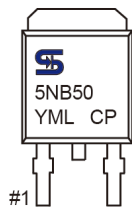


**TO-252 (DPAK) Mechanical Drawing**



Unit: Millimeters

**Marking Diagram**

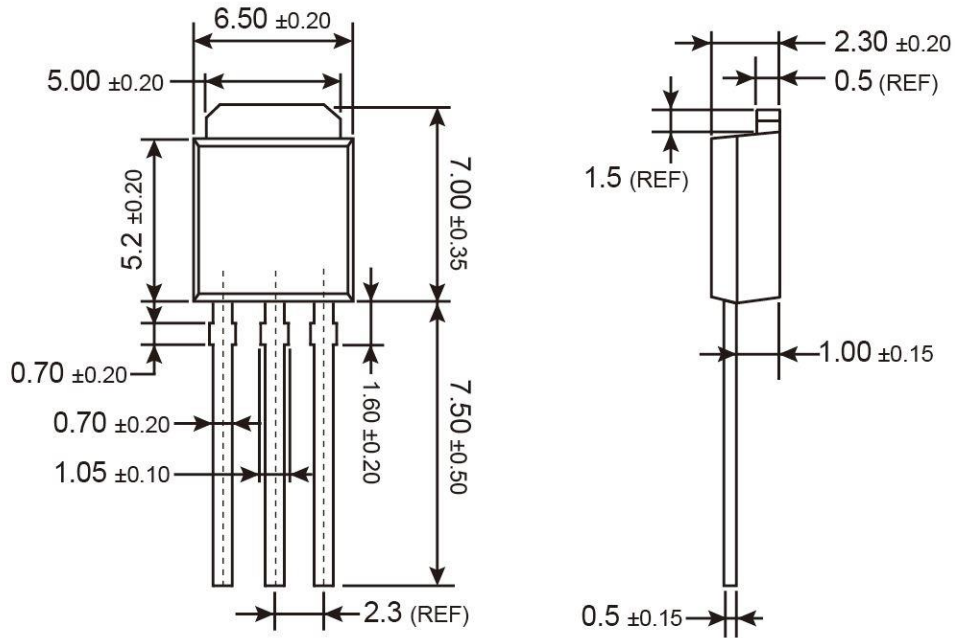


- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
- L** = Lot Code



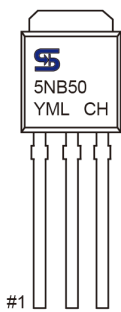


**TO-251 (IPAK) Mechanical Drawing**



Unit: Millimeters

**Marking Diagram**



- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apr, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
- L** = Lot Code

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