



ITO-220



TO-251 (IPAK)



**Pin Definition:**

1. Gate
2. Drain
3. Source

**Key Parameter Performance**

Parameter	Value	Unit
$V_{DS}$	600	V
$R_{DS(on)}$ (max)	0.38	Ω
$Q_g$	20.5	nC

TO-252 (DPAK)



**Features**

- Super-Junction technology
- High performance due to small figure-of-merit
- High ruggedness performance
- High commutation performance

**Application**

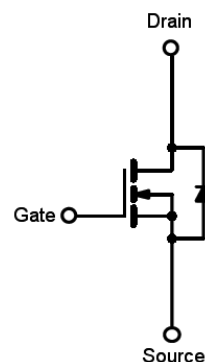
- Power Supply.
- Lighting

**Ordering Information**

Part No.	Package	Packing
TSM60N380CI C0G	ITO-220	50pcs / Tube
TSM60N380CH C5G	TO-251	75pcs / Tube
TSM60N380CP 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** ( $T_A=25^{\circ}C$  unless otherwise noted)

Parameter	Symbol	Limit		Unit
		ITO-220	IPAK/DPAK	
Drain-Source Voltage	$V_{DS}$	600		V
Gate-Source Voltage	$V_{GS}$	±30		V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	11		A
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	33		A
Total Power Dissipation @ $T_C=25^{\circ}C$	$P_{DTOT}$	33	125	W
Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	169		mJ
Single Pulsed Avalanche Current <sup>(Note 3)</sup>	$I_{AS}$	2.6		A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	- 55 to +150		°C



## Thermal Performance

Parameter	Symbol	Limit		Unit
		ITO-220	IPAK/DPAK	
Junction to Case Thermal Resistance	$R_{\theta JC}$	3.8	1	°C/W
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	62		°C/W

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

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2	--	4	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	$I_{GSS}$	--	--	±100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	$I_{DSS}$	--	--	1	μA
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 5.5A$	$R_{DS(ON)}$	--	0.31	0.38	Ω
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = 380V, I_D = 11A, V_{GS} = 10V$	$Q_g$	--	20.5	--	nC
Gate-Source Charge		$Q_{gs}$	--	4.8	--	
Gate-Drain Charge		$Q_{gd}$	--	6.5	--	
Input Capacitance	$V_{DS} = 100V, V_{GS} = 0V, f = 1.0MHz$	$C_{iss}$	--	1040	--	pF
Output Capacitance		$C_{oss}$	--	66	--	
Gate Resistance	$f=1MHz, \text{open drain}$	$R_g$	--	3.2	--	Ω
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = 380V, R_{GEN} = 35\Omega, I_D = 11A, V_{GS} = 10V,$	$t_{d(on)}$	--	24	--	ns
Turn-On Rise Time		$t_r$	--	28	--	
Turn-Off Delay Time		$t_{d(off)}$	--	70	--	
Turn-Off Fall Time		$t_f$	--	60	--	
<b>Source-Drain Diode</b> (Note 4)						
Forward On Voltage	$I_S = 11A, V_{GS} = 0V$	$V_{SD}$	--	--	1.4	V
Reverse Recovery Time	$V_R = 200V, I_S = 5.5A, di_f/dt = 100A/\mu s$	$t_{rr}$	--	210	--	ns
Reverse Recovery Charge		$Q_{rr}$	--	1.8	--	μC

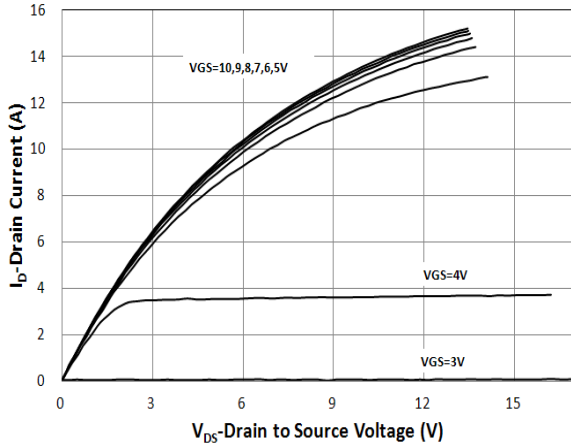
### Notes:

1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3.  $L=50mH, I_{AS}=2.6A, V_{DD}=50V, R_G=25\Omega, \text{Starting } T_J=25^\circ\text{C}$
4. Pulse test:  $PW \leq 300\mu s, \text{duty cycle} \leq 2\%$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

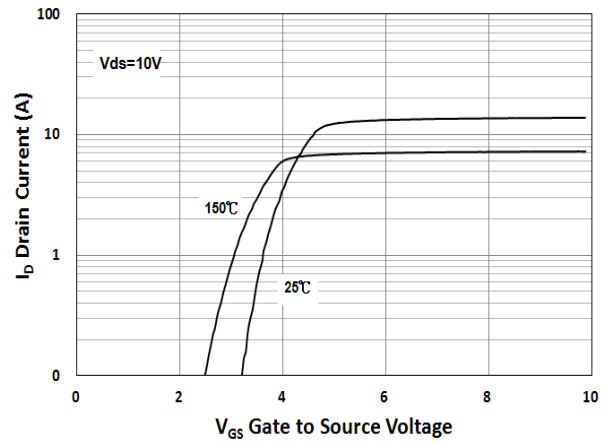


## Electrical Characteristics Curves

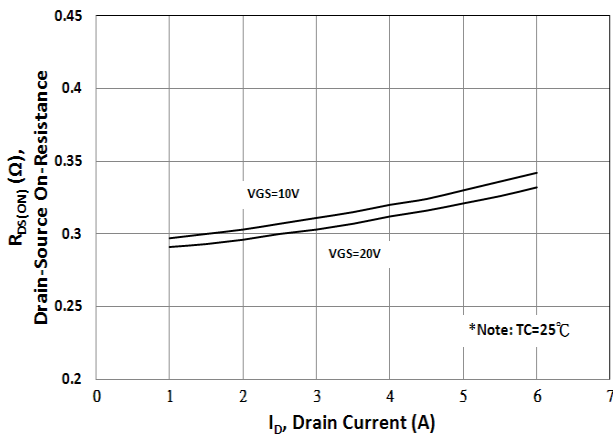
**Output Characteristics**



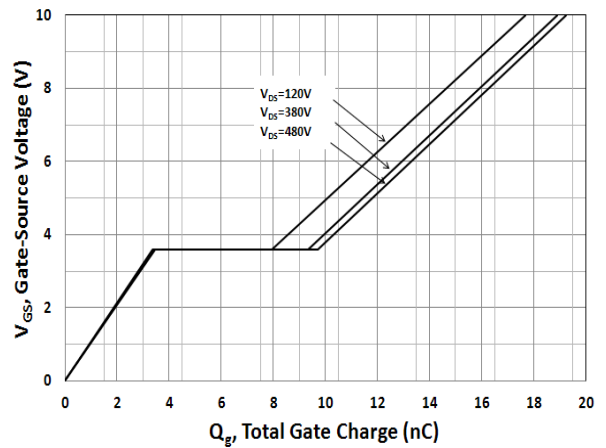
**Transfer Characteristics**



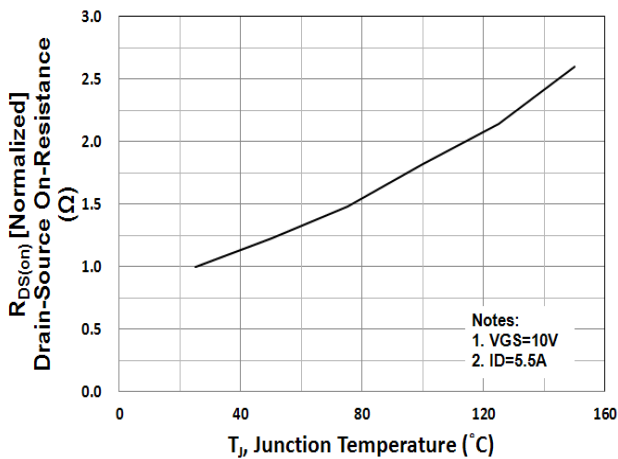
**On-Resistance vs. Drain Current**



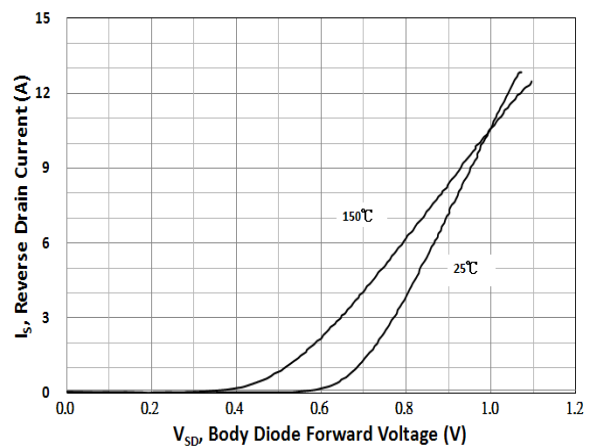
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**

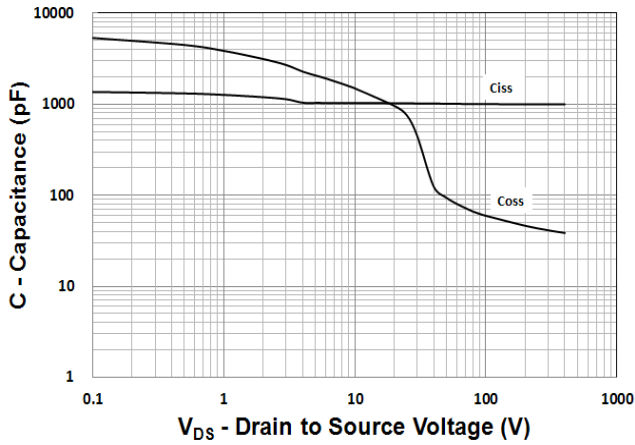


**Source-Drain Diode Forward Current vs. Voltage**

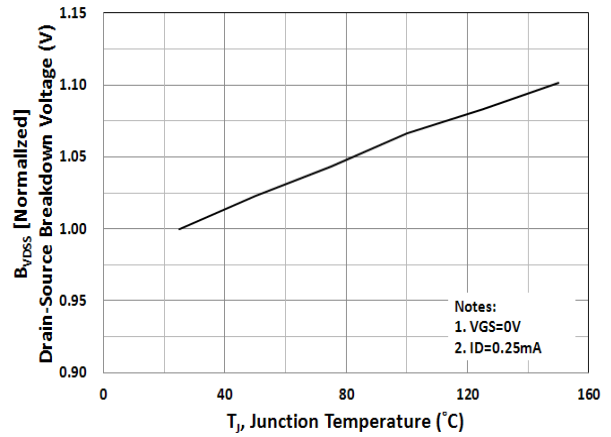


## Electrical Characteristics Curves

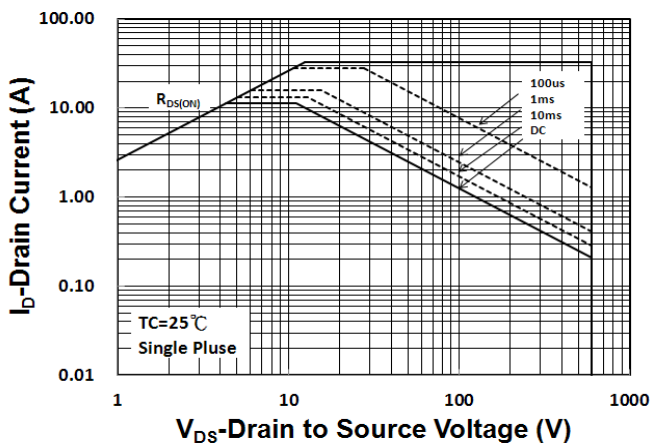
Capacitance vs. Drain-Source Voltage



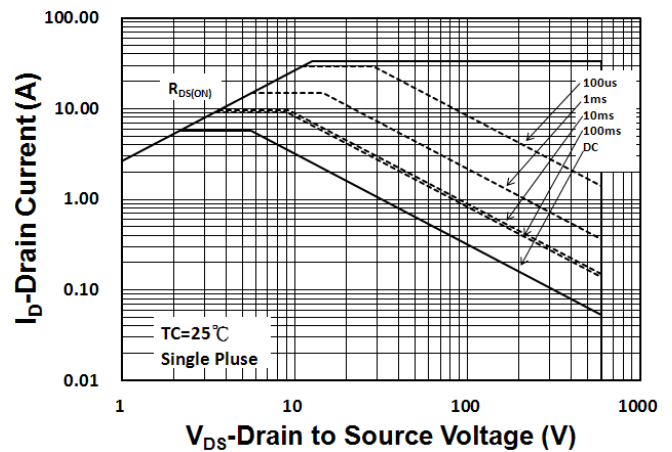
$BV_{DSS}$  vs. Junction Temperature



Maximum Safe Operating Area (DPAK/IPAK)



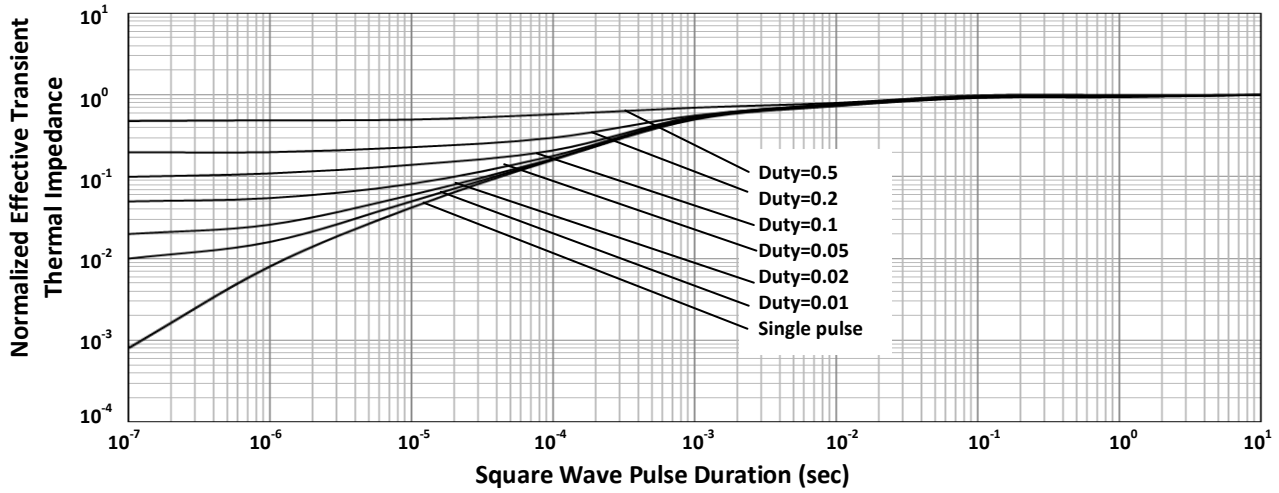
Maximum Safe Operating Area (ITO-220)



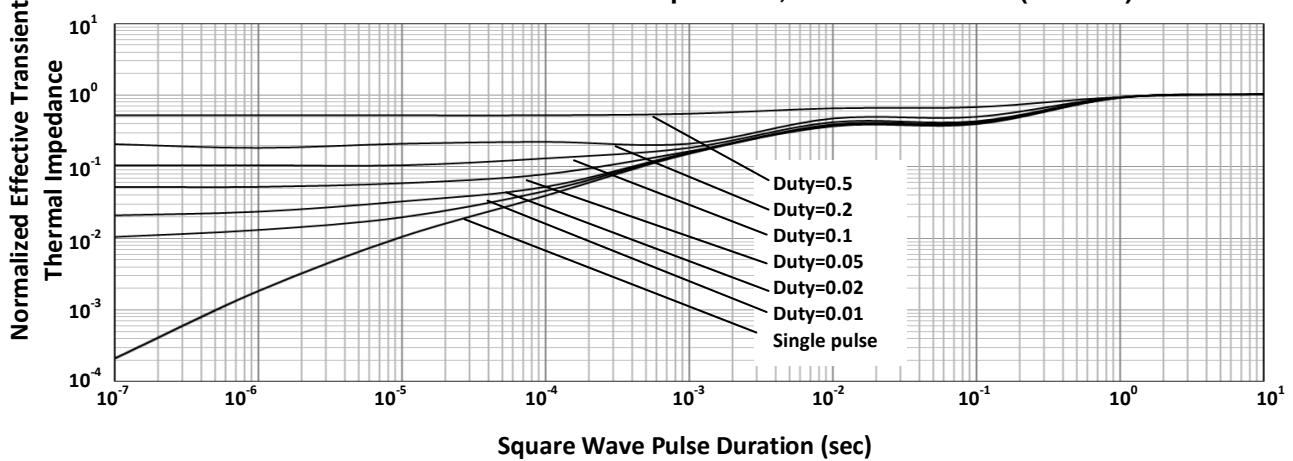


**Electrical Characteristics Curve**

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

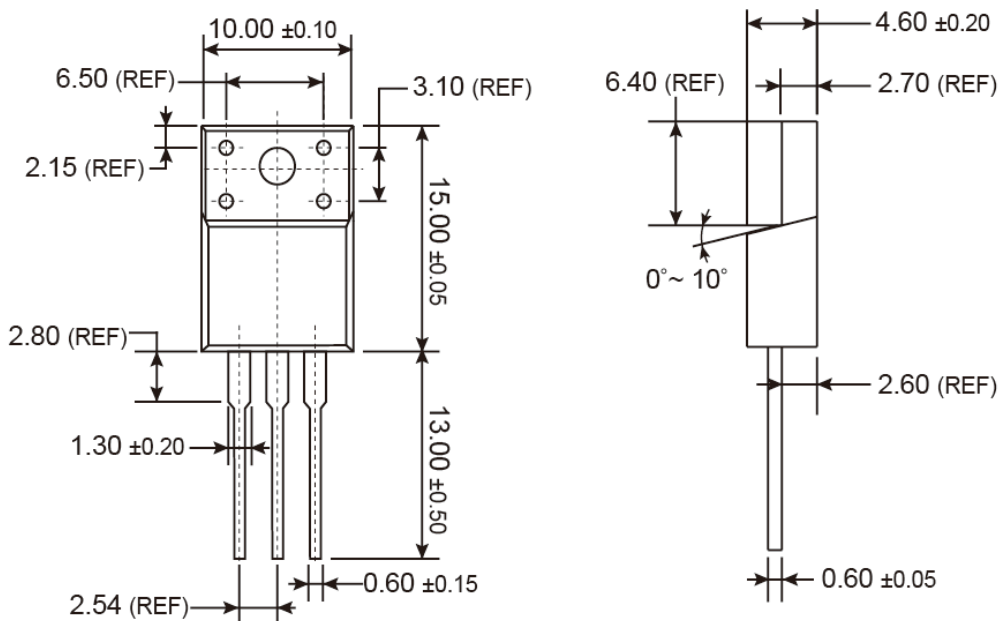


**Normalized Thermal Transient Impedance, Junction-to-Case (ITO-220)**



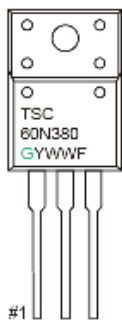


## ITO-220 Mechanical Drawing



Unit: Millimeters

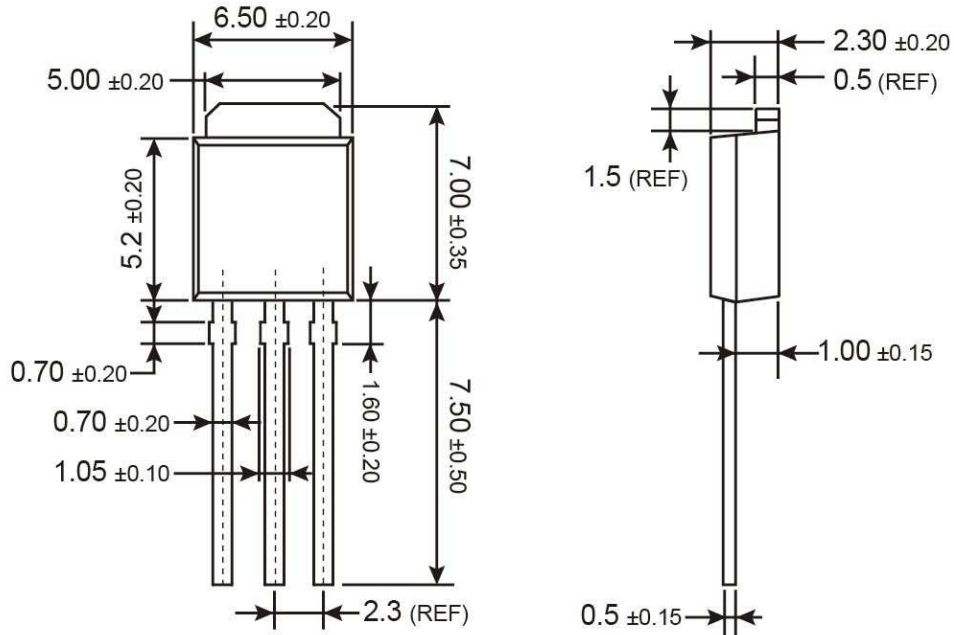
## Marking Diagram



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

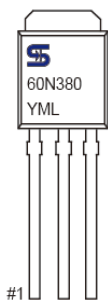


## TO-251 (IPAK) Mechanical Drawing



Unit: Millimeters

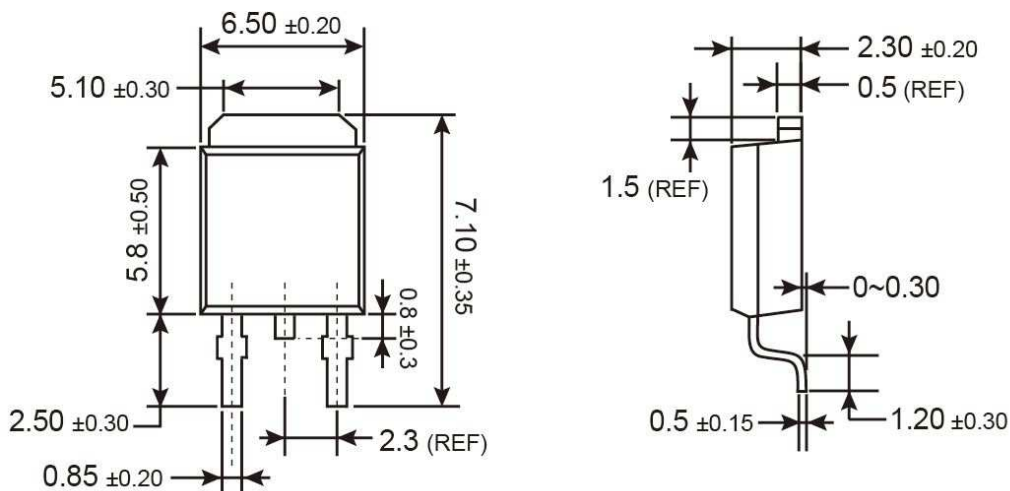
## Marking Diagram



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



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