

**Pin Definition:**

1. Gate
2. Drain
3. Source

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
900	5.1 @ $V_{GS}=10V$	1.5

**General Description**

The TSM3N90 N-Channel Power MOSFET is produced by new advance planar process. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

**Features**

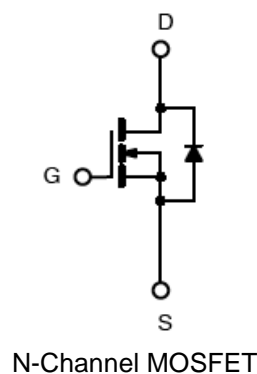
- Low  $R_{DS(ON)}$  4.3 $\Omega$  (Typ.)
- Low gate charge typical @ 17nC (Typ.)
- Low  $C_{rss}$  typical @ 8.7pF (Typ.)

**Ordering Information**

Part No.	Package	Packing
TSM3N90CH C5G	TO-251	75pcs / Tube
TSM3N90CP ROG	TO-252	2.5Kpcs / 13" Reel
TSM3N90CZ C0	TO-220	50pcs / Tube
TSM3N90CI C0	ITO-220	50pcs / Tube

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

**Block Diagram**



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

Parameter	Symbol	Limit			Unit
		IPAK/DPAK	ITO-220	TO-220	
Drain-Source Voltage	$V_{DS}$	900			V
Gate-Source Voltage	$V_{GS}$	$\pm 30$			V
Continuous Drain Current	$I_D$	$T_C = 25^\circ C$			A
		$T_C = 100^\circ C$			A
Pulsed Drain Current *	$I_{DM}$	10			A
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	16.6			mJ
Avalanche Current (Repetitive) (Note 1)	$I_{AR}$	2.5			A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	9.4			mJ
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5			V/ns
Total Power Dissipation @ $T_C = 25^\circ C$	$P_{TOT}$	94	32	94	W
Operating Junction Temperature	$T_J$	150			$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to +150			$^\circ C$

**Note:** Limited by maximum junction temperature

### Thermal Performance

Parameter	Symbol	IPAK/DPAK	ITO-220	TO-220	Unit
Thermal Resistance - Junction to Case	$R\theta_{JC}$	1.33	1.33	3.9	°C/W
Thermal Resistance - Junction to Ambient	$R\theta_{JA}$	110	62.5		

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

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	900	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 1.25A$	$R_{DS(ON)}$	--	4.3	5.1	$\Omega$
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	$V_{DS} = 900V, V_{GS} = 0V$	$I_{DSS}$	--	--	10	$\mu A$
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transfer Conductance	$V_{DS} = 30V, I_D = 1.25A$	$g_{fs}$	--	3	--	S
<b>Dynamic</b>						
Total Gate Charge	$V_{DS} = 720V, I_D = 2.5A,$ $V_{GS} = 10V$	$Q_g$	--	17	--	nC
Gate-Source Charge		$Q_{gs}$	--	2.4	--	
Gate-Drain Charge		$Q_{gd}$	--	6.6	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	748	--	pF
Output Capacitance		$C_{oss}$	--	55	--	
Reverse Transfer Capacitance		$C_{rss}$	--	8.7	--	
<b>Switching</b>						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 2.5A,$ $V_{DD} = 450V, R_G = 25\Omega$	$t_{d(on)}$	--	16	--	nS
Turn-On Rise Time		$t_r$	--	25	--	
Turn-Off Delay Time		$t_{d(off)}$	--	63	--	
Turn-Off Fall Time		$t_f$	--	31	--	
<b>Source-Drain Diode Ratings and Characteristic</b>						
Source Current	Integral reverse diode in the MOSFET	$I_S$	--	--	2.5	A
Source Current (Pulse)		$I_{SM}$	--	--	10	A
Diode Forward Voltage	$I_S = 2.5A, V_{GS} = 0V$	$V_{SD}$	--	--	1.5	V
Reverse Recovery Time	$V_{GS} = 0V, I_S = 2.5A,$	$t_{fr}$	--	355	--	nS
Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	$Q_{fr}$	--	1.8	--	$\mu C$

**Note 1:** Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

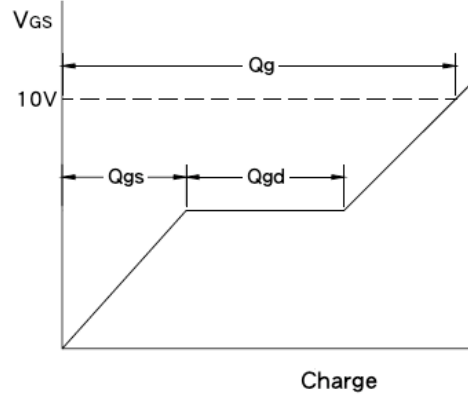
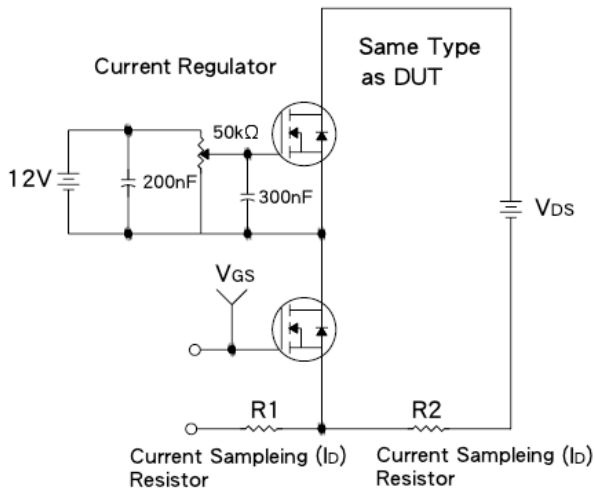
**Note 2:**  $V_{DD} = 50V, I_{AS} = 2.5A, L = 5mH, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$

**Note 3:**  $I_{SD} \leq 2.5A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ C$

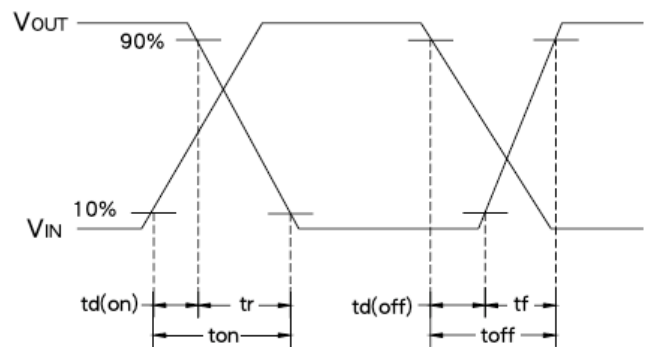
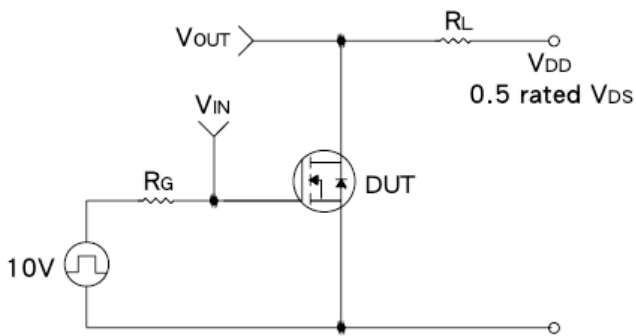
**Note 4:** Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$

**Note 5:** Essentially Independent of Operating Temperature

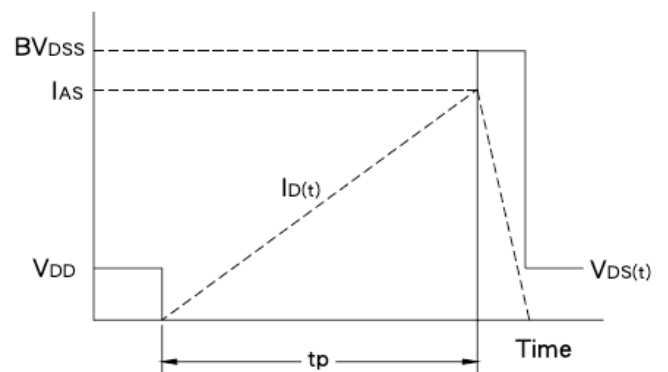
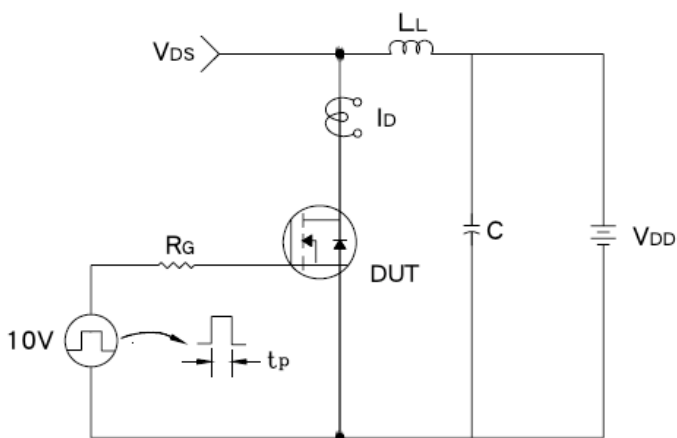
### Gate Charge Test Circuit & Waveform



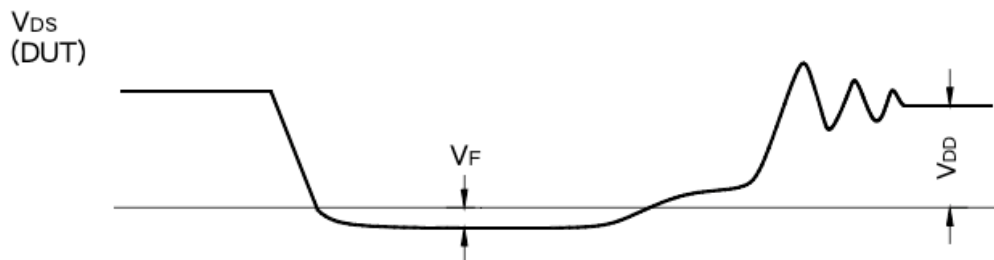
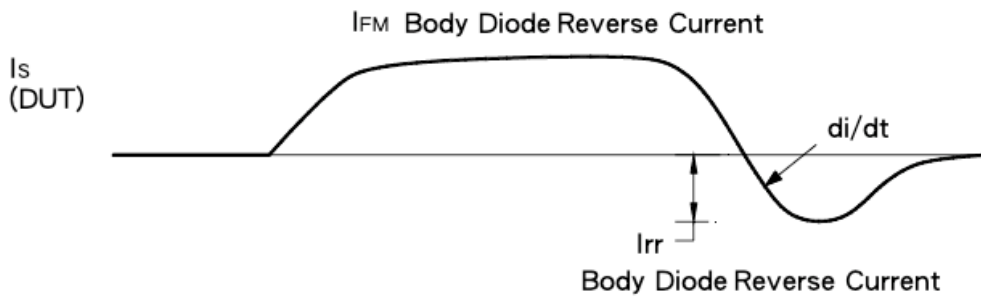
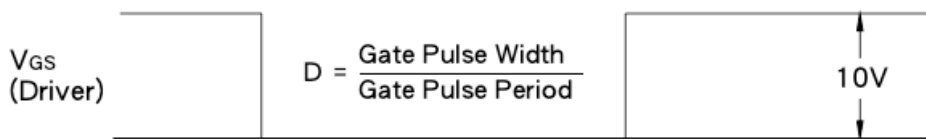
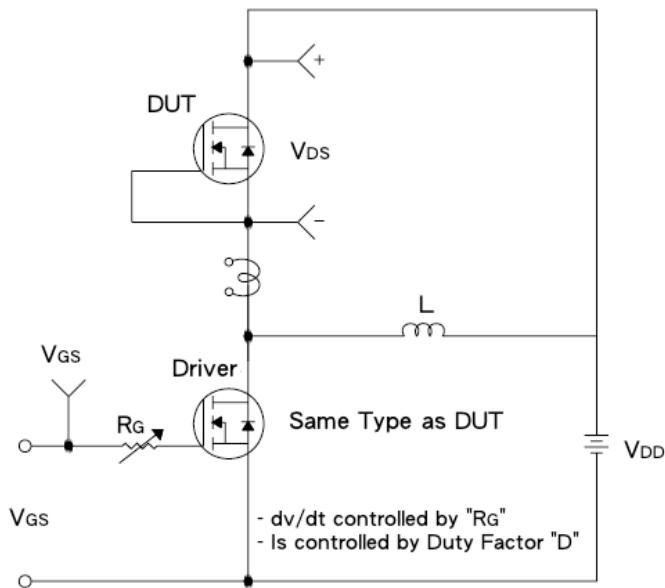
### Resistive Switching Test Circuit & Waveform



### E<sub>AS</sub> Test Circuit & Waveform

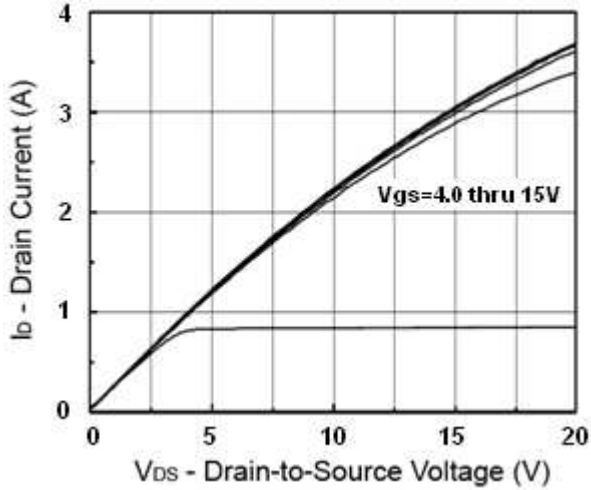


**Diode Reverse Recovery Time Test Circuit & Waveform**

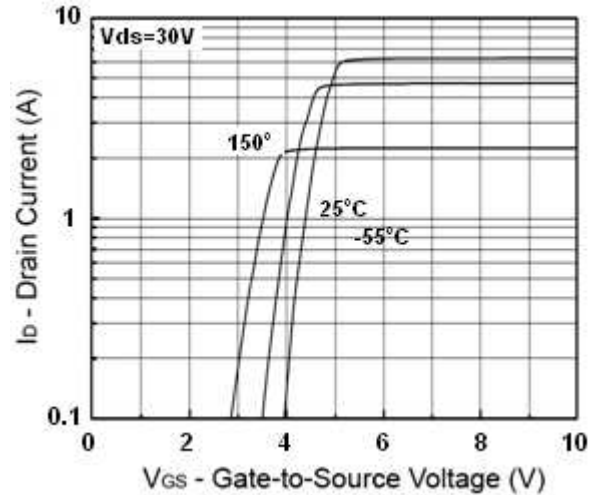


**Electrical Characteristics Curve** ( $T_c = 25^\circ\text{C}$ , unless otherwise noted)

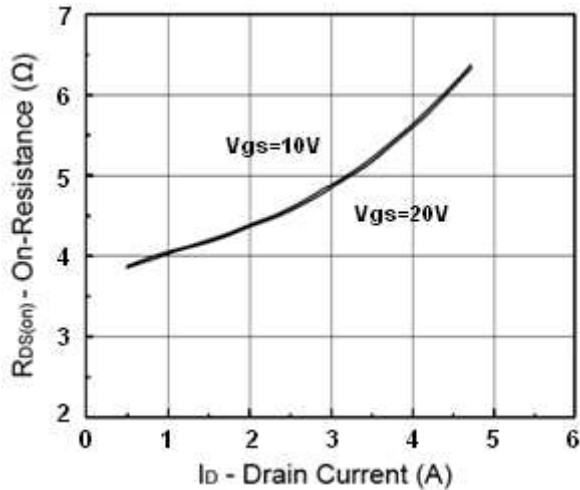
**Output Characteristics**



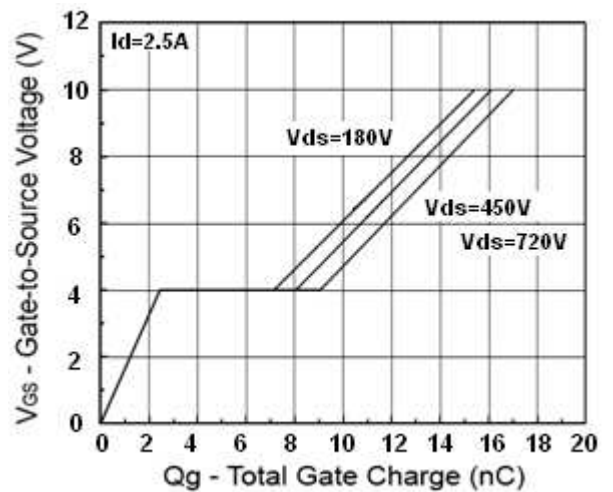
**Transfer Characteristics**



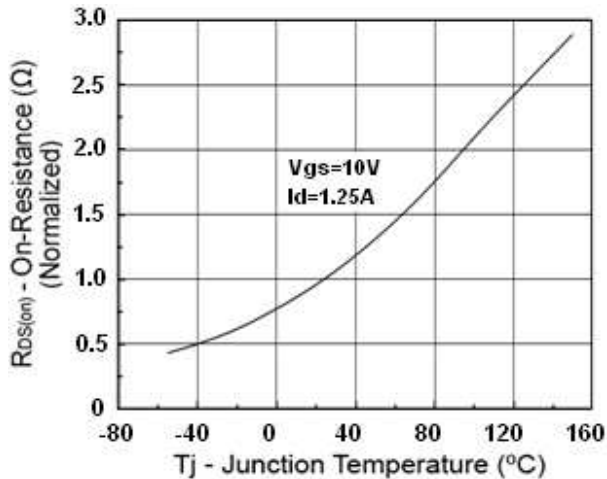
**On-Resistance vs. Drain Current**



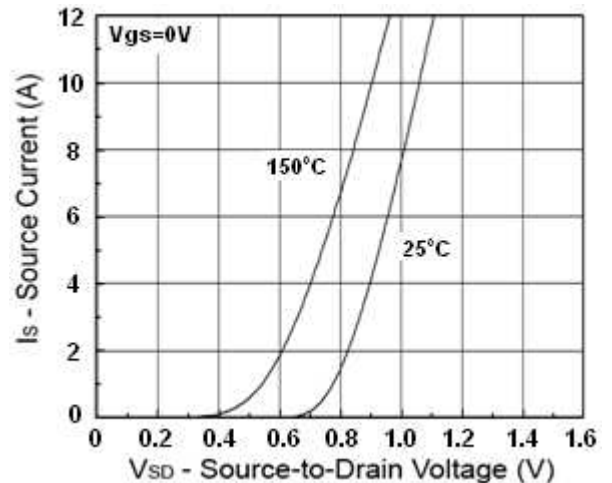
**Gate Charge**



**On-Resistance vs. Junction Temperature**

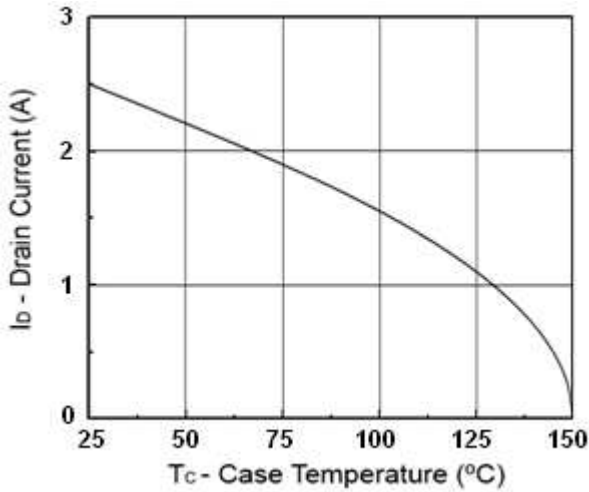


**Source-Drain Diode Forward Voltage**

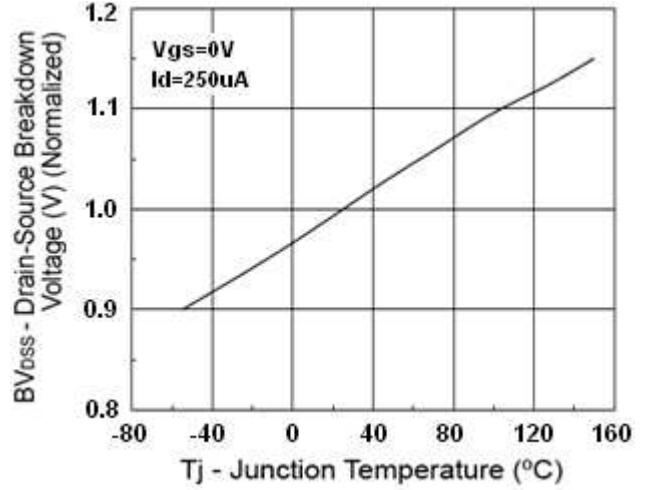


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

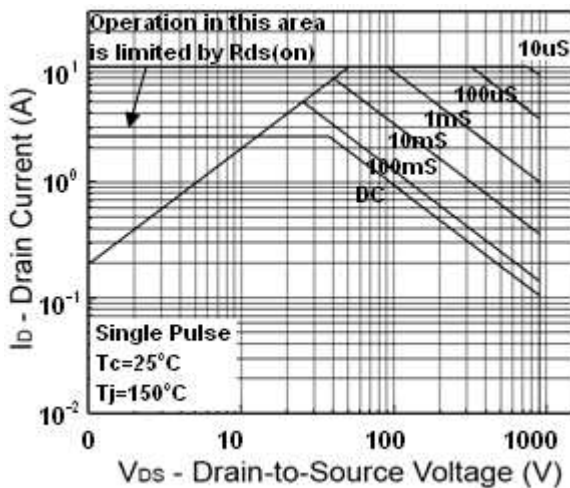
**Drain Current vs. Case Temperature**



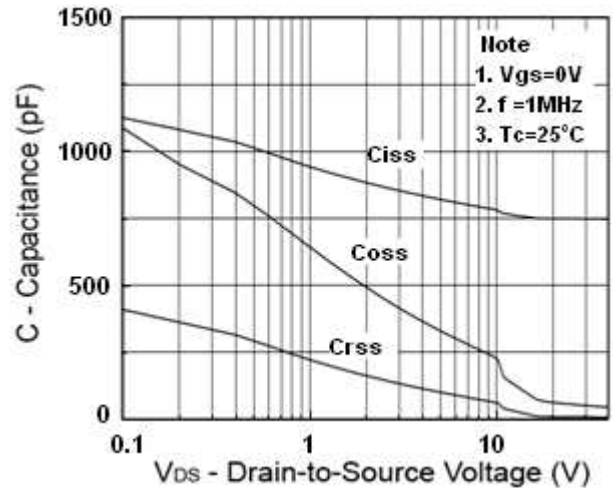
**$BV_{DSS}$  vs. Junction Temperature**



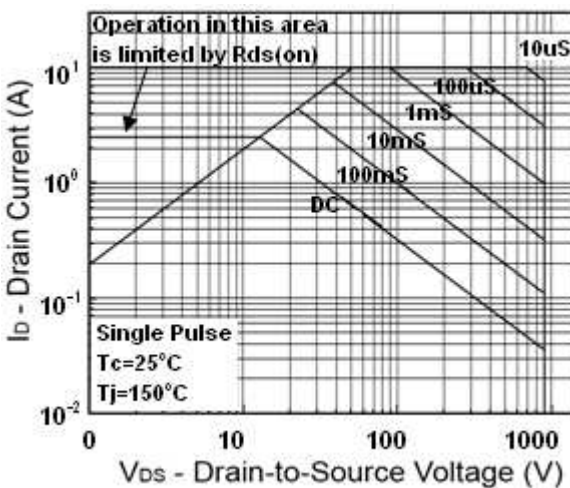
**Maximum Safe Operating Area**



**Capacitance vs. Drain-Source Voltage**



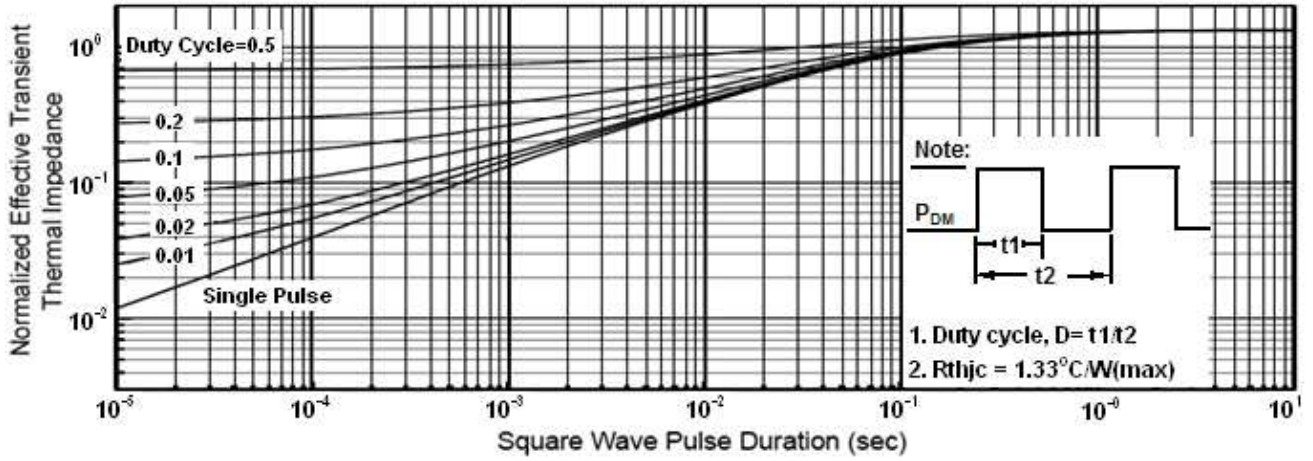
**Maximum Safe Operating Area (ITO-220)**



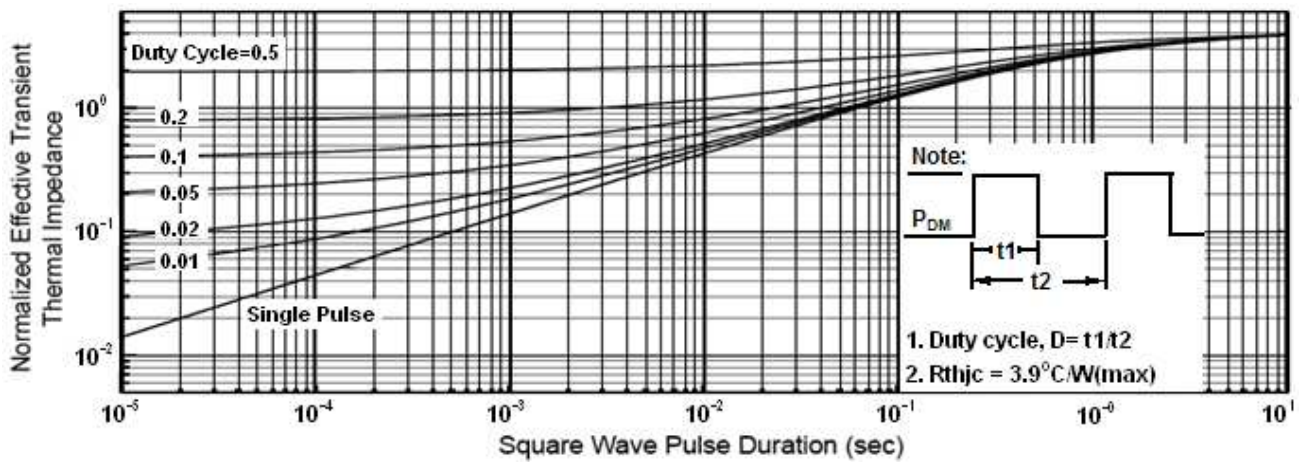


**Electrical Characteristics Curve** ( $T_a = 25^{\circ}\text{C}$ , unless otherwise noted)

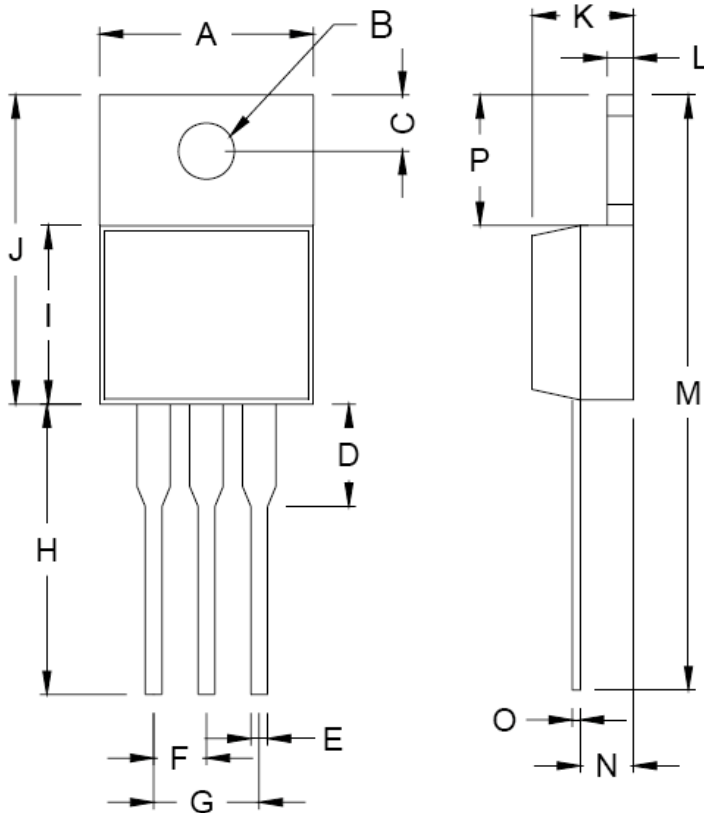
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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



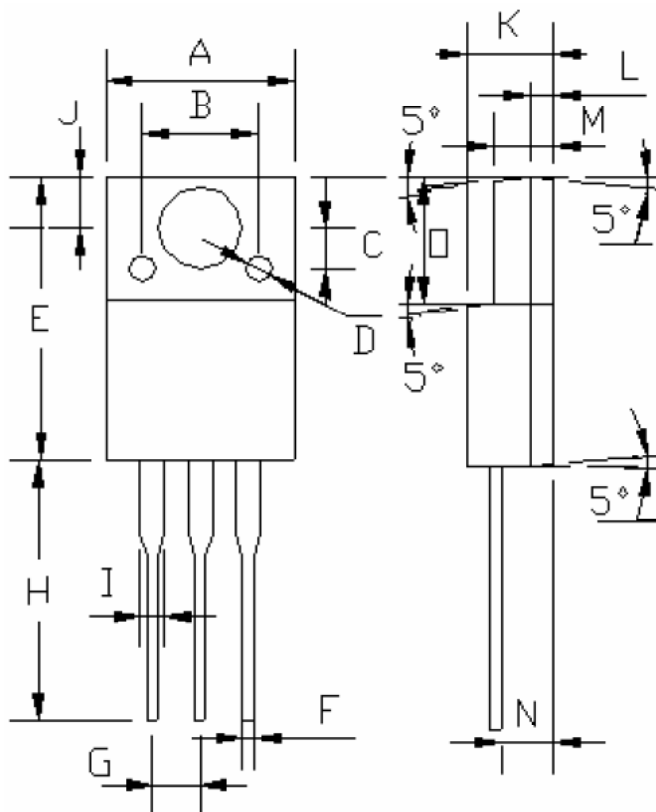
**TO-220 Mechanical Drawing**



DIM	TO-220 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.00	10.50	0.394	0.413
B	3.74	3.91	0.147	0.154
C	2.44	2.94	0.096	0.116
D	--	6.35	--	0.250
E	0.38	1.10	0.015	0.043
F	2.34	2.71	0.092	0.107
G	4.69	5.43	0.185	0.214
H	12.70	14.73	0.500	0.580
J	8.38	9.38	0.330	0.369
K	14.22	16.51	0.560	0.650
L	3.55	4.82	0.140	0.190
M	1.16	1.40	0.046	0.055
N	27.70	29.62	1.091	1.166
O	2.03	2.92	0.080	0.115
P	0.25	0.61	0.010	0.024

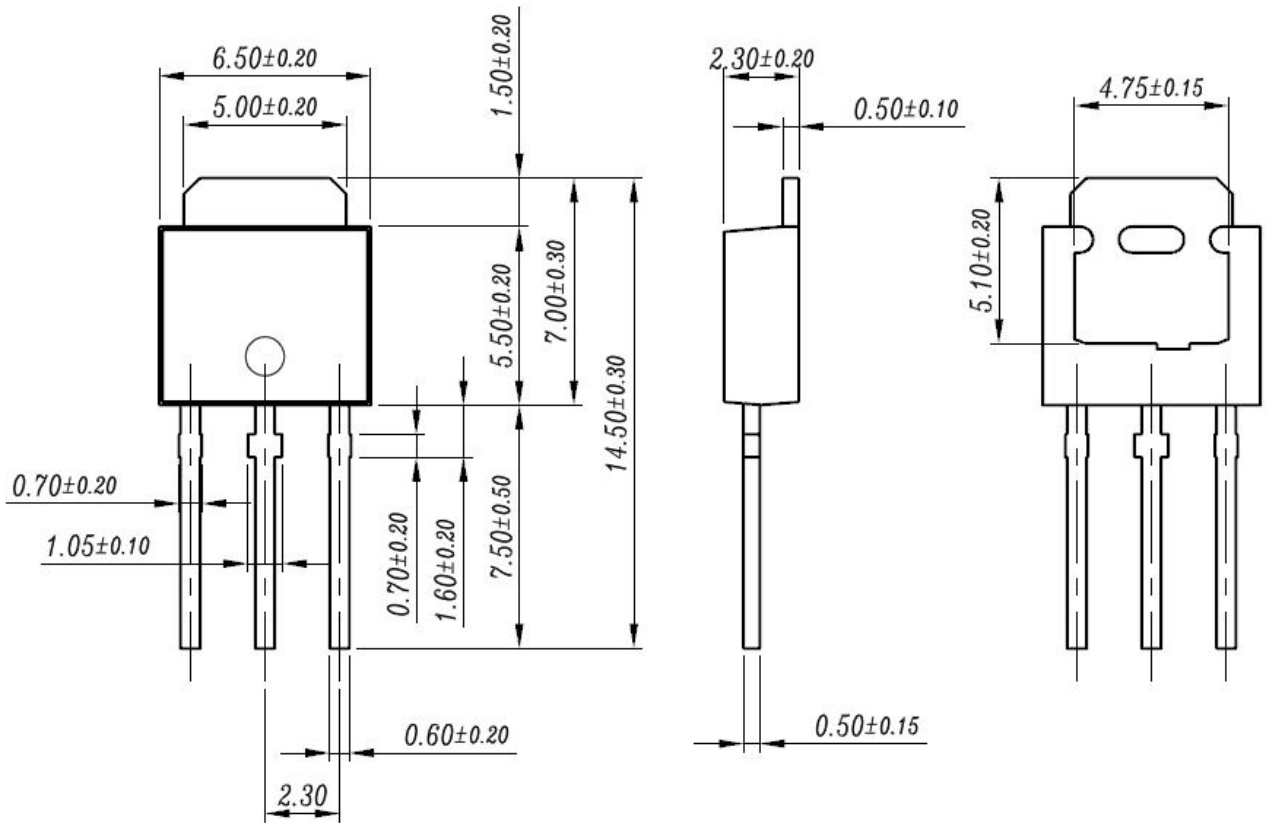


### ITO-220 Mechanical Drawing

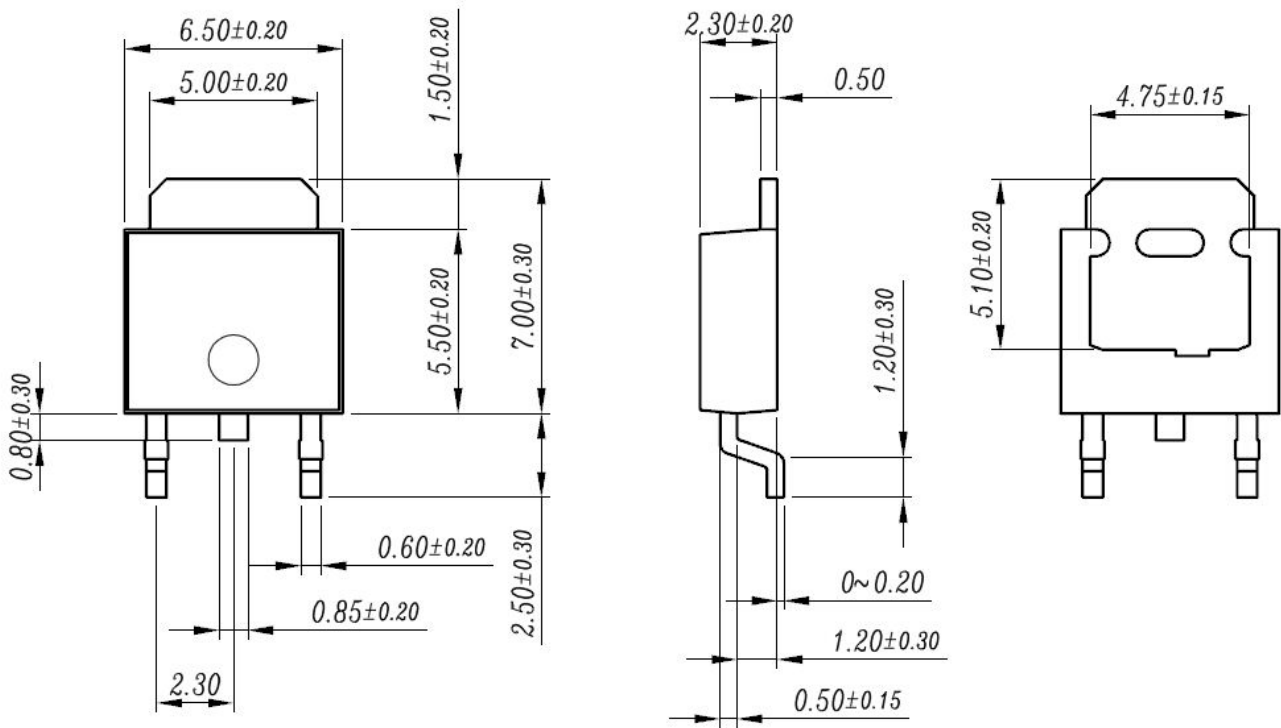


ITO-220 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.04	10.07	0.395	0.396
B	6.20 (typ.)		0.244 (typ.)	
C	2.20 (typ.)		0.087 (typ.)	
D	§ 1.40 (typ.)		§ 0.055 (typ.)	
E	15.0	15.20	0.591	0.598
F	0.52	0.54	0.020	0.021
G	2.35	2.73	0.093	0.107
H	13.50	13.55	0.531	0.533
I	1.11	1.49	0.044	0.058
J	2.60	2.80	0.102	0.110
K	4.49	4.50	0.176	0.177
L	1.15 (typ.)		0.045 (typ.)	
M	3.03	3.05	0.119	0.120
N	2.60	2.80	0.102	0.110
O	6.55	6.65	0.258	0.262

### TO-251 Mechanical Drawing



### TO-252 Mechanical Drawing



Unit: Millimeters

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