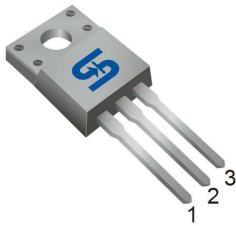
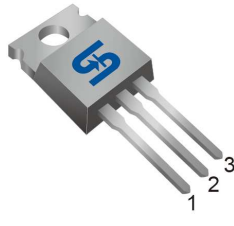


ITO-220



TO-220



Pin Definition:

1. Gate
2. Drain
3. Source

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)
600	1.2 @ $V_{GS}=10V$	3.5

General Description

The TSM7N60 N-Channel enhancement mode Power MOSFET is produced by planar stripe DMOS technology. 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. These devices are well suited for high efficiency switch mode power supply, power factor correction, electronic lamp ballast based on half bridge.

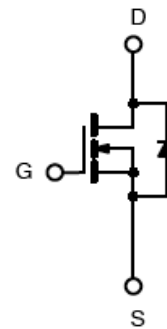
Features

- Low $R_{DS(on)}$ 1.2 Ω (Max.)
- Low gate charge typical @ 28nC (Typ.)
- Low C_{rss} typical @ 12pF (Typ.)
- Fast Switching

Ordering Information

Part No.	Package	Packing
TSM7N60CZ C0	TO-220	50pcs / Tube
TSM7N60CI C0	ITO-220	50pcs / Tube

Block Diagram



N-Channel MOSFET

Absolute Maximum Rating ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current	I_D	7	A
		3.2	A
Pulsed Drain Current *	I_{DM}	28	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	230	mJ
Repetitive Avalanche Current (Note 1)	I_{AR}	7	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	TO-220	125	W
	ITO-220	30	
Operating Junction Temperature	T_J	150	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to +150	$^\circ\text{C}$

* Limited by maximum junction temperature

Thermal Performance

Parameter		Symbol	Limit	Unit
Thermal Resistance - Junction to Case	TO-220	$R\theta_{JC}$	1.0	$^{\circ}\text{C/W}$
	ITO-220		4.2	
Thermal Resistance - Junction to Ambient		$R\theta_{JA}$	62.5	$^{\circ}\text{C/W}$

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

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

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	600	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 3.5A$	$R_{DS(ON)}$	--	1.0	1.2	Ω
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}	--	--	1	μA
	$V_{DS} = 600V, V_{GS} = 0V, T_C=125^{\circ}C$		--	--	50	
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	--	--	± 10	μA
Forward Transfer Conductance	$V_{DS} = 10V, I_D = 3.5A$	g_{fs}	--	7.3	--	S
Diode Forward Voltage	$I_S = 7A, V_{GS} = 0V$	V_{SD}	--	--	1.4	V
Dynamic						
Total Gate Charge	$V_{DS} = 300V, I_D = 7A, V_{GS} = 10V$	Q_g	--	28	--	nC
Gate-Source Charge		Q_{gs}	--	5.5	--	
Gate-Drain Charge		Q_{gd}	--	11	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	C_{iss}	--	950	--	pF
Output Capacitance		C_{oss}	--	85	--	
Reverse Transfer Capacitance		C_{rss}	--	12	--	
Switching						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 7A, V_{DD} = 300V, R_G = 25\Omega$	$t_{d(on)}$	--	16	--	nS
Turn-On Rise Time		t_r	--	60	--	
Turn-Off Delay Time		$t_{d(off)}$	--	80	--	
Turn-Off Fall Time		t_f	--	65	--	
Reverse Recovery Time	$V_{GS} = 0V, I_S = 7A, dI_F/dt = 100A/\mu s$	t_{fr}	--	365	--	nS
Reverse Recovery Charge		Q_{fr}	--	4.23	--	μC

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

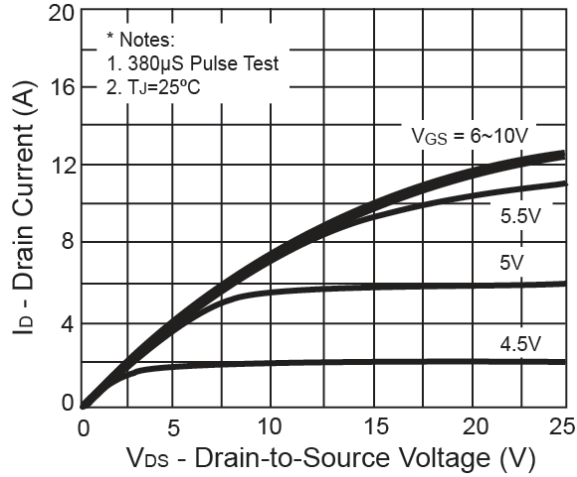
Note 2: $V_{DD} = 50\text{V}, I_{AS} = 7\text{A}, L = 9.8\text{mH}, R_G = 27\Omega$

Note 3: Pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$

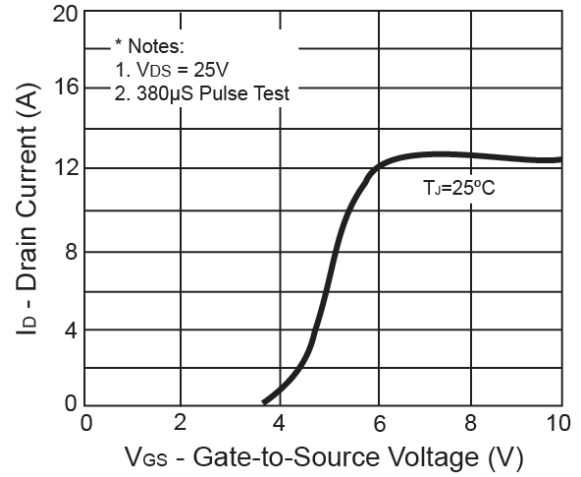
Note 4: Essentially Independent of Operating Temperature

Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

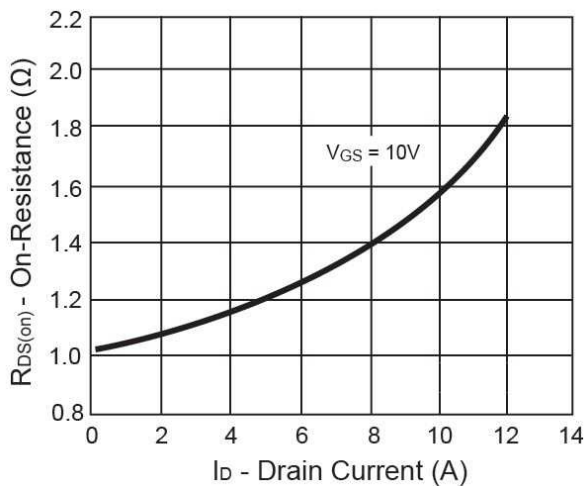
Output Characteristics



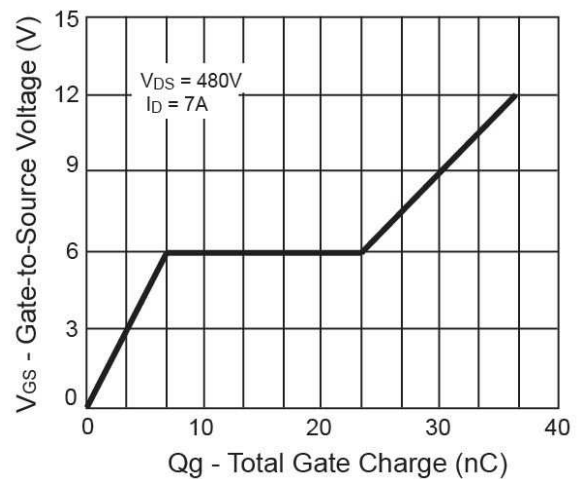
Transfer Characteristics



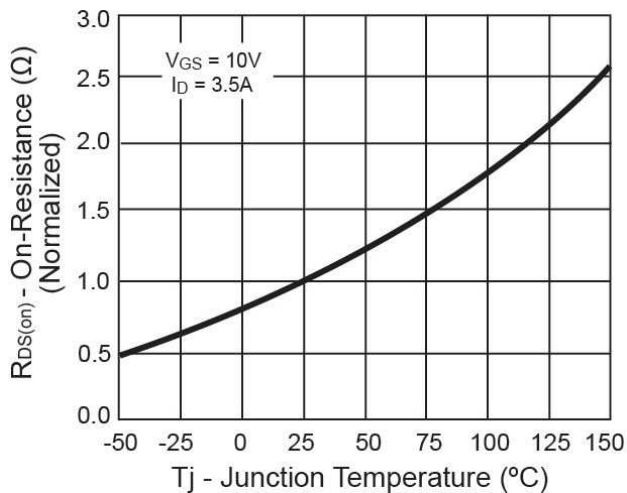
On-Resistance vs. Drain Current



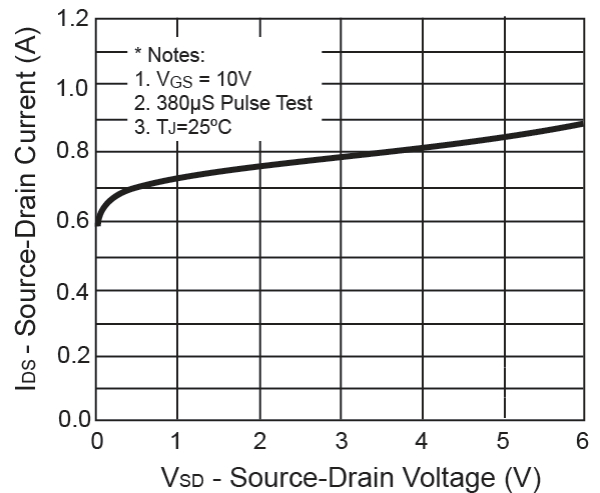
Gate Charge



On-Resistance vs. Junction Temperature

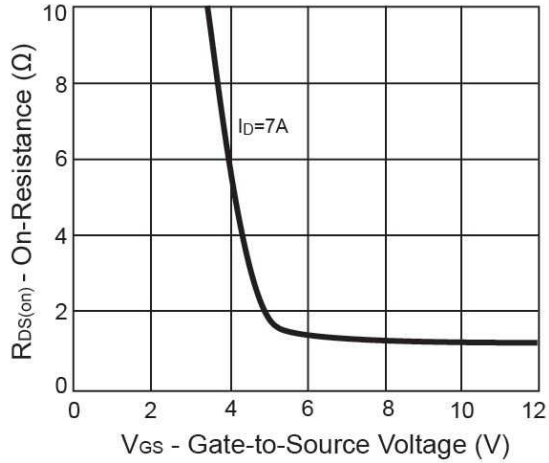


Source-Drain Diode Forward Voltage

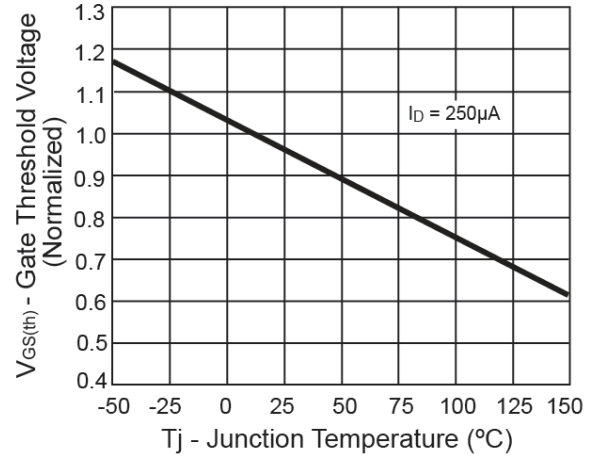


Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

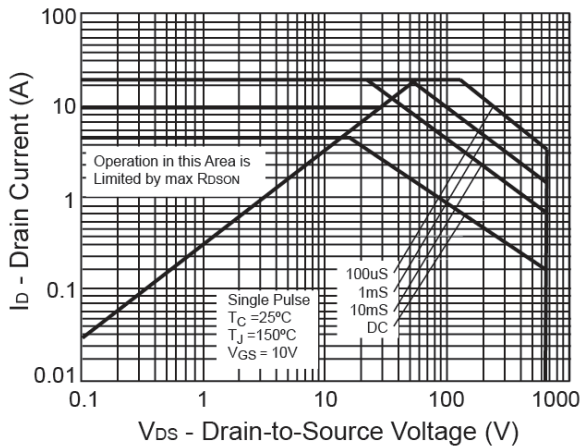
On-Resistance vs. Gate-Source Voltage



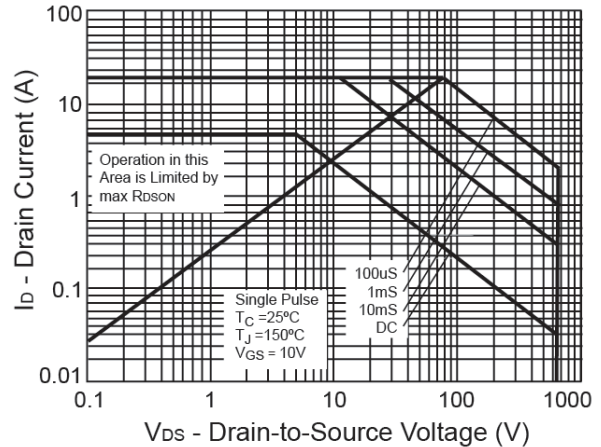
Threshold Voltage



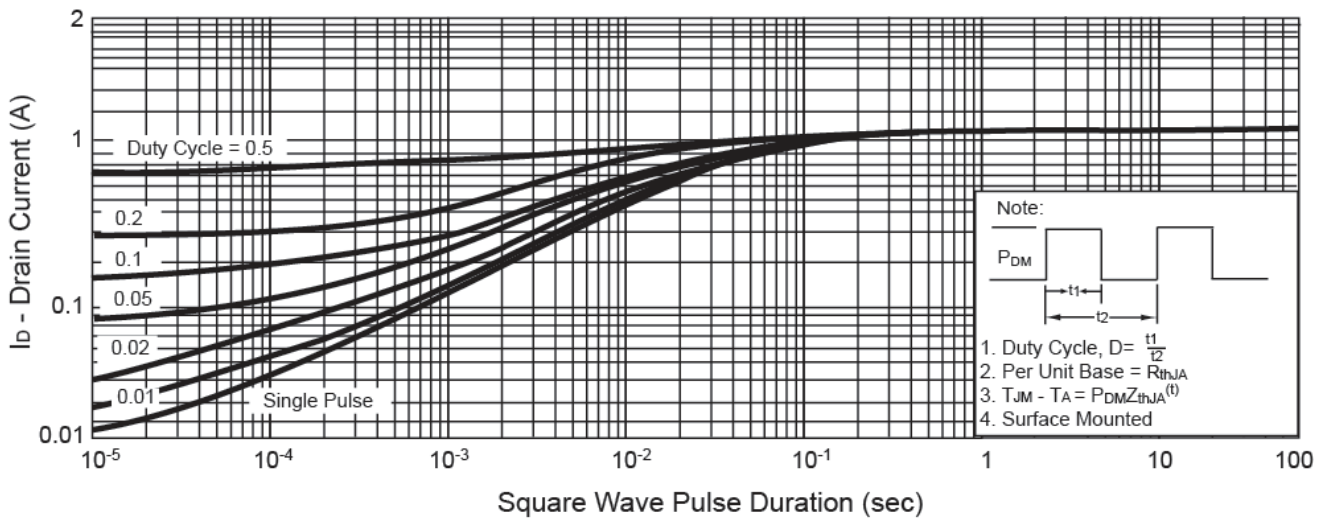
Maximum Safe Operating Area - TO-220



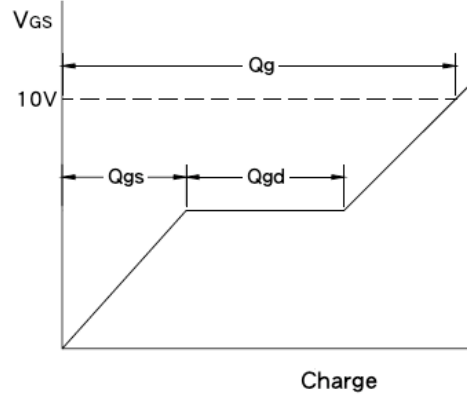
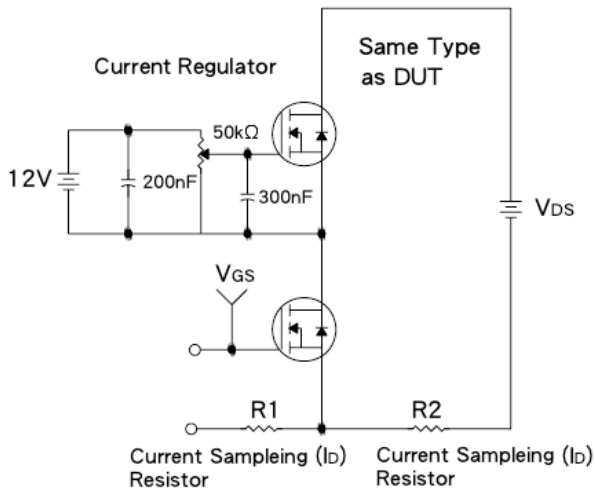
Maximum Safe Operating Area - ITO-220



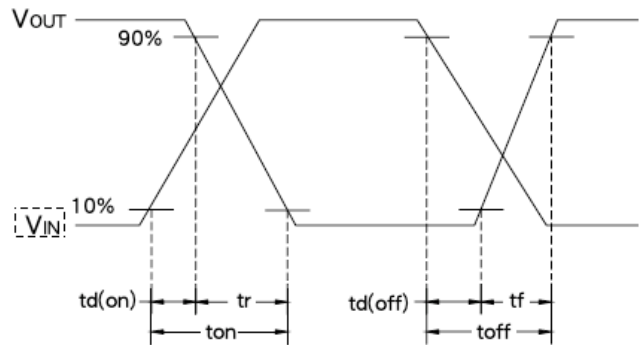
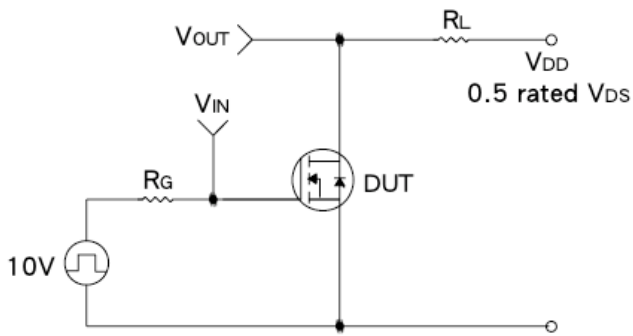
Normalized Thermal Transient Impedance, Junction-to-Ambient



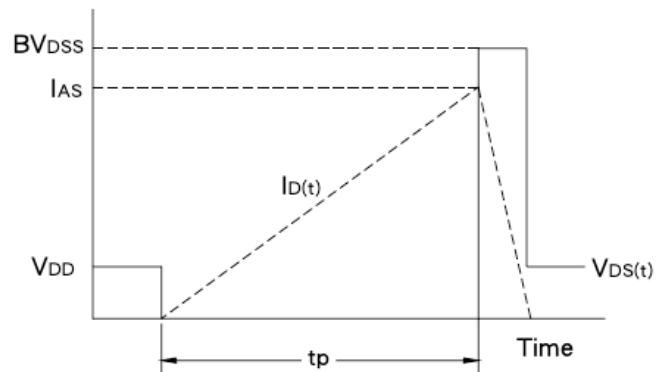
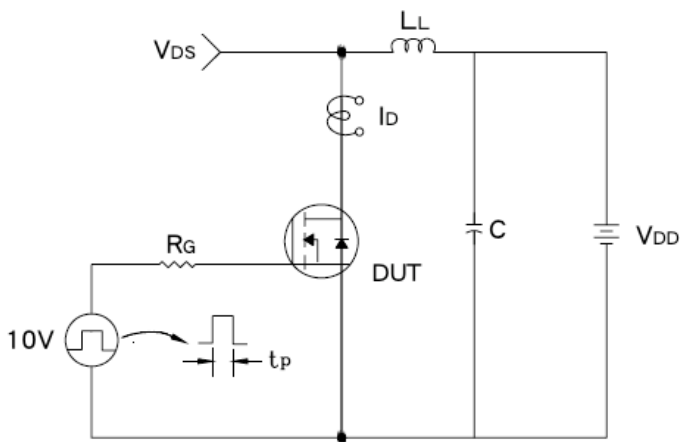
Gate Charge Test Circuit & Waveform



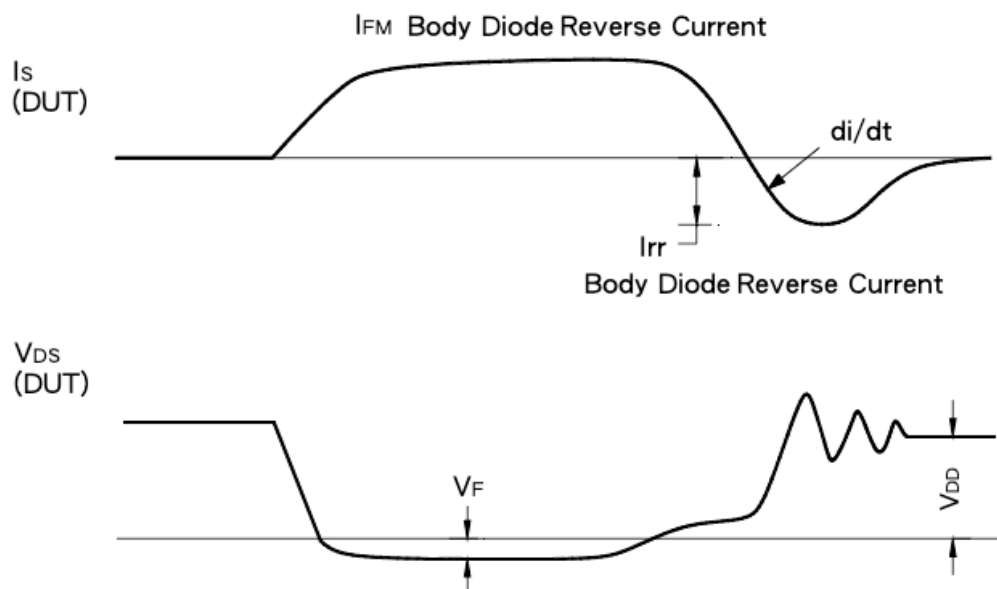
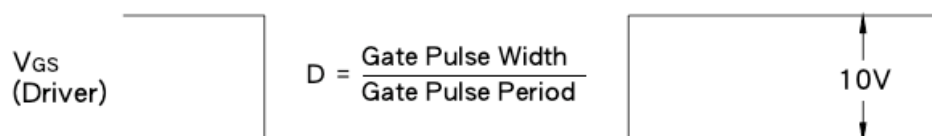
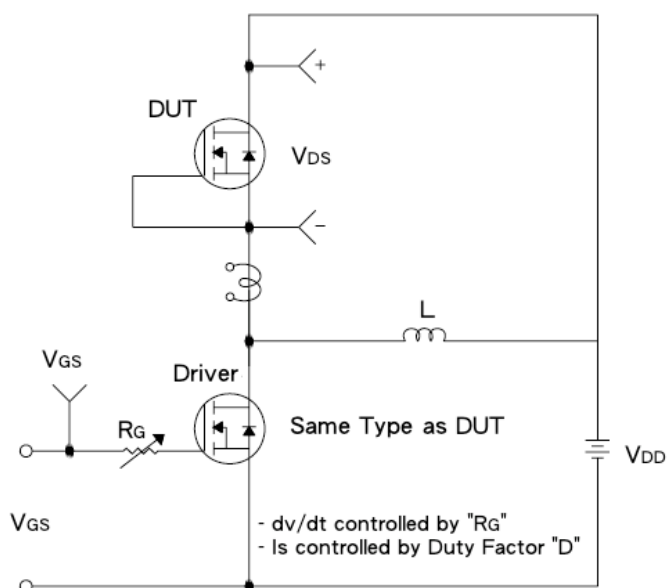
Resistive Switching Test Circuit & Waveform



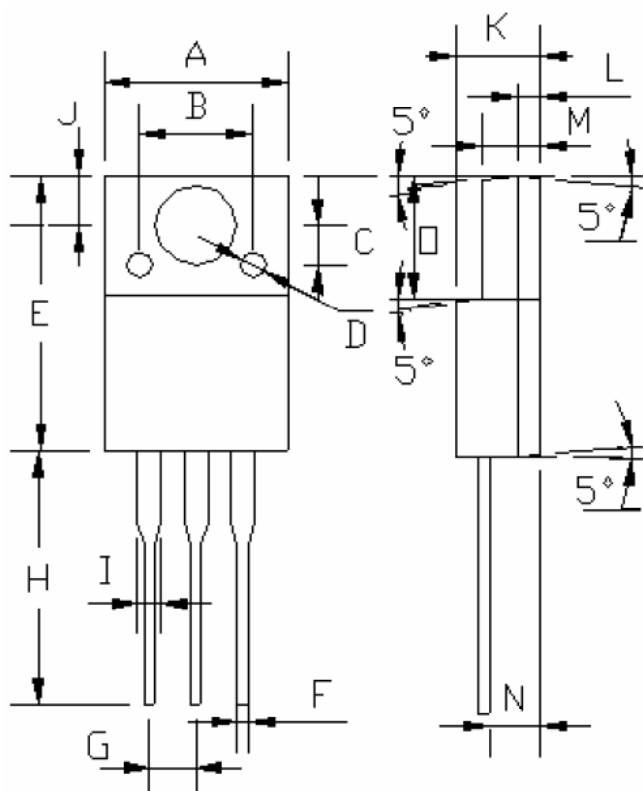
E_{AS} Test Circuit & Waveform



Diode Reverse Recovery Time Test Circuit & Waveform

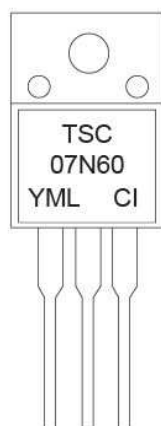


ITO-220 Mechanical Drawing



DIM	ITO-220 DIMENSION			
	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

Marking Diagram



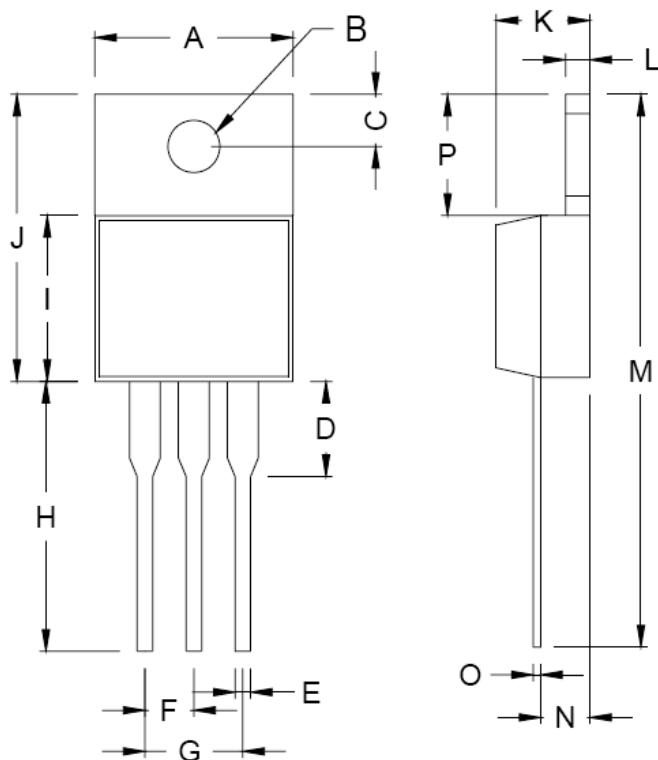
Y = Year Code

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)

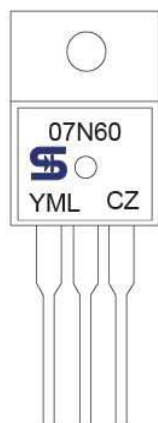
L = Lot Code

TO-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

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