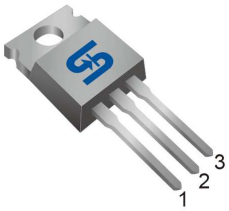
TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TSM9N90

900V N-Channel Power MOSFET

TO-220



ITO-220

Pin Definition:
1. Gate
2. Drain
3. Source

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)	I_D (A)
900	1.4 @ V_{GS}=10V	9

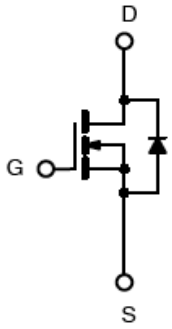
General Description

The TSM9N90 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, electronic lamp ballast based on half bridge.

Features

- Low $R_{DS(ON)}$ 1.4Ω (Max.)
- Low gate charge typical @ 65nC (Typ.)
- Improve dv/dt capability

Block Diagram



N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM9N90CZ C0G	TO-220	50pcs / Tube
TSM9N90CI C0G	ITO-220	50pcs / Tube

Note: "G" denote for Halogen Free Product

Absolute Maximum Rating (Ta = 25°C unless otherwise noted)

Parameter		Symbol	TO-220	ITO-220	Unit
Drain-Source Voltage		V_{DS}	900		V
Gate-Source Voltage		V_{GS}	±30		V
Continuous Drain Current	Tc = 25°C	I_D	9	9 *	A
	Tc = 100°C		5.7	5.7 *	
Pulsed Drain Current *		I_{DM}	36	36 *	A
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5		V
Single Pulse Avalanche Energy (Note 2)		E_{AS}	857		mJ
Avalanche Current (Repetitive) (Note 1)		I_{AR}	9		A
Repetitive Avalanche Energy (Note 1)		E_{AR}	29		mJ
Power Dissipation	Tc = 25°C	P_D	290	48	W
	Derate above 25℃		2.32	0.38	ºC/W
Operating Junction Temperature		T_J	150		ºC
Storage Temperature Range		T_{STG}	-55 to +150		°C

* Limited by maximum junction temperature

TSM9N90

900V N-Channel Power MOSFET

Thermal Performance

Parameter	Symbol	TO-220	ITO-220	Unit
Thermal Resistance - Junction to Case	$R\Theta_{JC}$	0.43	2.6	°C/W
Thermal Resistance - Junction to Ambient	$R\Theta_{JA}$	62.5		

Notes: Surface mounted on FR4 board t ≤ 10sec

Electrical Specifications (Tc = 25°C unless otherwise noted)

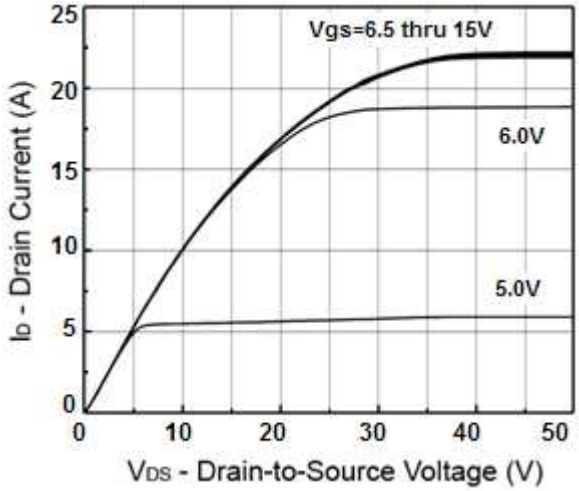
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250uA	BV_{DSS}	900	--	--	V
Drain-Source On-State Resistance	V_{GS} = 10V, I_D = 4.5A	$R_{DS(ON)}$	--	1.13	1.4	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(TH)}$	2.0	--	4.0	V
Zero Gate Voltage Drain Current	V_{DS} = 900V, V_{GS} = 0V	I_{DSS}	--	--	10	uA
Gate Body Leakage	V_{GS} = ±30V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	V_{DS} = 30V, I_D = 4.5A	g_{fs}	--	10	--	S
Diode Forward Voltage	I_S = 9A, V_{GS} = 0V	V_{SD}	--	--	1.5	V
Dynamic [b]						
Total Gate Charge	V_{DS} = 720V, I_D = 9A, V_{GS} = 10V	Q_g	--	65	--	nC
Gate-Source Charge		Q_{gs}	--	11	--	
Gate-Drain Charge		Q_{gd}	--	23	--	
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	2324	--	pF
Output Capacitance		C_{oss}	--	184	--	
Reverse Transfer Capacitance		C_{rss}	--	29	--	
Switching [c]						
Turn-On Delay Time	V_{GS} = 10V, I_D = 9A, V_{DD} = 450V, R_G = 25Ω	$t_{d(on)}$	--	61	--	nS
Turn-On Rise Time		t_r	--	49	--	
Turn-Off Delay Time		$t_{d(off)}$	--	318	--	
Turn-Off Fall Time		t_f	--	100	--	
Reverse Recovery Time	V_{GS} = 0V, I_S = 9A, dI_F/dt = 100A/us	t_{fr}	--	470	--	nS
Reverse Recovery Charge		Q_{fr}	--	4.9	--	uC

Notes:

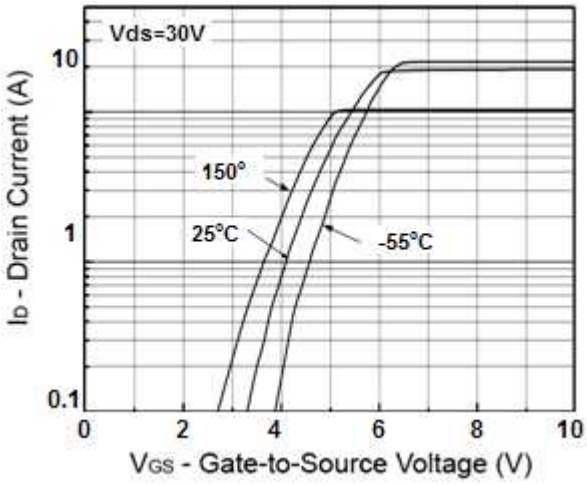
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Max Rating E_{AS} Test Condition: V_{DD} = 50V, I_{AS}=9A, L=20mH, R_G=25Ω, Starting T_J=25℃
3. Guaranteed 100% E_{AS} Test Condition: V_{DD} = 50V, I_{AS}=9A, L=1mH, R_G=25Ω, Starting T_J=25℃
4. I_{SD} ≤9A, di/dt ≤ 200A/uS, V_{DD} ≤ BV, Starting T_J=25℃
5. Pulse test: pulse width ≤300uS, duty cycle ≤2%
6. b For design reference only, not subject to production testing.
7. c Switching time is essentially independent of operating temperature.

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

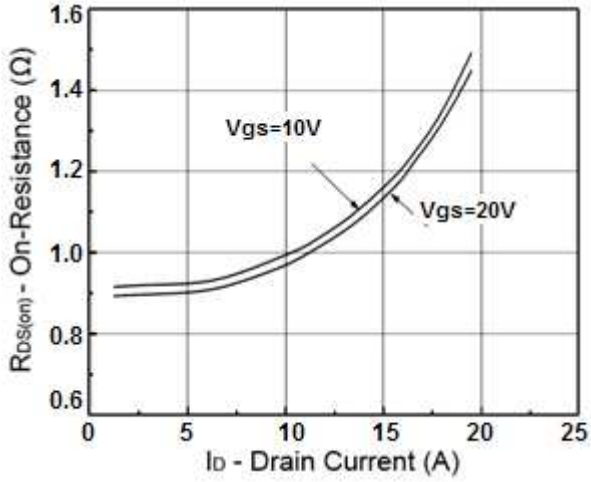
Output Characteristics



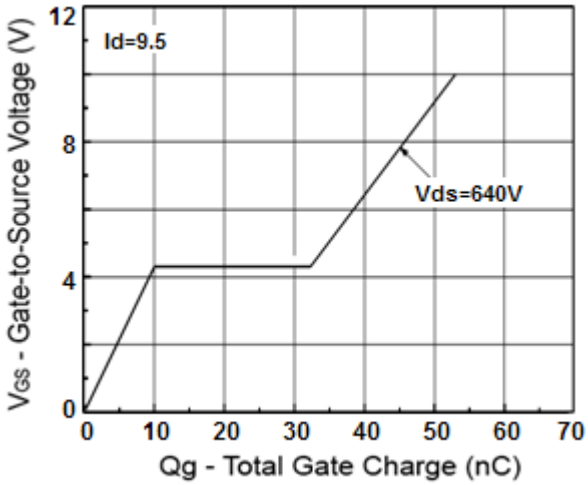
Transfer Characteristics



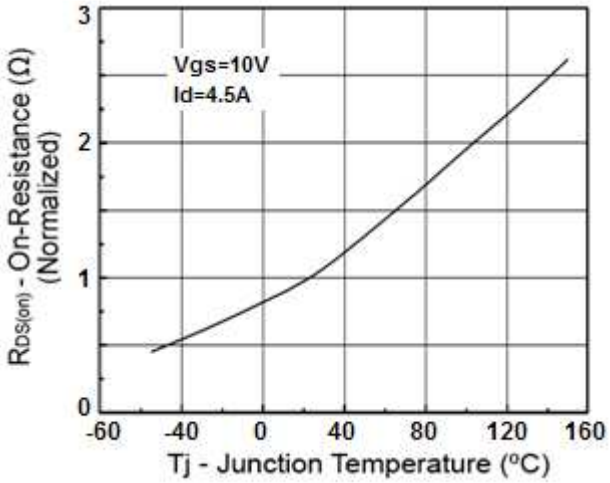
On-Resistance vs. Drain Current



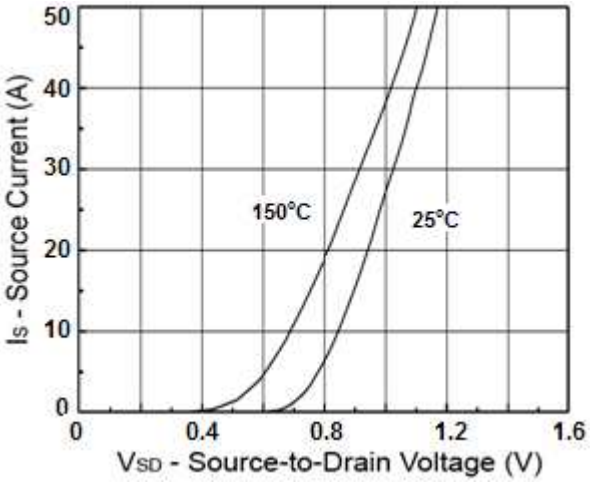
Gate Charge



On-Resistance vs. Junction Temperature

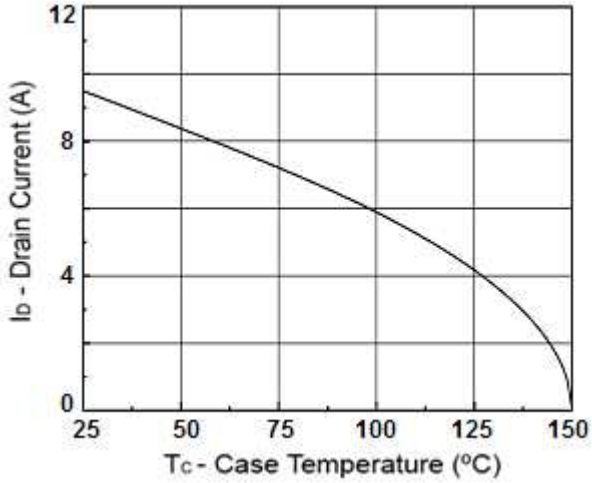


Source-Drain Diode Forward Voltage

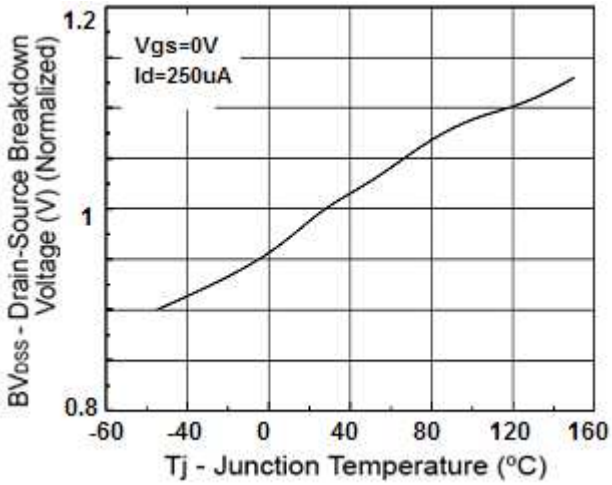


Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

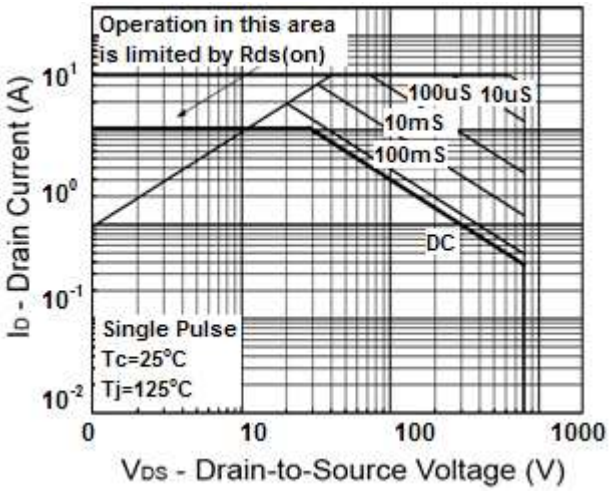
Drain Current vs. Case Temperature



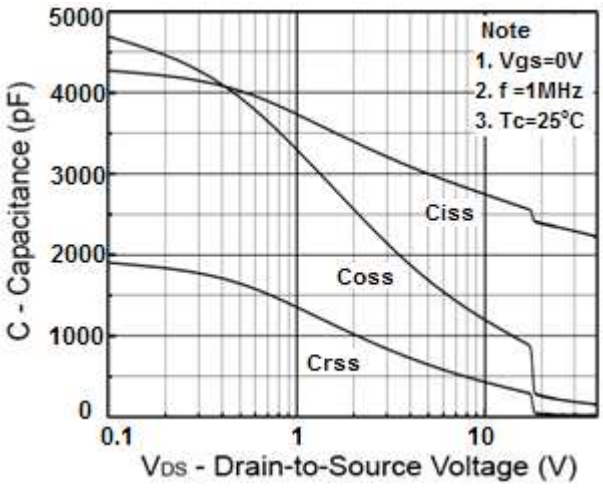
BV_{DSS} vs. Junction Temperature



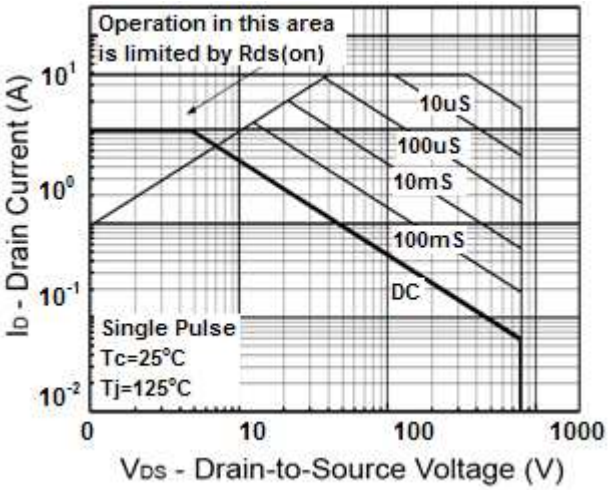
Maximum Safe Operating Area



Capacitance vs. Drain-Source Voltage

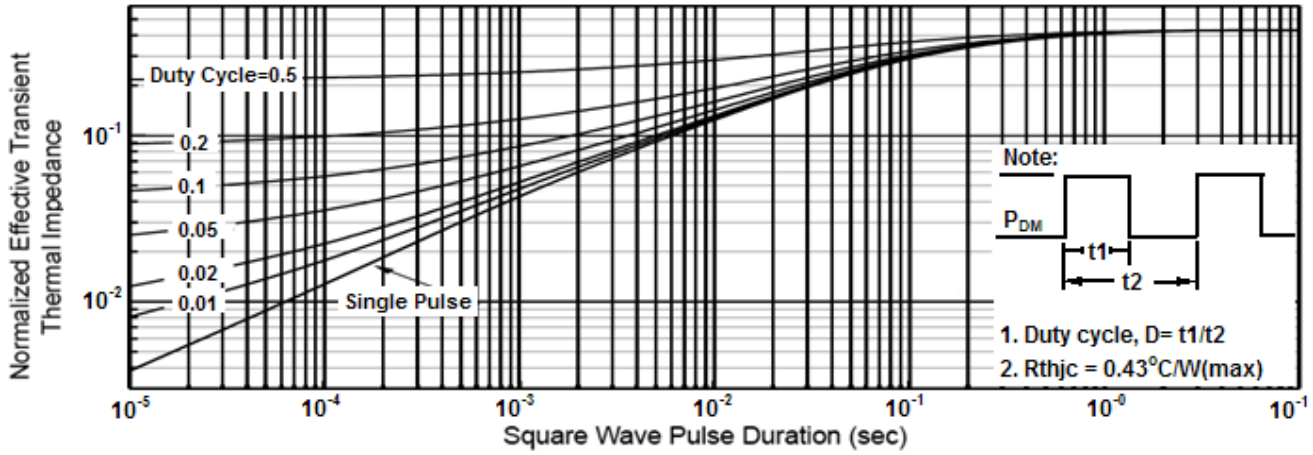


Maximum Safe Operating Area (ITO-220)

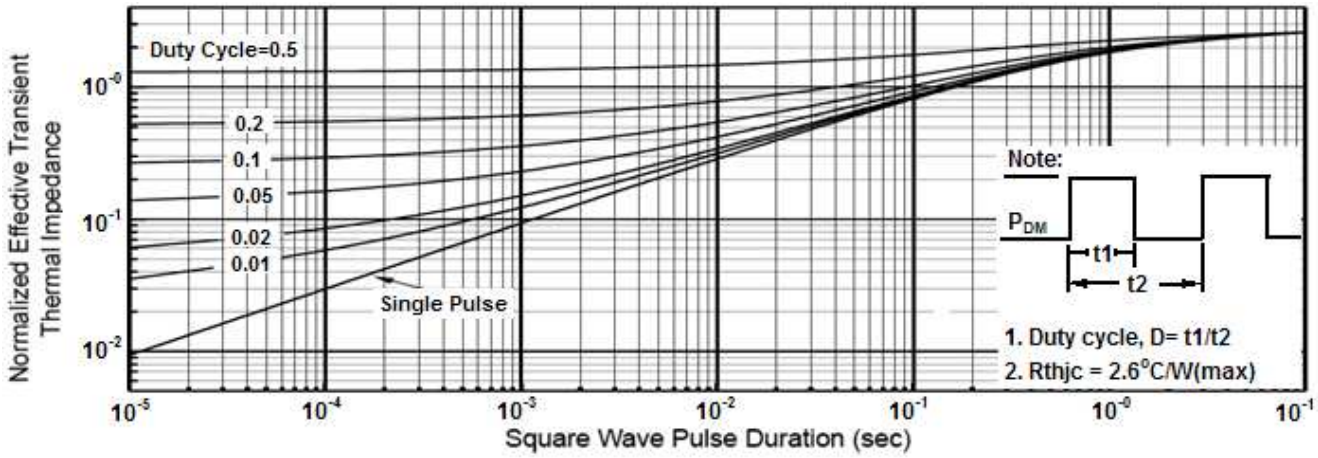


Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

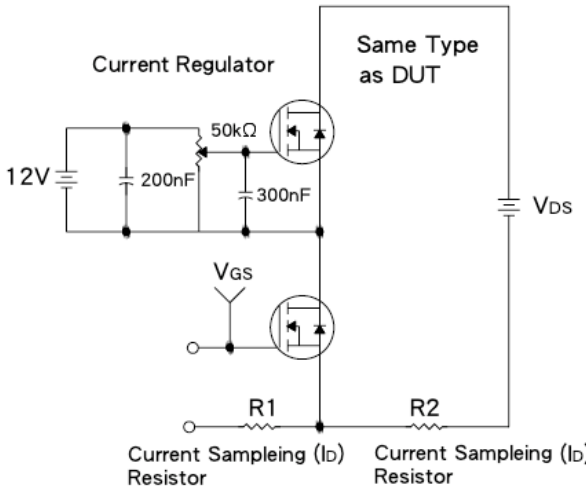
Normalized Thermal Transient Impedance, Junction-to-Ambient

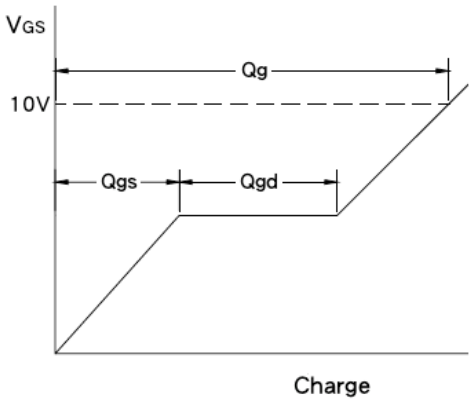


Normalized Thermal Transient Impedance, Junction-to-Ambient(ITO-220)

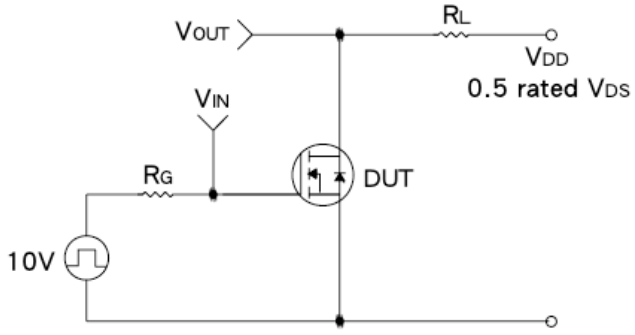


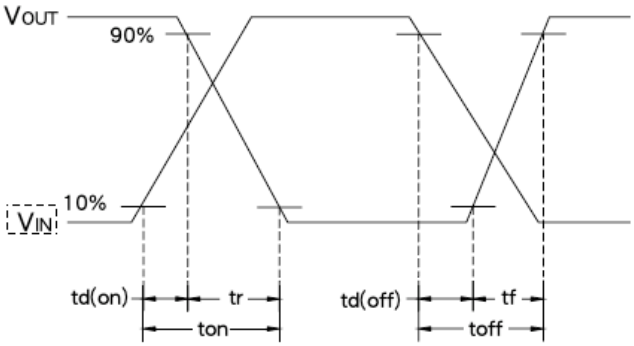
Gate Charge Test Circuit & Waveform



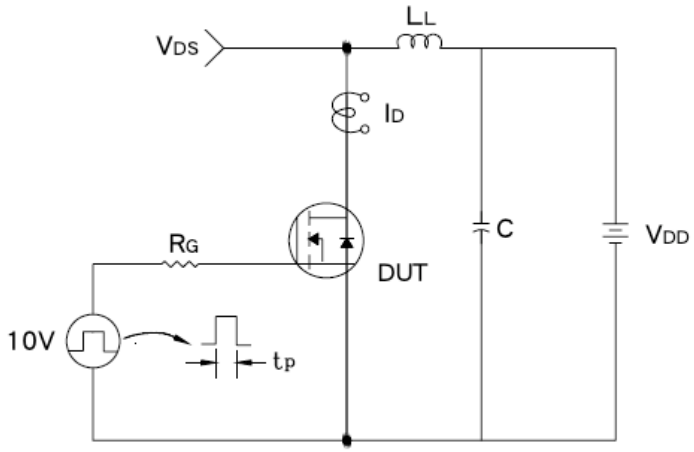


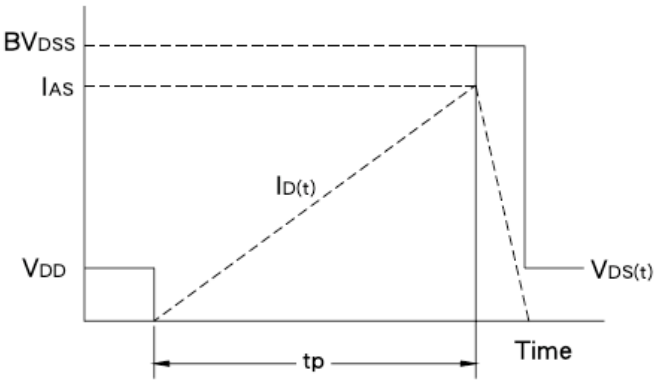
Resistive Switching Test Circuit & Waveform



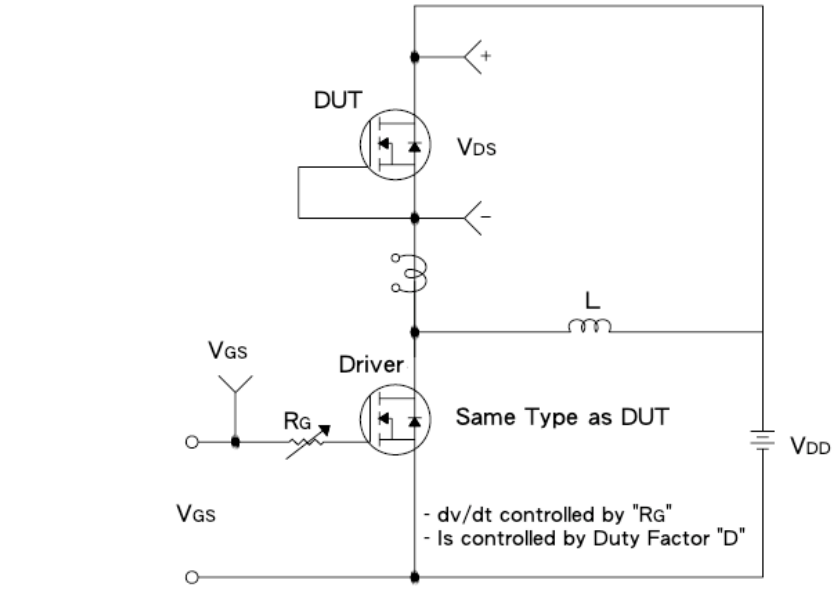


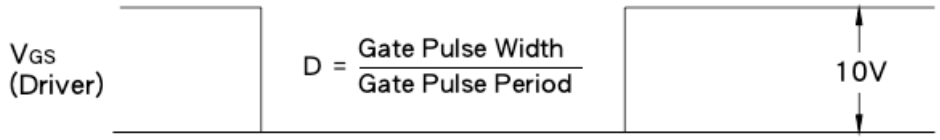
E_{AS} Test Circuit & Waveform

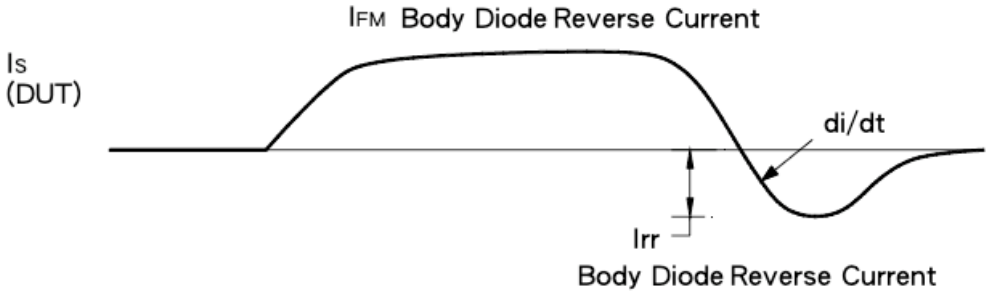


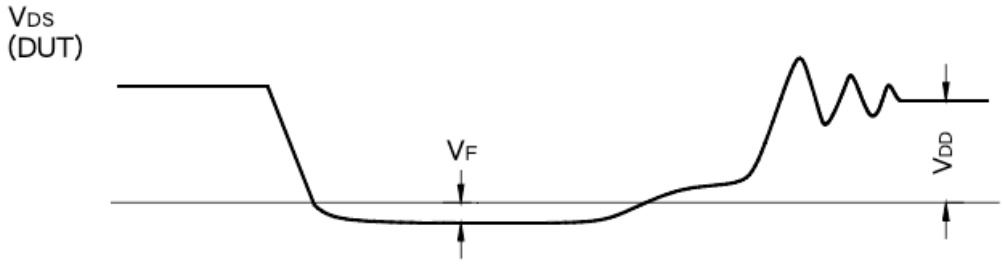


Diode Reverse Recovery Time Test Circuit & Waveform

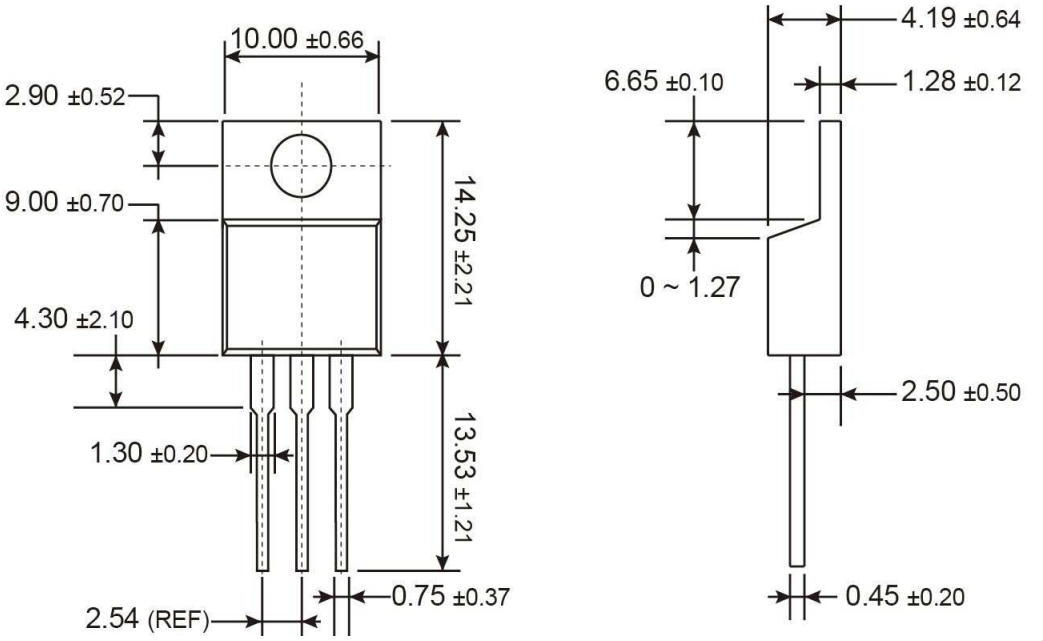






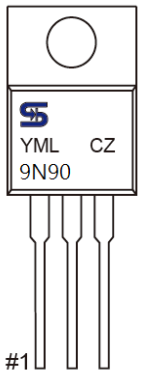


TO-220 Mechanical Drawing



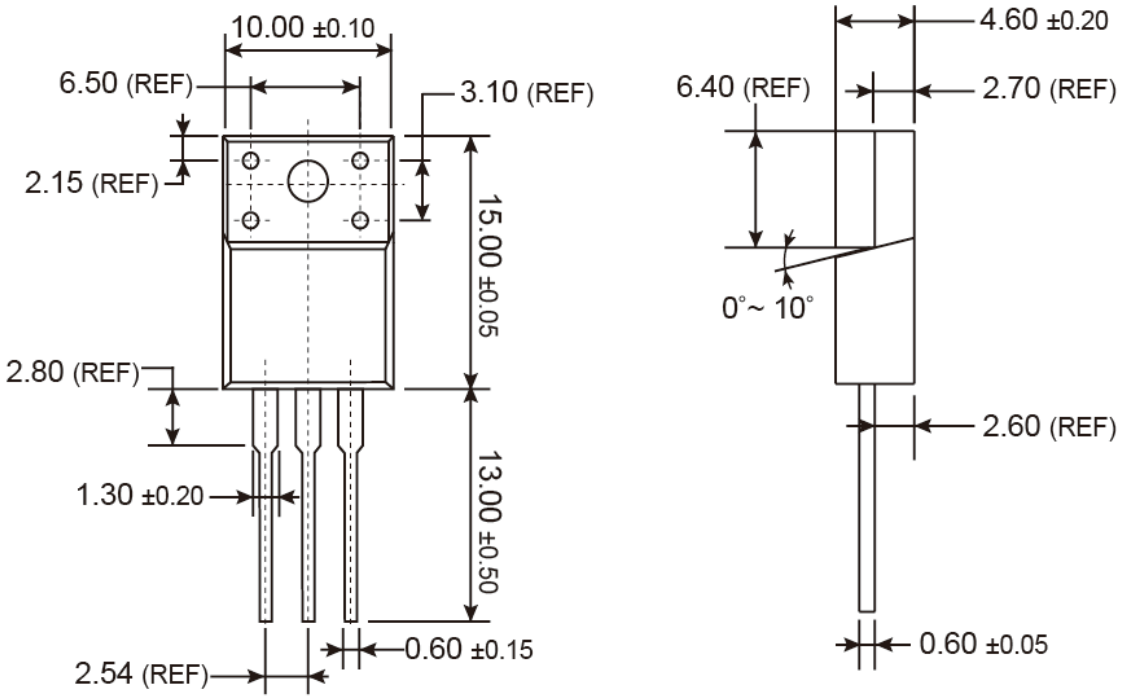
Unit: Millimeters

Marking Diagram



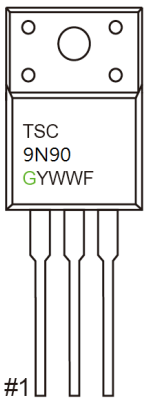
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
= Month Code for Halogen Free Product
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apl, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct,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

ITO-220 Mechanical Drawing



Unit: Millimeters

Marking Diagram



Y = Year Code
G = Halogen Free
WW = Week Code by Calendar Year
F = Factory Code

Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.