TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TSM1N45

450V N-Channel Power MOSFET

TO-92

SOT-223

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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)	I_D (A)
450	4.25 @ V_{GS} =10V	0.25

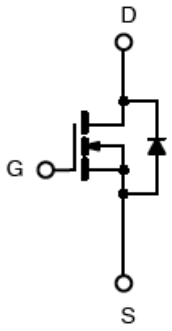
General Description

The TSM1N45 is N-Channel enhancement mode power field effect transistors are produced using planar DMOS technology process. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand higher energy pulse in the avalanche and commutation mode. There devices are well suited for electronic ballasts base and half bridge configuration.

Features

- Low gate charge @ typical 6.5nC
- Low Crss @ typical 6.5pF
- Avalanche energy specified
- Improved dv/dt capability
- Gate-Source Voltage ±30V guaranteed

Block Diagram



N-Channel MOSFET

Ordering Information

Part No.	Package	Packing
TSM1N45CT B0	TO-92	1Kpcs / Bulk
TSM1N45CT A3	TO-92	2Kpcs / Ammo
TSM1N45CW RP	SOT-223	2.5Kpcs / 13” Reel

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

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	450	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current		I_D	0.5	A
Pulsed Drain Current (Note 1)		I_{DM}	4	A
Single Pulse Drain to Source Avalanche Energy (Note 2)		E_{AS}	108	mJ
Avalanche Current (Note 1)		I_{AR}	0.5	A
Repetitive Avalanche Energy (Note 1)		E_{AR}	0.25	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	5.5	V/ns
Total Power Dissipation @T_C =25°C	TO-92	P_{DTOT}	2	W
	SOT-223		15	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

*Surface Mounted on 1”x1” FR4 board

Thermal Performance

Parameter		Symbol	Limit	Unit
Thermal Resistance - Junction to Lead	TO-92	$R\Theta_{JL}$	50	°C/W
Thermal Resistance - Junction to Case	SOT-223	$R\Theta_{JC}$	8.5	
Thermal Resistance - Junction to Ambient *	TO-92	$R\Theta_{JA}$	140	°C/W
	SOT-223		60	

*When mounted on the minimum pad size recommended (PCB mount)

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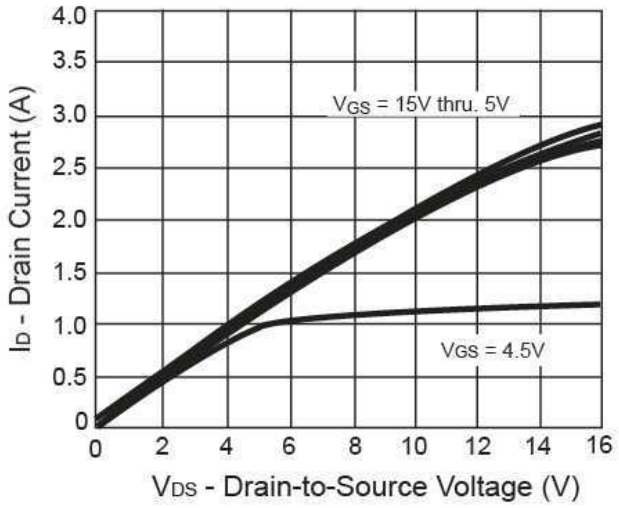
Electrical Specifications (Ta=25°C, unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250uA	BV_{DSS}	450	--	--	V
Drain-Source On-State Resistance	V_{GS} = 10V, I_D = 0.25A	$R_{DS(ON)}$	--	3.7	4.25	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250uA	$V_{GS(TH)}$	2.3	3.0	3.7	V
	V_{DS} = V_{GS}, I_D = 250mA		3.2	4.0	4.8	
Zero Gate Voltage Drain Current	V_{DS} = 450V, V_{GS} = 0V	I_{DSS}	--	--	10	uA
Gate Body Leakage	V_{GS} = ±30V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	V_{DS} = 50V, I_D = 0.25A	g_{fs}	--	0.7	--	S
Dynamic						
Total Gate Charge	V_{DS} = 360V, I_D = 0.5A, V_{GS} = 10V (Note 4,5)	Q_g	--	6.5	10	nC
Gate-Source Charge		Q_{gs}	--	1.3	--	
Gate-Drain Charge		Q_{gd}	--	3.2	--	
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	C_{iss}	--	235	--	pF
Output Capacitance		C_{oss}	--	29	--	
Reverse Transfer Capacitance		C_{rss}	--	6.5	--	
Switching						
Turn-On Delay Time	V_{GS} = 25V, I_D = 0.5A, V_{DS} = 225V, R_G = 25Ω (Note 4,5)	$t_{d(on)}$	--	14.7	--	nS
Turn-On Rise Time		t_r	--	32.8	--	
Turn-Off Delay Time		$t_{d(off)}$	--	25.2	--	
Turn-Off Fall Time		t_f	--	23.7	--	
Drain-Source Diode Characteristics and Maximum Ratings						
Maximum Continuous Drain-Source Diode Forward Current		I_S	--	--	0.5	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}	--	--	4.0	A
Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 0.5A	V_{SD}	--	--	1.4	V
Reverse Recovery Time	V_{GS} = 0V, I_S = 1A, dI_F/dt = 100A/μS (Note 4)	t_{rr}	--	110	--	nS
Reverse Recovery Charge		Q_{rr}	--	0.35	--	μC

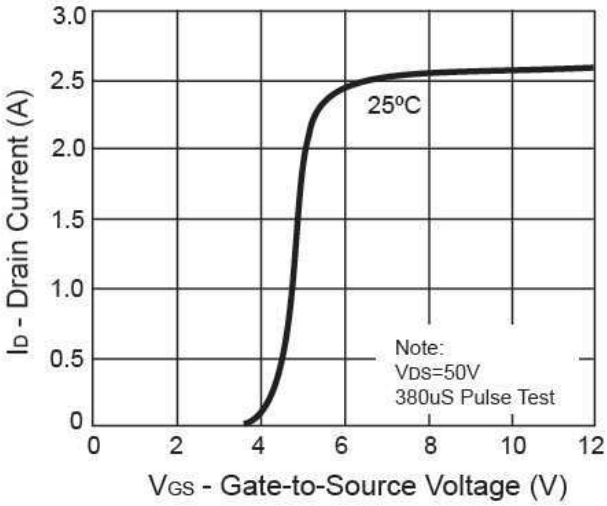
Notes:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=75mH, I_{AS}=1.6A, V_{DD}=50V, R_G=25Ω, Starting T_J=25ºC
3. I_{SD} ≤ 0.5A, di/dt ≤ 300A/μS, V_{DD} ≤ BV_{DSS}, Starting T_J=25ºC
4. Pulse test: pulse width ≤ 300uS.
5. Essentially independent of operating temperature
6. a) Reference point of the is the drain $R\Theta_{JL}$ lead
   b) When mounted on 3"x4.5" FR-4 PCB without any pad copper in a still air environment
   ($R\Theta_{JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance. $R\Theta_{CA}$ is determined by the user's board design)

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

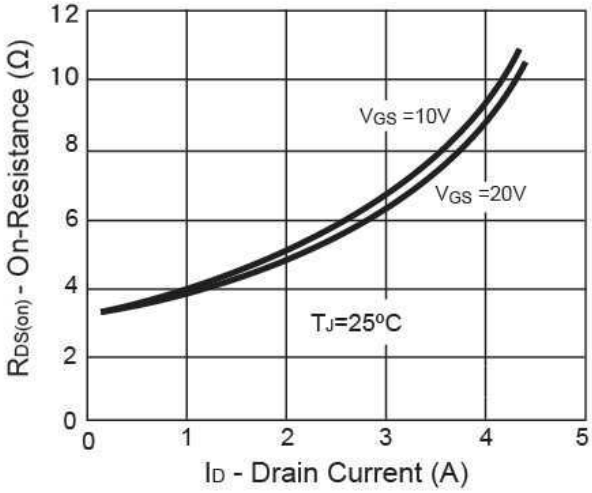
Output Characteristics



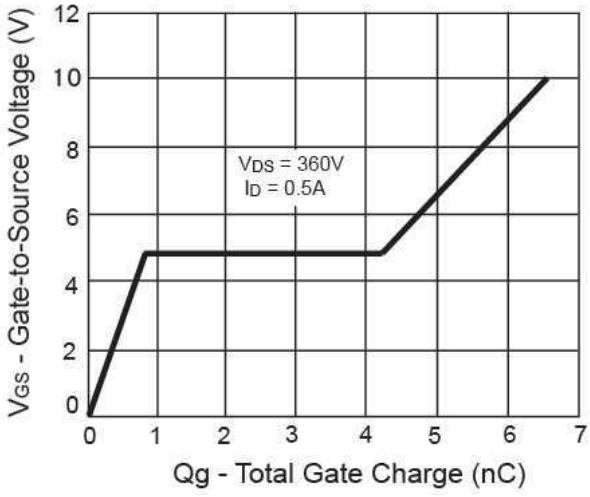
Transfer Characteristics



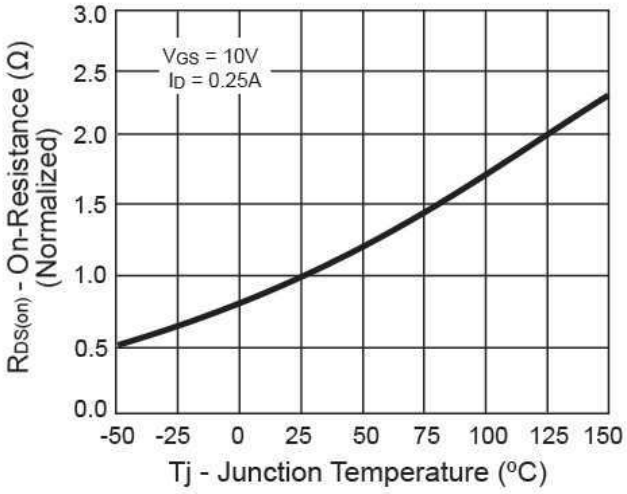
On-Resistance vs. Drain Current



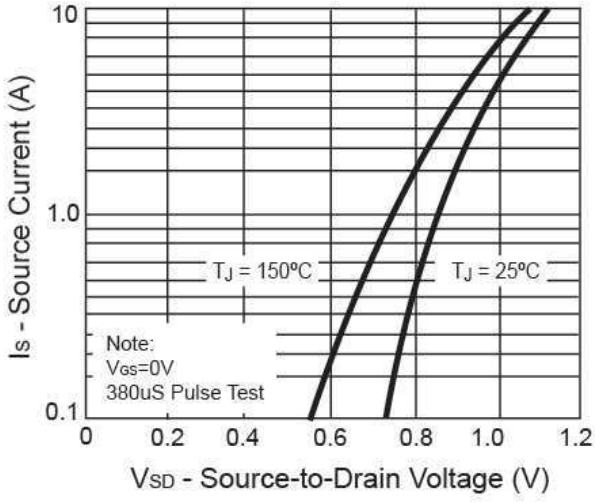
Gate Charge



On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



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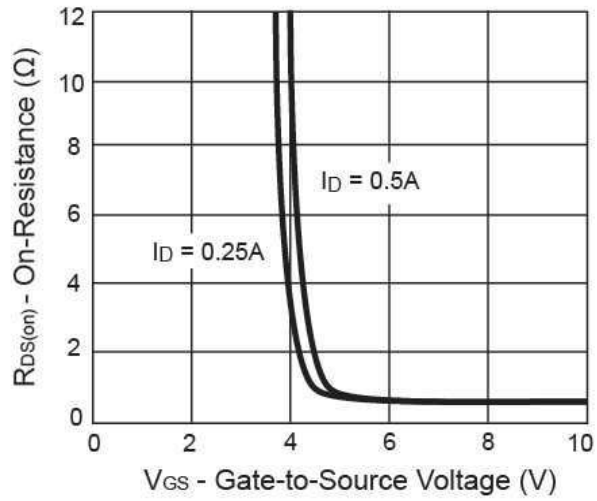
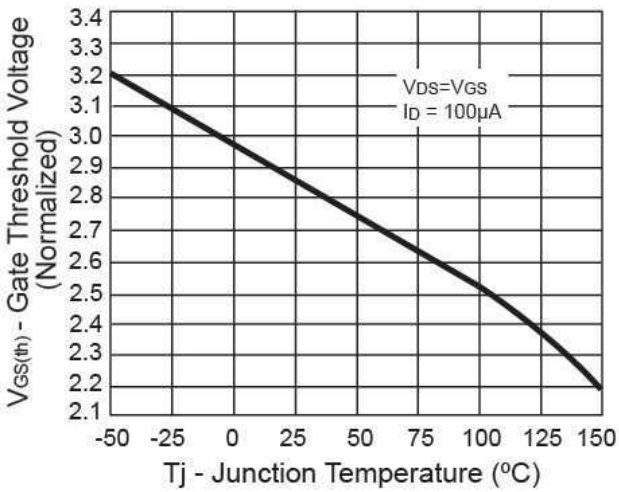
Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

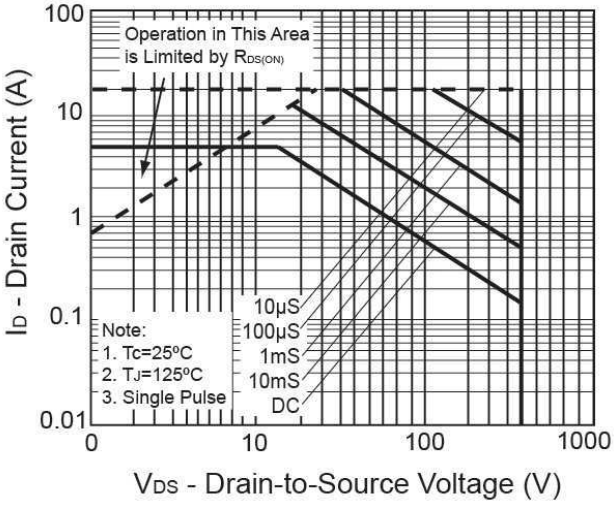
On-Resistance vs. Gate-Source Voltage



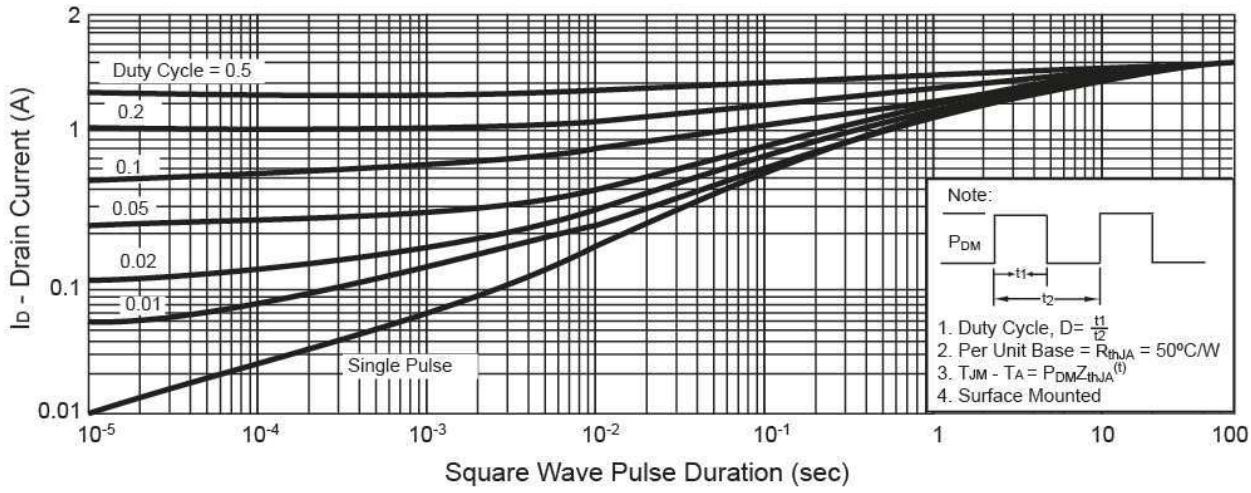
Threshold Voltage



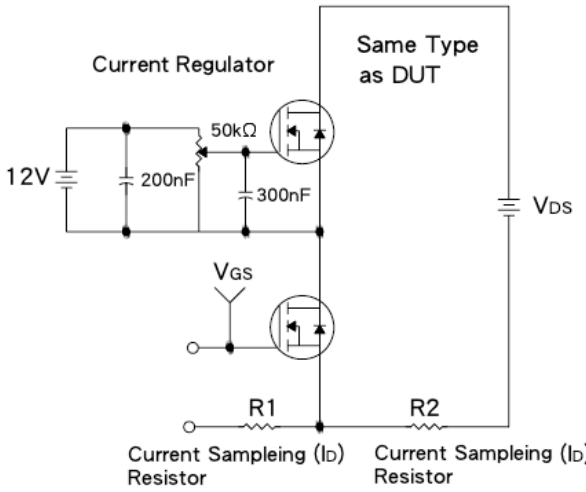
Maximum Safe Operating Area

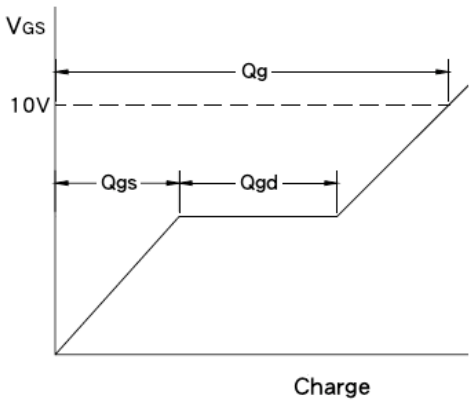


Normalized Thermal Transient Impedance, Junction-to-Ambient

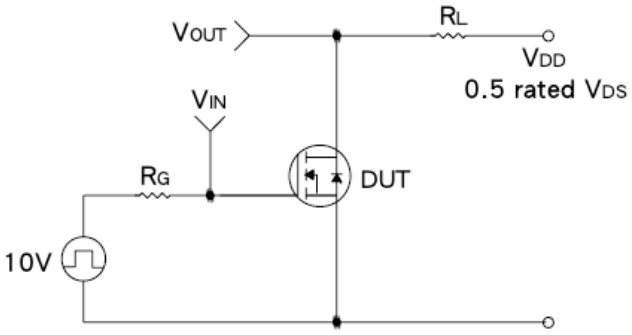


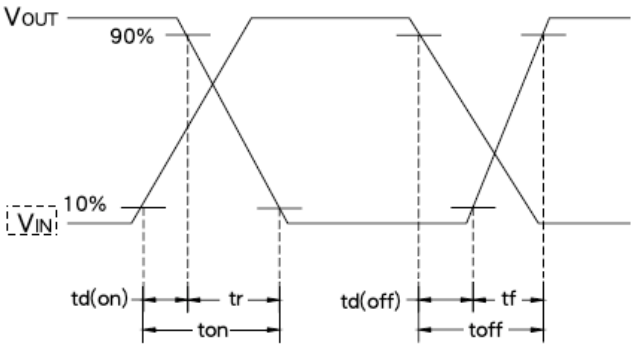
Gate Charge Test Circuit & Waveform



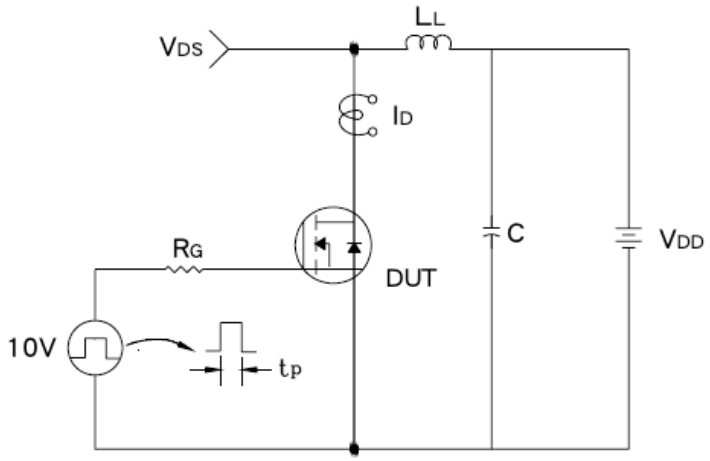


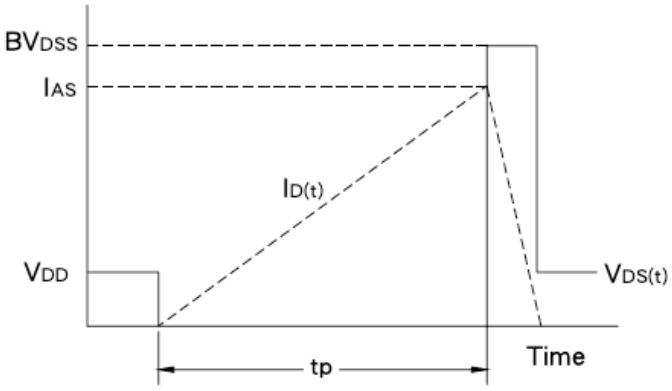
Resistive Switching Test Circuit & Waveform



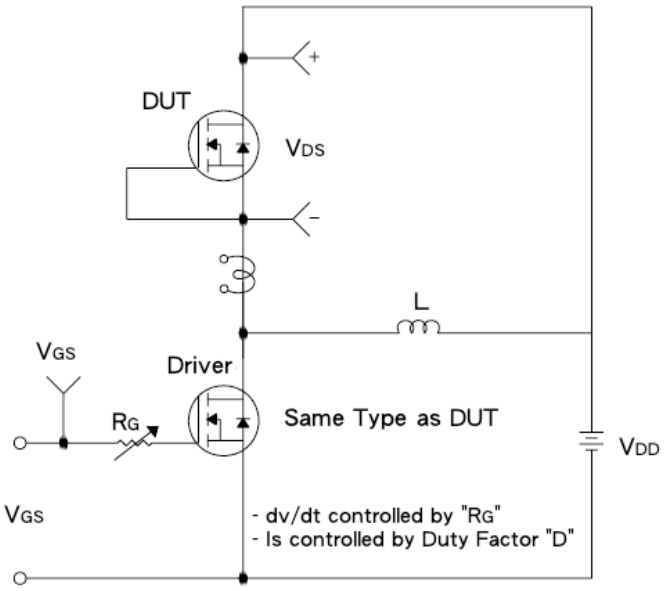


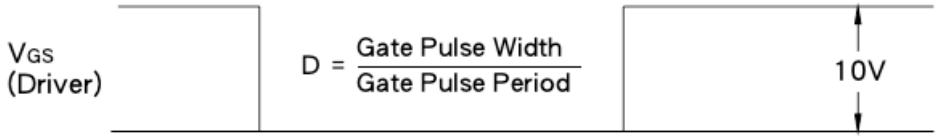
E_{AS} Test Circuit & Waveform

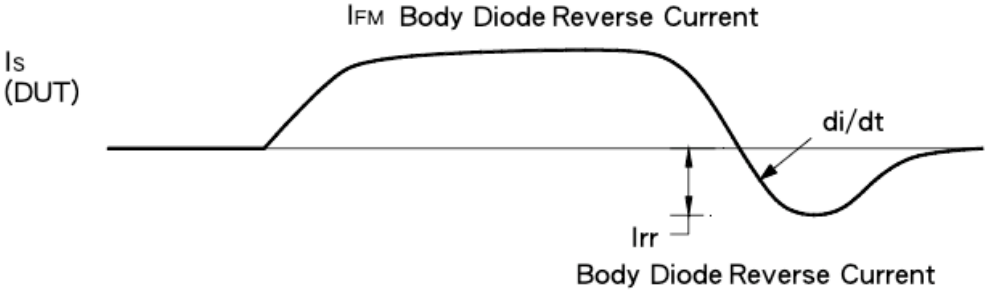


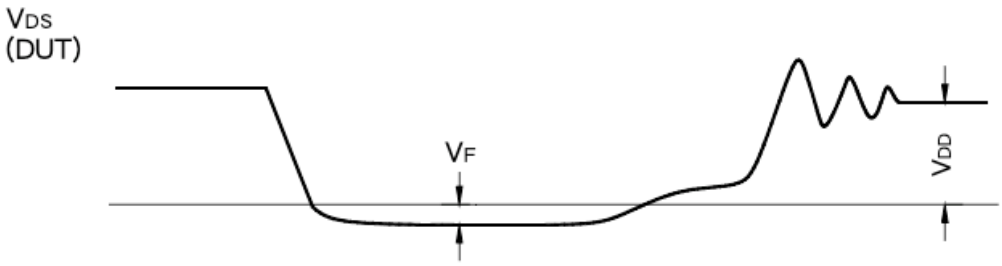


Diode Reverse Recovery Time Test Circuit & Waveform

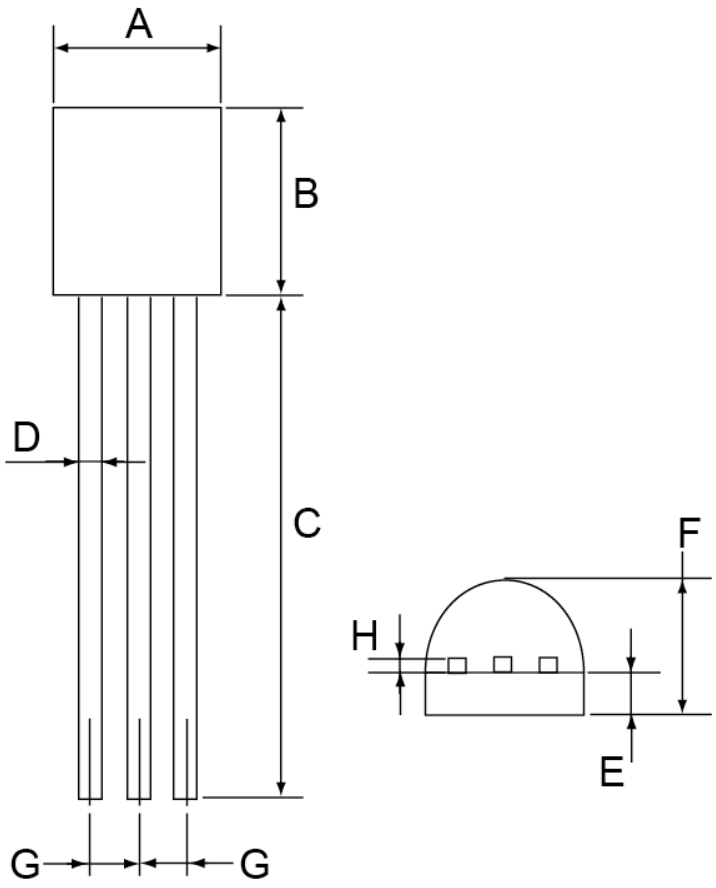






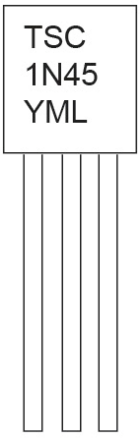


TO-92 Mechanical Drawing



TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	13.53 (typ)		0.532 (typ)	
D	0.39	0.49	0.015	0.019
E	1.18	1.28	0.046	0.050
F	3.30	3.70	0.130	0.146
G	1.27	1.31	0.050	0.051
H	0.33	0.43	0.013	0.017

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)
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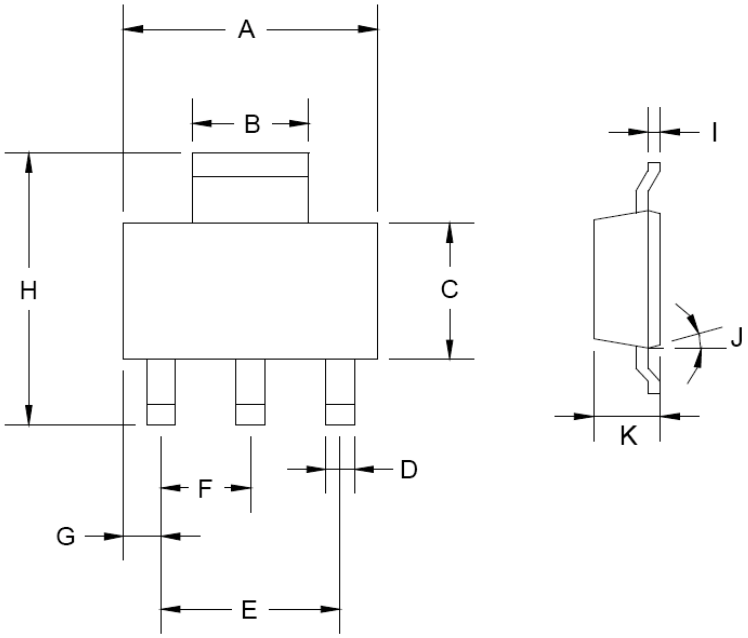
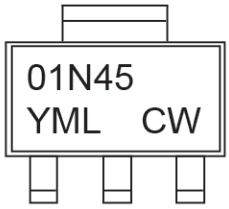
SOT-223 Mechanical Drawing



SOT-223 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.350	6.850	0.250	0.270
B	2.900	3.100	0.114	0.122
C	3.450	3.750	0.136	0.148
D	0.595	0.635	0.023	0.025
E	4.550	4.650	0.179	0.183
F	2.250	2.350	0.088	0.093
G	0.835	1.035	0.032	0.041
H	6.700	7.300	0.263	0.287
I	0.250	0.355	0.010	0.014
J	10°	16°	10°	16°
K	1.550	1.800	0.061	0.071

Marking Diagram



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