



TO-92



SOT-223



**Pin Definition:**

1. Gate
2. Drain
3. Source

**PRODUCT SUMMARY**

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

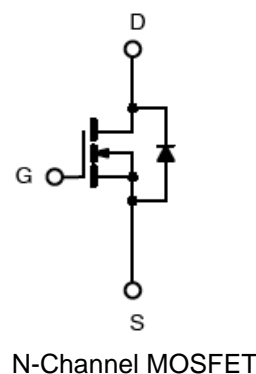
**General Description**

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  $\pm 30V$  guaranteed

**Block Diagram**



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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	450	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	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 @ $T_c = 25^\circ C$	TO-92	2	W
	SOT-223	15	
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ C$

\*Surface Mounted on 1"x1" FR4 board

**Thermal Performance**

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

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

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

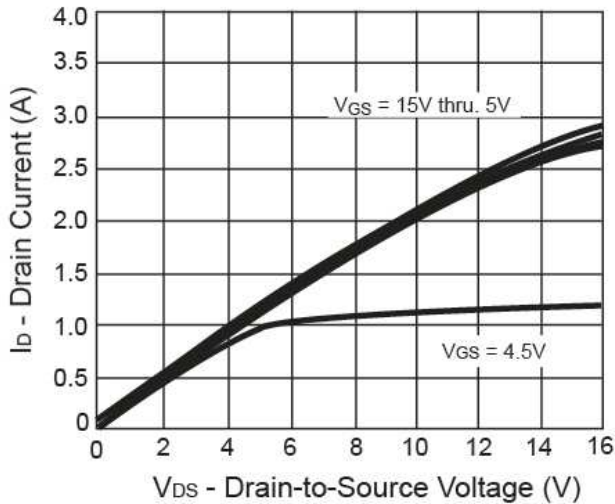
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	450	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 0.25A$	$R_{DS(ON)}$	--	3.7	4.25	$\Omega$
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	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	$\mu A$
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance	$V_{DS} = 50V, I_D = 0.25A$	$g_{fs}$	--	0.7	--	S
<b>Dynamic</b>						
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	--	
<b>Switching</b>						
Turn-On Delay Time	$V_{GS} = 25V, I_D = 0.5A,$ $V_{DS} = 225V, R_G = 25\Omega$ (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	--	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
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	$V_{GS} = 0V, I_S = 1A$ $di_F/dt = 100A/\mu S$ (Note 4)	$t_{rr}$	--	110	--	nS
Reverse Recovery Charge		$Q_{rr}$	--	0.35	--	$\mu C$

#### Notes:

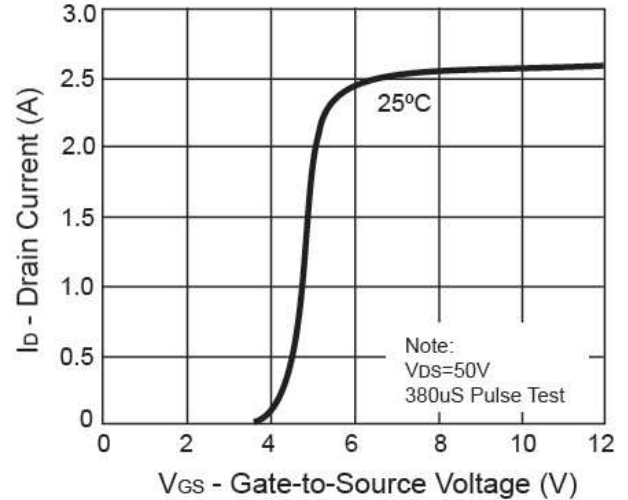
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L=75mH, I_{AS}=1.6A, V_{DD}=50V, R_G=25\Omega, \text{Starting } T_J=25^\circ C$
3.  $I_{SD} \leq 0.5A, di/dt \leq 300A/\mu S, V_{DD} \leq BV_{DSS}, \text{Starting } T_J=25^\circ C$
4. Pulse test: pulse width  $\leq 300\mu S$ .
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)

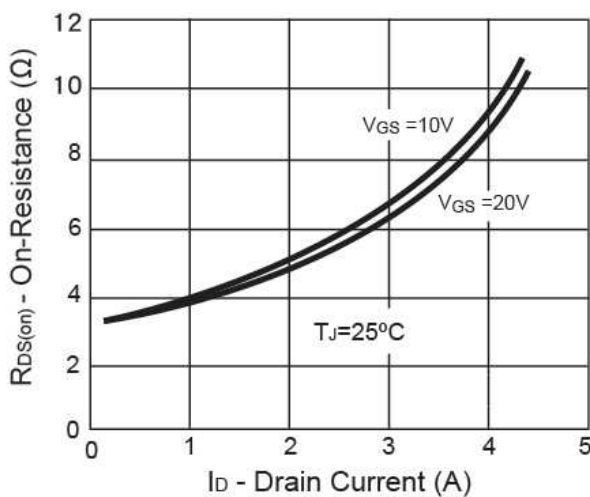
**Output Characteristics**



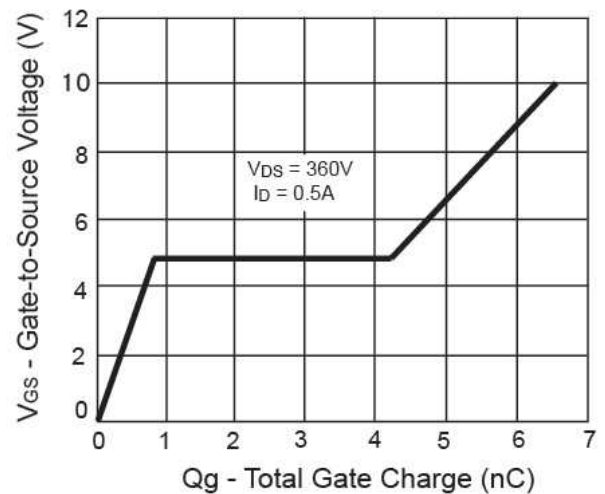
**Transfer Characteristics**



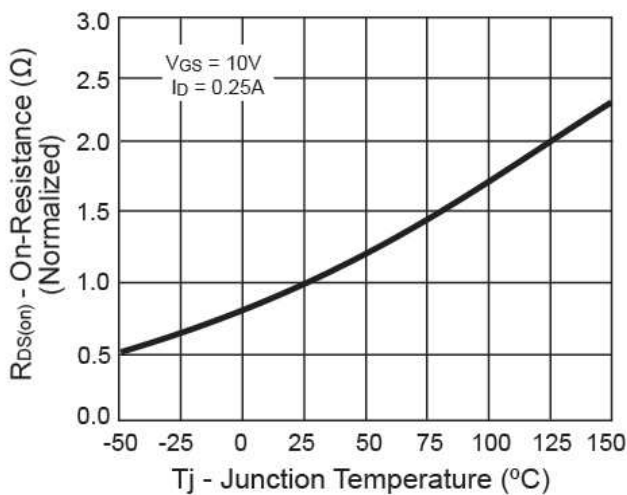
**On-Resistance vs. Drain Current**



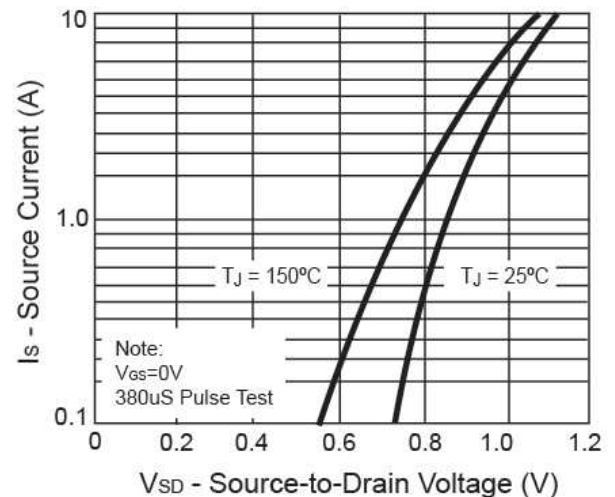
**Gate Charge**



**On-Resistance vs. Junction Temperature**

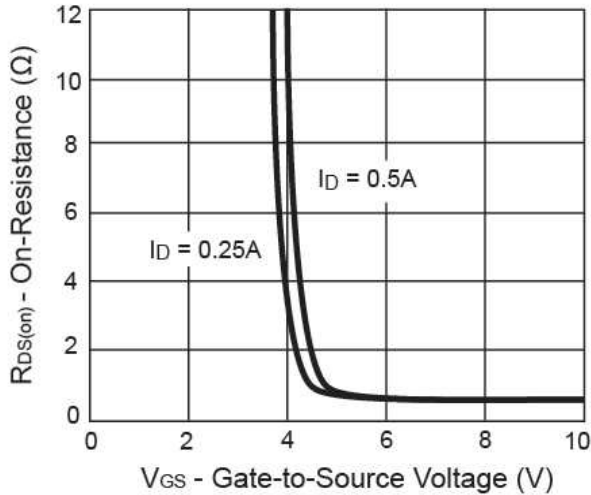


**Source-Drain Diode Forward Voltage**

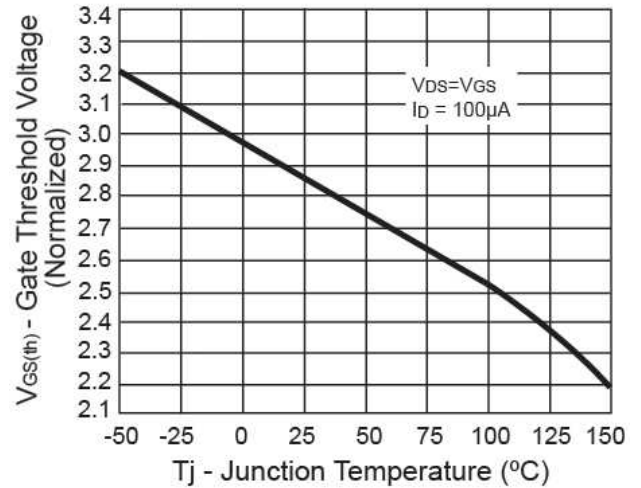


**Electrical Characteristics Curve** (Ta = 25°C, unless otherwise noted)

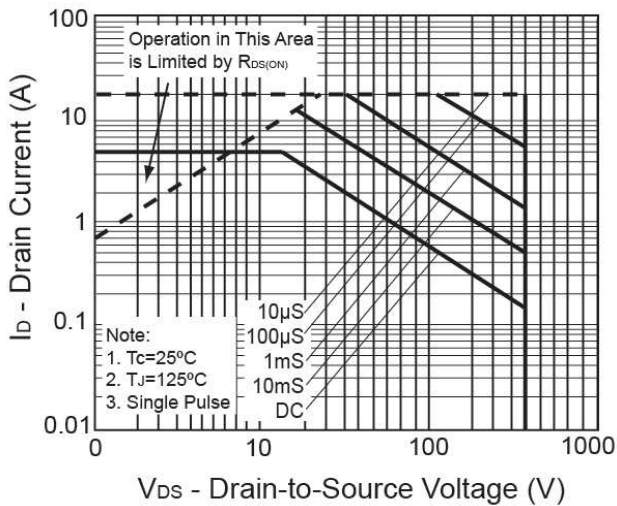
**On-Resistance vs. Gate-Source Voltage**



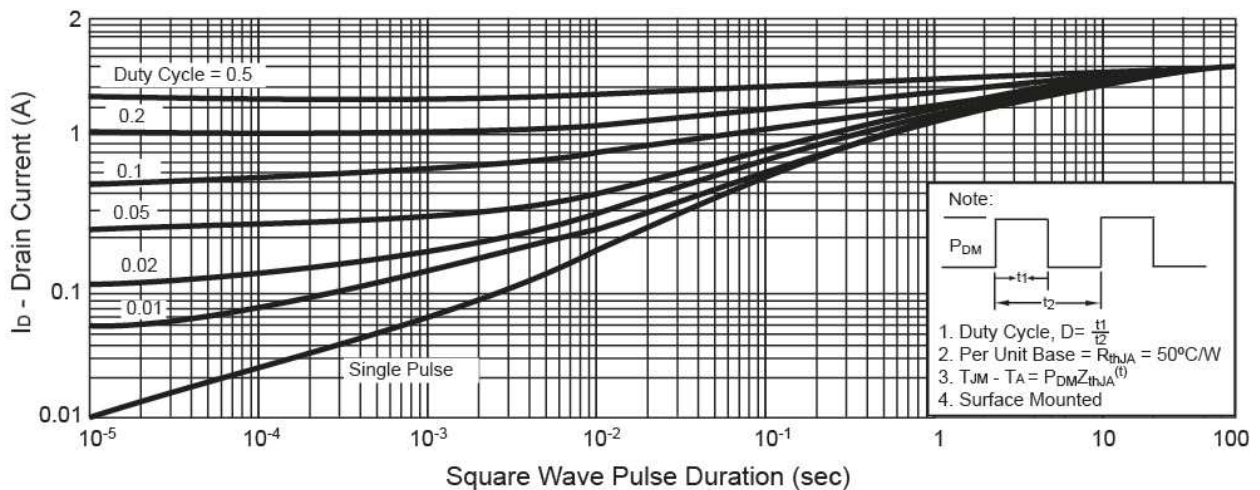
**Threshold Voltage**



**Maximum Safe Operating Area**

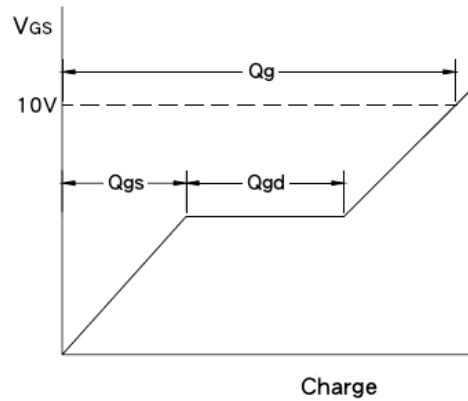
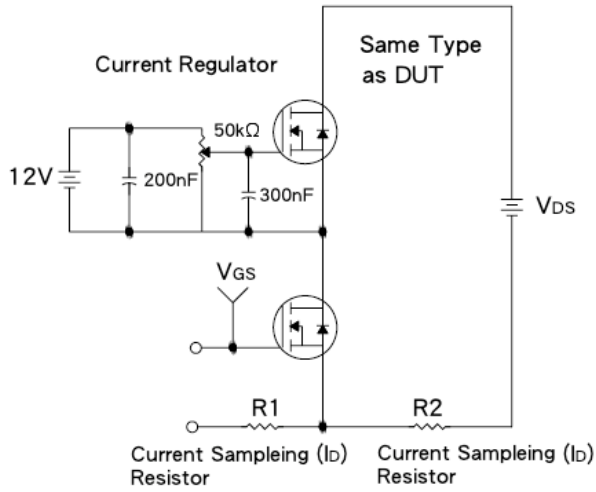


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

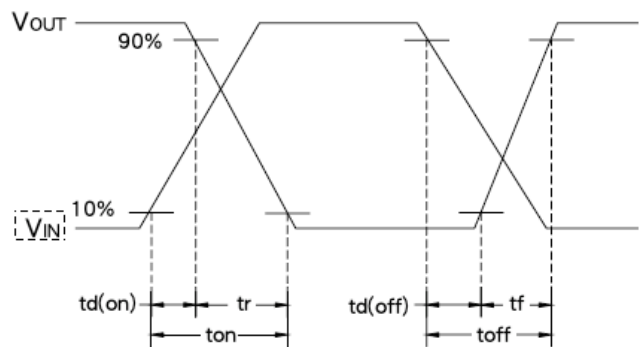
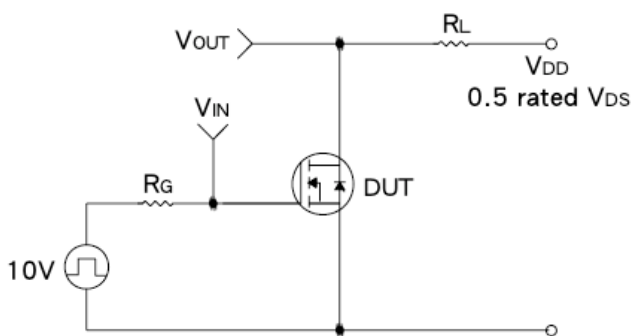




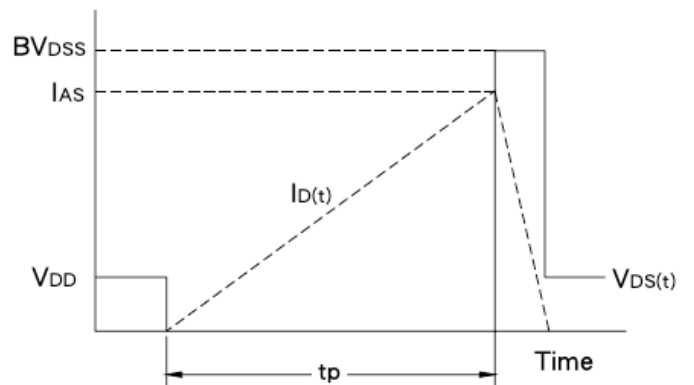
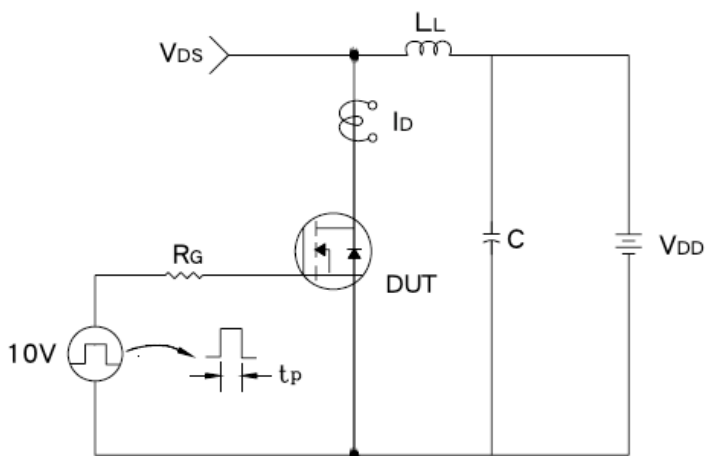
### Gate Charge Test Circuit & Waveform



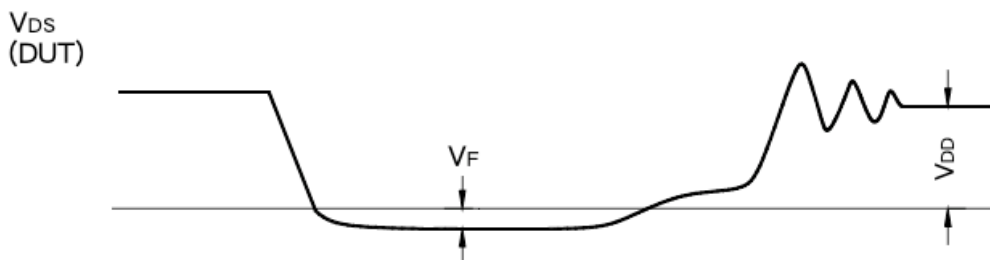
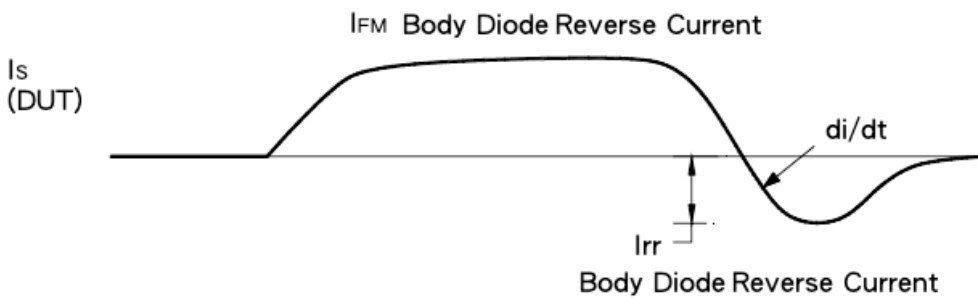
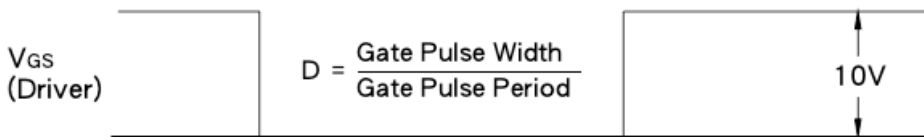
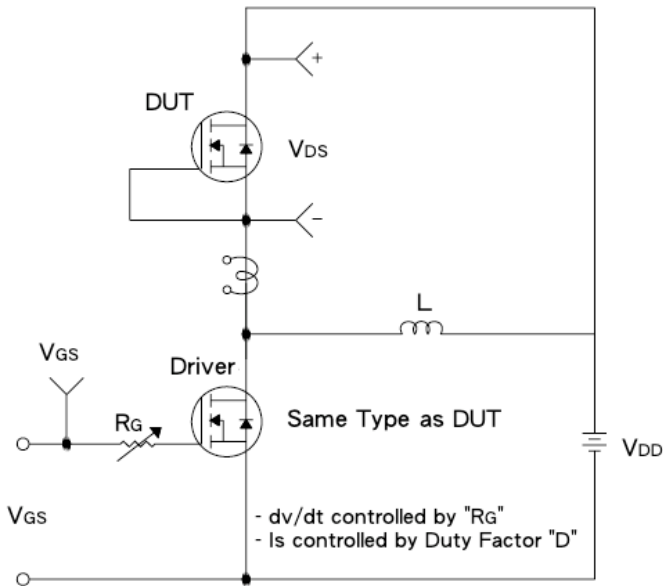
### Resistive Switching Test Circuit & Waveform



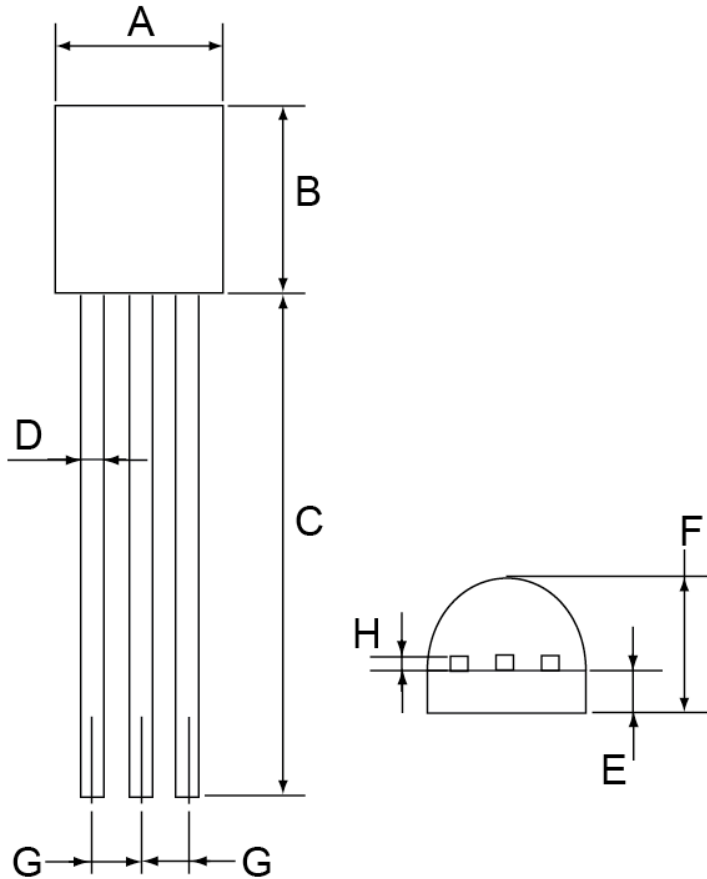
### E<sub>AS</sub> Test Circuit & Waveform



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

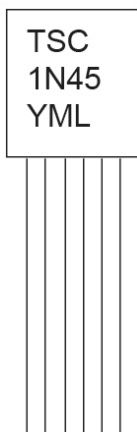


### TO-92 Mechanical Drawing



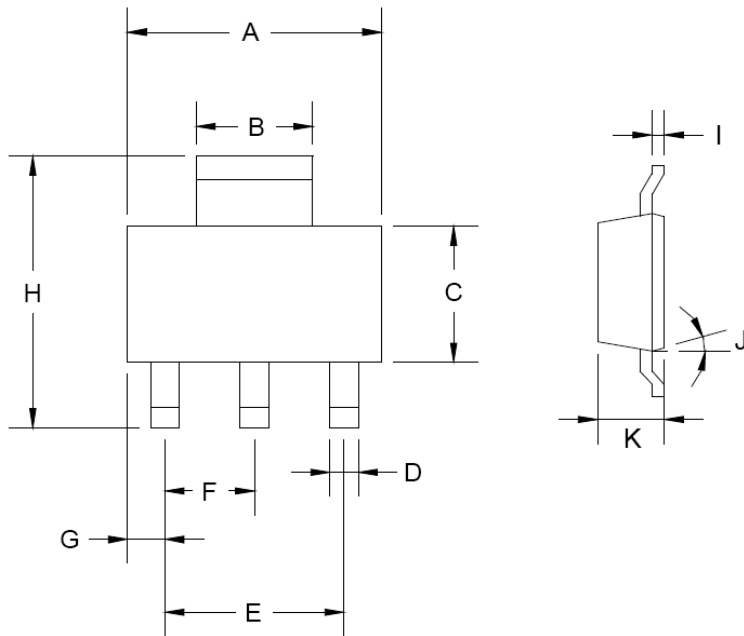
TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	13.53 (typ)		0.532 (typ)	
D	0.39	0.49	0.015	0.019
E	1.18	1.28	0.046	0.050
F	3.30	3.70	0.130	0.146
G	1.27	1.31	0.050	0.051
H	0.33	0.43	0.013	0.017

### Marking Diagram



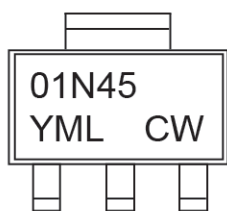
- Y** = Year Code
- M** = Month Code
- (**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apr, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
- L** = Lot Code

**SOT-223 Mechanical Drawing**



DIM	SOT-223 DIMENSION			
	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**



**Y** = Year Code  
**M** = Month Code  
 (A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
**L** = Lot Code



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