
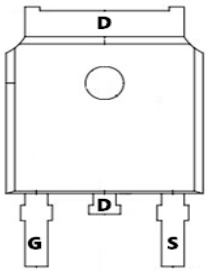


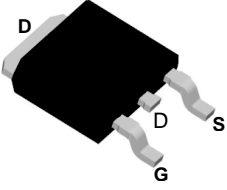
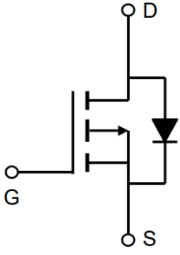
TM50P02AD

P -Channel Enhancement Mosfet

<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>General Features</b></p> <p><math>V_{DS} = -20V</math> <math>I_D = -48A</math></p> <p><math>R_{DS(ON)} = 13m\Omega</math> (typ.) @ <math>V_{GS} = -4.5V</math></p> <p>100% UIS Tested 100% <math>R_g</math> Tested</p> 
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**D:TO-252-3L**

Marking: 50P02

**Absolute Maximum Ratings (TC=25°C unless otherwise noted)**

Symbol	Parameter	Rating	Unit	
$V_{DSS}$	Drain-Source Voltage	-20	V	
$V_{GSS}$	Gate-Source Voltage	±12		
$I_D^a$	Continuous Drain Current ( $V_{GS} = -4.5V$ )	$T_A = 25^\circ C$	-48	A
		$T_A = 70^\circ C$	-36	
$I_{DM}^a$	Pulsed Drain Current ( $V_{GS} = -4.5V$ )	-44		
$I_D^c$	Continuous Drain Current	$T_C = 25^\circ C$	-35	
		$T_C = 100^\circ C$	-22	
$I_S^a$	Diode Continuous Forward Current	-10		
$T_J$	Maximum Junction Temperature	150	°C	
$I_{AS}^d$	Avalanche Current, Single pulse	L=0.5mH	-12	A
$E_{AS}^d$	Avalanche Energy, Single pulse	L=0.5mH	36	mJ
$T_{STG}$	Storage Temperature Range	-55 to 150	°C	
$P_D^a$	Maximum Power Dissipation	$T_A = 25^\circ C$	3.1	W
		$T_A = 70^\circ C$	2	
$P_D^c$	Maximum Power Dissipation	$T_C = 25^\circ C$	31.25	
		$T_C = 100^\circ C$	12.5	
$R_{\theta JA}^{a,b}$	Thermal Resistance-Junction to Ambient	$t \leq 10s$	40	°C/W
		Steady State	80	
$R_{\theta JC}^c$	Thermal Resistance-Junction to Case	4	°C/W	

Note \* : Package limited.

a : Surface Mounted on 1in<sup>2</sup> pad area,  $t \leq 10sec$ .

b : Maximum under Steady State conditions is 75 °C/W.

c : The power dissipation  $P_D$  is based on  $T_{J(MAX)} = 150^\circ C$ , and it is useful for reducing junction-to-case thermal resistance ( $R_{\theta JC}$ ) when additional heat sink is used.

d : UIS tested and pulse width limited by maximum junction temperature 150oC (initial temperature  $T_J = 25oC$ )

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Noted)

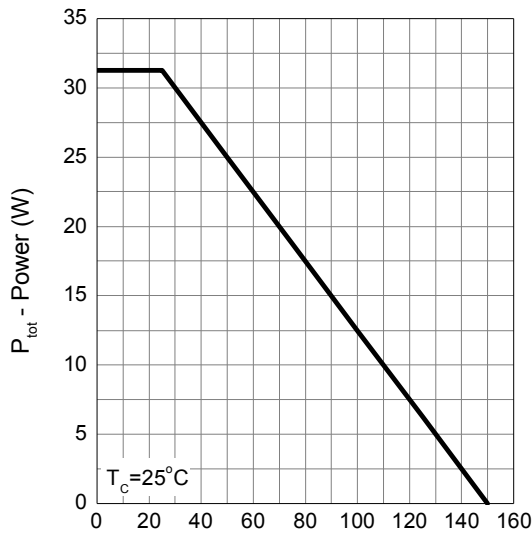
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu A$	-20	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-16V, V_{GS}=0V$	-	-	-1	$\mu A$
		$T_J=85^\circ\text{C}$	-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-0.5	-0.7	-1	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 10$	$\mu A$
$R_{DS(ON)}^e$	Drain-Source On-state Resistance	$V_{GS}=-4.5V, I_{DS}=-11A$	-	13	17	m $\Omega$
		$V_{GS}=-2.5V, I_{DS}=-6A$	-	18	25	
		$V_{GS}=-1.8V, I_{DS}=-1A$	-	26	45	
<b>Diode Characteristics</b>						
$V_{SD}^e$	Diode Forward Voltage	$I_{SD}=-1A, V_{GS}=0V$	-	-0.7	-1	V
$t_{rr}^f$	Reverse Recovery Time	$I_{SD}=-11A, di_{SD}/dt=100A/\mu s$	-	63	-	ns
$Q_{rr}^f$	Reverse Recovery Charge		-	54	-	nC
<b>Dynamic Characteristics<sup>f</sup></b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=-10V,$ Frequency=1.0MHz	-	1620	-	pF
$C_{oss}$	Output Capacitance		-	320	-	
$C_{rss}$	Reverse Transfer Capacitance		-	290	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=-10V, R_L=10\Omega,$ $I_{DS}=-1A, V_{GEN}=-4.5V,$ $R_G=6\Omega$	-	9	-	ns
$t_r$	Turn-on Rise Time		-	13	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	26	-	
$t_f$	Turn-off Fall Time		-	167	-	
<b>Gate Charge Characteristics<sup>f</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=-10V, V_{GS}=-4.5V,$ $I_{DS}=-11A$	-	25	-	nC
$Q_{gs}$	Gate-Source Charge		-	1.6	-	
$Q_{gd}$	Gate-Drain Charge		-	11	-	

Note e : Pulse test; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

Note f : Guaranteed by design, not subject to production testing.

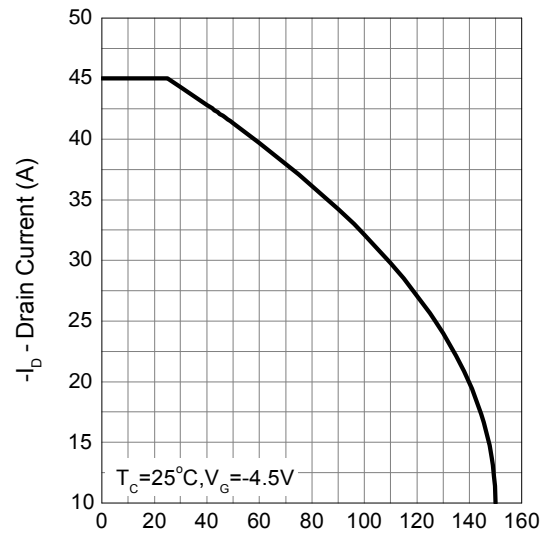
## Typical Operating Characteristics

Power Dissipation



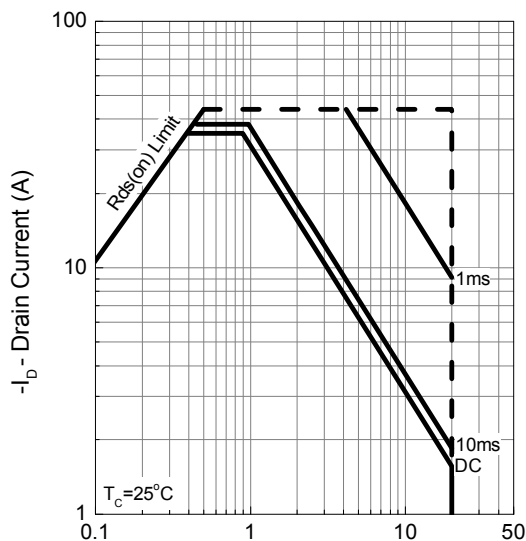
T<sub>j</sub> - Junction Temperature (°C)

Drain Current



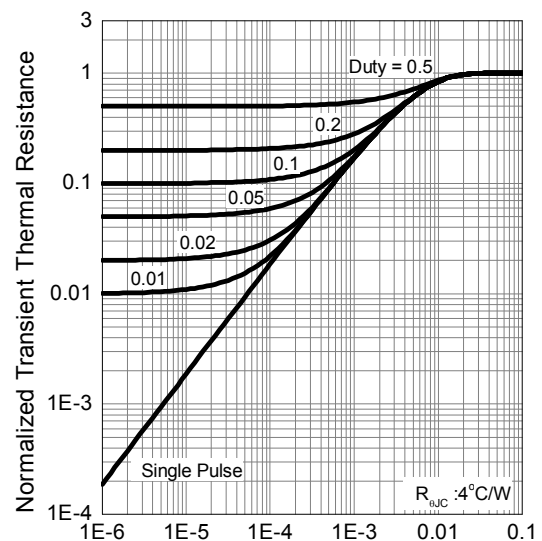
T<sub>j</sub> - Junction Temperature (°C)

Safe Operation Area



-V<sub>DS</sub> - Drain - Source Voltage (V)

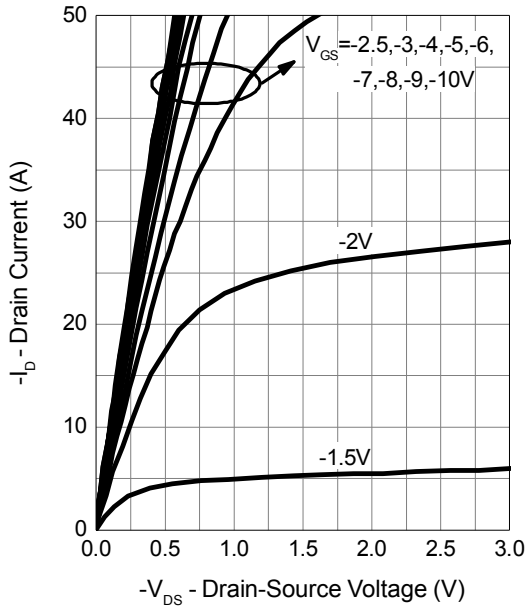
Thermal Transient Impedance



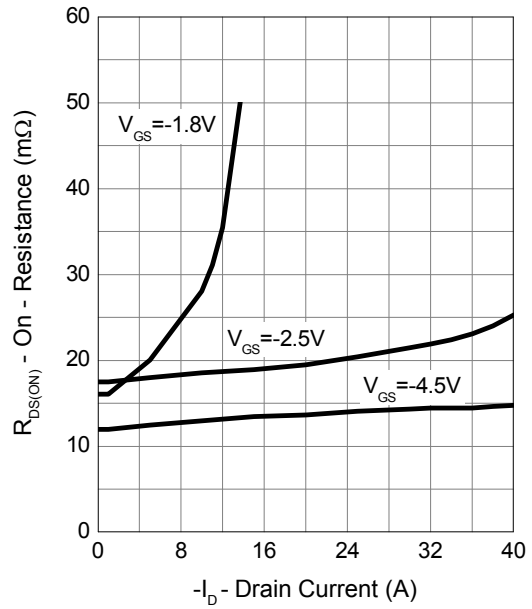
Square Wave Pulse Duration (sec)



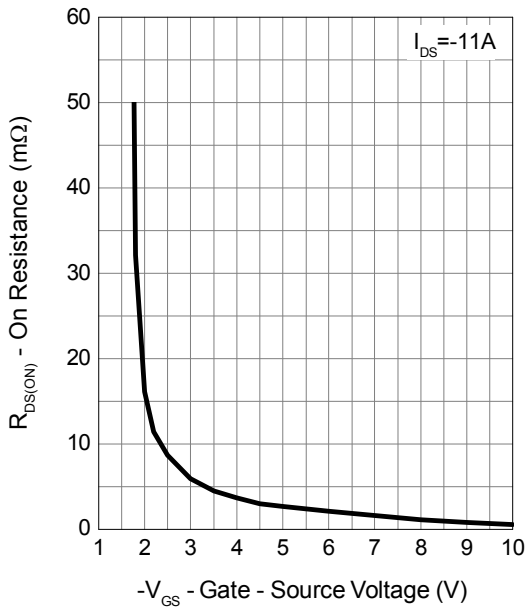
Output Characteristics



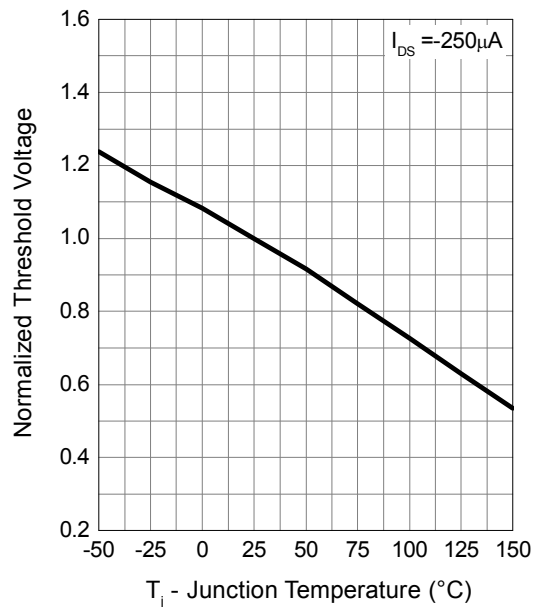
Drain-Source On Resistance



Gate-Source On Resistance

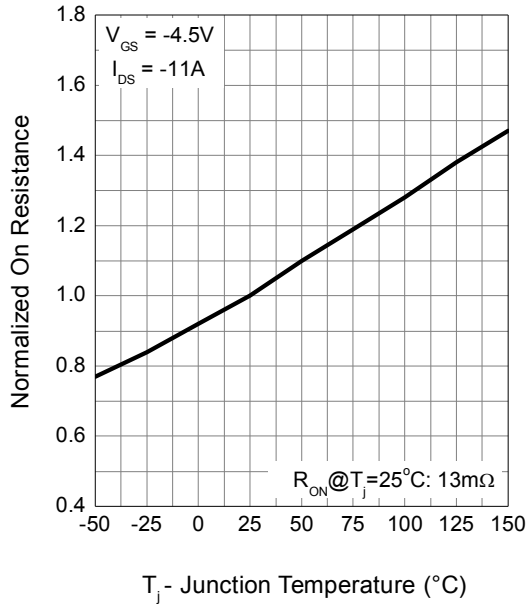


Gate Threshold Voltage

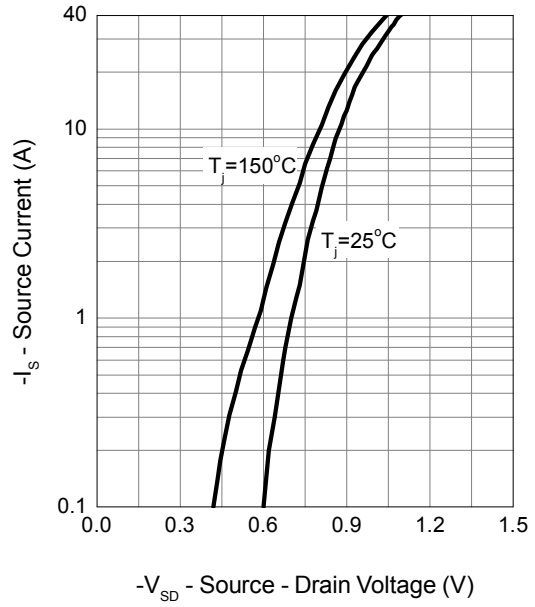




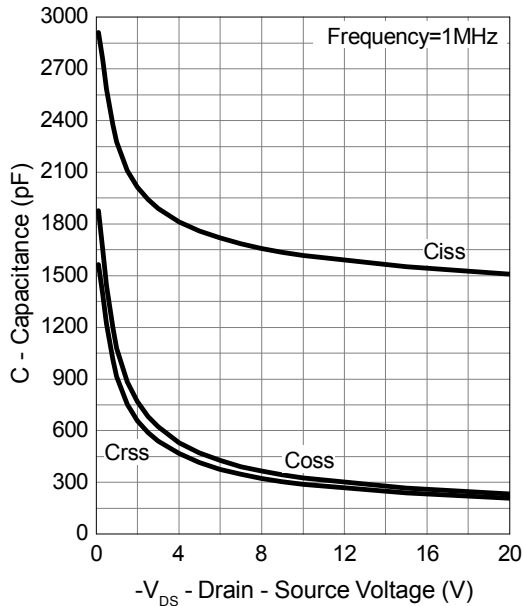
Drain-Source On Resistance



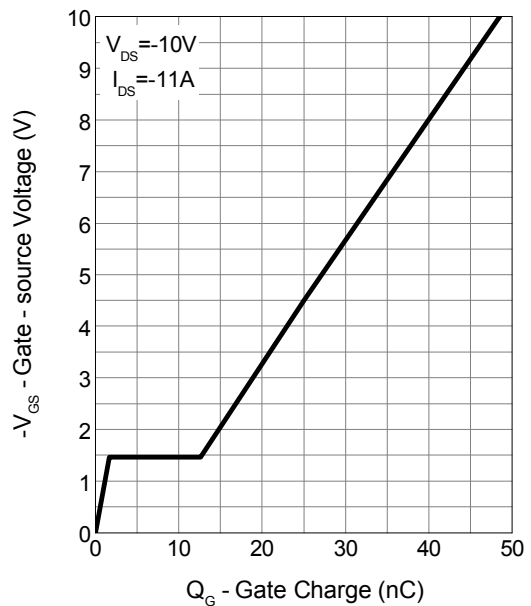
Source-Drain Diode Forward



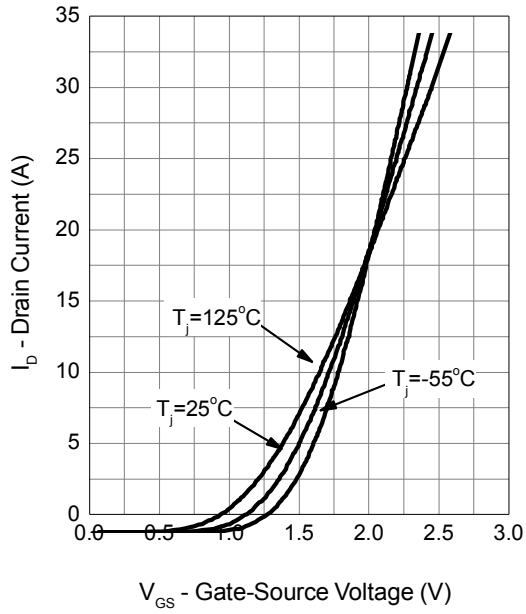
Capacitance



Gate Charge

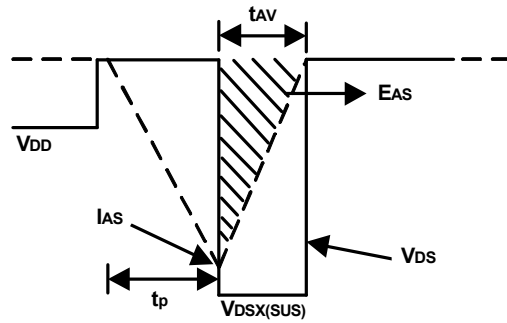
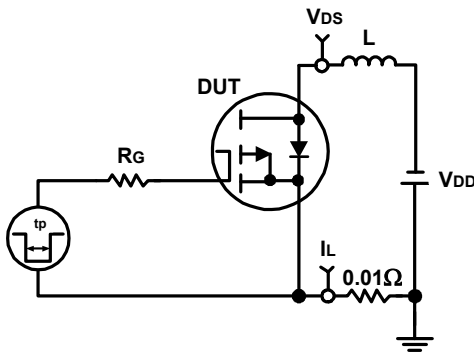


Transfer Characteristics

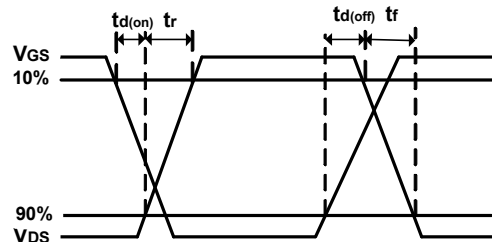
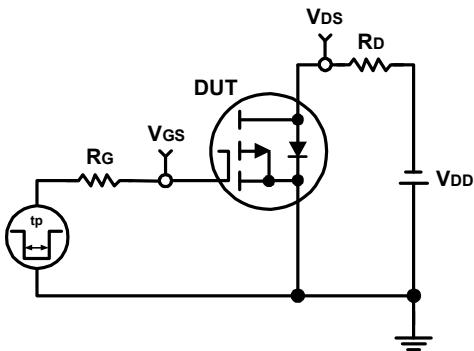




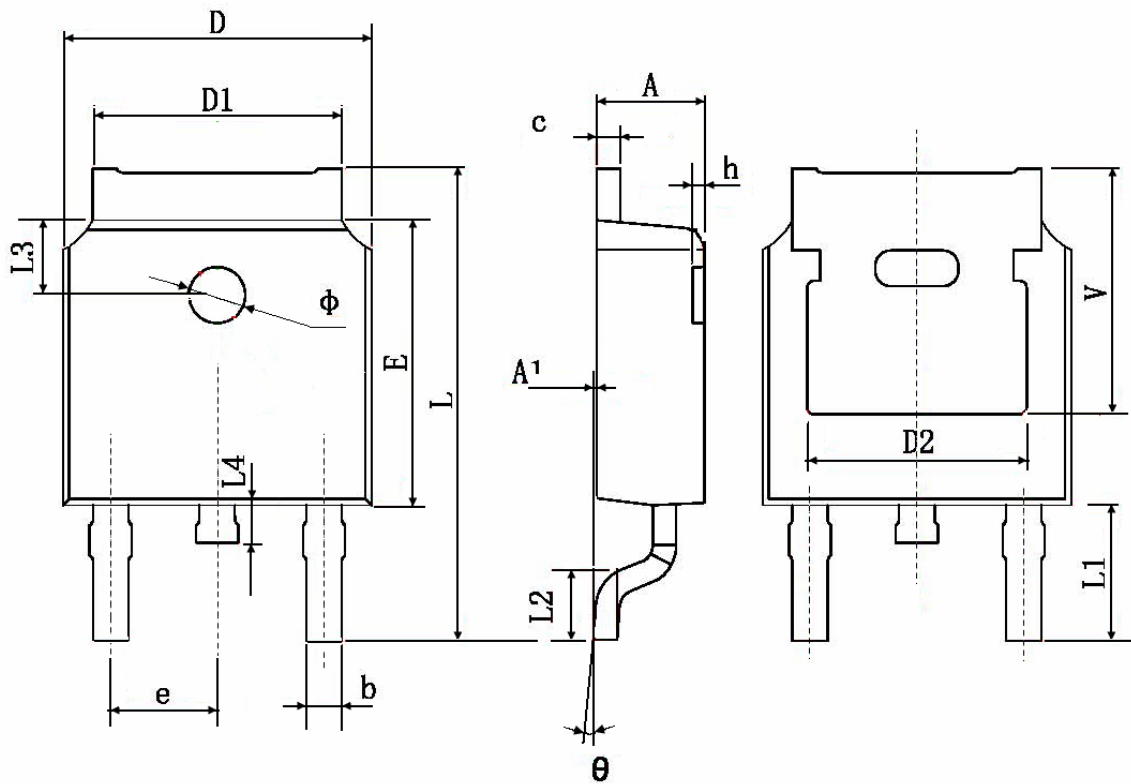
### Avalanche Test Circuit and Waveforms



### Switching Time Test Circuit and Waveforms



## Package Mechanical Data: TO-252-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	