

FNK N-Channel Enhancement Mode Power MOSFET

General Description

The FNK06N02D combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is ideal for load switch and battery protection applications.

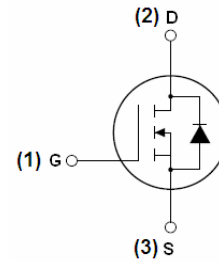
Product Summary

V_{DS}	20V
I_D (at $V_{GS}=4.5V$)	50A
$R_{DS(ON)}$ (at $V_{GS}=4.5V$)	< 5.4m Ω
$R_{DS(ON)}$ (at $V_{GS}=2.5V$)	< 7.2m Ω

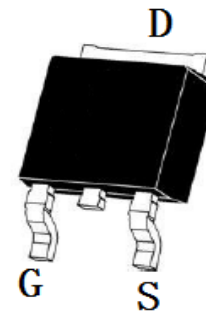
- High Power and current handing capability
- Lead free product is acquired

Application

- Battery Switch
- Load switch
- Power management



Schematic diagram



TO-252-2L top view

Absolute Maximum Ratings $T_A=25^{\circ}C$ unless otherwise noted			
Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current ^G	I_D	$T_C=25^{\circ}C$	50
		$T_C=100^{\circ}C$	35
Pulsed Drain Current ^C	I_{DM}	200	A
Avalanche Current ^C	I_{AS}	36	A
Avalanche energy $L=0.5mH$ ^C	E_{AS}	97	mJ
Power Dissipation ^B	P_D	$T_C=25^{\circ}C$	100
		$T_C=100^{\circ}C$	50
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^{\circ}C$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	16	20	$^{\circ}C/W$
	Steady-State		41	50	$^{\circ}C/W$
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	1.2	1.5	$^{\circ}C/W$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V	20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =20V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±12V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	0.5	0.7	1.6	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	160			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =4.5V, I _D =20A		4.3	5.4	mΩ
		V _{GS} =2.5V, I _D =20A		5.6	7.2	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		105		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.7	1	V
I _S	Maximum Body-Diode Continuous Current ⁶				45	A
DYNAMIC PARAMETERS						
C	Input Capacitance	V _{GS} =0V, V _{DS} =10V, f=1MHz		2680		pF
C	Output Capacitance			345		pF
C	Reverse Transfer Capacitance			320		pF
R	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		1.4		Ω
SWITCHING PARAMETERS						
Q _{g(4.5V)}	Total Gate Charge	V _{GS} =10V, V _{DS} =10V, I _D =20A	28	36	43	nC
Q _{gs}	Gate Source Charge				9	nC
Q _{gd}	Gate Drain Charge				12	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =10V, R _L =0.5Ω, R _{GEN} =3Ω		7		ns
t _r	Turn-On Rise Time			8		ns
t _{D(off)}	Turn-Off DelayTime			70		ns
t _f	Turn-Off Fall Time			18		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=500A/μs	13	17	20	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs	29	36	43	nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.

B. The power dissipation P_D is based on T_{J(MAX)}=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=175° C. Ratings are based on low frequency and duty cycles to keep initial T_J=25° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=175° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

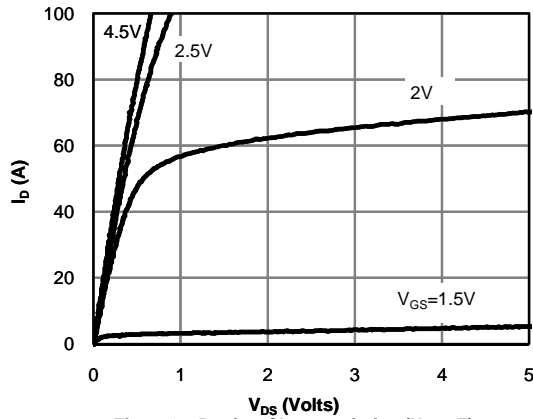


Fig 1: On-Region Characteristics (Note E)

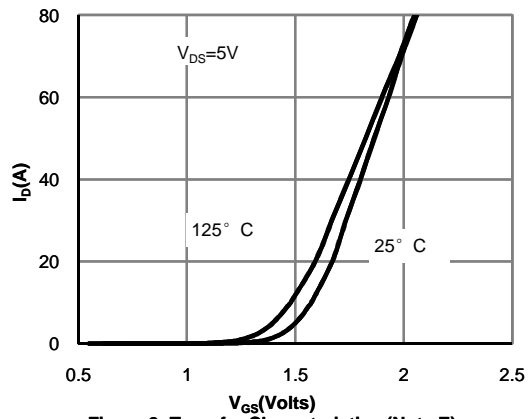


Figure 2: Transfer Characteristics (Note E)

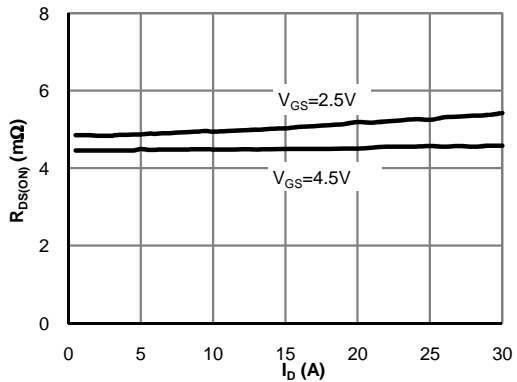


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

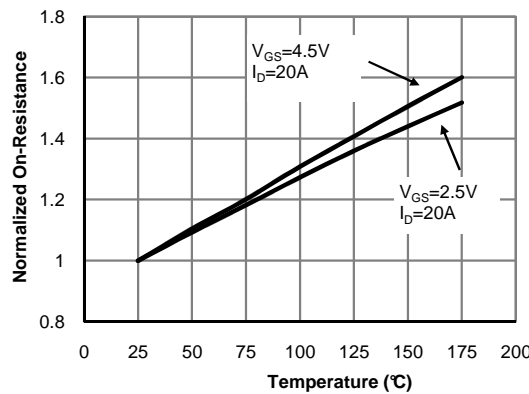


Figure 4: On-Resistance vs. Junction Temperature (Note E)

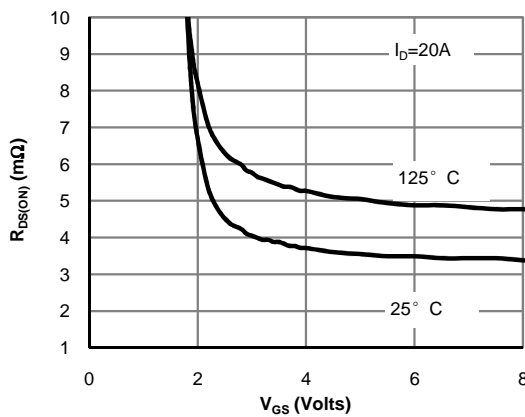


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

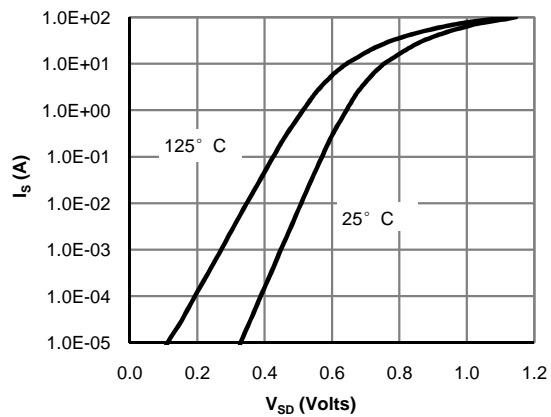


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

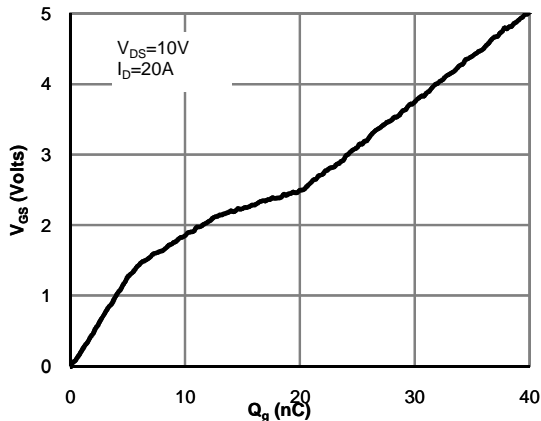


Figure 7: Gate-Charge Characteristics

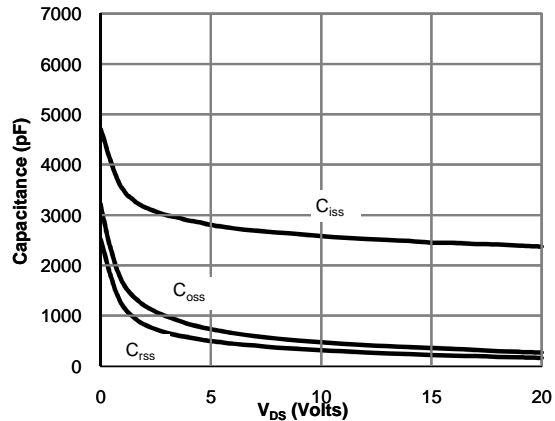


Figure 8: Capacitance Characteristics

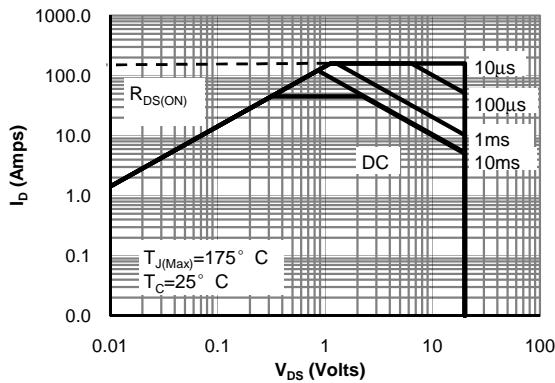


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

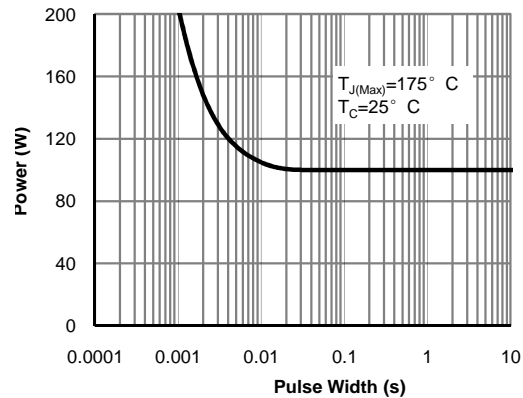


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

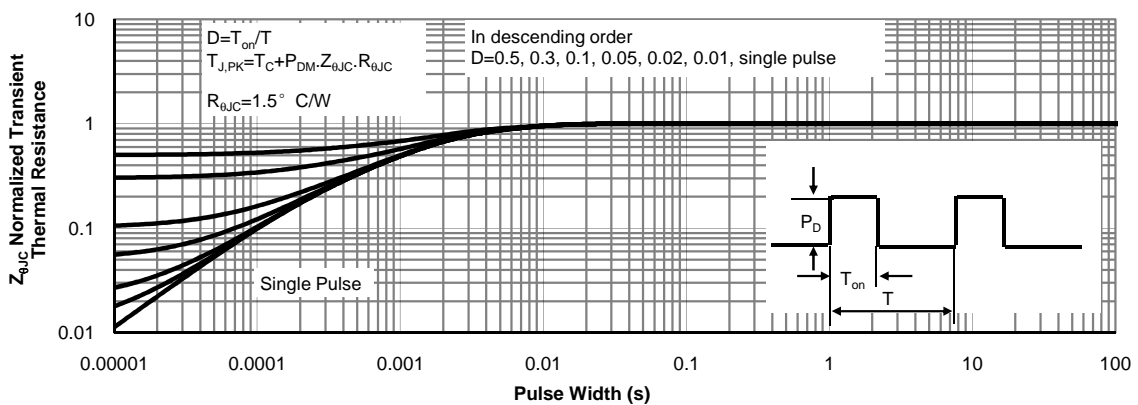


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

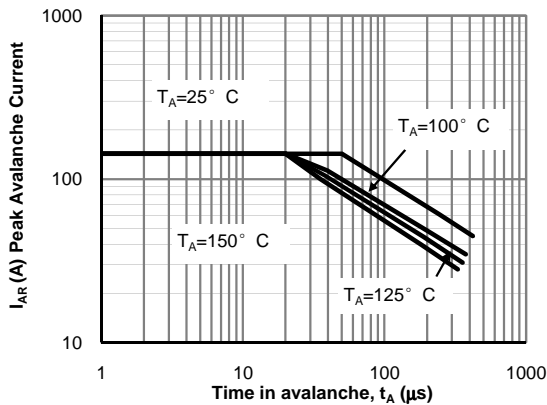


Figure 12: Single Pulse Avalanche capability (Note C)

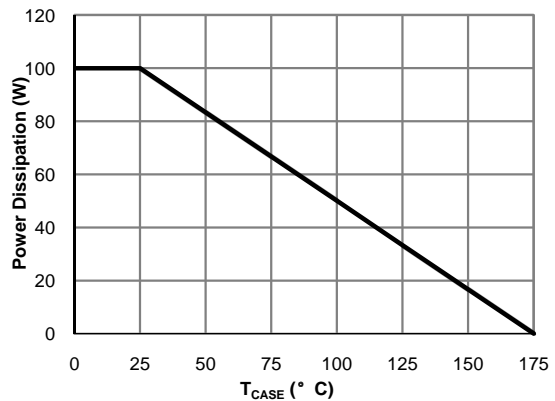


Figure 13: Power De-rating (Note F)

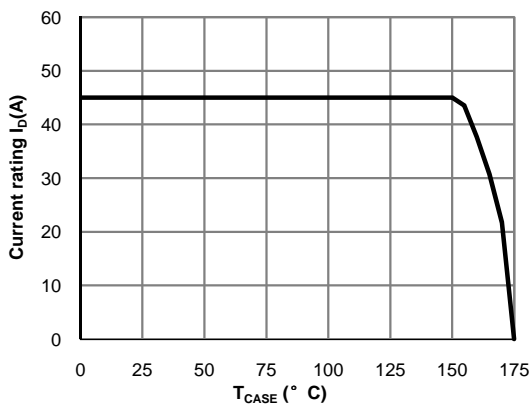


Figure 14: Current De-rating (Note F)

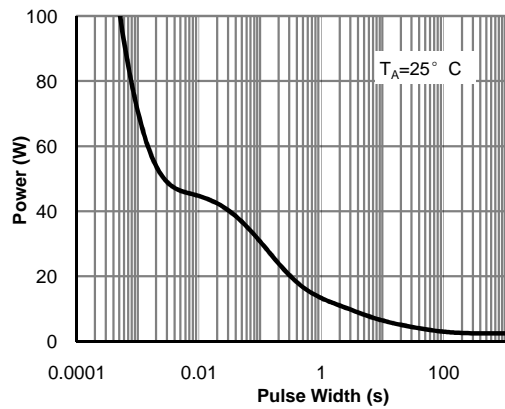


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

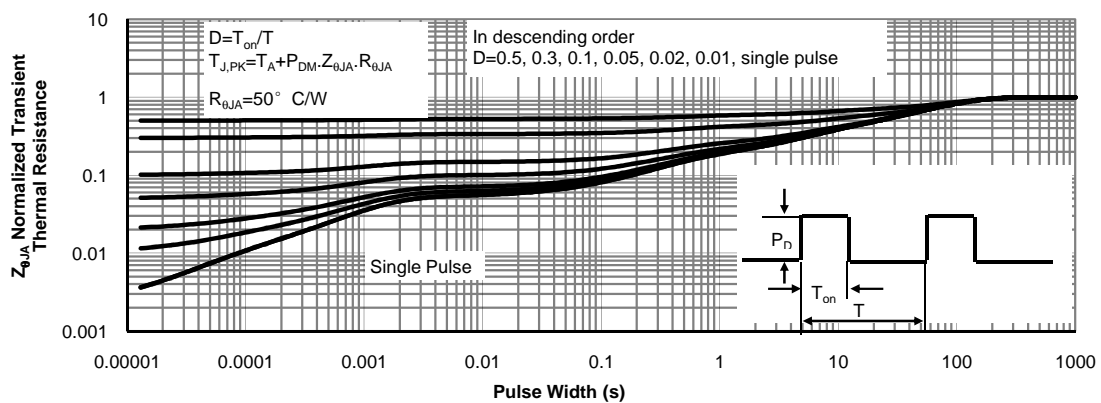
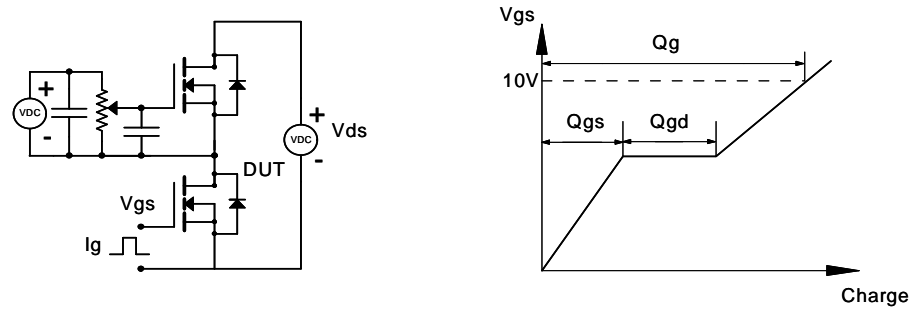
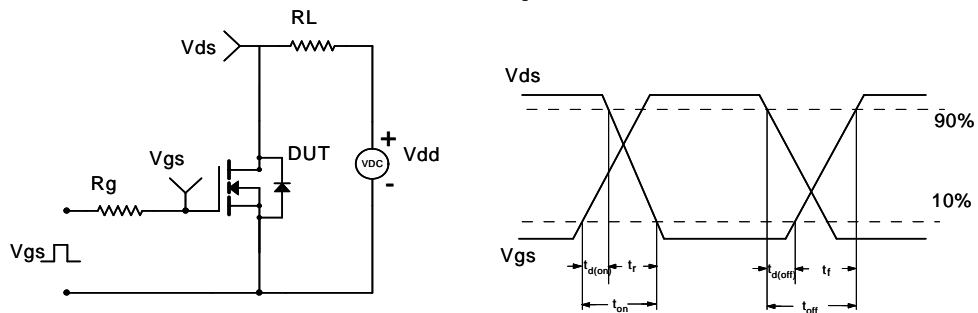


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

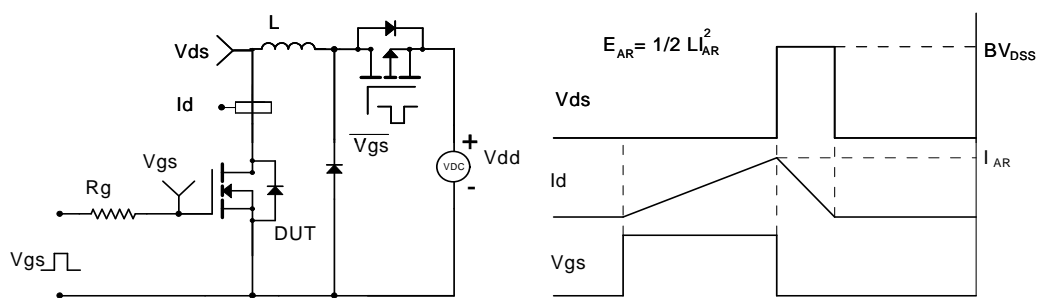
Gate Charge Test Circuit & Waveform



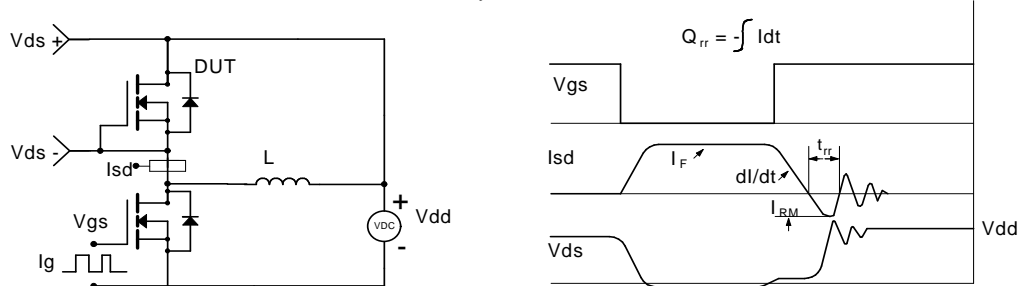
Resistive Switching Test Circuit & Waveforms

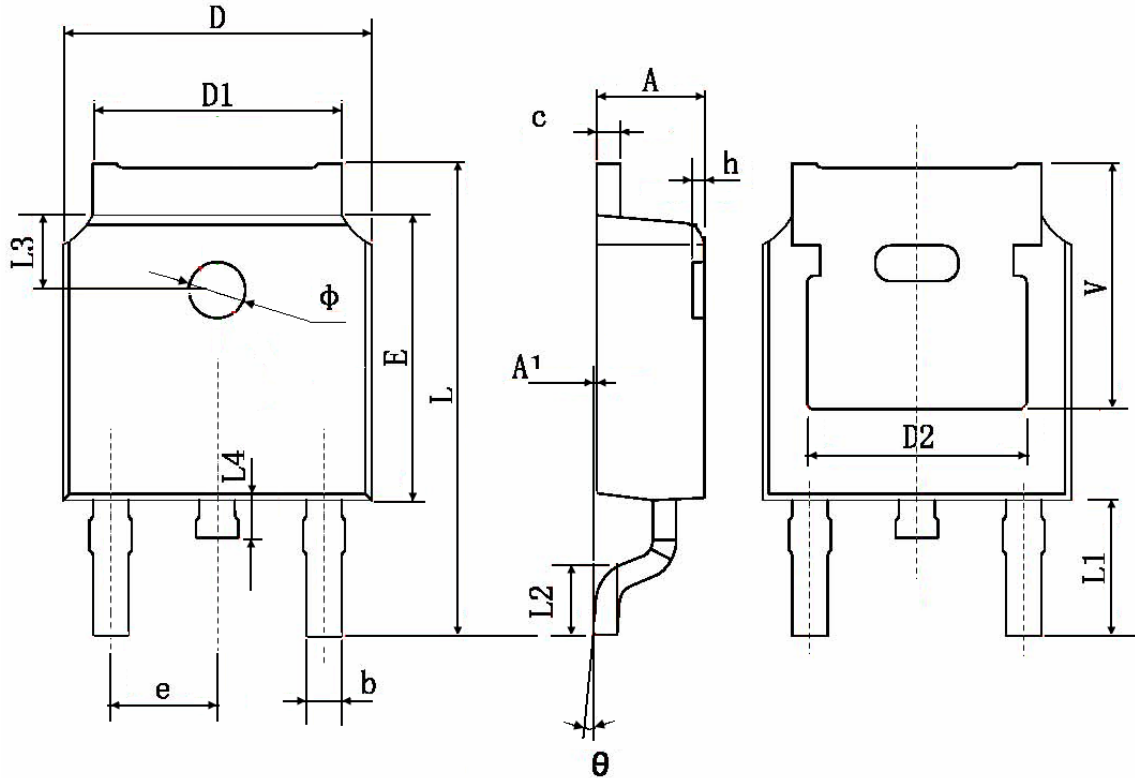


Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



TO-252 Package Information


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.	

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