

## N-Channel MOSFET

### Features

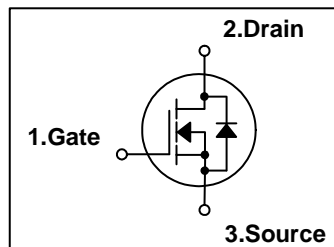
$R_{DS(on)}$  (Max 1.5 )@ $V_{GS}=10V$

Gate Charge (Typical 32nC)

Improved dv/dt Capability

High ruggedness

100% Avalanche Tested



$BV_{DSS} = 500V$

$R_{DS(ON)} = 1.5 \text{ ohm}$

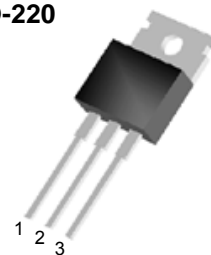
$I_D = 4.5A$

### General Description

This N-channel enhancement mode field-effect power transistor using DI semiconductor's advanced planar stripe, DMOS technology intended for off-line switch mode power supply.

Also, especially designed to minimize  $r_{ds(on)}$  and high rugged avalanche characteristics. The TO-220 pkg is well suited for half bridge and full bridge resonant topology like a electronic ballast.

TO-220



### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain to Source Voltage	500	V
$I_D$	Continuous Drain Current(@ $T_C = 25^\circ C$ )	4.5	A
	Continuous Drain Current(@ $T_C = 100^\circ C$ )	2.9	A
$I_{DM}$	Drain Current Pulsed (Note 1)	18	A
$V_{GS}$	Gate to Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	390	mJ
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	7.4	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	3.5	V/ns
$P_D$	Total Power Dissipation(@ $T_C = 25^\circ C$ )	74	W
	Derating Factor above $25^\circ C$	0.59	W/ $^\circ C$
$T_{STG}, T_J$	Operating Junction Temperature & Storage Temperature	- 55 ~ 150	$^\circ C$
$T_L$	Maximum Lead Temperature for soldering purpose, 1/8 from Case for 5 seconds.	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Value			Units
		Min.	Typ.	Max.	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	-	1.7	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Sink	-	0.5	-	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	-	-	62	$^\circ C/W$

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## Electrical Characteristics ( $T_C = 25\text{ }^\circ\text{C}$ unless otherwise noted )

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	500	-	-	V
$BV_{DSS}/T_J$	Breakdown Voltage Temperature coefficient	$I_D = 250\mu A$ , referenced to $25\text{ }^\circ\text{C}$	-	0.6	-	$V/^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS} = 500V, V_{GS} = 0V$	-	-	1	$\mu A$
		$V_{DS} = 400V, T_C = 125\text{ }^\circ\text{C}$	-	-	10	$\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	$V_{GS} = 30V, V_{DS} = 0V$	-	-	100	nA
	Gate-source Leakage, Reverse	$V_{GS} = -30V, V_{DS} = 0V$	-	-	-100	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain-Source On-state Resistance	$V_{GS} = 10V, I_D = 2.7A$	-	1.2	1.5	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 25V, f = 1MHz$	-	580	-	pF
$C_{oss}$	Output Capacitance		-	152	-	
$C_{rss}$	Reverse Transfer Capacitance		-	23	-	
<b>Dynamic Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, I_D = 4.5A, R_G = 25$ <b>see fig. 13.</b> (Note 4, 5)	-	28	36	ns
$t_r$	Rise Time		-	60	78	
$t_{d(off)}$	Turn-off Delay Time		-	134	175	
$t_f$	Fall Time		-	38	50	
$Q_g$	Total Gate Charge	$V_{DS} = 400V, V_{GS} = 10V, I_D = 4.5A$ <b>see fig. 12.</b> (Note 4, 5)	-	30	36	nC
$Q_{gs}$	Gate-Source Charge		-	4	-	
$Q_{gd}$	Gate-Drain Charge(Miller Charge)		-	12	-	

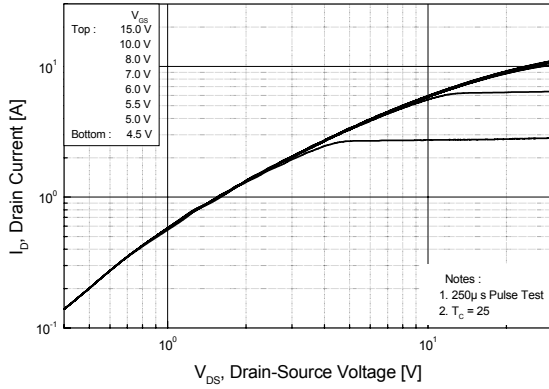
## Source-Drain Diode Ratings and Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit.
$I_S$	Continuous Source Current	Integral Reverse p-n Junction Diode in the MOSFET	-	-	4.5	A
$I_{SM}$	Pulsed Source Current		-	-	18	
$V_{SD}$	Diode Forward Voltage	$I_S = 4.5A, V_{GS} = 0V$	-	-	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S = 4.5A, V_{GS} = 0V, di/dt = 100A/\mu s$	-	416	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	1.58	-	$\mu C$

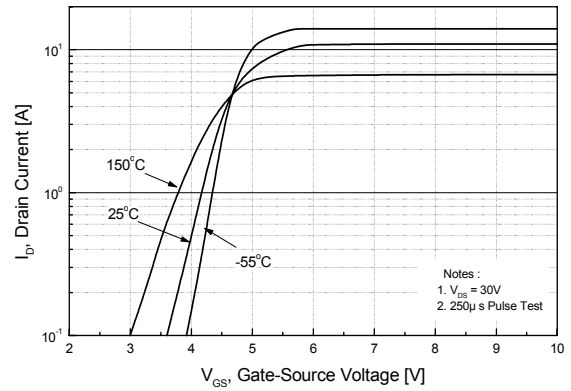
### NOTES

1. Repeatability rating : pulse width limited by junction temperature
2.  $L = 34.7mH, I_{AS} = 4.5A, V_{DD} = 50V, R_G = 50$  , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} = 4.5A, di/dt = 300A/\mu s, V_{DD} = BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse Width  $300\mu s$ , Duty Cycle  $2\%$
5. Essentially independent of operating temperature.

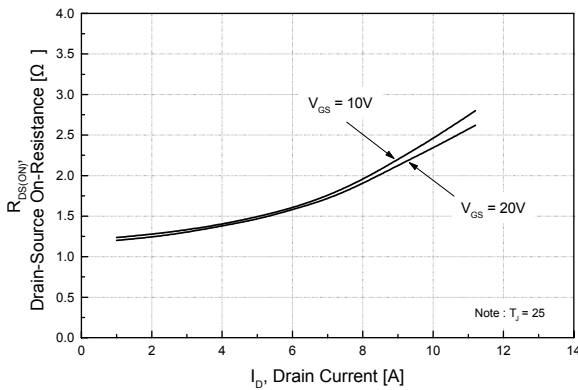
**Fig 1. On-State Characteristics**



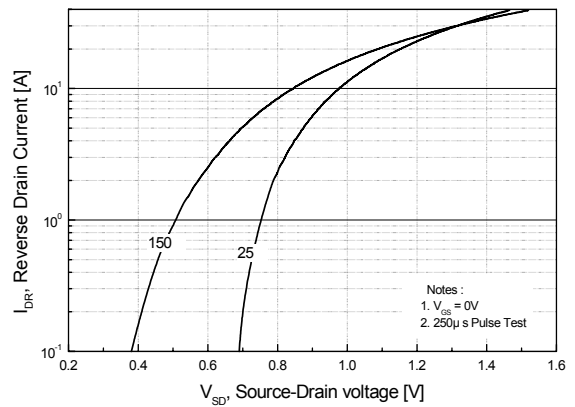
**Fig 2. Transfer Characteristics**



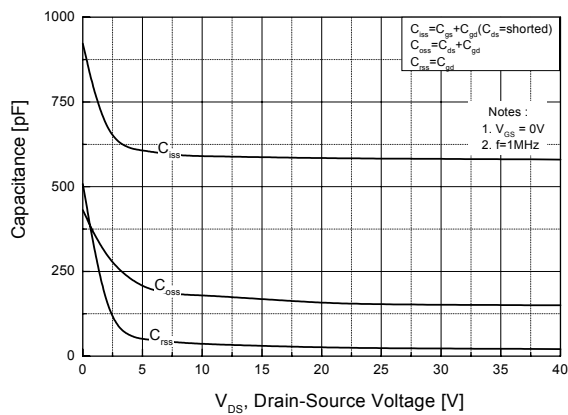
**Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage**



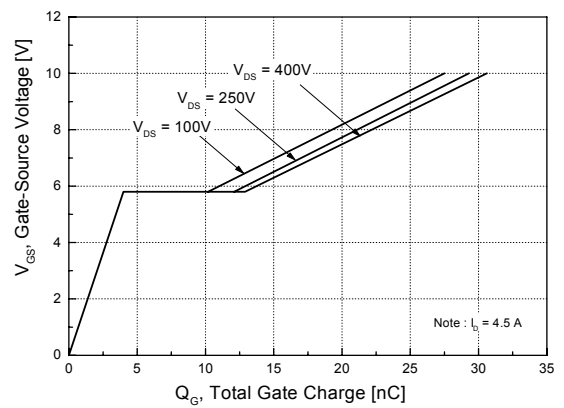
**Fig 4. On State Current vs. Allowable Case Temperature**



**Fig 5. Capacitance Characteristics**

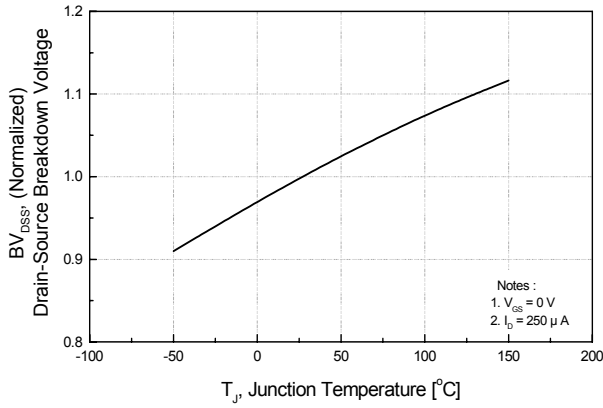


**Fig 6. Gate Charge Characteristics**

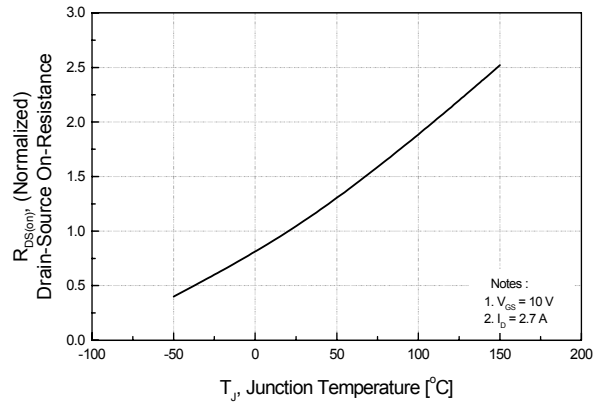


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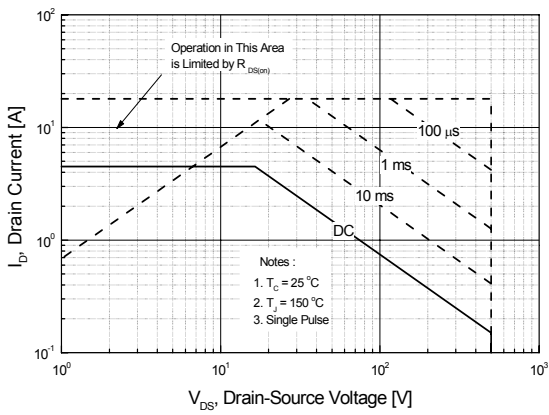
**Fig 7. Breakdown Voltage Variation vs. Junction Temperature**



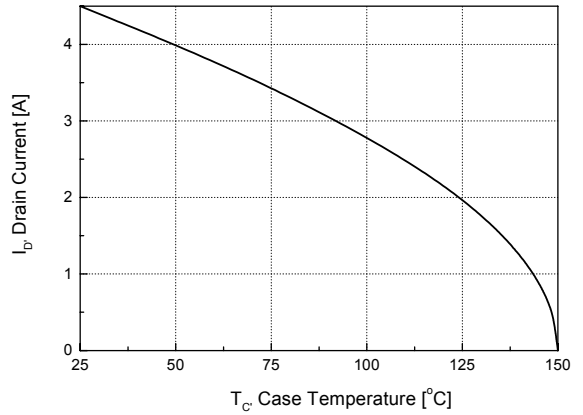
**Fig 8. On-Resistance Variation vs. Junction Temperature**



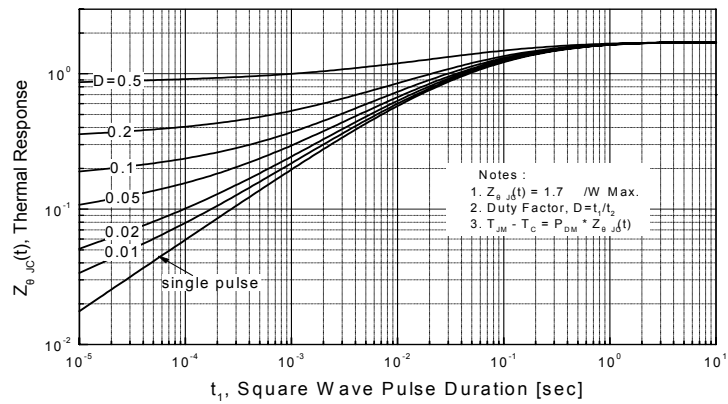
**Fig 9. Maximum Safe Operating Area**



**Fig 10. Maximum Drain Current**



**Fig 11. Transient Thermal Response Curve**



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Fig. 12. Gate Charge Test Circuit & Waveforms

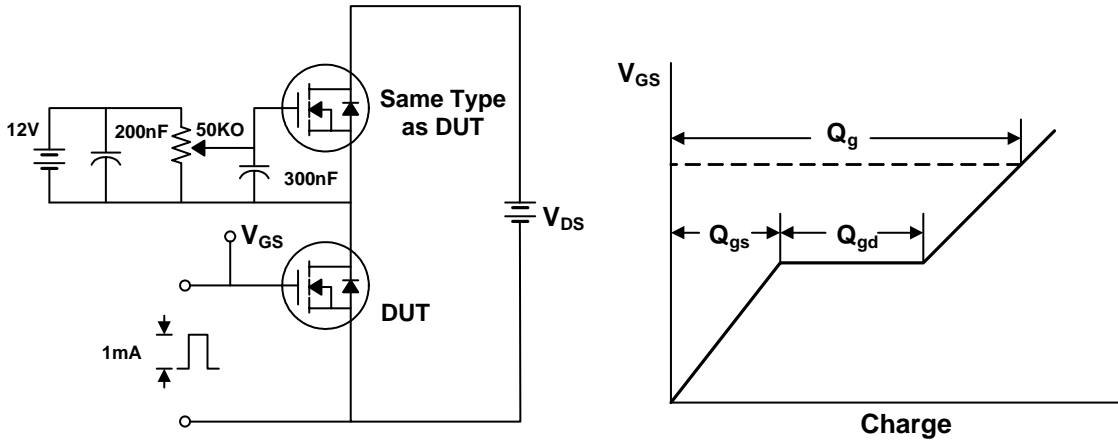


Fig. 13. Switching Time Test Circuit & Waveforms

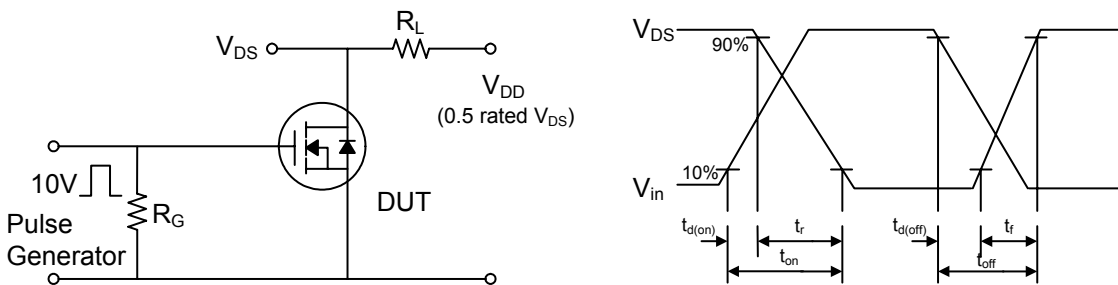
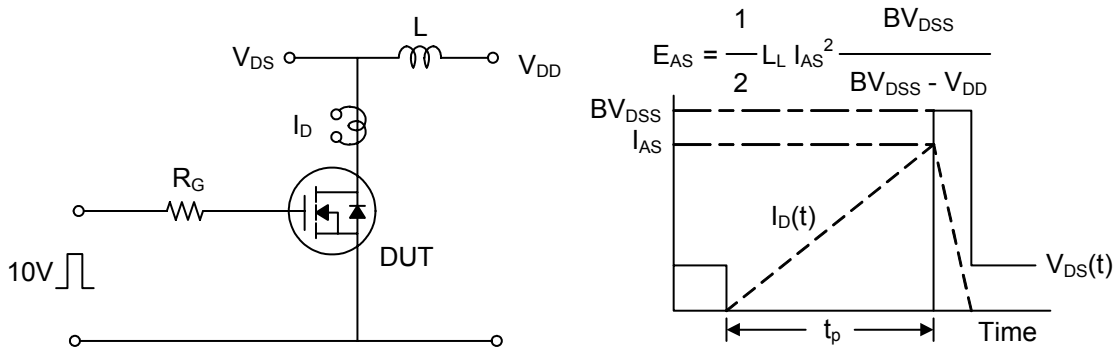
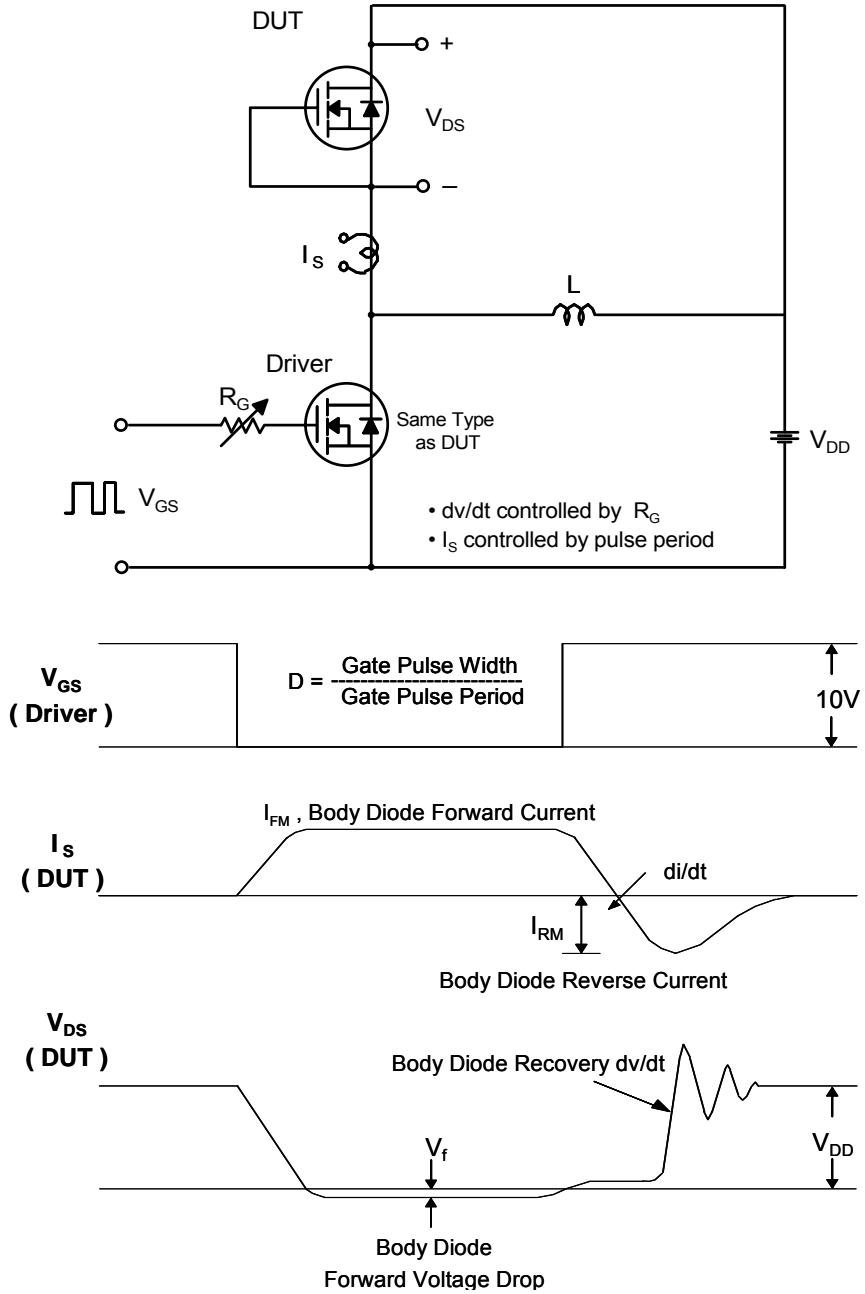


Fig. 14. Unclamped Inductive Switching Test Circuit & Waveforms



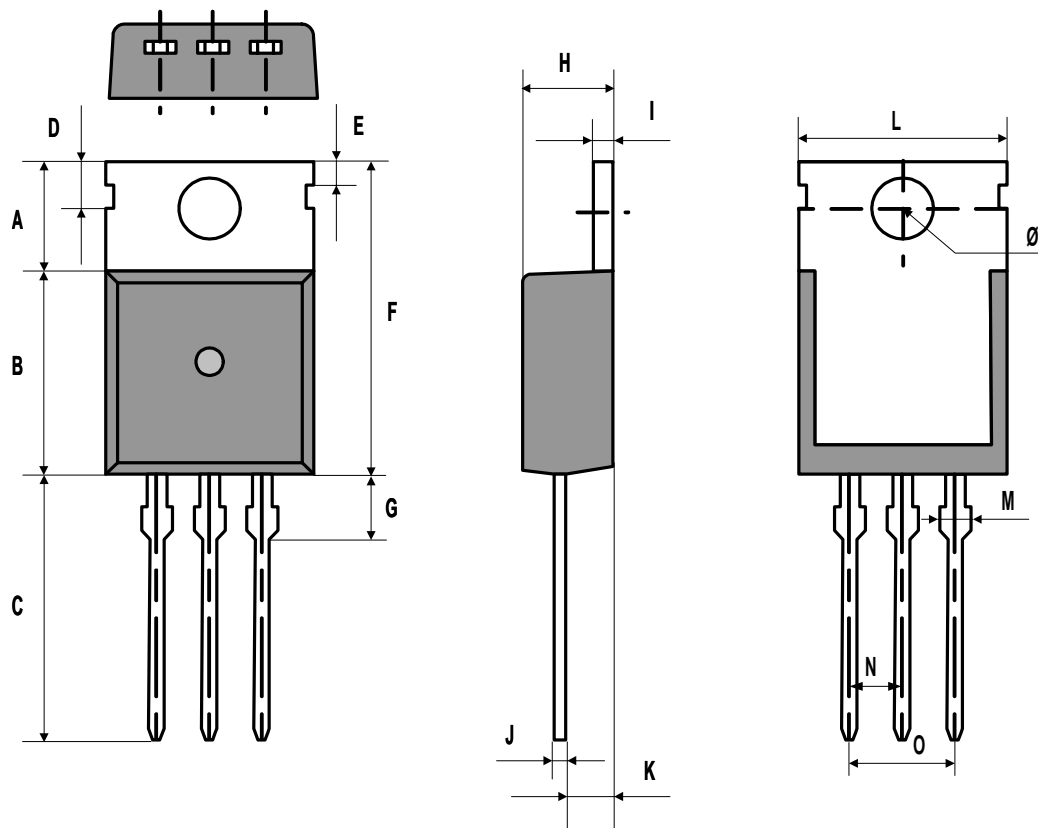
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Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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## TO-220 Package Dimension



DIMENSION		A	B	C	D	E	F	G	H
m m	Min	6.12	9.00	12.88	2.70	1.20	15.12	2.70	4.30
	Typ.	6.32	9.20	13.08	2.80	1.30	15.52	3.00	4.50
	Max	6.52	9.40	13.28	2.90	1.40	15.92	3.30	4.70

DIMENSION		I	J	K	L	M	N	O	Ø
m m	Min	1.25	0.45	2.30		1.42	2.44	4.88	
	Typ.	1.30	0.50	2.40	9.90	1.52	2.54	5.08	3.60
	Max	1.40	0.60	2.50		1.62	2.64	5.28	