

## FEATURES

- | Low Gate Charge

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- | Low ON Resistance

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- | Improved dv/dt Capability

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- | 100% Avalanche Tested

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## APPLICATION

- | Switching Mode Power Supplies (SMPS)

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- | PWM Motor Controls

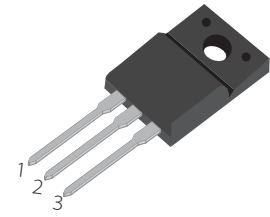
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- | LED Lighting

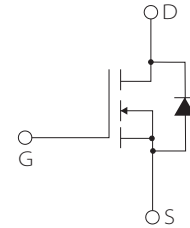
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- | Adapter

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TO-220F



Schematic Symbol

## APPROVALS

<b>RoHS</b>	Compliance with 2011/65/EU
<b>HF</b>	Compliance with IEC61249-2-21:2003

## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	650	V
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> =25°C	4 <sup>(1)</sup>
		T <sub>C</sub> =100°C	2.5 <sup>(1)</sup>
Drain current pulsed <sup>(2)</sup>	I <sub>DM</sub>	16 <sup>(1)</sup>	A
Gate-Source Voltage	V <sub>GS</sub>	±30	V
Single pulsed Avalanche Energy <sup>(3)</sup>	E <sub>AS</sub>	54	mJ
Peak diode Recovery dv/dt <sup>(4)</sup>	dv/dt	5	V/ns
Total power dissipation (@T <sub>C</sub> =25°C)	P <sub>D</sub>	30.5	W
Derating Factor above 25°C	P <sub>D</sub>	0.24	W/°C
Operating Junction Temperature & Storage Temperature	T <sub>STG</sub> , T <sub>J</sub>	-55 to +150	°C
Maximum lead temperature for soldering purpose	T <sub>L</sub>	260	°C
Thermal resistance, Junction to case (Maximum)	R <sub>thjc</sub>	4.1	°C/W
Thermal resistance, Junction to ambient (Maximum)	R <sub>thja</sub>	69.6	°C/W

### Notes

1. Drain current is limited by maximum junction temperature.  
 3. L = 12mH, I<sub>AS</sub> = 3A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting at T<sub>J</sub> = 25°C

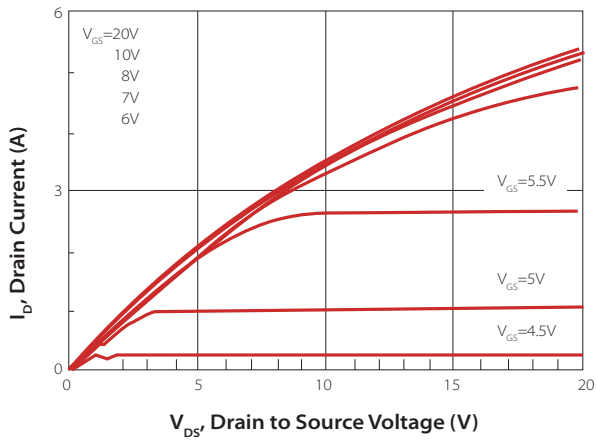
2. Repetitive rating : pulse width limited by junction temperature.  
 4. I<sub>SD</sub> ≤ I<sub>DR</sub>, di/dt = 100A/us, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting at T<sub>J</sub> = 25°C

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

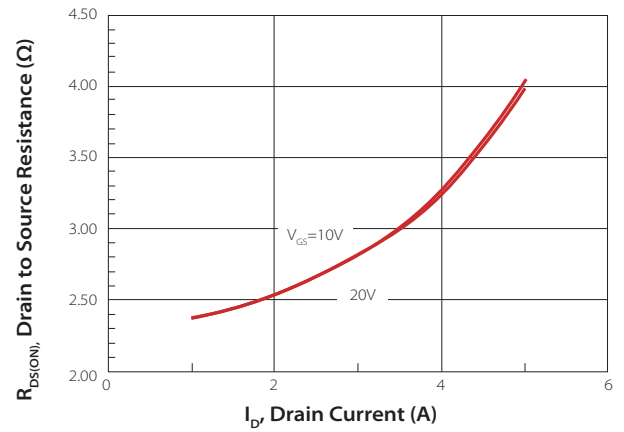
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650			V
Breakdown voltage temperature coefficient	$\frac{\Delta BV_{DSS}}{\Delta T_J}$	I <sub>D</sub> =250uA, referenced to 25°C		0.7		V/°C
Zero Gate Voltage Drain current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V			1	uA
		V <sub>DS</sub> =520V, T <sub>C</sub> =125°C			10	uA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =30V, V <sub>DS</sub> =0V			100	nA
		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100	nA
<b>Off Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.5	3.5	4.5	V
Drain-Source On-Resistance (note2)	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2A		2.5	3.0	Ω
Forward Tran conductance	gFS	V <sub>DS</sub> =10V, I <sub>D</sub> =2A		3		S
<b>Dynamic Characteristics</b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f=1MHz		506		pF
Output capacitance	C <sub>OSS</sub>			42.5		pF
Reverse Transfer capacitance	C <sub>rss</sub>			3.5		pF
Turn-on Delay Time	td(on)	V <sub>DS</sub> =325V, I <sub>D</sub> =4A, R <sub>G</sub> =25Ω V <sub>GS</sub> =10V		19.3		ns
Rising time	tf			12		ns
Turn-off Delay Time	td(off)			35.3		ns
Input capacitance	tf			13		ns
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =325V, I <sub>D</sub> =4A, V <sub>GS</sub> =10V		11.2		nC
Gate-source charge	Q <sub>gs</sub>			2.7		nC
Gate-drain charge	Q <sub>gd</sub>			4.3		nC
Continuous source current	I <sub>S</sub>	Integral reverse p-n Junction diode in the MOSFET			4	A
Pulsed source current	I <sub>SM</sub>				16	A
Diode forward voltage drop.	V <sub>SD</sub>	I <sub>S</sub> =4A, V <sub>GS</sub> =0V		0.9	1.3	V
Reverse recovery time	T <sub>rr</sub>	I <sub>S</sub> =4A, V <sub>GS</sub> =0V, di <sub>r</sub> /dt=100A/us		335		ns
Reverse recovery Charge	Q <sub>rr</sub>				1.84	

# CHARACTERISTIC CURVES

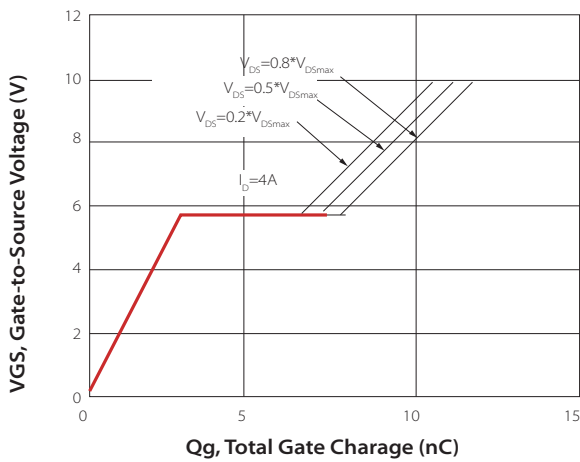
**Fig.1 Output characteristics**



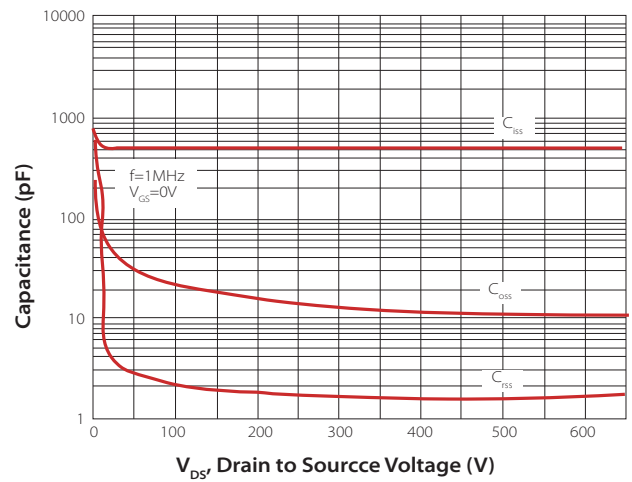
**Fig.2 Reverse Characteristics**



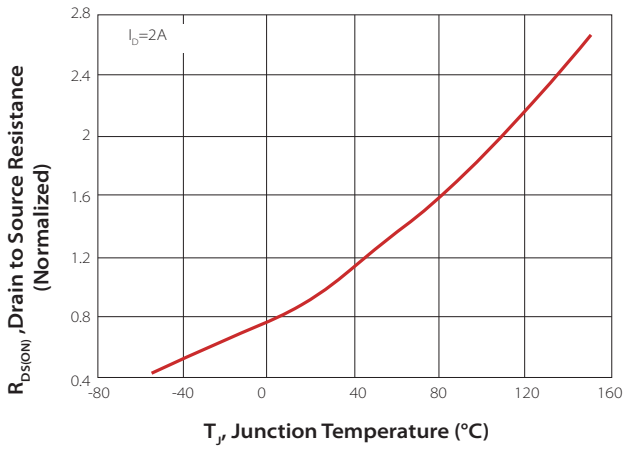
**Fig.3 Gate charge characteristics**



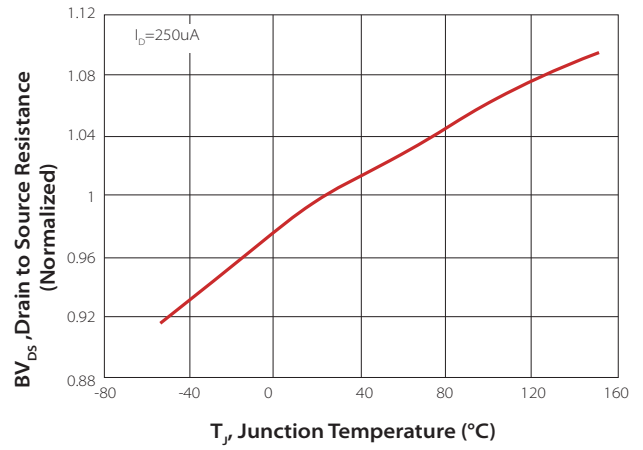
**Fig.4 Capacitance Characteristics**



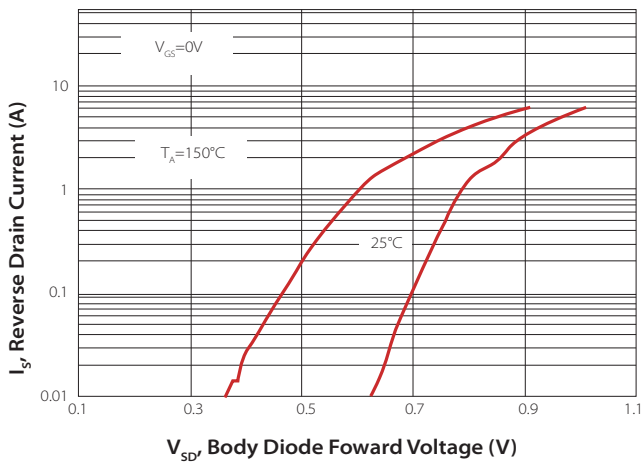
**Fig.5  $R_{DS(ON)}$  vs junction temperature**



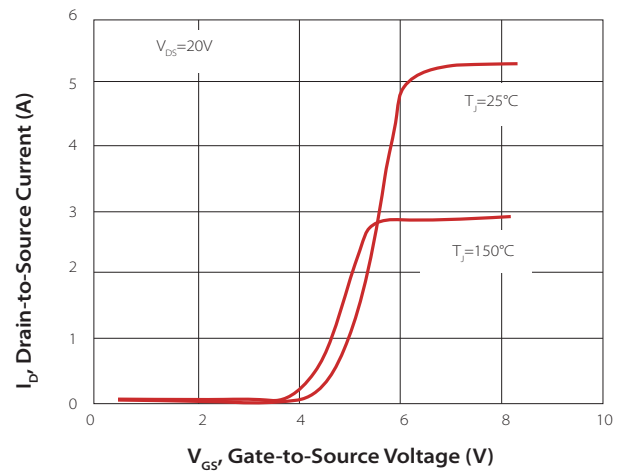
**Fig. 6  $BV_{DSS}$  vs junction temperature**



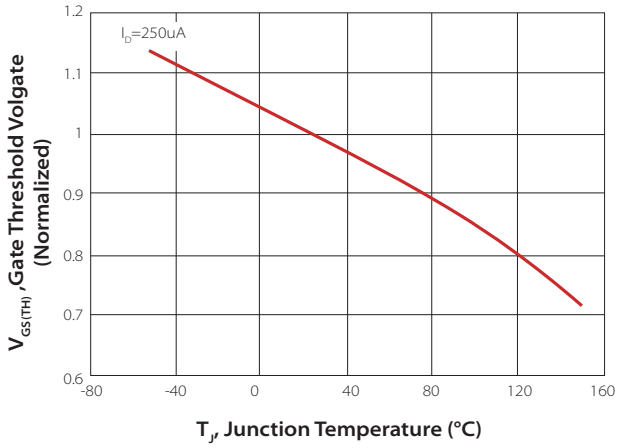
**Fig.7 Forward characteristics of reverse diode**



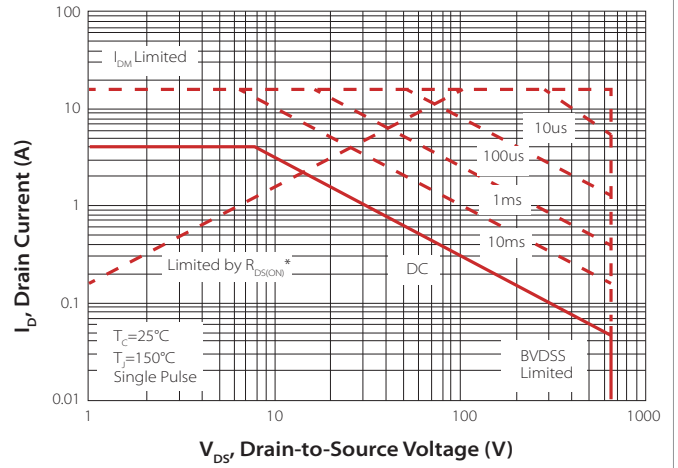
**Fig.8 Transfer characteristics**



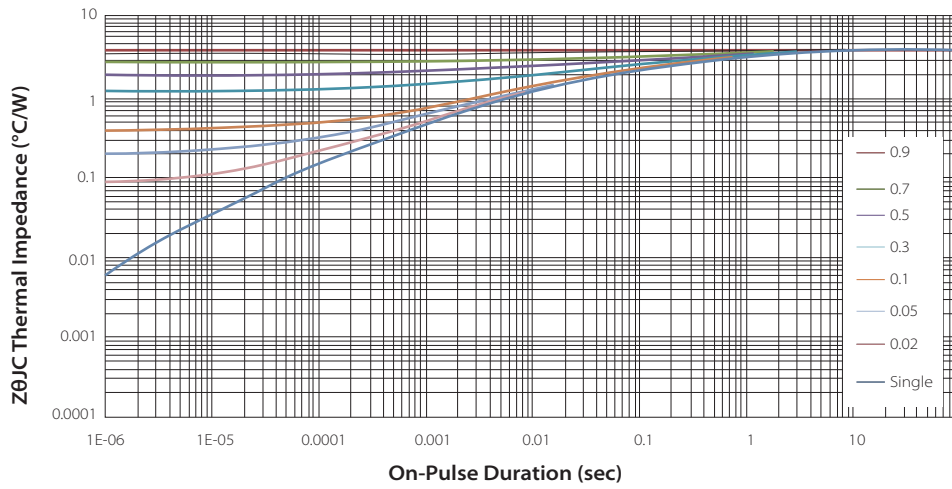
**Fig.9**  $V_{GS(TH)}$  vs junction temperature



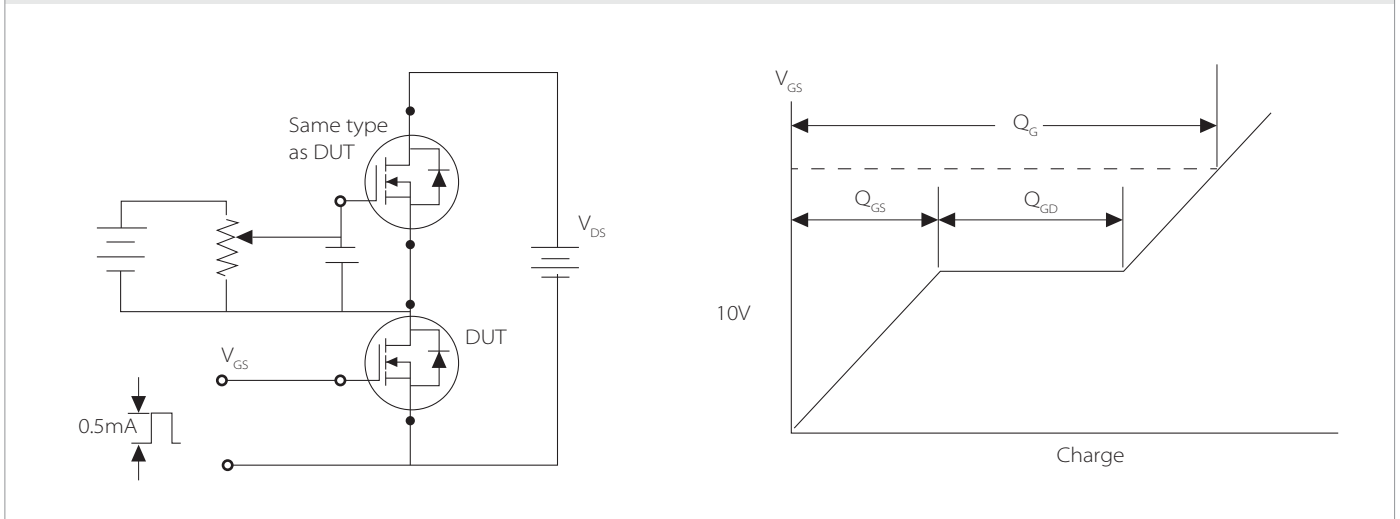
**Fig. 10** Safe operating area



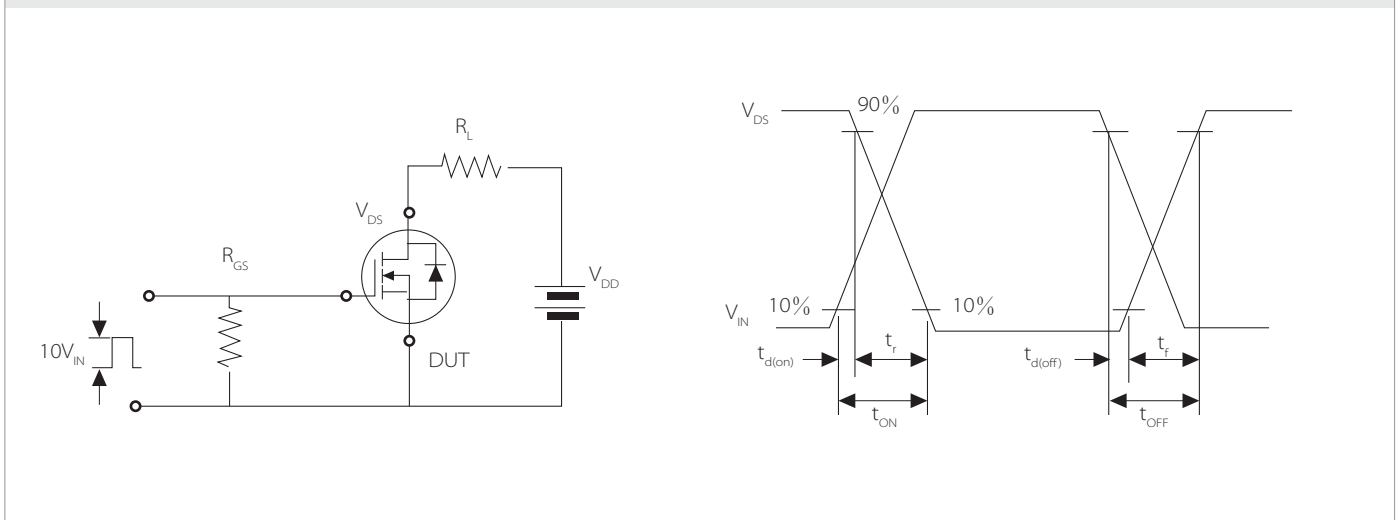
**Fig.11** Transient thermal impedance



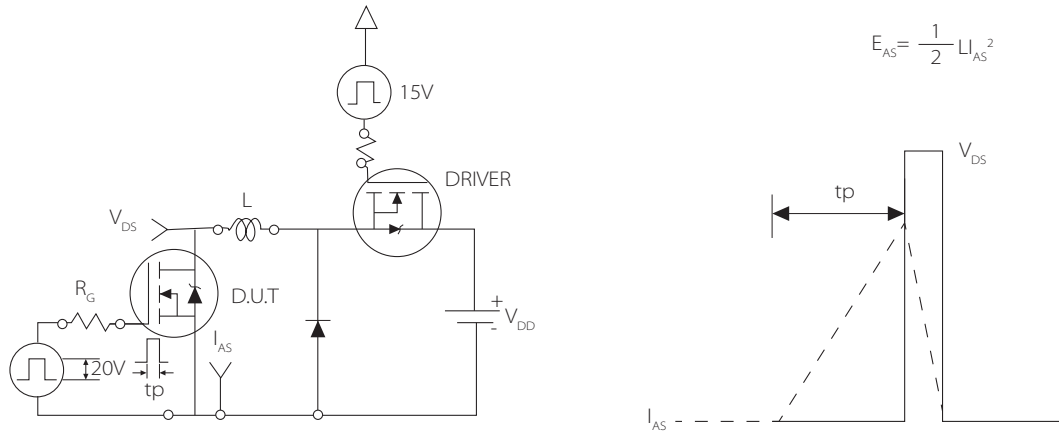
**Fig.12 Gate charge test circuit & waveform**



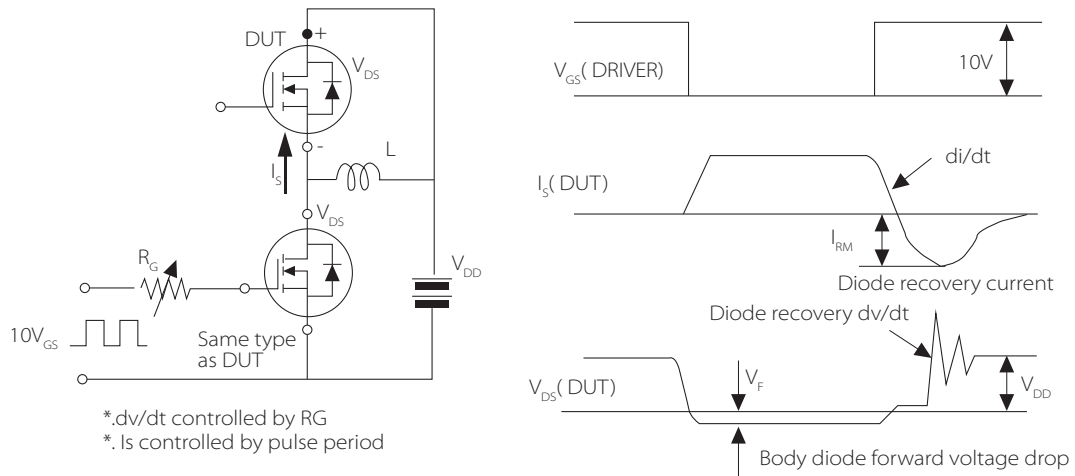
**Fig.13 Switching time test circuit & waveform**



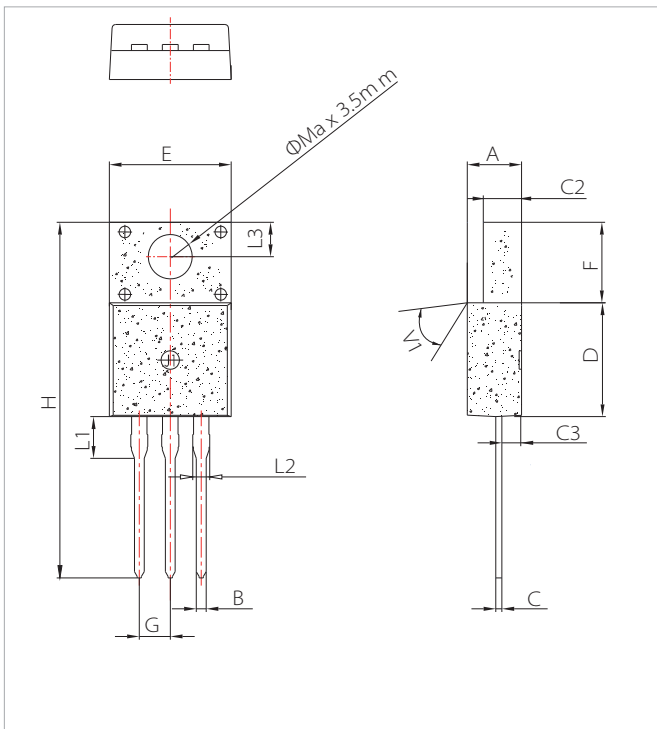
**Fig.14 Unclamped Inductive switching test circuit & waveform**



**Fig.15 Peak diode recovery dv/dt test circuit & waveform**



## TO-220F PACKAGE MECHANICAL DATA



Ref.	Dimensions					
	Ref. Millimeters Inches			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.80	0.173		0.181
B	0.74	0.80	0.83	0.029		0.033
C	0.48		0.75	0.019		0.030
C2	2.40		2.70	0.094		0.106
C3	2.60		3.00	0.102		0.118
D	8.80		9.30	0.346		0.366
E	9.70		10.3	0.382		0.406
F	6.40		7.00	0.252		0.276
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.63			0.143	
L2	1.14		1.70	0.045		0.067
L3		3.30			0.130	
V1		45°			45°	

## ORDERING INFORMATION

Part Number	Component Package	Marking	QTY/Tube	Box
SNMF4N65	TO-220F	PDI4N65P2	50PCS	1000PCS



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