

## Features

- Uses PingWei advanced PerfectMOS technology
- Extremely low on-resistance  $R_{DS(on)}$
- Excellent  $Q_g \times R_{DS(on)}$  product(FOM)
- Excellent Low Ciss
- Qualified according to JEDEC criteria



**100% DVDS Tested**  
**100% Avalanche Tested**

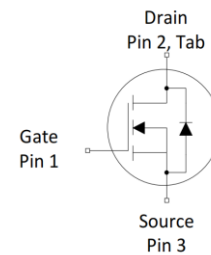
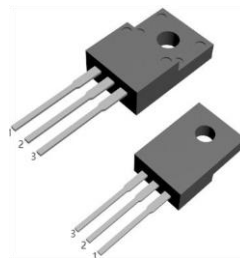
## Applications

- PFC stages, hard switching PWM stages and resonant switching
- PWM stages for e.g. PC Silverbox, Adapter, LCD & PDP TV, Lighting, Server, Telecom and UPS

## Product Summary

$V_{DS}$	900V
$R_{DS(on)@10V \text{ typ}}$	0.85Ω
$I_D$	9A

TO-220MF-3L



## Package Marking and Ordering Information

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
9N90MF	9N90MF	TO-220MF-3L	Tube	N/A	N/A	50pcs

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	900	V
Continuous drain current <sup>1)</sup> $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_D$	9 6	A
Pulsed drain current ( $T_C = 25^\circ\text{C}$ )	$I_{D \text{ pulse}}$	36	A
Avalanche energy, single pulse (L=10mH)	$E_{AS}$	551	mJ
Gate-Source voltage	$V_{GS}$	±30	V
Power dissipation $T_C = 25^\circ\text{C}$	$P_{tot}$	83	W
Operating junction and storage temperature	$T_j, T_{stg}$	-55...+150	°C
Soldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s)	$T_{sold}$	260	°C

1) TO-220 equivalent. Limited by  $T_j$  max.  $T_j = 25^\circ\text{C}$ . Maximum duty cycle  $D=0.5$

## Thermal Resistance

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Thermal resistance, junction – case.	RthJC	-	-	1.5	°C/W	-
Thermal resistance, junction - ambient(min. footprint)	RthJA	-	-	62.5	°C/W	-

## Electrical Characteristic (at Tj = 25 °C, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

## Static Characteristic

Drain-source breakdown voltage	BV <sub>DSS</sub>	900	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA
Gate threshold voltage	V <sub>GS(th)</sub>	3	-	5	V	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA
Zero gate voltage drain current	I <sub>DSS</sub>	-	-	1	μA	V <sub>DS</sub> =900V, V <sub>GS</sub> =0V T <sub>j</sub> =25°C T <sub>j</sub> =150°C
Gate-source leakage current	I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V
Drain-source on-state resistance	R <sub>DS(on)</sub>	-	0.85	1.1	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =4.5A
Transconductance	g <sub>fs</sub>	-	10	-	S	V <sub>DS</sub> =5V, I <sub>D</sub> =4.5A

## Dynamic Characteristic

Input Capacitance	C <sub>iss</sub>	-	2832	-	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz
Output Capacitance	C <sub>oss</sub>	-	211	-		
Reverse Transfer Capacitance	C <sub>rss</sub>	-	3	-		
Gate Total Charge	Q <sub>G</sub>	-	54	-	nC	V <sub>DS</sub> =450V, I <sub>D</sub> =4.5A, V <sub>GS</sub> =10V
Gate-Source charge	Q <sub>gs</sub>	-	16	-		
Gate-Drain charge	Q <sub>gd</sub>	-	18	-		
Turn-on delay time	t <sub>d(on)</sub>	-	17	-	ns	V <sub>GS</sub> =10V, V <sub>DD</sub> =450V, R <sub>G_ext</sub> =2.5Ω, I <sub>D</sub> =2.67A
Rise time	t <sub>r</sub>	-	15	-		
Turn-off delay time	t <sub>d(off)</sub>	-	47	-		
Fall time	t <sub>f</sub>	-	37	-		
Gate resistance	R <sub>G</sub>	-	1.1	-	Ω	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz

## Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	$V_{SD}$	-	-	1.5	V	$V_{GS}=0V, I_{SD}=4.5A$
Body Diode Continuous Forward Current	$I_S$	-	-	9	A	TC = 25°C
Body Diode Pulsed Current	$I_S$ pulse	-	-	36	A	TC = 25°C

## Typical Performance Characteristics

Fig 1: Output Characteristics

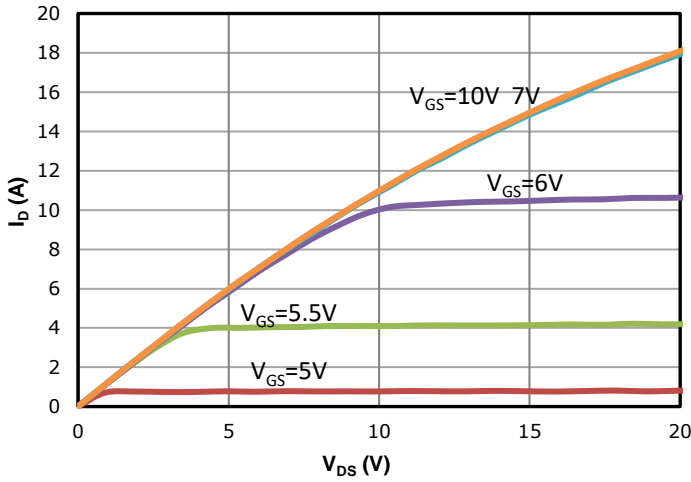


Fig 2: Transfer Characteristics

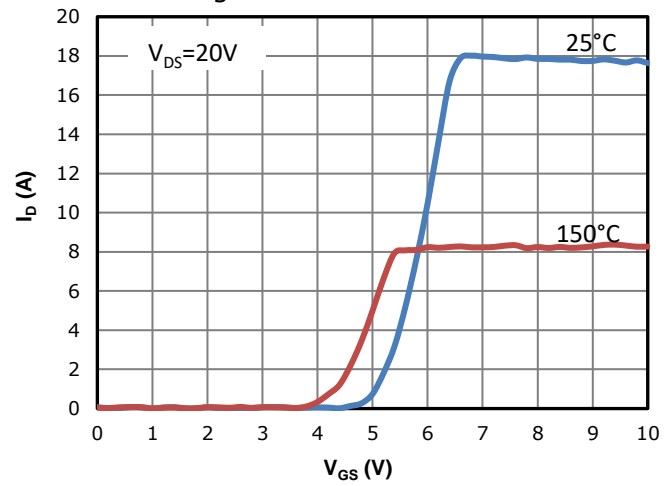


Fig 3:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

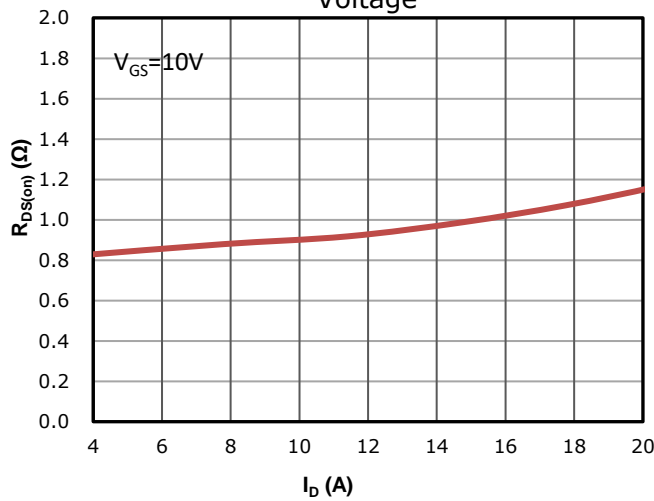


Fig 4:  $R_{DS(on)}$  vs Gate Voltage

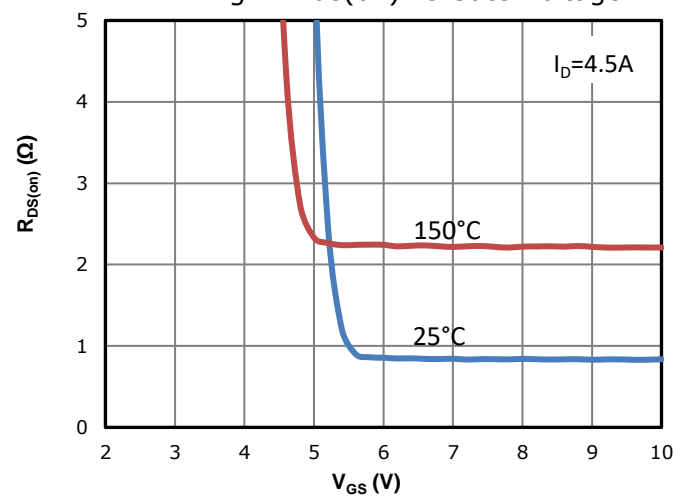


Fig 5:  $R_{DS(on)}$  vs. Temperature

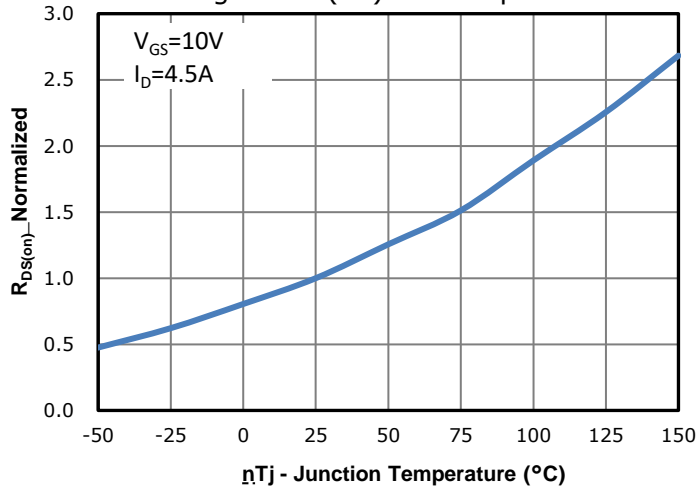
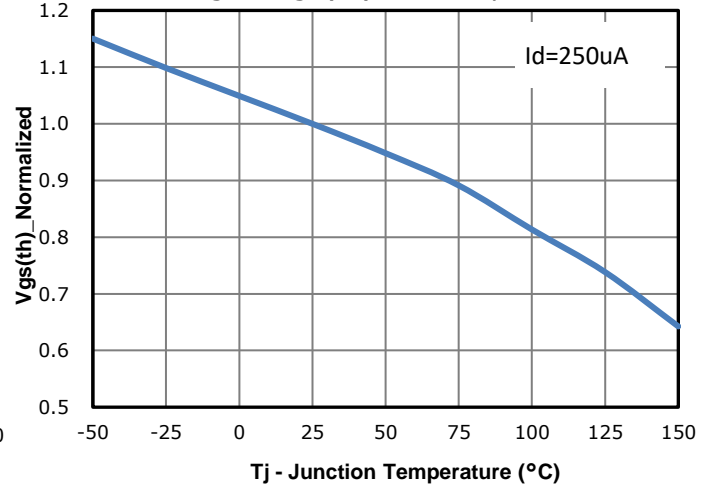


Fig 6:  $V_{GS(th)}$  vs. Temperature



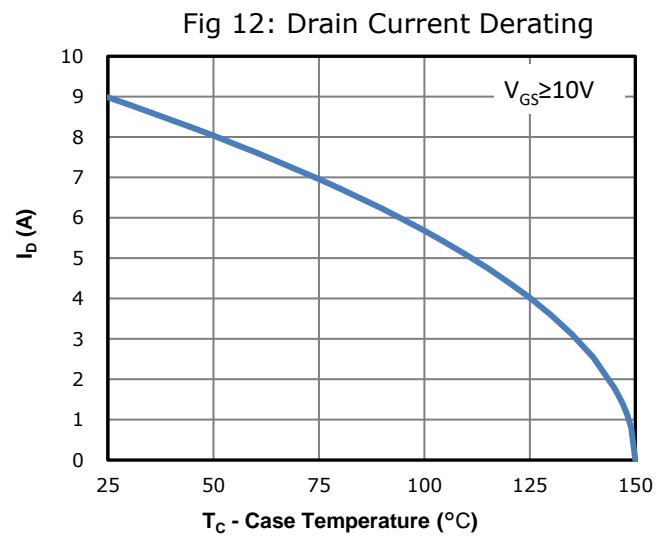
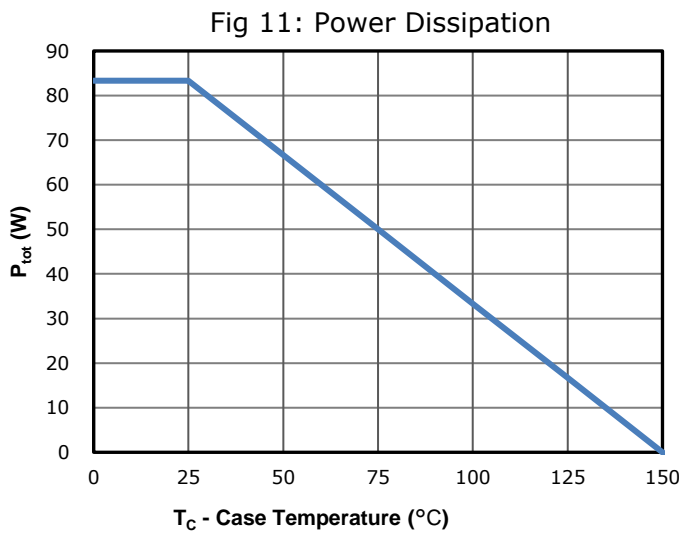
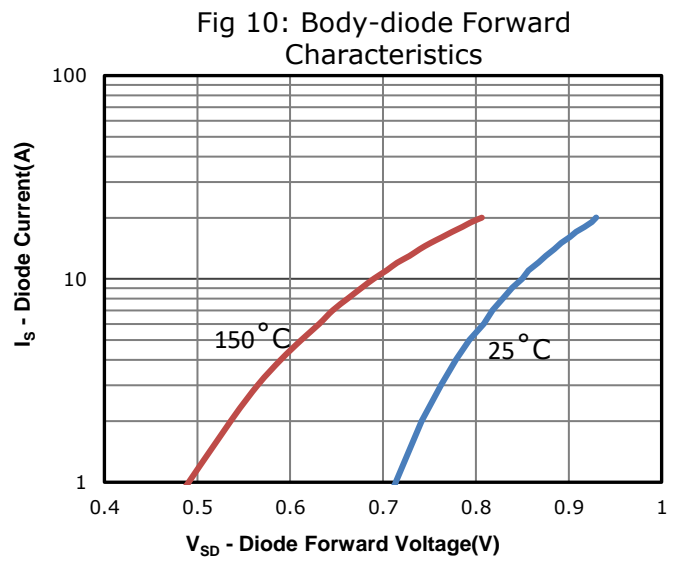
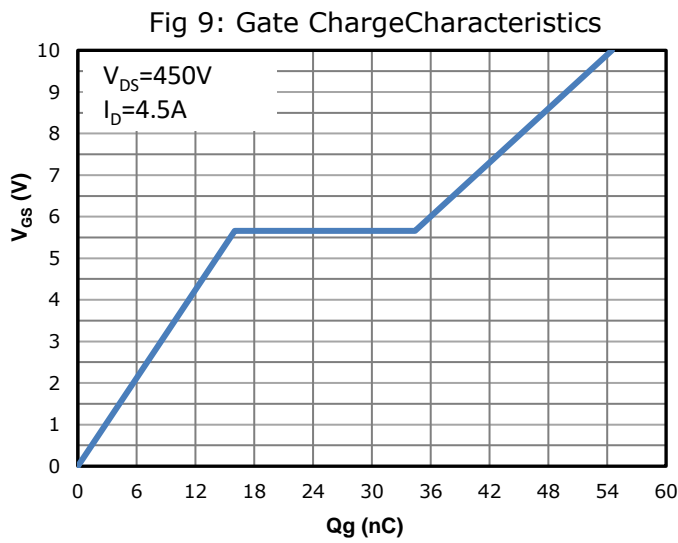
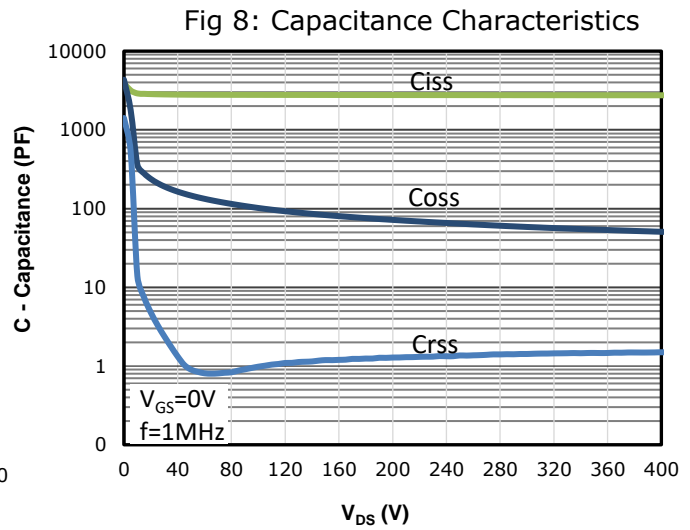
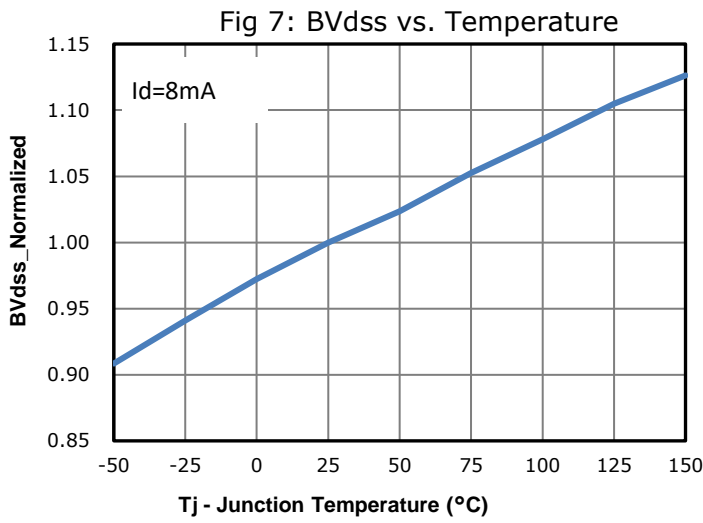


Fig 13: Safe Operating Area

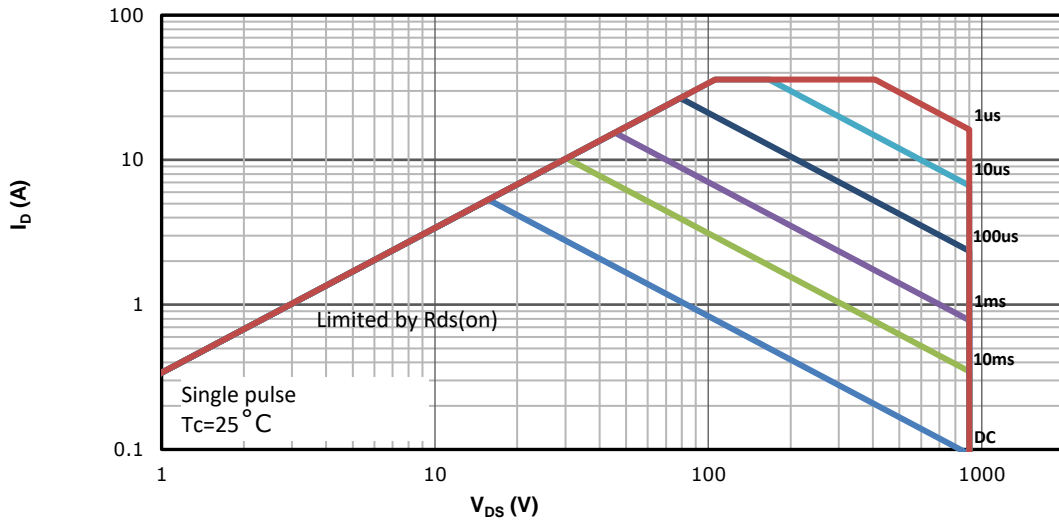
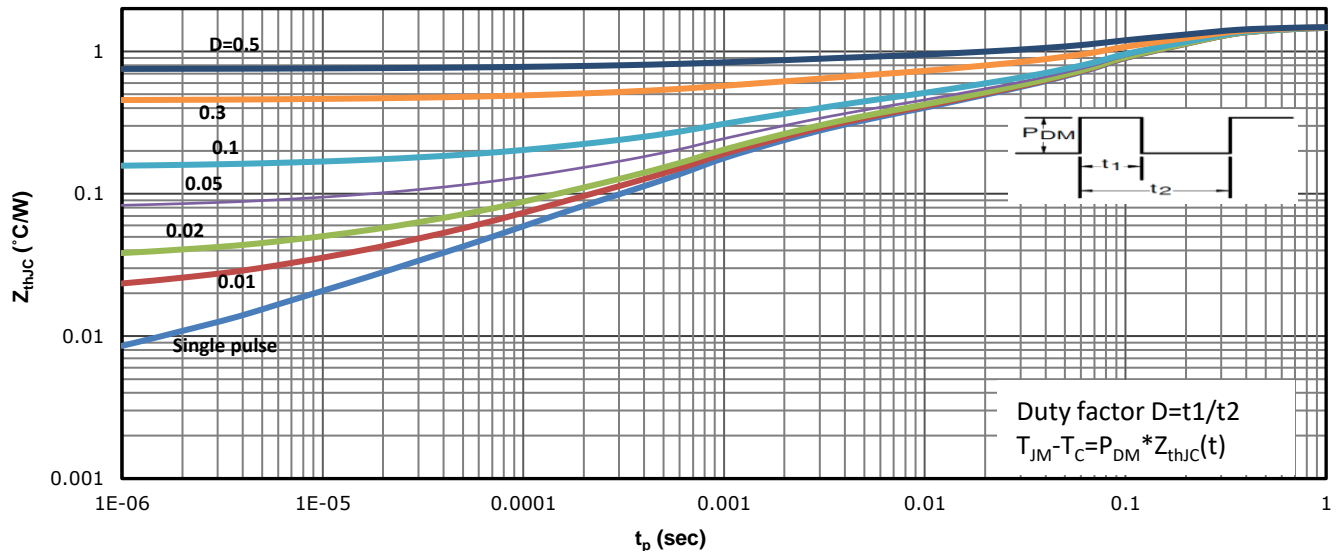
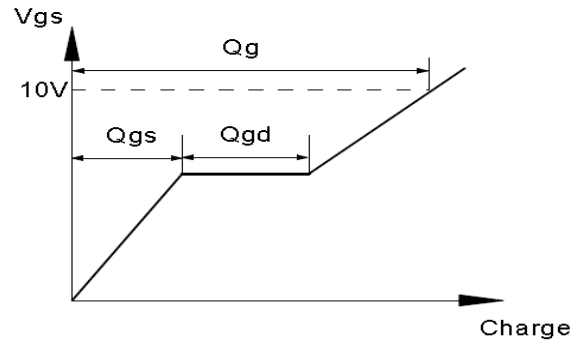
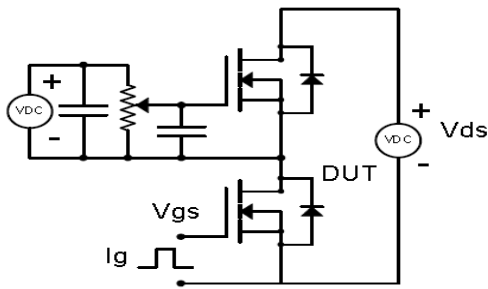


Fig 14: Max. Transient Thermal Impedance

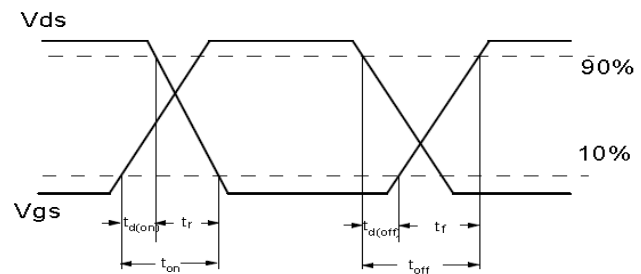
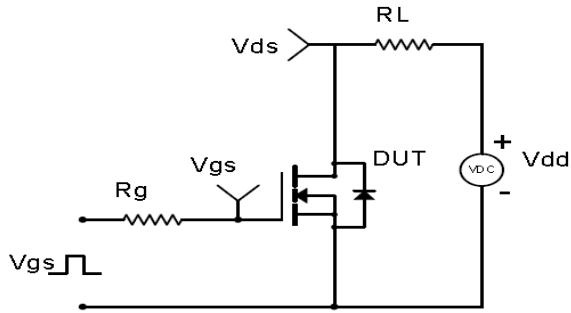


## Test Circuit & Waveform

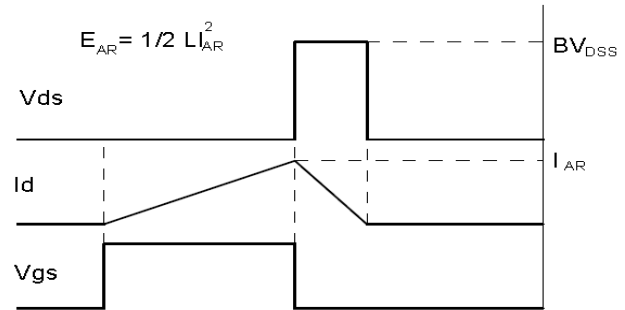
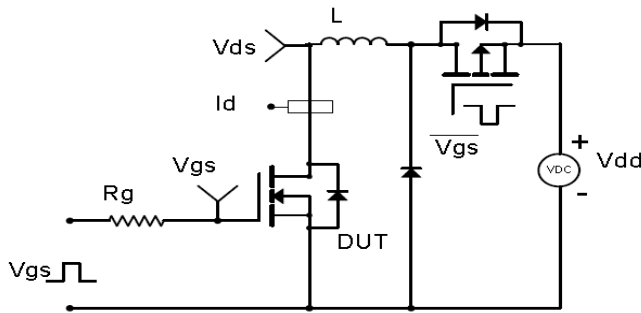
Gate Charge Test Circuit & Waveform



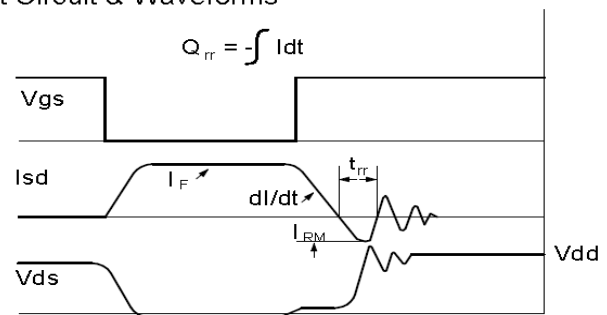
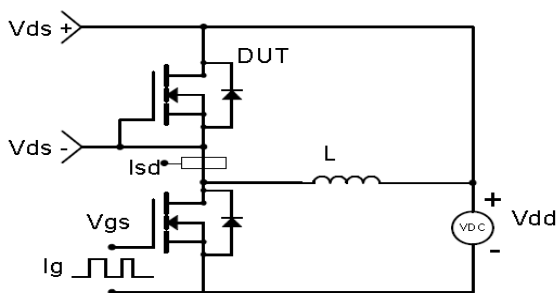
Resistive Switching Test Circuit & Waveforms



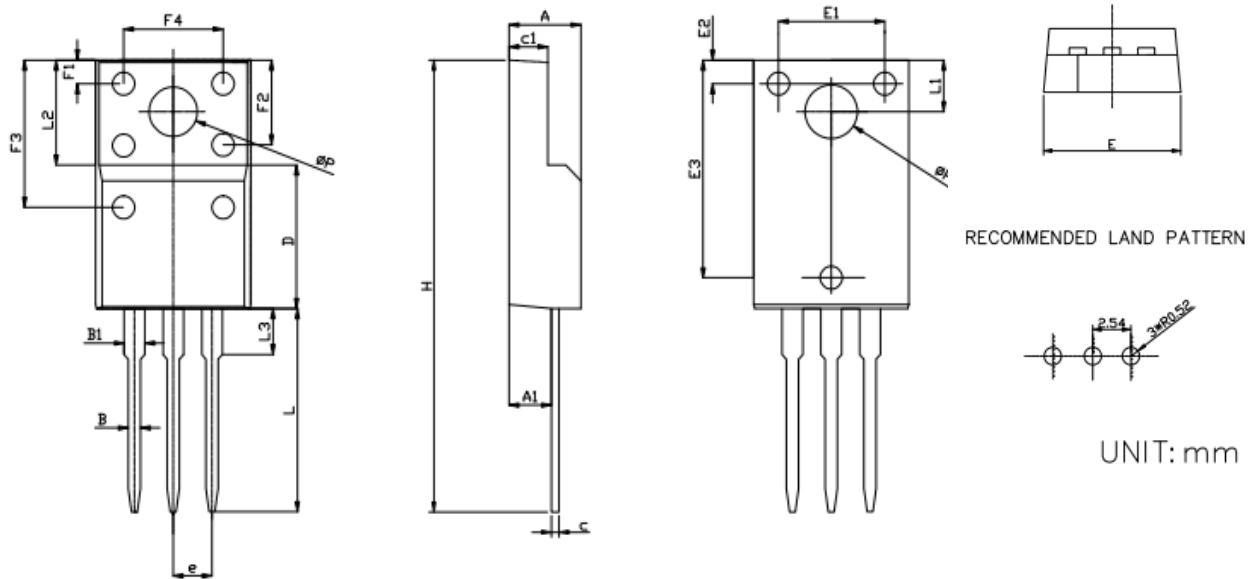
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



## Package Outline: TO-220MF-3L



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.50	4.90	0.177	0.193
A1	2.63	2.89	0.104	0.114
B	0.75	0.90	0.030	0.035
B1	1.15	1.55	0.045	0.061
C	0.40	0.60	0.016	0.024
C1	2.34	2.74	0.092	0.108
D	8.87	9.47	0.349	0.373
e	2.54		0.100	
E	9.86	10.46	0.388	0.412
E1	6.86	7.06	0.270	0.278
E2	1.40	1.60	0.055	
E3	13.80	14.00	0.543	0.551
F1	1.40	1.60	0.055	
F2	5.15	5.65	0.203	0.222
F3	9.10	9.70	0.358	0.382
F4	6.70	7.30	0.264	0.287
H	28.50	29.50	1.122	1.161
L	12.58	13.38	0.495	0.527
L1	3.15	3.45	0.124	0.136
L2	6.70		0.264	
L3	2.63	3.23	0.104	0.127
φP	2.90	3.48	0.114	0.137
φP1	3.15	3.75	0.124	0.148



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## Disclaimer

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

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