

## Features

- Uses PingWei advanced PerfectMOS4 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

## Benefits

- High robustness and reliability
- Increases maximum current capability
- Low power loss, high power density
- Easy paralleling

## Applications

- Synchronous Rectification for AC/DC Quick Charger
- Battery management
- UPS (Uninterruptible Power Supplies)

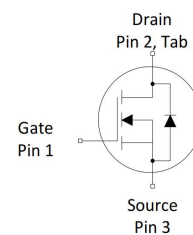
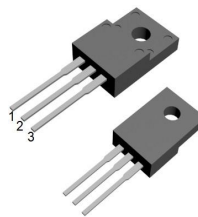


**100% DVDS Tested**  
**100% Avalanche Tested**

## Product Summary

$V_{DS}$	200V
$R_{DS(on)@10V \text{ typ}}$	9.1mΩ
$I_D$	36A

TO-220MF-3L



## Package Marking and Ordering Information

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
PW110N20MFS	PW110N20MFS	TO-220MF-3L	Tube	N/A	N/A	50pcs

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	200	V
Continuous drain current	$I_D$	36	A
$T_C = 25^\circ\text{C}$ (Silicon limit)		180	
$T_C = 25^\circ\text{C}$ (Package limit)		23	
$T_C = 100^\circ\text{C}$ (Silicon limit)		9	
$T_a = 25^\circ\text{C}$			
Pulsed drain current ( $T_C = 25^\circ\text{C}$ , $t_p = 100\mu\text{s}$ )	$I_{D \text{ pulse}}$	146	A
Avalanche energy, single pulse ( $L=0.5\text{mH}$ , $V_{ds}=100\text{V}$ )	$E_{AS}$	342	mJ
Gate-Source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation	$P_{tot}$	34	W
$T_C = 25^\circ\text{C}$		1.9	
$T_a = 25^\circ\text{C}$			
Operating junction and storage temperature	$T_j, T_{stg}$	-55...+150	$^\circ\text{C}$
Soldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s)	$T_{sold}$	260	$^\circ\text{C}$



## Thermal Resistance

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Thermal resistance, junction – case.	RthJC	-	-	3.7	°C/W	-
Thermal resistance, junction - ambient(min. footprint)	RthJA	-	-	65	°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	$BV_{DSS}$	200	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Gate threshold voltage	$V_{GS(th)}$	2.0	-	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	$I_{DSS}$	-	0.02	1	$\mu A$	$V_{DS}=200V, V_{GS}=0V$ $T_j=25^\circ C$ $T_j=150^\circ C$
Gate-source leakage current	$I_{GSS}$	-	$\pm 10$	$\pm 100$	nA	$V_{GS}=\pm 20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	9.1	11.0	mΩ	$V_{GS}=10V, I_D=55A$
Transconductance	$g_{fs}$	-	74	-	S	$V_{DS}=5V, I_D=55A$

## Dynamic Characteristic

Input Capacitance	$C_{iss}$	-	10380	-	pF	$V_{GS}=0V, V_{DS}=100V,$ $f=1MHz$
Output Capacitance	$C_{oss}$	-	364	-		
Reverse Transfer Capacitance	$C_{rss}$	-	64	-		
Gate Total Charge	$Q_G$	-	143	-	nC	$V_{DS}=100V, I_D=55A,$ $V_{GS}=10V$
Gate-Source charge	$Q_{gs}$	-	49	-		
Gate-Drain charge	$Q_{gd}$	-	30	-		
Turn-on delay time	$t_{d(on)}$	-	46	-	ns	$V_{GS}=10V, V_{DD}=100V,$ $R_{G\_ext}=4.7\Omega, I_D=55A$
Rise time	$t_r$	-	21	-		
Turn-off delay time	$t_{d(off)}$	-	88	-		
Fall time	$t_f$	-	18	-		
Gate resistance	$R_G$	-	1	-	Ω	$V_{GS}=0V, V_{DS}=0V,$ $f=1MHz$



## Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	$V_{SD}$	-	-	1.2	V	$V_{GS}=0V, I_{SD}=55A$
Body Diode Continuous Forward Current	$I_S$	-	-	36	A	TC = 25°C
Body Diode Pulsed Current	$I_S$ pulse	-	-	146	A	TC = 25°C
Body Diode Reverse Recovery Time	$t_{rr}$	-	185	-	ns	$I_F=55A, dI/dt=100A/\mu$
Body Diode Reverse Recovery Charge	$Q_{rr}$	-	469	-	nC	s



## Typical Performance Characteristics

Fig 1: Output Characteristics

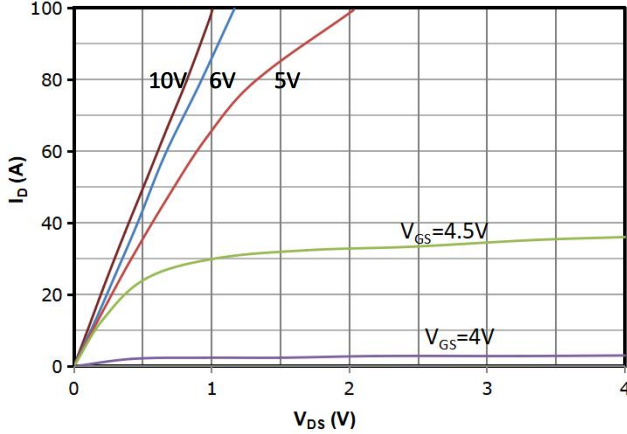


Fig 2: Transfer Characteristics

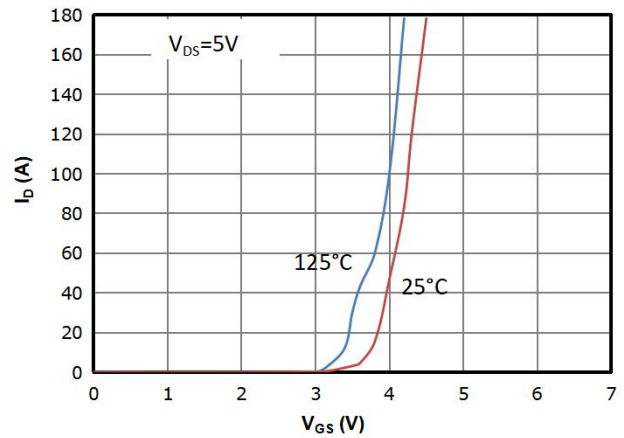


Fig 3:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

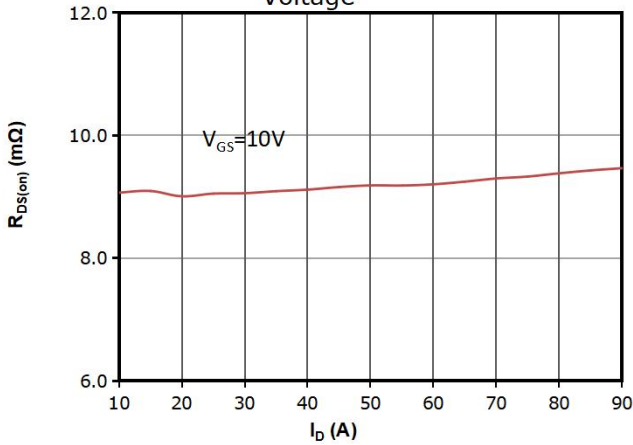


Fig 4:  $R_{DS(on)}$  vs Gate Voltage

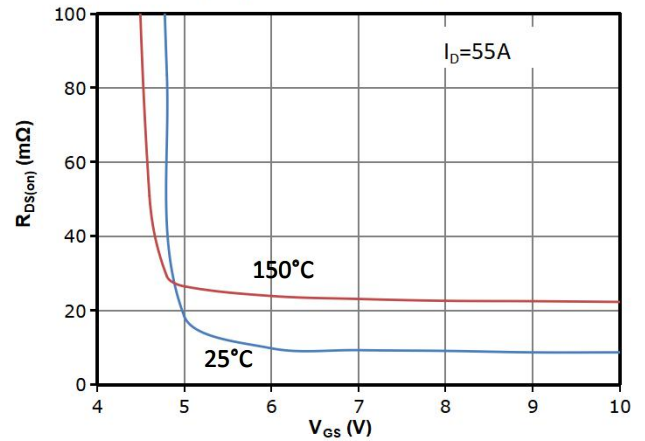


Fig 5:  $R_{DS(on)}$  vs. Temperature

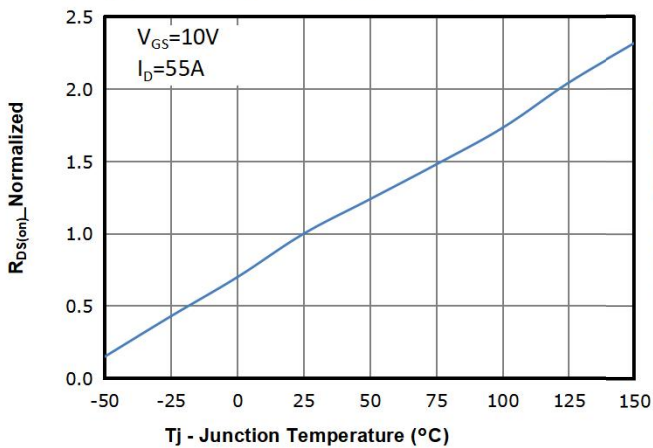


Fig 6:  $V_{GS(th)}$  vs. Temperature

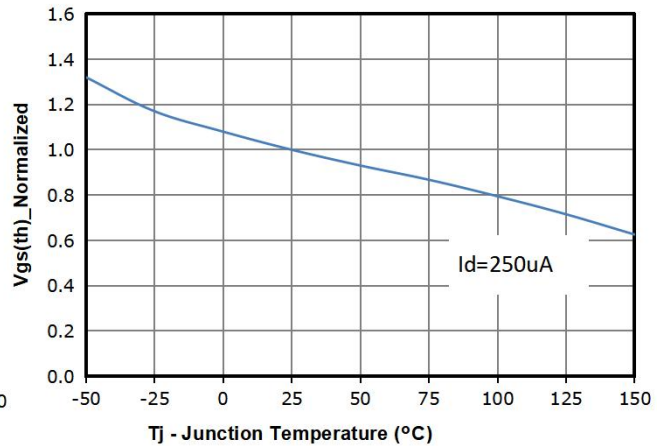




Fig 7: BVdss vs. Temperature

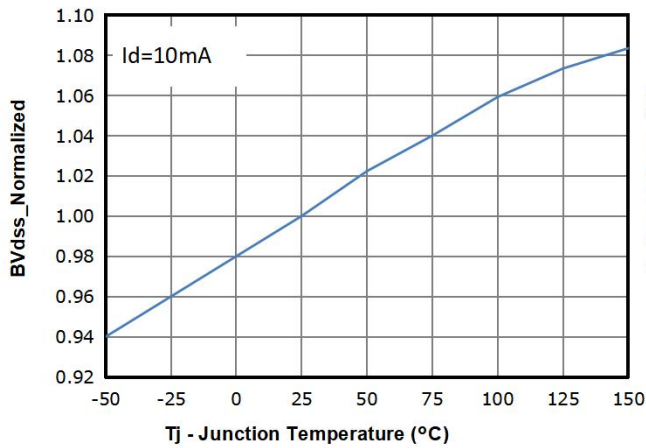


Fig 8: Capacitance Characteristics

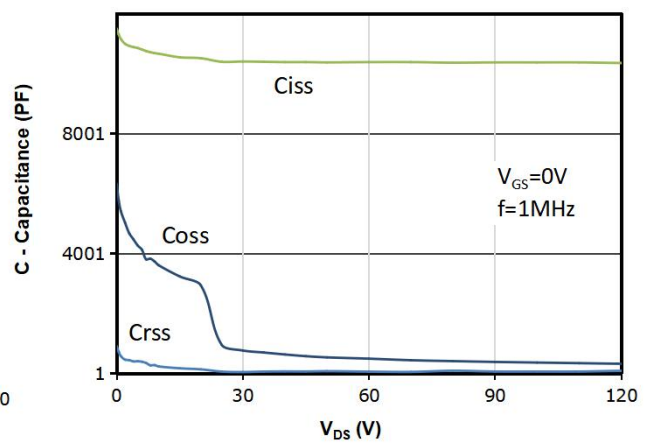


Fig 9: Gate Charge Characteristics

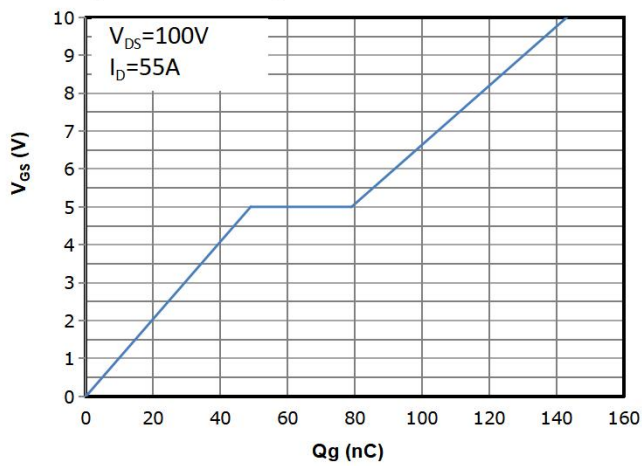


Fig 10: Body-diode Forward Characteristics

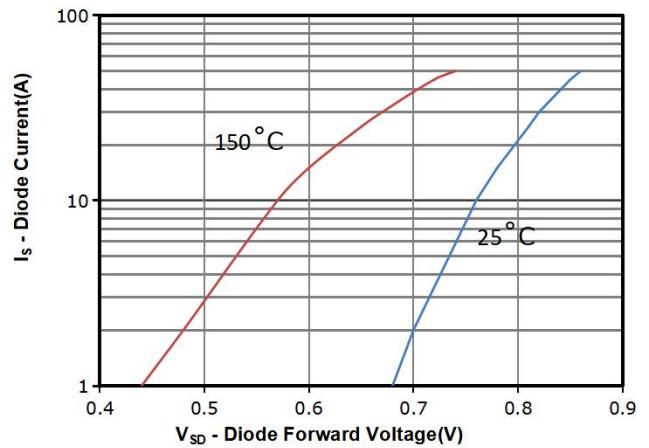


Fig 11: Power Dissipation

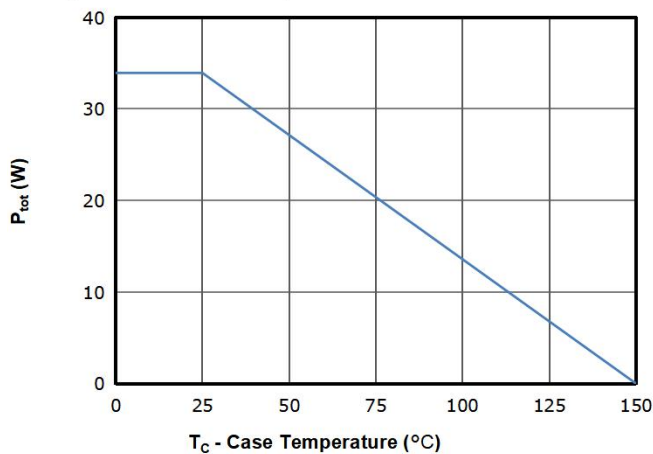


Fig 12: Drain Current Derating

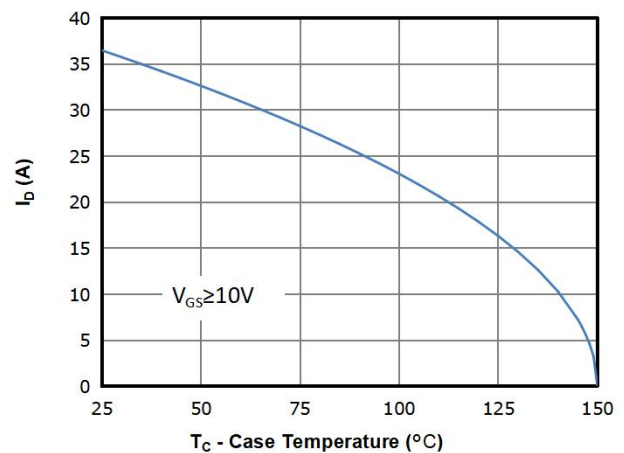




Fig 13: Safe Operating Area

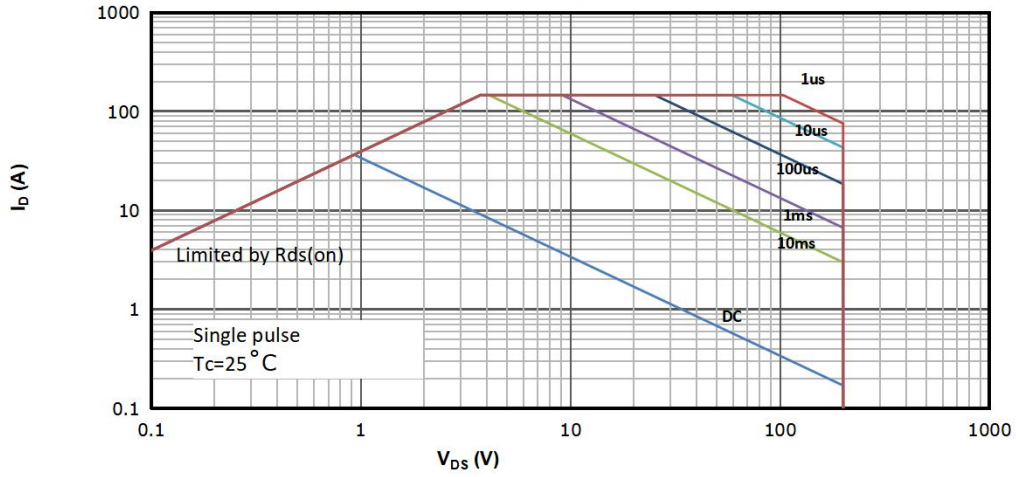
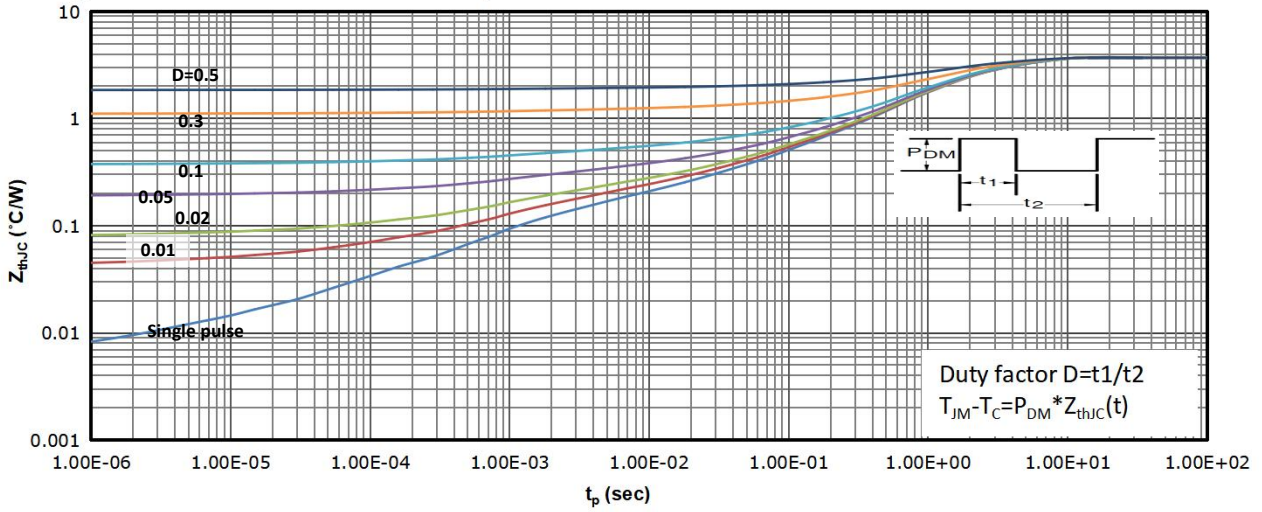
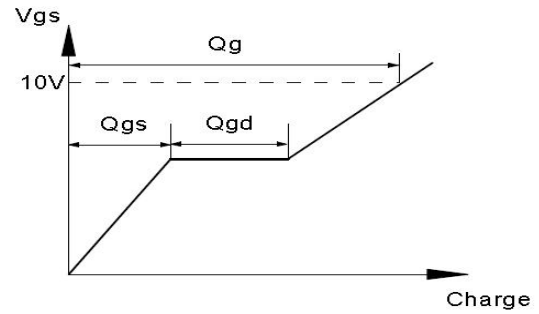
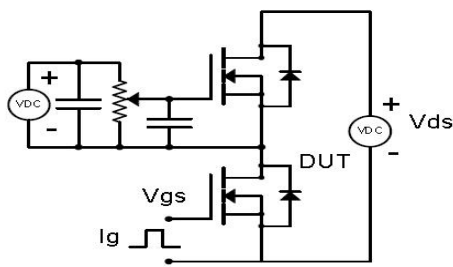


Fig 14: Max. Transient Thermal Impedance

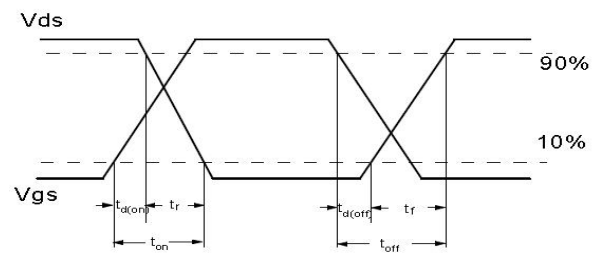
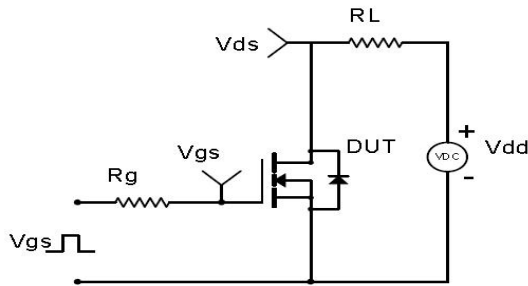


## Test Circuit & Waveform

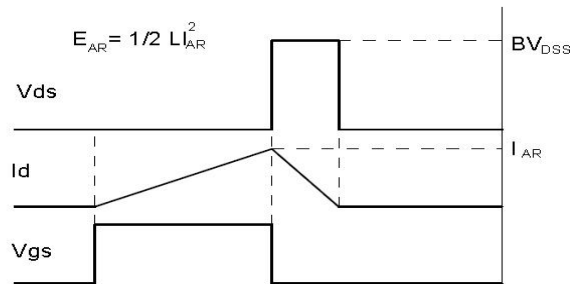
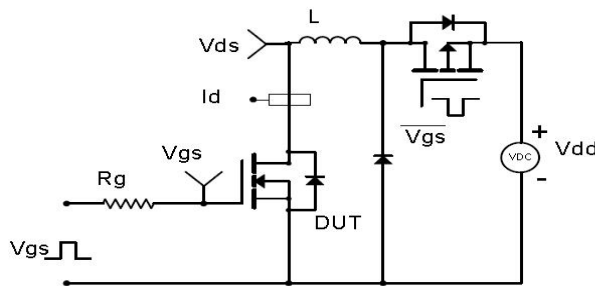
Gate Charge Test Circuit & Waveform



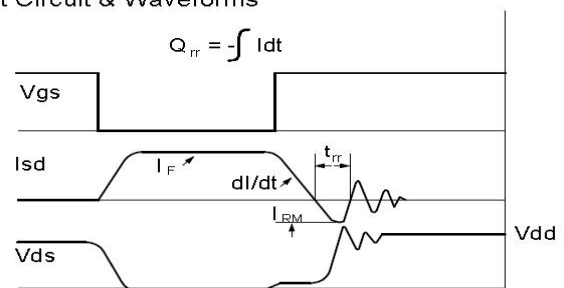
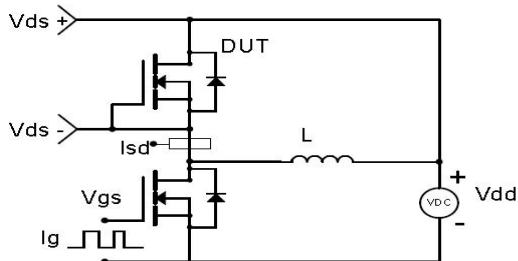
Resistive Switching Test Circuit & Waveforms



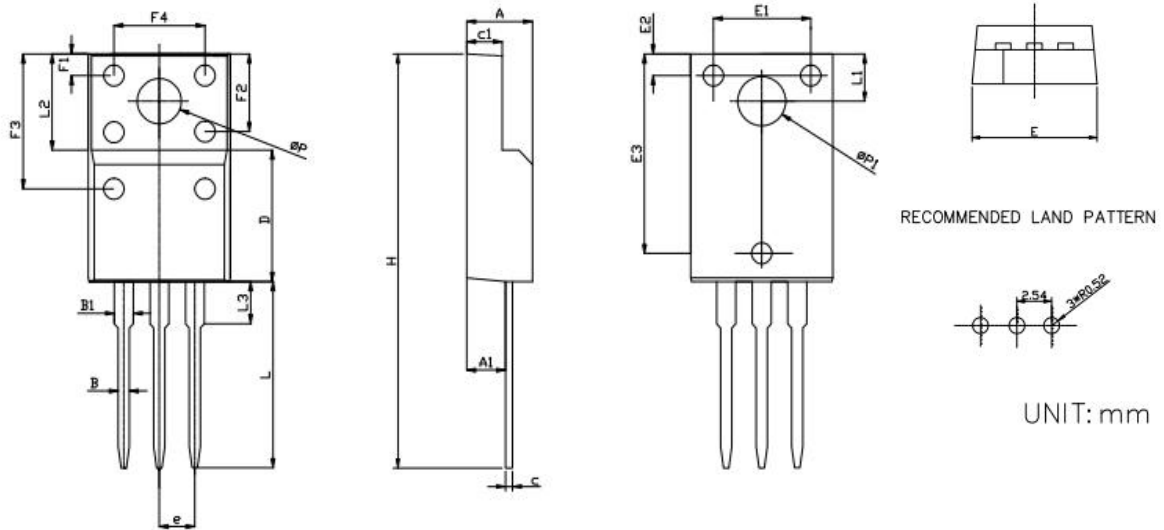
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



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





## Revision History

Revision	Date	Major changes
1.0	2023/7/22	Release of Formal Version.

## 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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