WTM502P057L-HAF

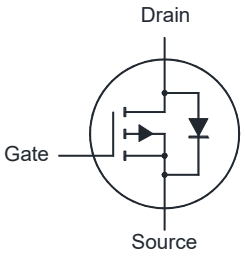
P-Channel Enhancement Mode MOSFET

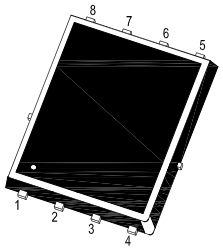
Features

- Low leakage current
- Low drain-source on-resistance
- Enhancement mode
- Halogen and Antimony Free(HAF), RoHS compliant

Applications

- Lithium-Iom Secondary Batteries
- Power Management Switches





1. Source 2. Source 3. Source 4. Gate
5. Drain 6. Drain 7. Drain 8. Drain
DFN5060 Plastic Package

Key Parameters

Parameter	Value	Unit
$-BV_{DSS}$	20	V
$R_{DS(ON)}$ Max	5.7 @ $-V_{GS}$ = 4.5 V	mΩ
	8 @ $-V_{GS}$ = 2.5 V	
$-V_{GS(th)}$ typ	0.57	V
Q_g typ	88 @ $-V_{GS}$ = 4.5 V	nC

Absolute Maximum Ratings (at T_a = 25℃ unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		$-V_{DS}$	20	V
Gate-Source Voltage		V_{GS}	± 12	V
Drain Current	T_c = 25℃	$-I_D$	72.5	A
	T_c = 100℃		45.6	
Peak Drain Current, Pulsed [1]		$-I_{DM}$	300	A
Single-Pulse Avalanche Current		$-I_{AS}$	43.4	A
Single-Pulse Avalanche Energy [2]		E_{AS}	178.9	mJ
Power Dissipation	T_c = 25℃	P_D	40.9	W
Operating Junction and Storage Temperature Range		T_J,T_{stg}	- 55 to + 150	℃

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	3	℃/W
Thermal Resistance from Junction to Ambient [3]	$R_{\theta JA}$	37	℃/W

[1] Pulse Test: Pulse Width ≤ 100 μs, Duty Cycle ≤ 2%,Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C.

[2] Limited by $T_{J(MAX)}$, starting T_J = 25 °C, L = 0.19 mH, R_g = 25 Ω, $-I_{AS}$ = 43.4 A, V_{GS} = 10 V.

[3] Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.

Dated: 03/01/2023 Rev: 02

Characteristics at T_a = 25℃ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $-I_D$ = 1 mA	$-BV_{DSS}$	20	-	-	V
Drain-Source Leakage Current at $-V_{DS}$ = 16 V	$-I_{DSS}$	-	-	10	μA
Gate Leakage Current at V_{GS} = ± 12 V	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $-V_{DS}$ = 10 V, $-I_D$ = 1 mA	$-V_{GS(th)}$	0.5	-	1.2	V
Drain-Source On-State Resistance at $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A at $-V_{GS}$ = 2.5 V, $-I_D$ = 16 A	$R_{DS(on)}$	- -	4.9 -	5.7 8	mΩ
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS}$ = 5 V, $-I_D$ = 18 A	g_{FS}	-	68	-	S
Gate Resistance at V_{DS} = 0 V, V_{GS} = 0 V, f = 1 MHz	R_g	-	3.8	-	Ω
Input Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{iss}	-	8215	-	pF
Output Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{oss}	-	1087	-	pF
Reverse Transfer Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{rss}	-	957	-	pF
Gate Charge Total at $-V_{DS}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A at $-V_{DS}$ = 10 V, $-V_{GS}$ = 2.5 V, $-I_D$ = 18 A	Q_g	- -	88 52	- -	nC
Gate to Source Charge at $-V_{DS}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A	Q_{gs}	-	12	-	nC
Gate to Drain Charge at $-V_{DS}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A	Q_{gd}	-	22	-	nC
Turn-On Delay Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A, R_G = 4.7 Ω	$t_{d(on)}$	-	65	-	ns
Turn-On Rise Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A, R_G = 4.7 Ω	t_r	-	111	-	ns
Turn-Off Delay Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A, R_G = 4.7 Ω	$t_{d(off)}$	-	113	-	ns
Turn-Off Fall Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 4.5 V, $-I_D$ = 18 A, R_G = 4.7 Ω	t_f	-	36	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $-I_S$ = 1 A, V_{GS} = 0 V	$-V_{SD}$	-	-	1.2	V
Body-Diode Continuous Current	$-I_S$	-	-	72.5	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	300	A
Body Diode Reverse Recovery Time at $-I_S$ = 18 A, di/dt = 100 A / μs	t_{rr}	-	69	-	ns
Body Diode Reverse Recovery Charge at $-I_S$ = 18 A, di/dt = 100 A / μs	Q_{rr}	-	44	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

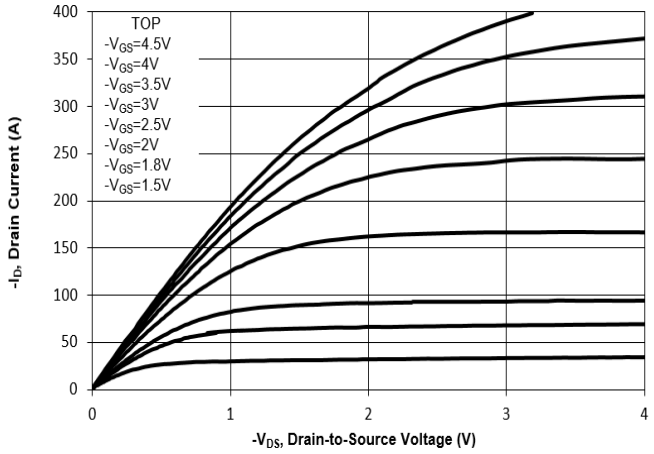


Fig. 2 Typical Transfer Characteristics

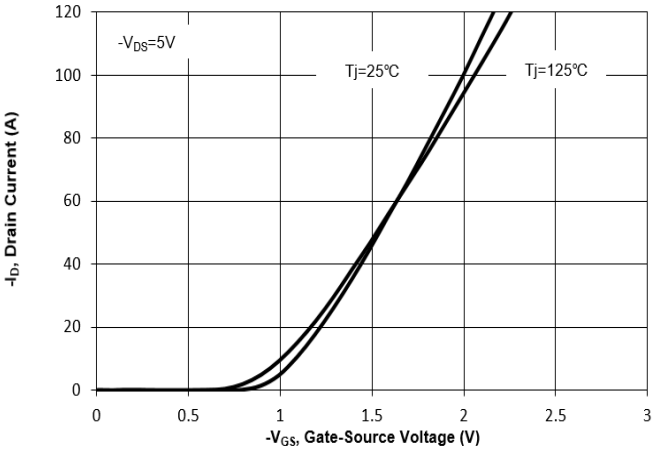


Fig. 3 on-Resistance vs. Drain Current

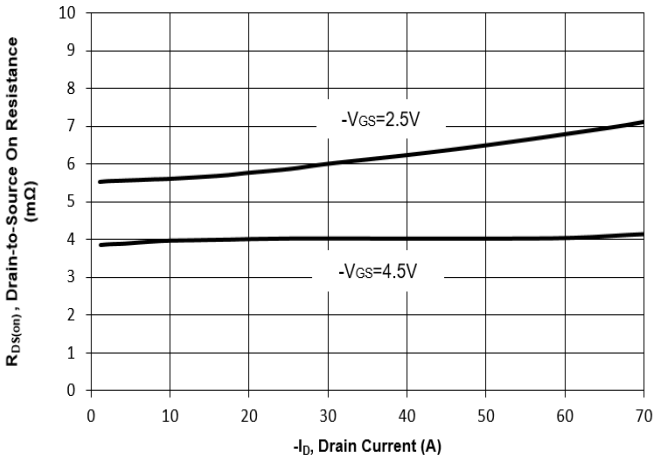


Fig. 4 on-Resistance vs. Gate to Source Voltage

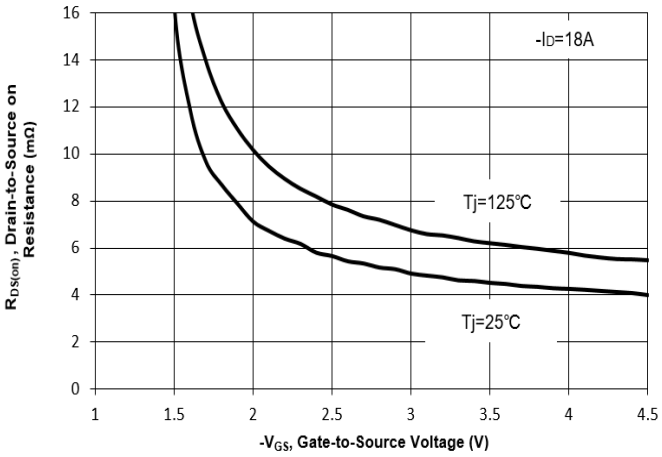


Fig. 5 on-Resistance vs.T_j

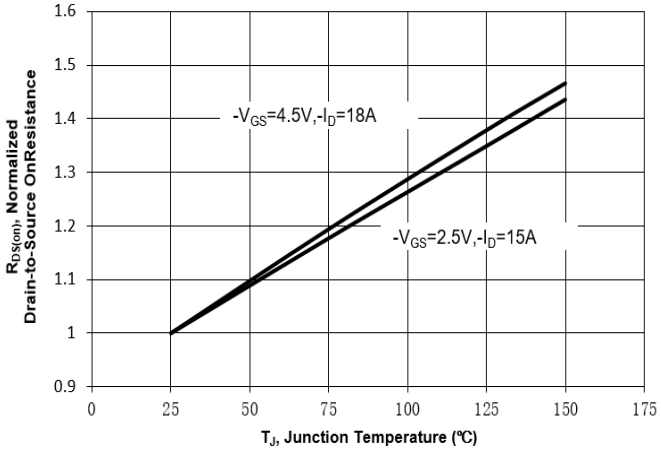
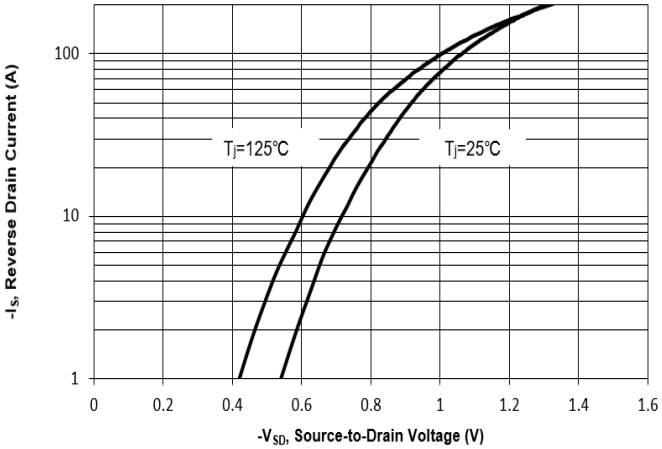


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

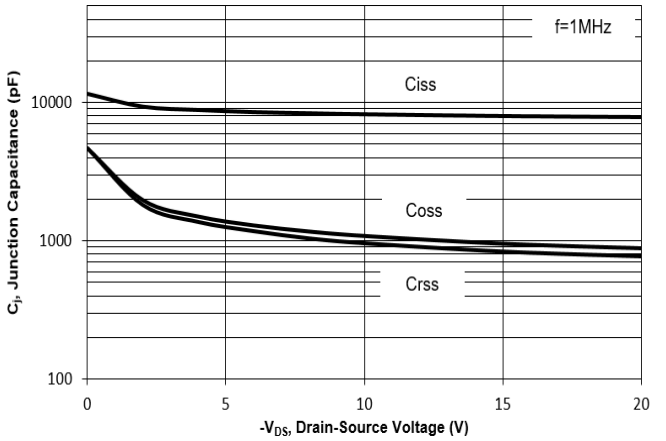


Fig. 8 Drain-Source Leakage Current vs. T_j

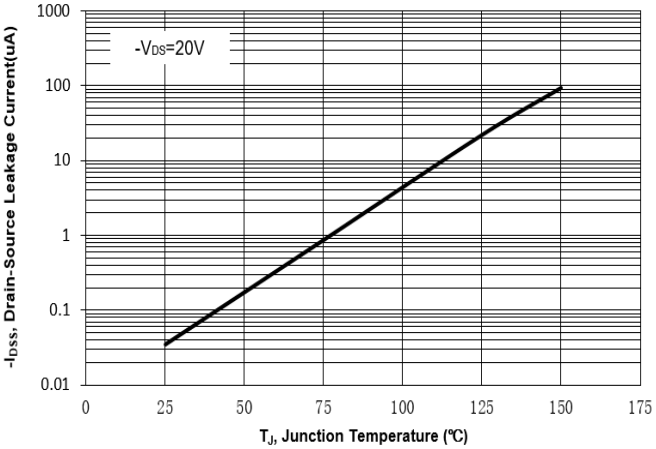


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

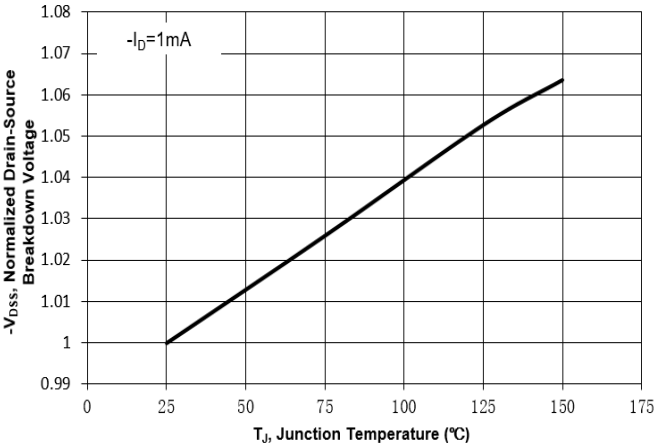


Fig. 10 Gate Threshold Variation vs. T_j

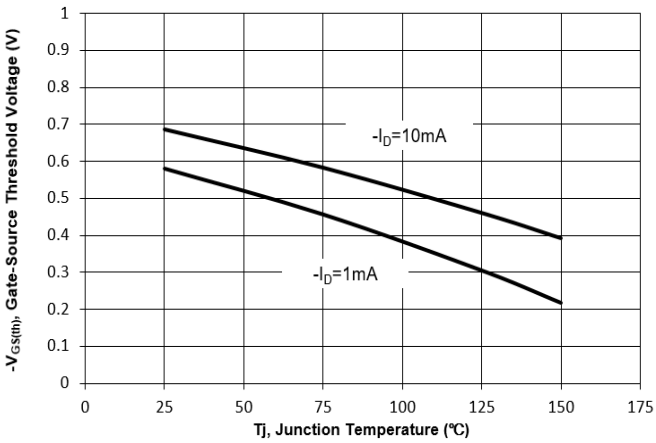


Fig. 11 Gate Charge

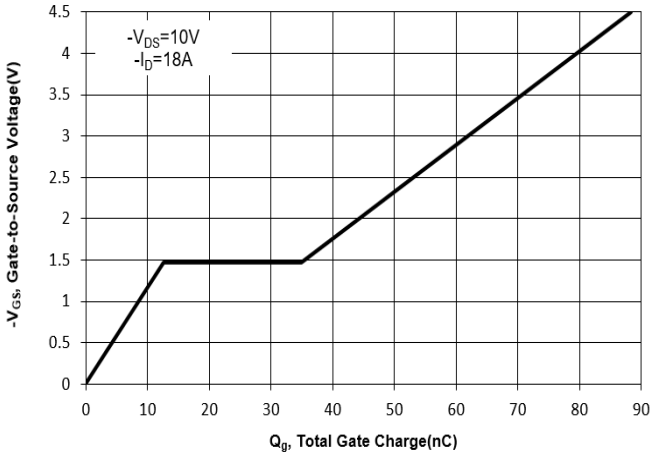
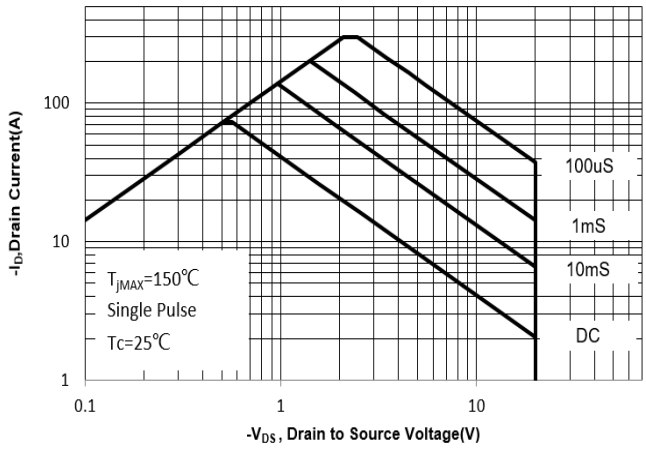


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

Fig. 13 Normalized Maximum Transient Thermal Impedance($z_{\Theta JC}$)

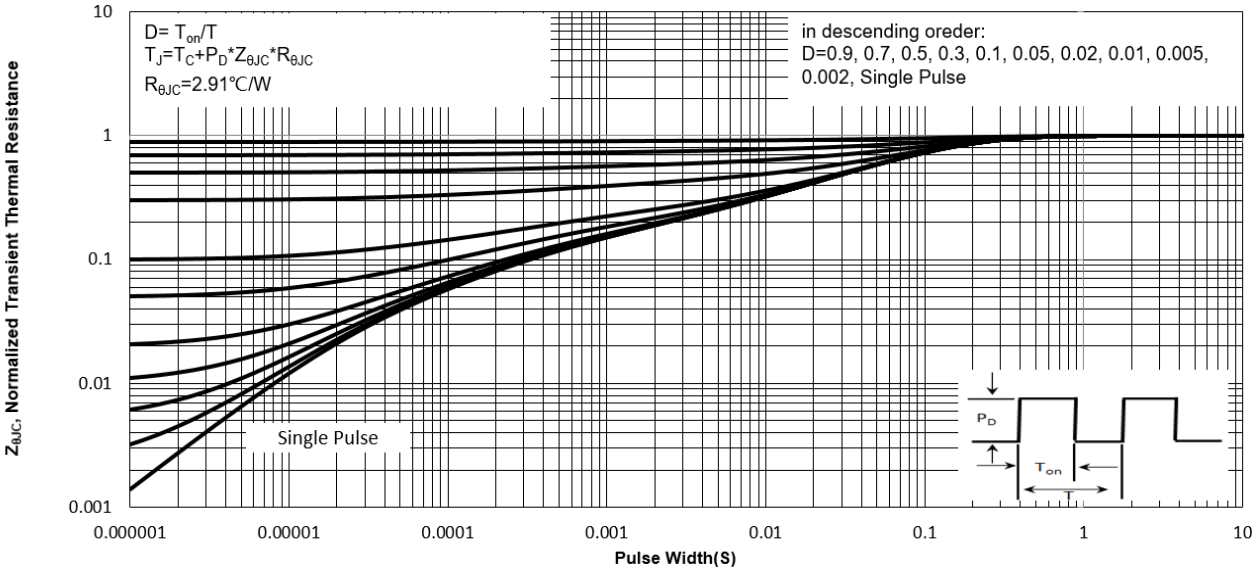
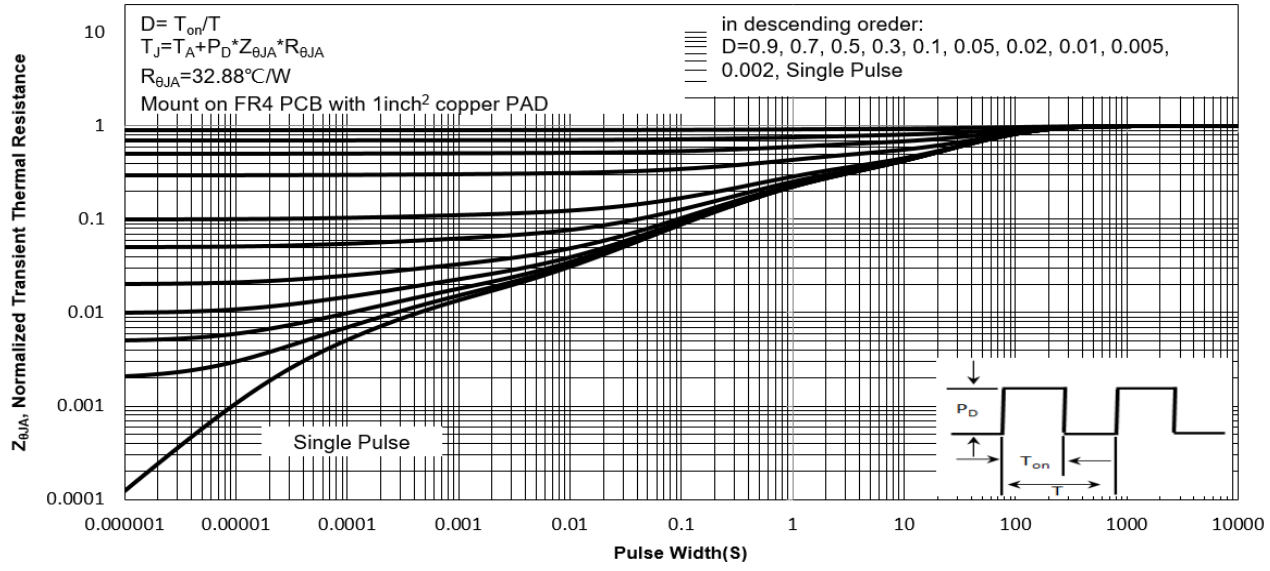


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\Theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

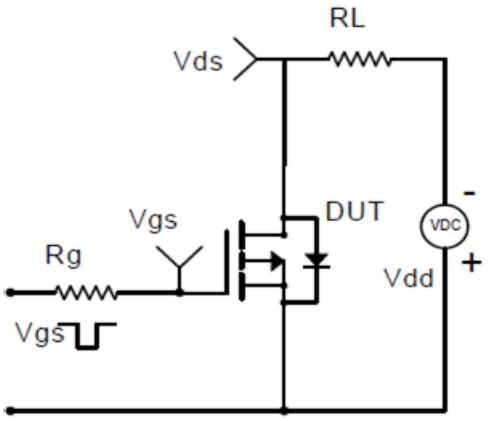


Fig.1-2 Switching Waveform

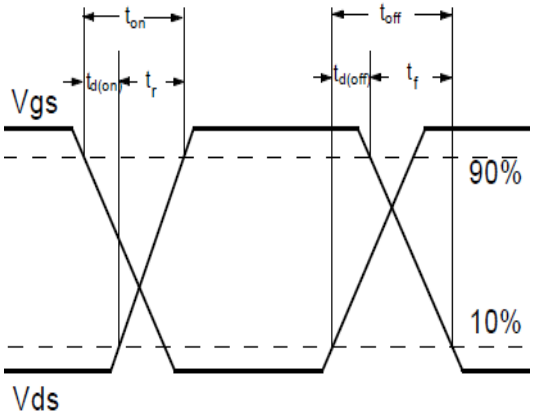


Fig.2-1 Gate charge test circuit

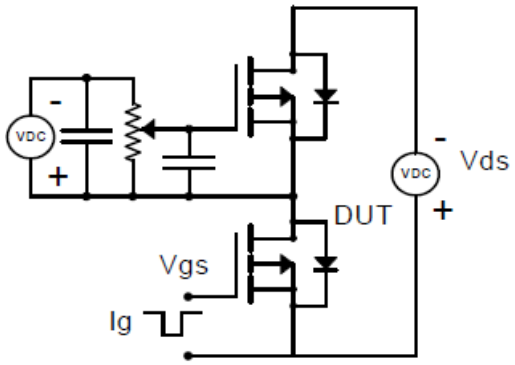


Fig.2-2 Gate charge waveform

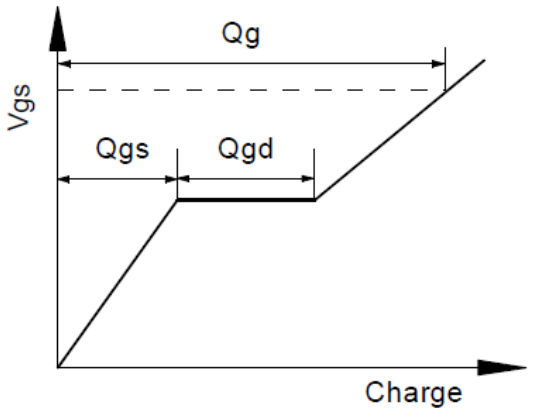


Fig.3-1 Avalanche test circuit

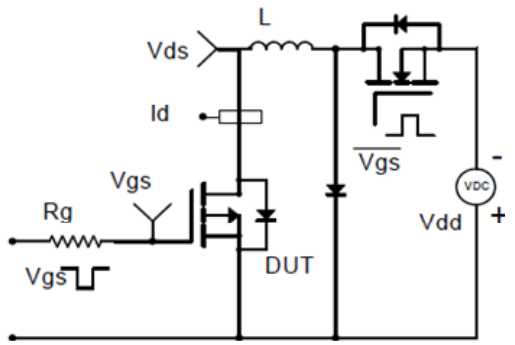
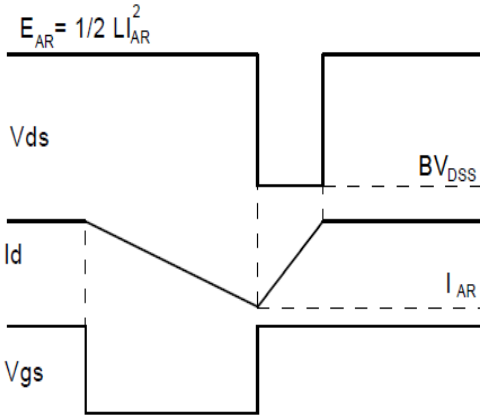
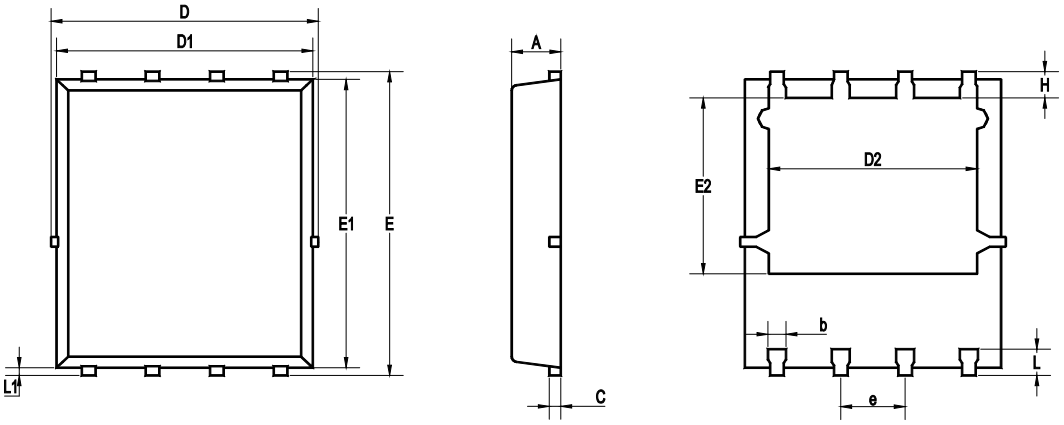


Fig.3-2 Avalanche waveform

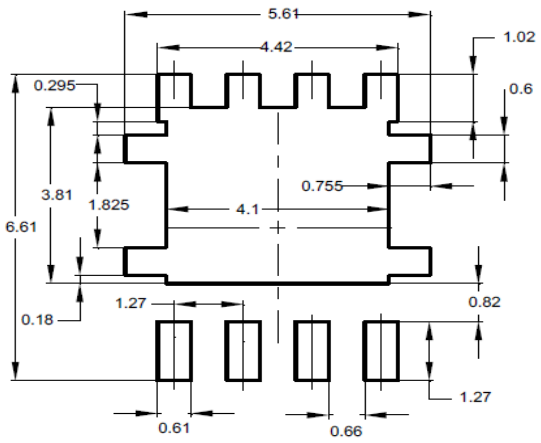


Package Outline Dimensions (Units: mm) DFN5060



UNIT	A	b	C	D	D1	D2	E	E1	E2	e	L	L1	H
mm	1.12 0.9	0.51 0.33	0.34 0.11	5.26 4.7	5.1 4.7	4.5 3.56	6.25 5.75	6 5.6	3.66 3.18	1.37 1.17	0.71 0.35	0.2 0.06	0.71 0.35

Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
DFN5060	12	8 ± 0.1	0.315 ± 0.004	330	13	5,000

Marking information

" TM502P057L " = Part No.

" ****** " = Date Code Marking

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