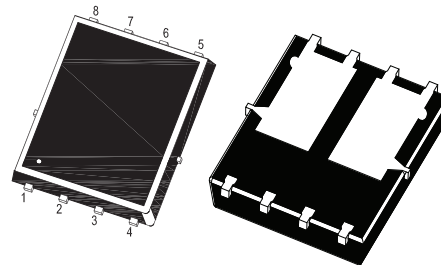
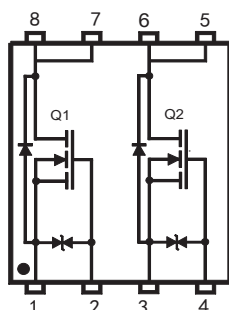


Dual N-Channel Enhancement Mode MOSFET

Features

- Low $R_{DS(ON)}$
- Halogen and Antimony Free(HAF), RoHS compliant
- Built-in G-S Protection Diode
- Typical ESD Protection HBM Class 2

Classification	Voltage Range(V)
0A	< 125
0B	125 to < 250
1A	250 to < 500
1B	500 to < 1000
1C	1000 to < 2000
2	2000 to < 4000
3A	4000 to < 8000
3B	≥ 8000



Q1:1.Source 2.Gate 7.Drain 8.Drain
 Q2:3.Source 4.Gate 5.Drain 6.Drain
 DFN5060 Plastic Package

Key Parameters (Q1/Q2)

Parameter	Value	Unit
BV_{DSS}	40	V
$R_{DS(ON)} \text{ Max}$	9.9 @ $V_{GS} = 10 \text{ V}$	m Ω
	12.6 @ $V_{GS} = 4.5 \text{ V}$	
$V_{GS(th)} \text{ typ}$	1.5	V
$Q_g \text{ typ}$	48 @ $V_{GS} = 10 \text{ V}$	nC

Application

- Load Switch
- DC-DC converters and Off-line UPS

Absolute Maximum Ratings (at $T_a = 25^\circ\text{C}$ unless otherwise specified) (Q1/Q2)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current	I_D	36	A
		22	
Peak Drain Current, Pulsed ¹⁾	I_{DM}	200	A
Avalanche Current	I_{AS}	26.8	A
Single Pulse Avalanche Energy ²⁾	E_{AS}	36	mJ
Total Power Dissipation	P_{tot}	28.8	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 175	$^\circ\text{C}$

Thermal Characteristics (Q1/Q2)

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	5.2	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	60	$^\circ\text{C/W}$

¹⁾ Pulse Test: Pulse Width $\leq 100 \mu\text{s}$, Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 175^\circ\text{C}$.

²⁾ Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 0.1 \text{ mH}$, $R_g = 25 \Omega$, $I_{AS} = 26.8 \text{ A}$, $V_{GS} = 10 \text{ V}$.

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

Characteristics at T_a = 25°C unless otherwise specified (Q1/Q2)

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at I _D = 250 μA	BV _{DSS}	40	-	-	V
Drain-Source Leakage Current at V _{DS} = 32 V	I _{DSS}	-	-	1	μA
Gate Leakage Current at V _{GS} = ± 16 V	I _{GSS}	-	-	± 10	μA
Gate-Source Threshold Voltage at V _{DS} = V _{GS} , I _D = 250 μA	V _{GS(th)}	1	-	2.5	V
Drain-Source On-State Resistance at V _{GS} = 10 V, I _D = 12 A at V _{GS} = 4.5 V, I _D = 10 A	R _{DS(on)}	- -	8.8 -	9.9 12.6	mΩ
DYNAMIC PARAMETERS					
Forward Transconductance at V _{DS} = 5 V, I _D = 12 A	g _{fs}	-	24	-	S
Gate resistance at V _{DS} = 0 V, V _{GS} = 0 V, f = 1 MHz	R _g	-	0.8	-	Ω
Input Capacitance at V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	C _{iss}	-	2268	-	pF
Output Capacitance at V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	C _{oss}	-	168	-	pF
Reverse Transfer Capacitance at V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	C _{rss}	-	121	-	pF
Gate charge total at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A at V _{GS} = 4.5 V, V _{DS} = 20 V, I _D = 12 A	Q _g	- -	48 23	- -	nC
Gate to Source Charge at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A	Q _{gs}	-	8	-	nC
Gate to Drain Charge at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A	Q _{gd}	-	9	-	nC
Turn-On Delay Time at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A, R _g = 3.3 Ω	t _{d(on)}	-	17	-	ns
Turn-On Rise Time at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A, R _g = 3.3 Ω	t _r	-	30	-	ns
Turn-Off Delay Time at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A, R _g = 3.3 Ω	t _{d(off)}	-	17	-	ns
Turn-Off Fall Time at V _{GS} = 10 V, V _{DS} = 20 V, I _D = 12 A, R _g = 3.3 Ω	t _f	-	2	-	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	-	-	36	A
Body-Diode Continuous Current, Pulsed	I _{SM}	-	-	200	A
Body Diode Reverse Recovery Time at I _S = 12 A, di/dt = 100 A / μs	t _{rr}	-	13	-	ns
Body Diode Reverse Recovery Charge at I _S = 12 A, di/dt = 100 A / μs	Q _{rr}	-	6	-	nC

Electrical Characteristics Curves (Q1/Q2)

Fig. 1 Typical Output Characteristics

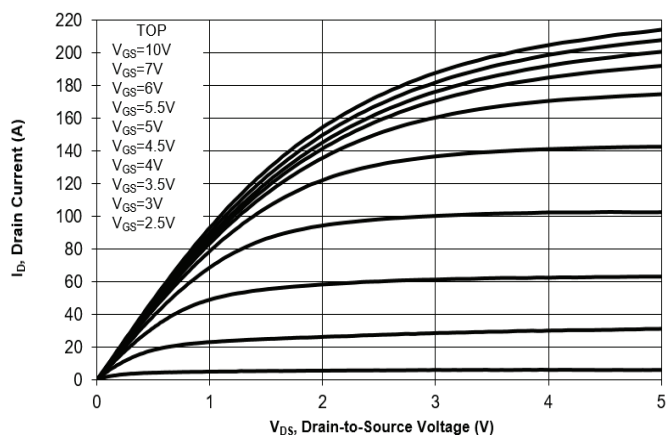


Fig. 2 Typical Transfer Characteristics

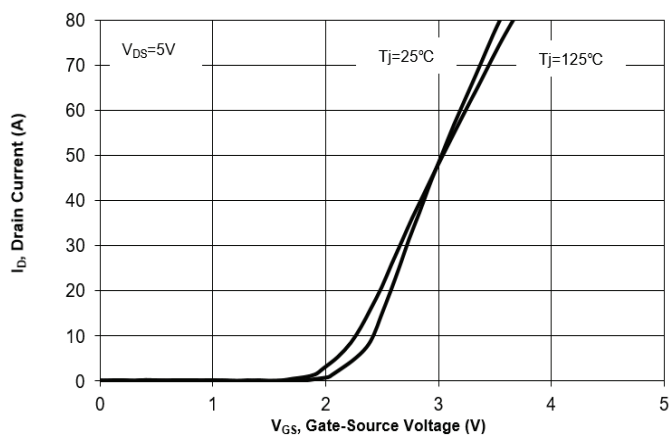


Fig. 3 On-Resistance vs. Drain Current

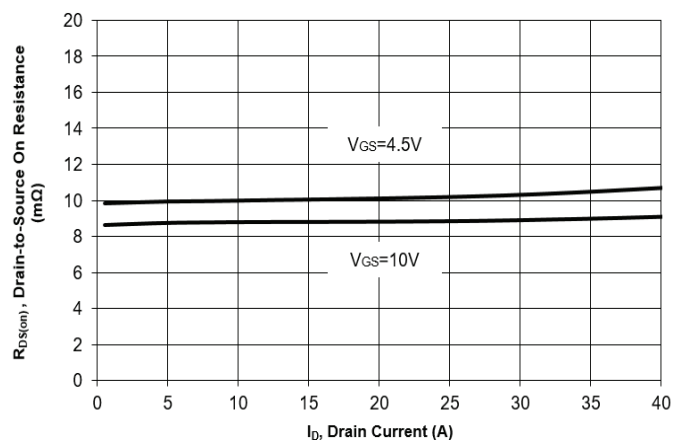


Fig. 4 On-Resistance vs. Gate to Source Voltage

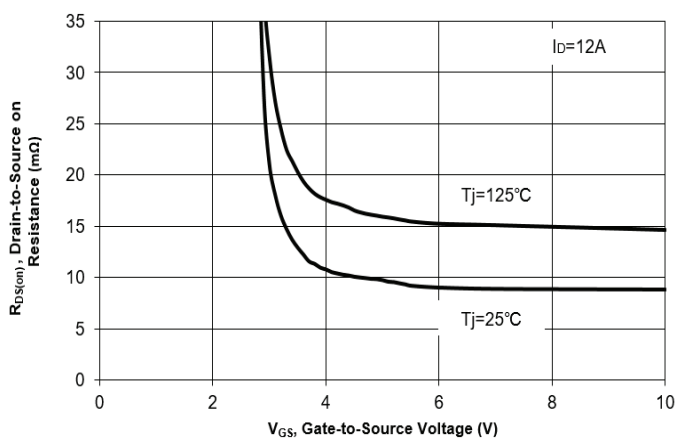


Fig. 5 On-Resistance vs. T_J

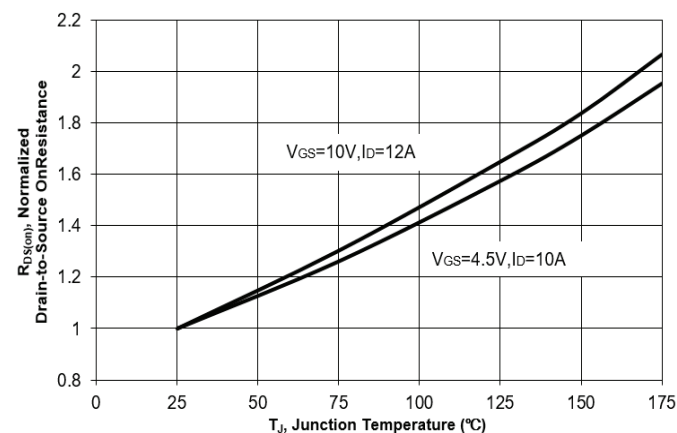
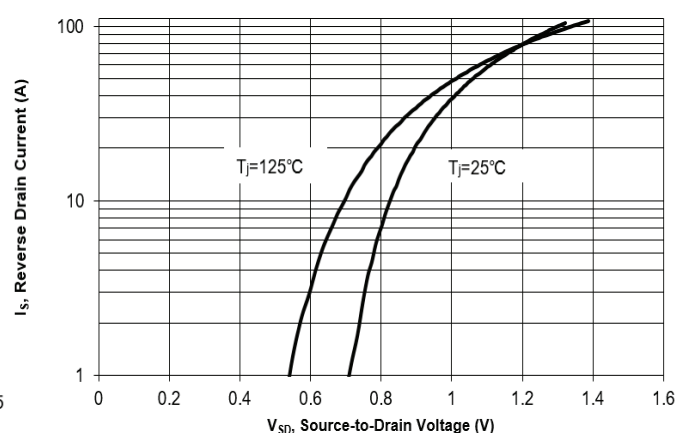


Fig. 6 Typical Body Diode Forward Characteristics



Electrical Characteristics Curves (Q1/Q2)

Fig. 7 Typical Junction Capacitance

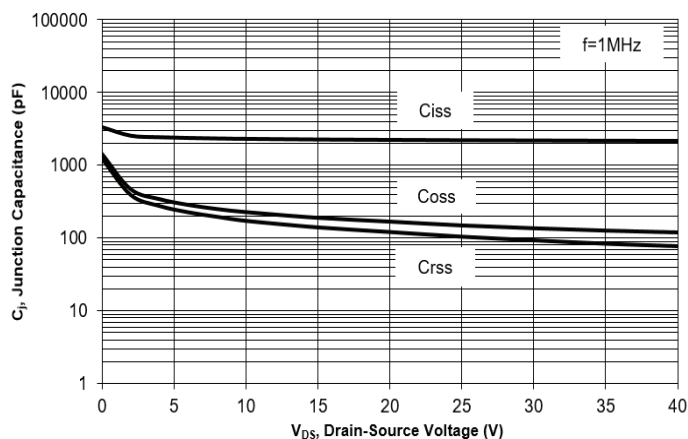


Fig. 8 Drain-Source Leakage Current vs. T_J

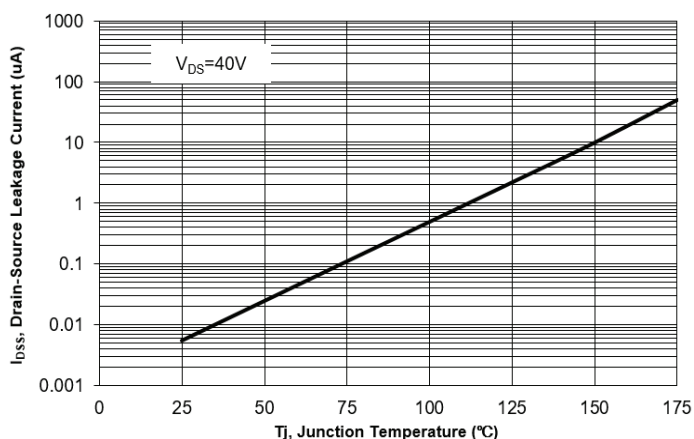


Fig. 9 V_{(BR)DSS} vs. Junction Temperature

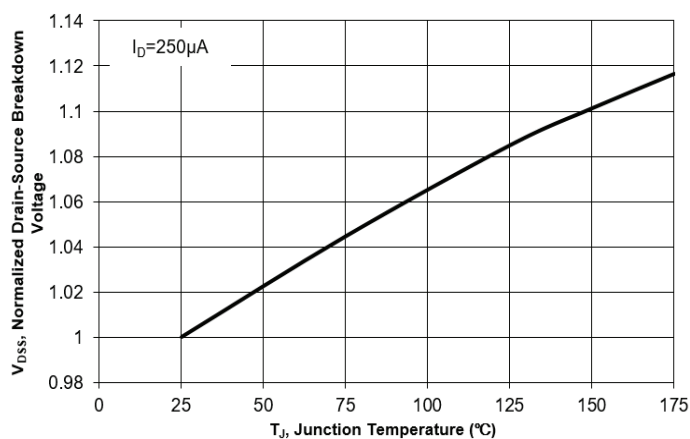


Fig. 10 Gate Threshold Variation vs. T_J

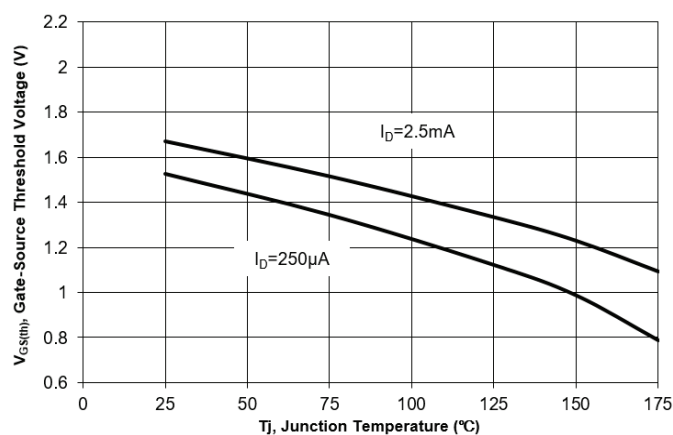


Fig. 11 Gate Charge

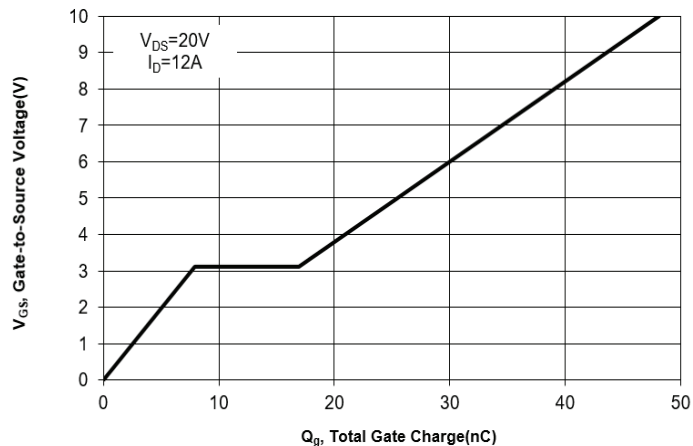
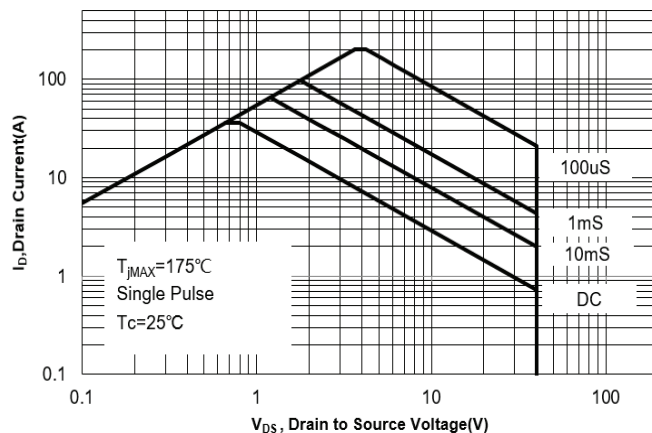
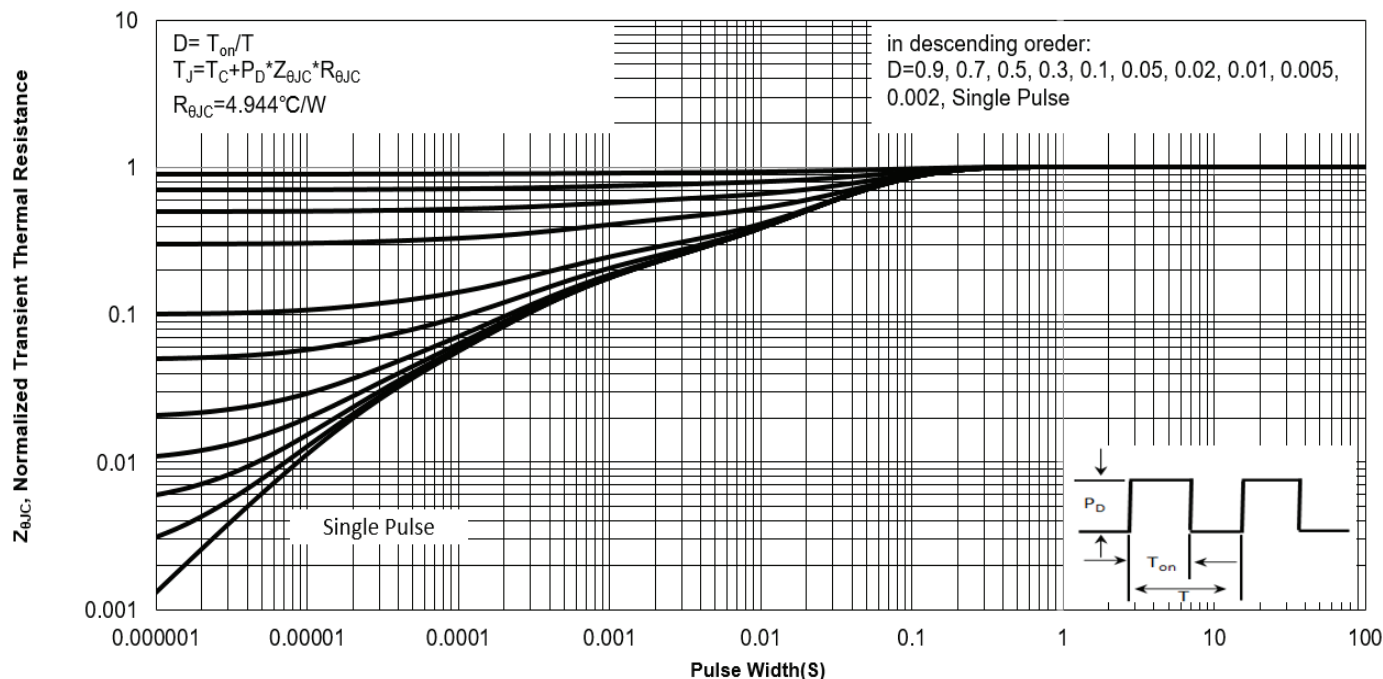
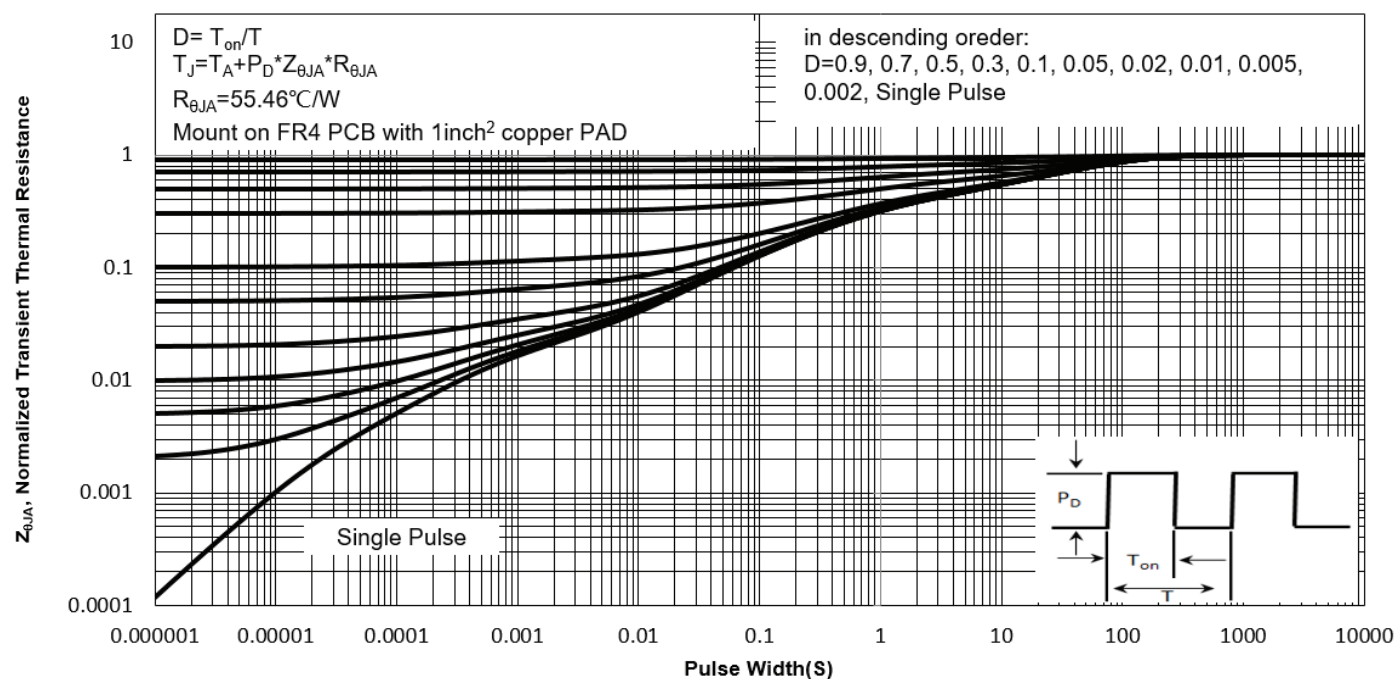


Fig. 12 Safe Operation Area



Electrical Characteristics Curves (Q1/Q2)

Fig.13 Normalized Maximum Transient Thermal Impedance($Z_{\theta JC}$)

Fig.14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)


Test Circuits (Q1/Q2)

Fig.1-1 Switching times test circuit

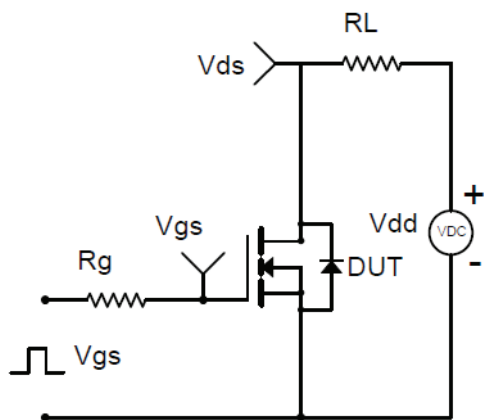


Fig.1-2 Switching Waveform

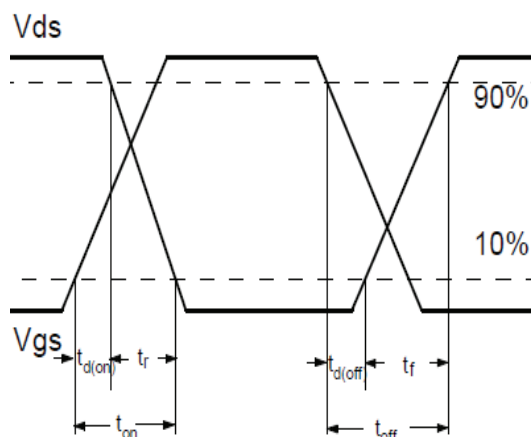


Fig.2-1 Gate charge test circuit

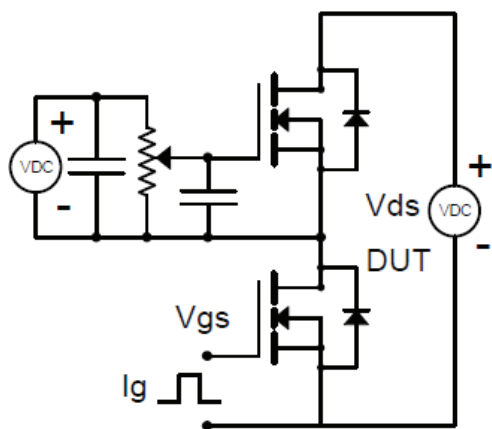


Fig.2-2 Gate charge waveform

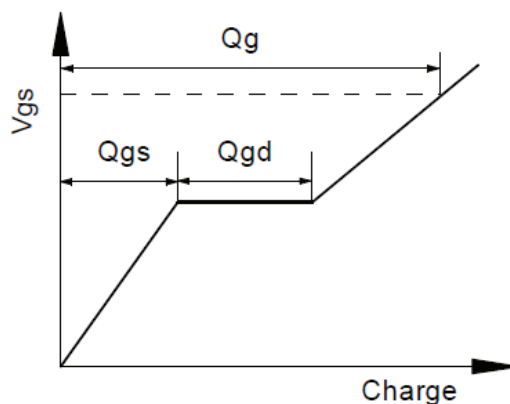


Fig.3-1 Avalanche test circuit

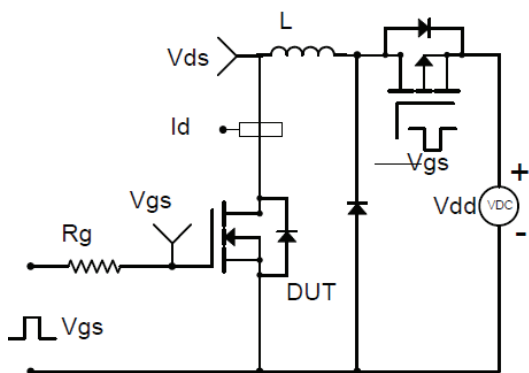
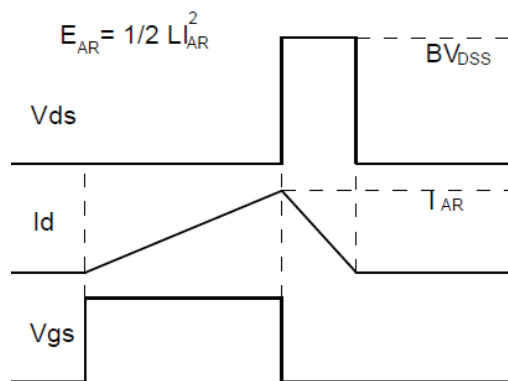
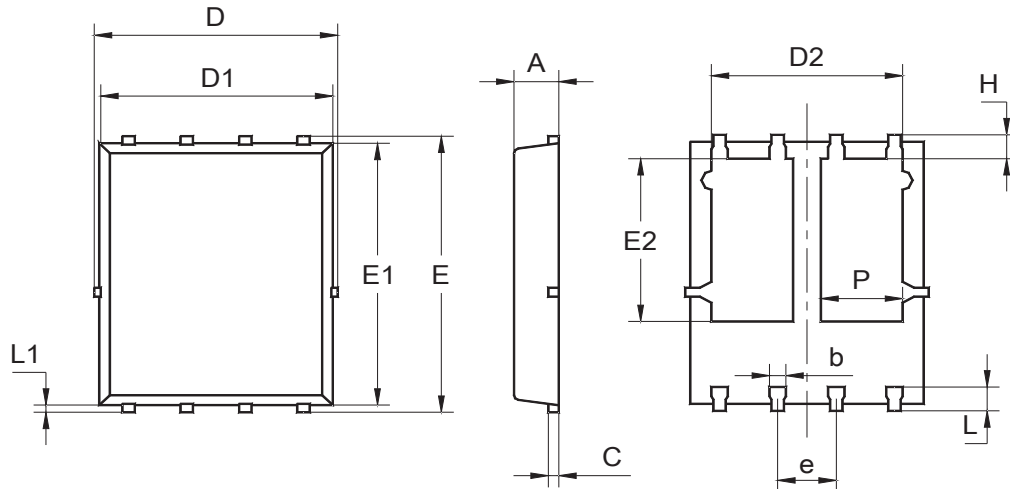


Fig.3-2 Avalanche waveform



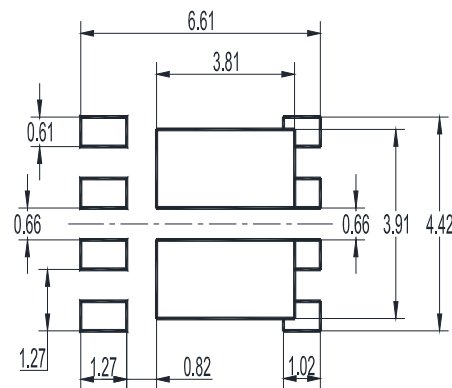
Package Outline Dimensions (Units: mm)

DFN5060



Unit	A	b	C	D	D1	D2	E	E1	E2	e	L	L1	H	P
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	2.0 1.6

Recommended Soldering Footprint



Packing information

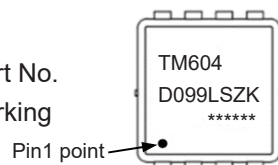
Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
DFN5060	12	8 ± 0.1	0.315 ± 0.004	330	13	5,000

Marking information

" TM604D099LSZK " = Part No.

" ***** " = Date Code Marking

Font type: Arial



Disclaimer: Our company reserve the right to make modifications, enhancements, improvements, corrections or other changes to improve product design, functions and reliability, anytime without notice. Semtech Electronics Limited makes no warranties, representations or warranties regarding the suitability of its products for any particular purpose, and does not accept any liability arising from the application or use of any product or circuit such as: Apply to medical, military, aircraft, space or life support equipment and expressly waive any and all liability, including but not limited to special, consequential or collateral damage.