

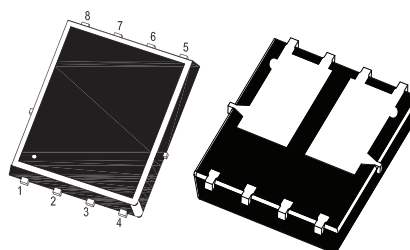
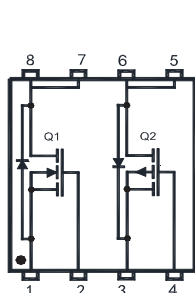
Complementary N/P-Channel Enhancement Mode MOSFET

Features

- Low $R_{DS(ON)}$
- Low Input Capacitance
- Halogen and Antimony Free(HAF), RoHS compliant

Application

- Motor/Body Load Control
- Load Switch
- DC-DC converters and Off-line UPS



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

Key Parameters(Q1)

Parameter	Value	Unit
BV_{DSS}	30	V
$R_{DS(ON)}$ Max	9.3 @ $V_{GS} = 10$ V	m Ω
	13 @ $V_{GS} = 4.5$ V	
$V_{GS(th)}$ typ	1.5	V
Q_g typ	25 @ $V_{GS} = 10$ V	nC

Key Parameters(Q2)

Parameter	Value	Unit
$-BV_{DSS}$	30	V
$R_{DS(ON)}$ Max	25 @ $-V_{GS} = 10$ V	m Ω
	45 @ $-V_{GS} = 4.5$ V	
$-V_{GS(th)}$ typ	1.5	V
Q_g typ	19 @ $-V_{GS} = 10$ V	nC

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

Parameter	Symbol	Value		Unit
		Q1	Q2	
Drain-Source Voltage	V_{DS}	30	- 30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	40	- 24	A
$T_c = 100^\circ\text{C}$		25	- 15	
Peak Drain Current, Pulsed ¹⁾	I_{DM}	170	- 70	A
Avalanche Current	I_{AS}	19	- 20.8	A
Single Pulse Avalanche Energy ²⁾	E_{AS}	18	21.7	mJ
Power Dissipation	P_D	19.7		W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150		$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	6.3	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	63	$^\circ\text{C/W}$

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

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

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

Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified(Q1)

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	BV_{DS}	30	-	-	V
Drain-Source Leakage Current at $V_{DS} = 24\ \text{V}$	I_{DSS}	-	-	1	μA
Gate Leakage Current at $V_{GS} = \pm 16\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	1	-	2.5	V
Drain-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 15\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 10\ \text{A}$	$R_{DS(on)}$	- -	7.2 9.8	9.3 13	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 15\ \text{A}$	g_{fs}	-	18	-	S
Gate resistance at $V_{DS} = 0\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	1	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1132	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	135	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	103	-	pF
Total Gate Charge at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$	Q_g	- -	25 12	- -	nC
Gate to Source Charge at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$	Q_{gs}	-	4.5	-	nC
Gate to Drain Charge at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$	Q_{gd}	-	5	-	nC
Turn-On Delay Time at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$, $R_g = 2.2\ \Omega$	$t_{d(on)}$	-	11	-	ns
Turn-On Rise Time at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$, $R_g = 2.2\ \Omega$	t_r	-	38	-	ns
Turn-Off Delay Time at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$, $R_g = 2.2\ \Omega$	$t_{d(off)}$	-	11	-	ns
Turn-Off Fall Time at $V_{GS} = 10\ \text{V}$, $V_{DS} = 15\ \text{V}$, $I_D = 15\ \text{A}$, $R_g = 2.2\ \Omega$	t_f	-	2	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = 1\ \text{A}$, $V_{GS} = 0\ \text{V}$	V_{SD}	-	-	1.2	V
Body-Diode Continuous Current	I_S	-	-	40	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	170	A
Body Diode Reverse Recovery Time at $I_S = 15\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	9	-	ns
Body Diode Reverse Recovery Charge at $I_S = 15\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	3	-	nC

Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified (Q2)

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $-I_D = 250\ \mu\text{A}$	$-BV_{DS}$	30	-	-	V
Drain-Source Leakage Current at $-V_{DS} = 24\ \text{V}$	$-I_{DSS}$	-	-	1	μA
Gate Source Leakage Current at $V_{GS} = \pm 16\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $-I_D = 250\ \mu\text{A}$	$-V_{GS(th)}$	1.2	-	2.5	V
Drain-Source On-State Resistance at $-V_{GS} = 10\ \text{V}$, $-I_D = 10\ \text{A}$ at $-V_{GS} = 4.5\ \text{V}$, $-I_D = 5\ \text{A}$	$R_{DS(on)}$	- -	21 32	25 45	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS} = 5\ \text{V}$, $-I_D = 10\ \text{A}$	g_{fs}	-	15	-	S
Gate resistance at $V_{DS} = 0\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	5	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1195	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	125	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 15\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	93	-	pF
Total Gate Charge at $-V_{DS} = 15\ \text{V}$, $-I_D = 10\ \text{A}$, $-V_{GS} = 10\ \text{V}$ at $-V_{DS} = 15\ \text{V}$, $-I_D = 10\ \text{A}$, $-V_{GS} = 4.5\ \text{V}$	Q_g	- -	19 9	- -	nC
Gate to Source Charge at $-V_{DS} = 15\ \text{V}$, $-I_D = 10\ \text{A}$, $-V_{GS} = 10\ \text{V}$	Q_{gs}	-	4	-	nC
Gate to Drain Charge at $-V_{DS} = 15\ \text{V}$, $-I_D = 10\ \text{A}$, $-V_{GS} = 10\ \text{V}$	Q_{gd}	-	3	-	nC
Turn-On Delay Time at $-V_{DS} = 15\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 10\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	9.3	-	ns
Turn-On Rise Time at $-V_{DS} = 15\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 10\ \text{A}$, $R_g = 3.3\ \Omega$	t_r	-	31	-	ns
Turn-Off Delay Time at $-V_{DS} = 15\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 10\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	14	-	ns
Turn-Off Fall Time at $-V_{DS} = 15\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 10\ \text{A}$, $R_g = 3.3\ \Omega$	t_f	-	2.8	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $-I_S = 1\ \text{A}$, $V_{GS} = 0\ \text{V}$	$-V_{SD}$	-	-	1.2	V
Body-Diode Continuous Current	$-I_S$	-	-	24	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	70	A
Body Diode Reverse Recovery Time at $-I_S = 10\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	9.7	-	ns
Body Diode Reverse Recovery Charge at $-I_S = 10\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	4	-	nC

Electrical Characteristics Curves(Q1)

Fig. 1 Typical Output Characteristics

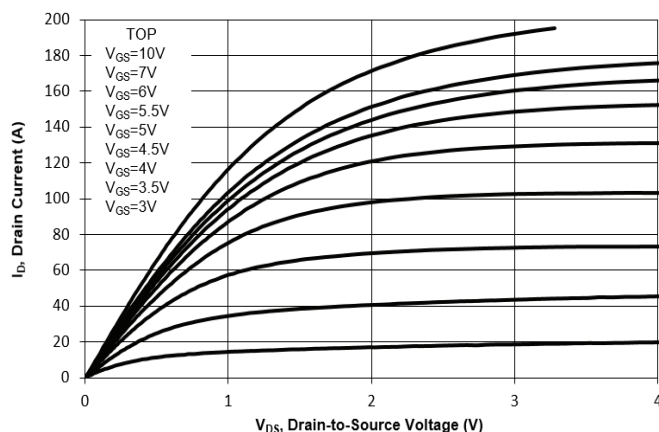


Fig. 2 Typical Transfer Characteristics

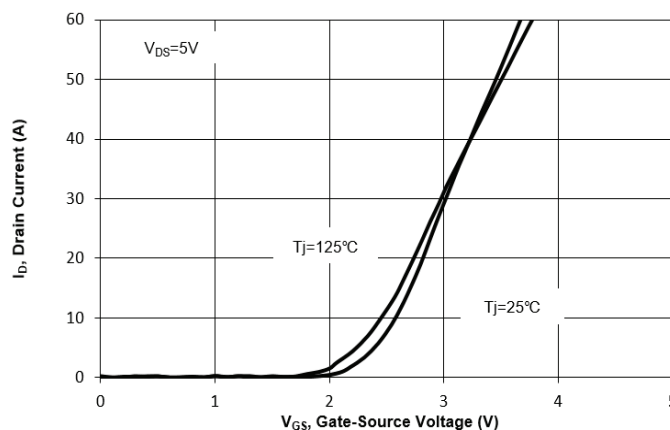


Fig. 3 on-Resistance vs. Drain Current

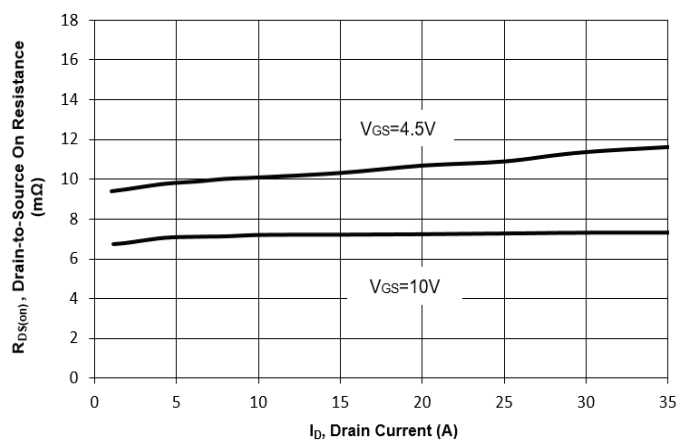


Fig. 4 on-Resistance vs. Gate to Source Voltage

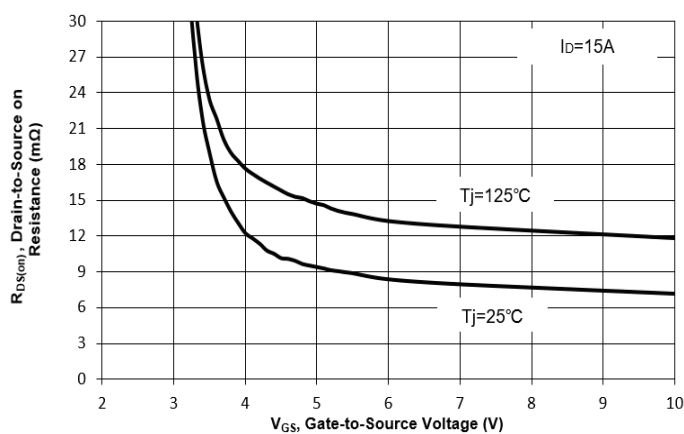


Fig. 5 on-Resistance vs. T_J

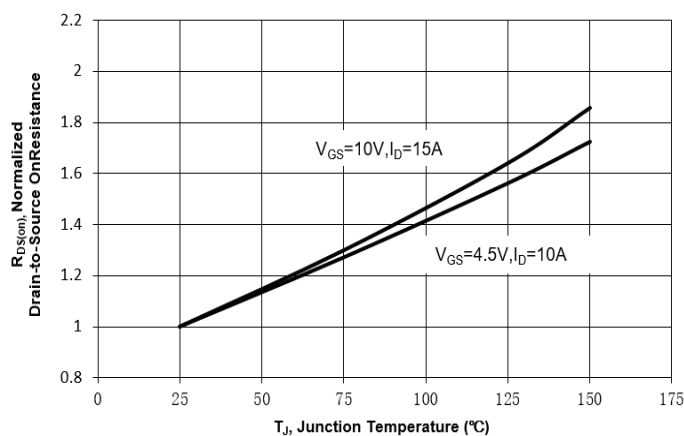
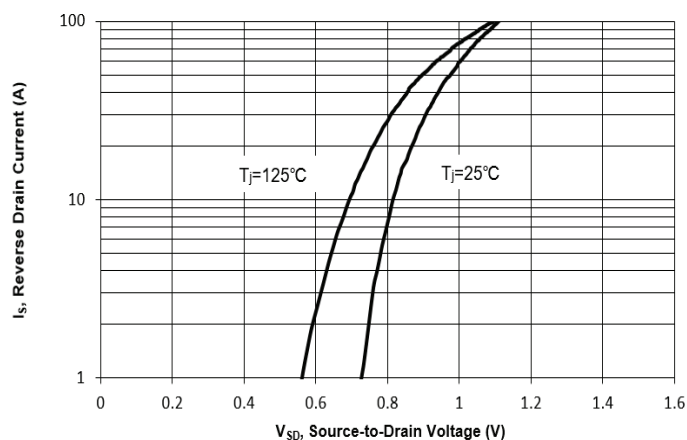


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves(Q1)

Fig. 7 Typical Junction Capacitance

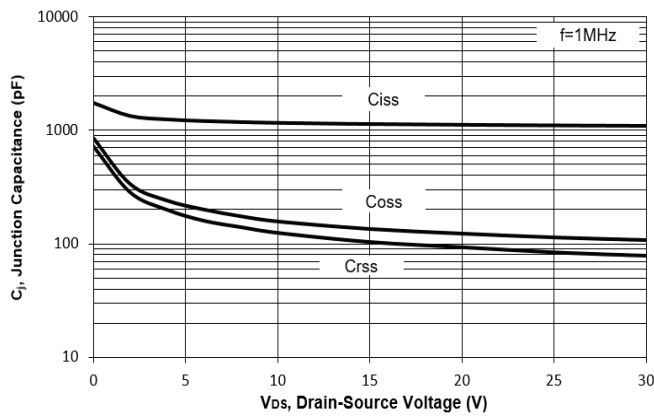


Fig. 8 Drain-Source Leakage Current vs. T_j

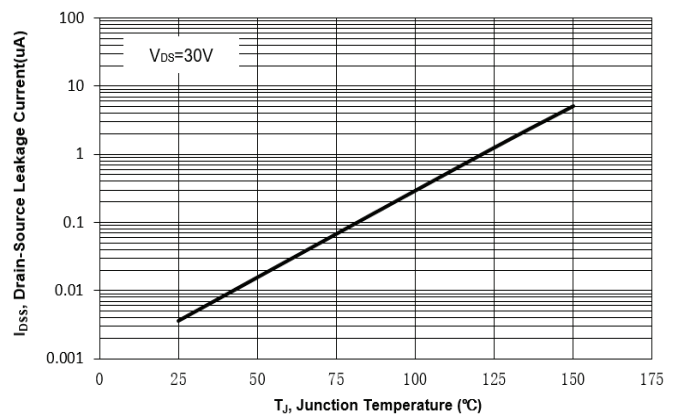


Fig. 9 V_{(BR)DSS} vs. Junction Temperature

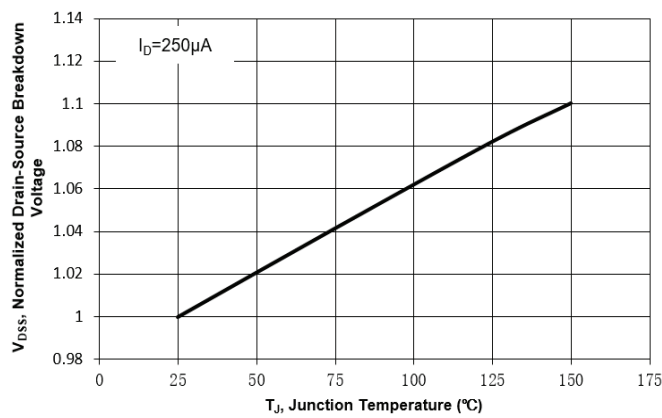


Fig. 10 Gate Threshold Variation vs. T_j

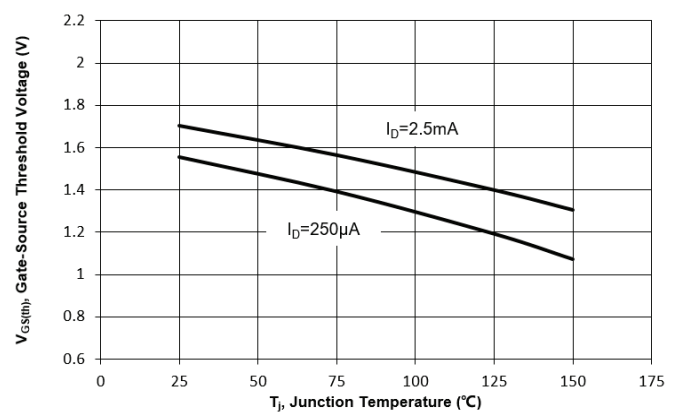


Fig. 11 Gate Charge

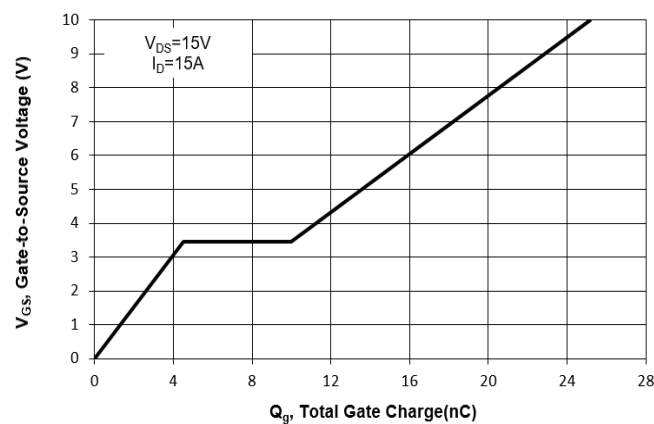
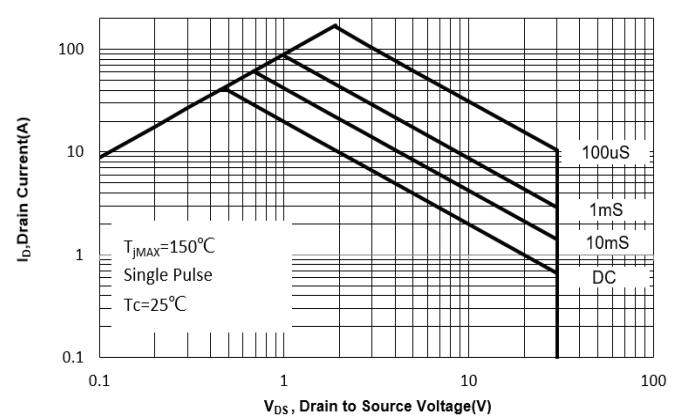


Fig. 12 Safe Operation Area



Electrical Characteristics Curves(Q1)

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

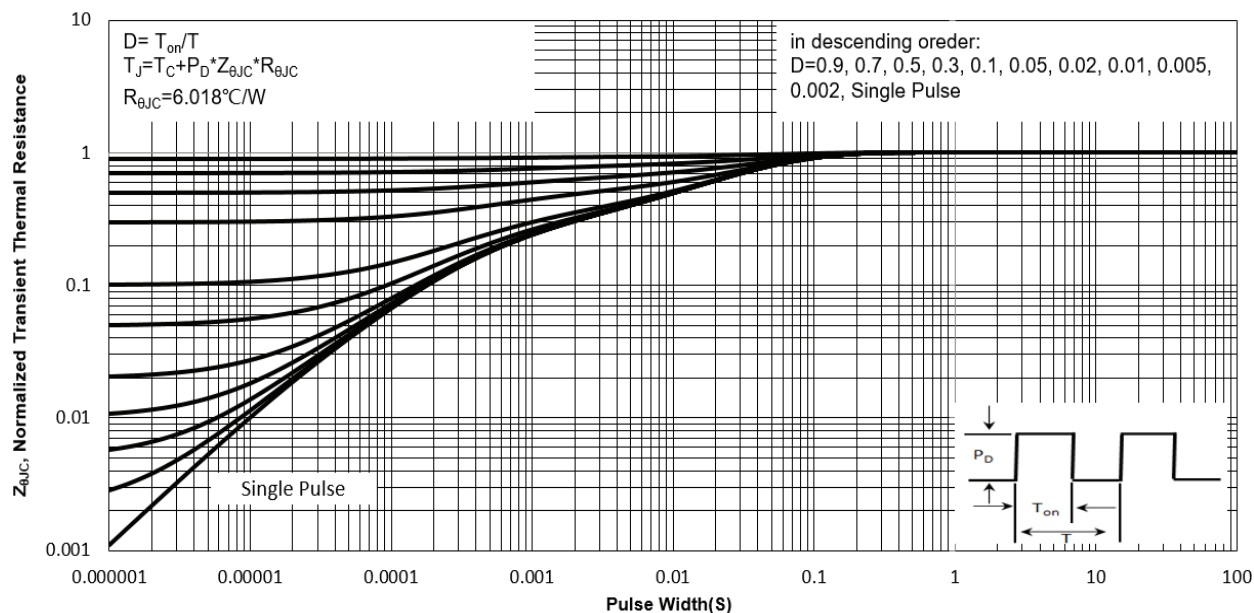
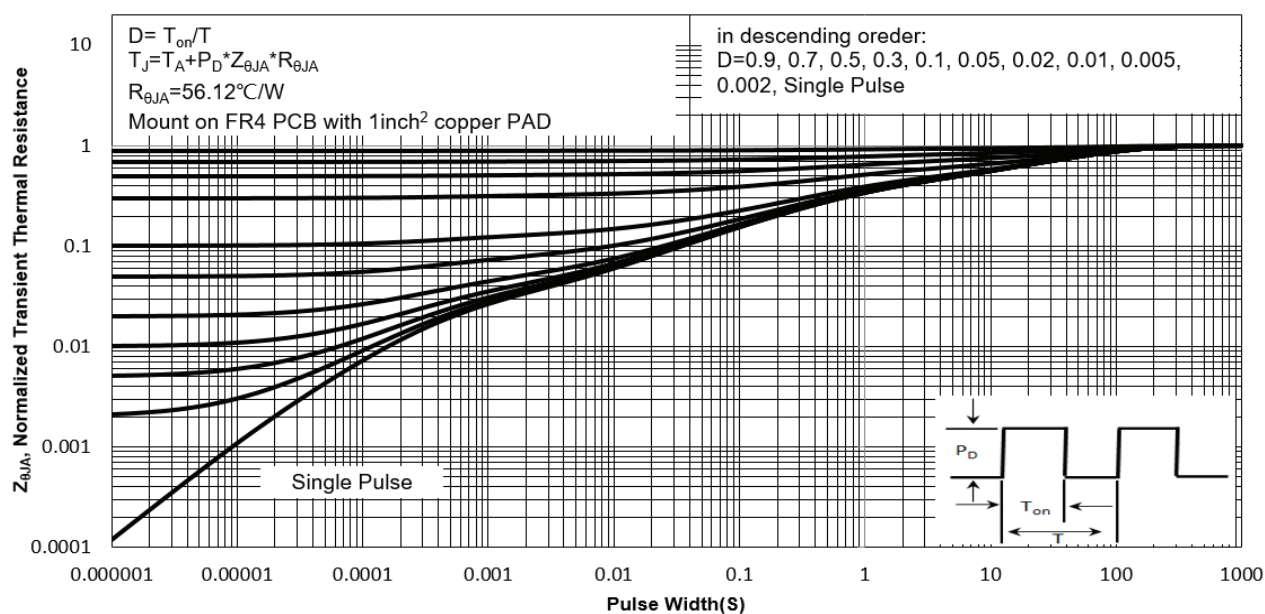


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)



Electrical Characteristics Curves(Q2)

Fig. 1 Typical Output Characteristics

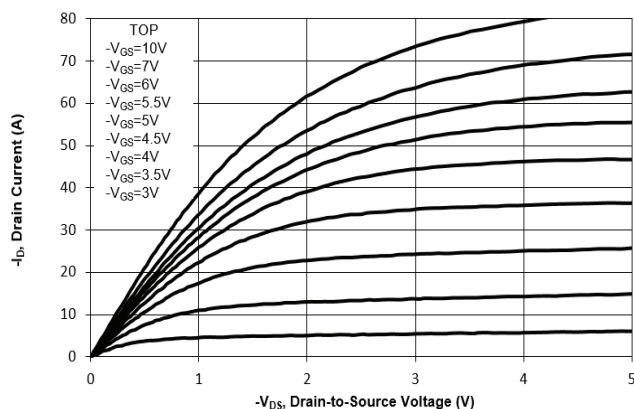


Fig. 2 Typical Transfer Characteristics

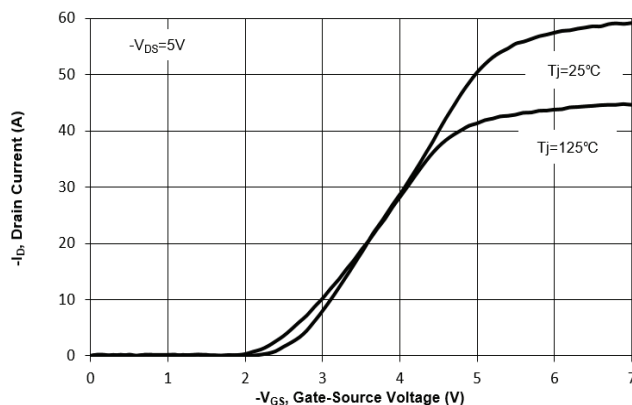


Fig. 3 on-Resistance vs. Drain Current

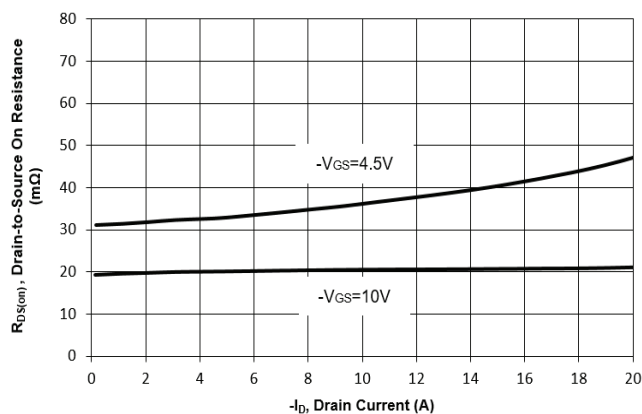


Fig. 4 on-Resistance vs. Gate to Source

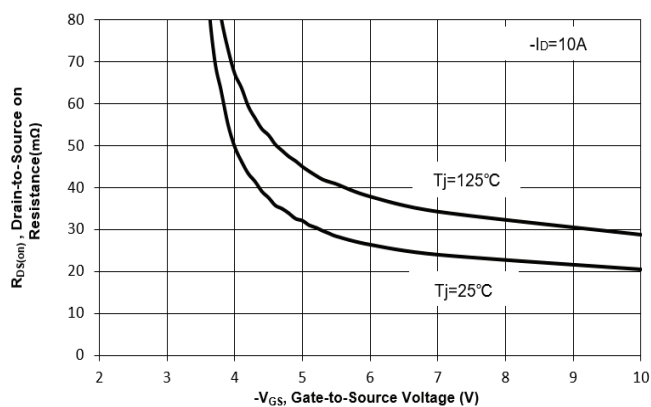


Fig. 5 on-Resistance vs. T_J

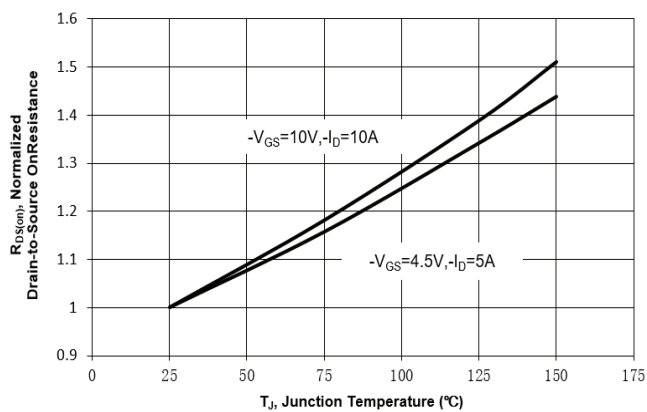
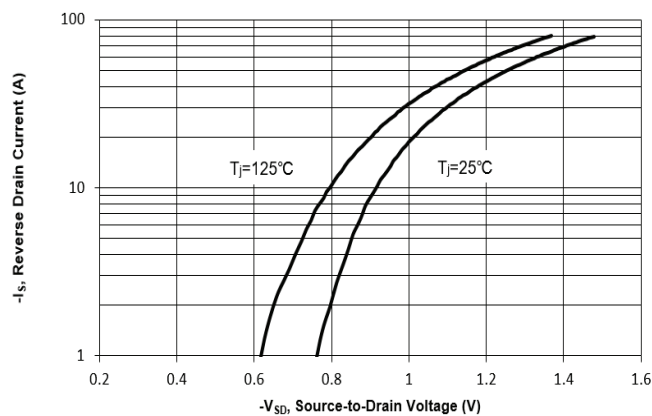


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves(Q2)

Fig. 7 Typical Junction Capacitance

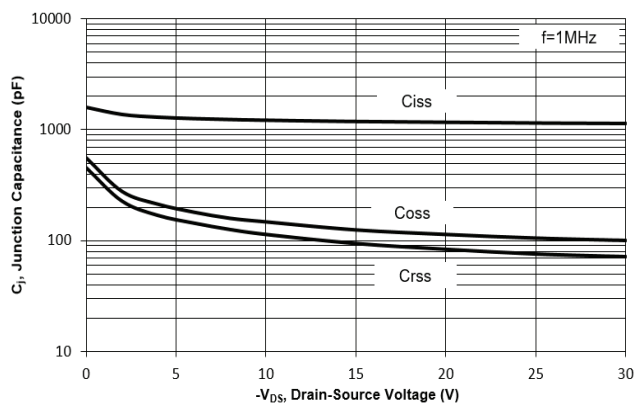


Fig. 8 Drain-Source Leakage Current vs. T_J

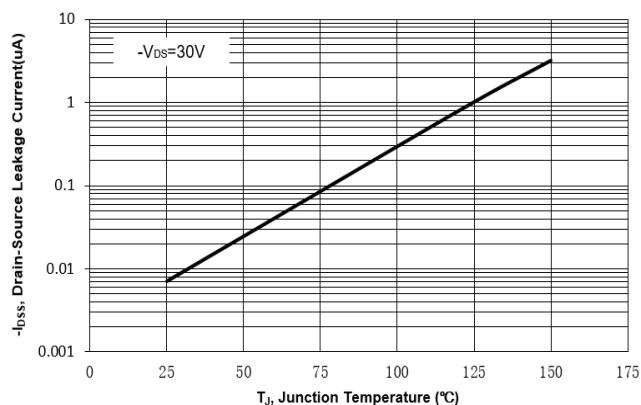


Fig. 9 V_{(BR)DSS} vs. Junction Temperature

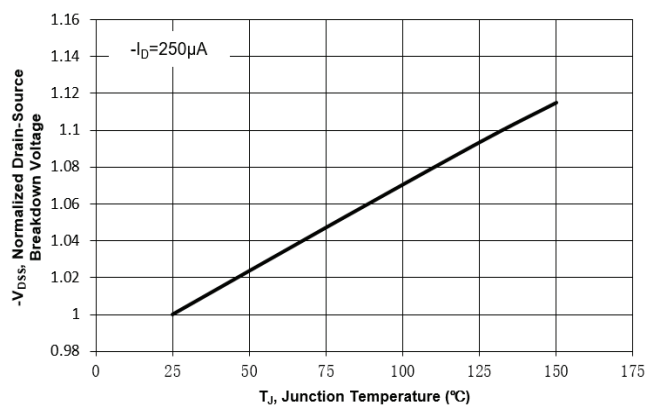


Fig. 10 Gate Threshold Variation vs. T_J

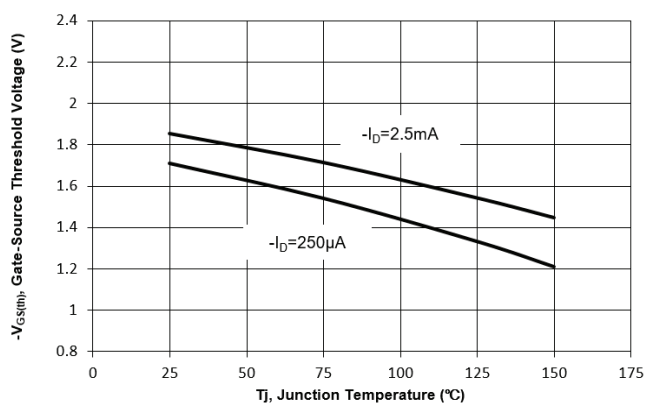


Fig. 11 Gate Charge

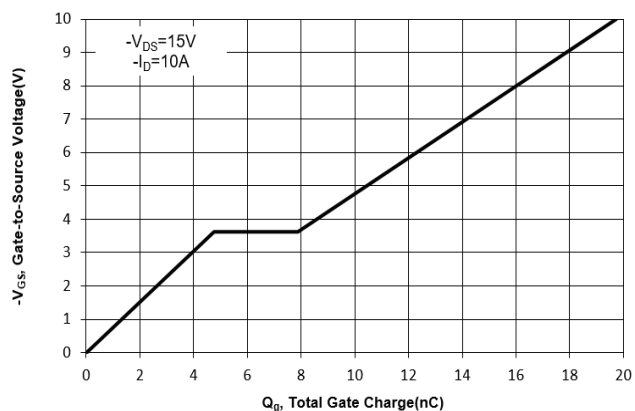
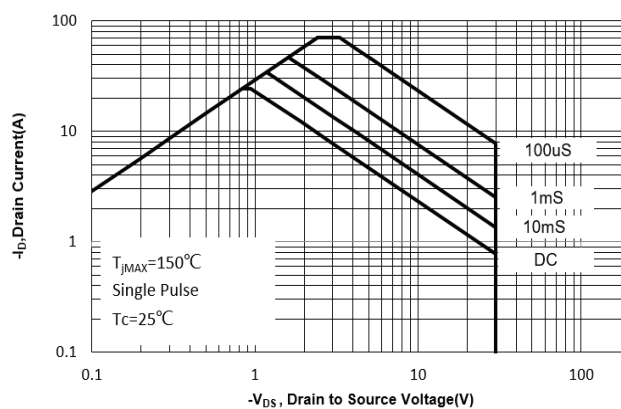


Fig. 12 Safe Operation Area



Electrical Characteristics Curves(Q2)

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

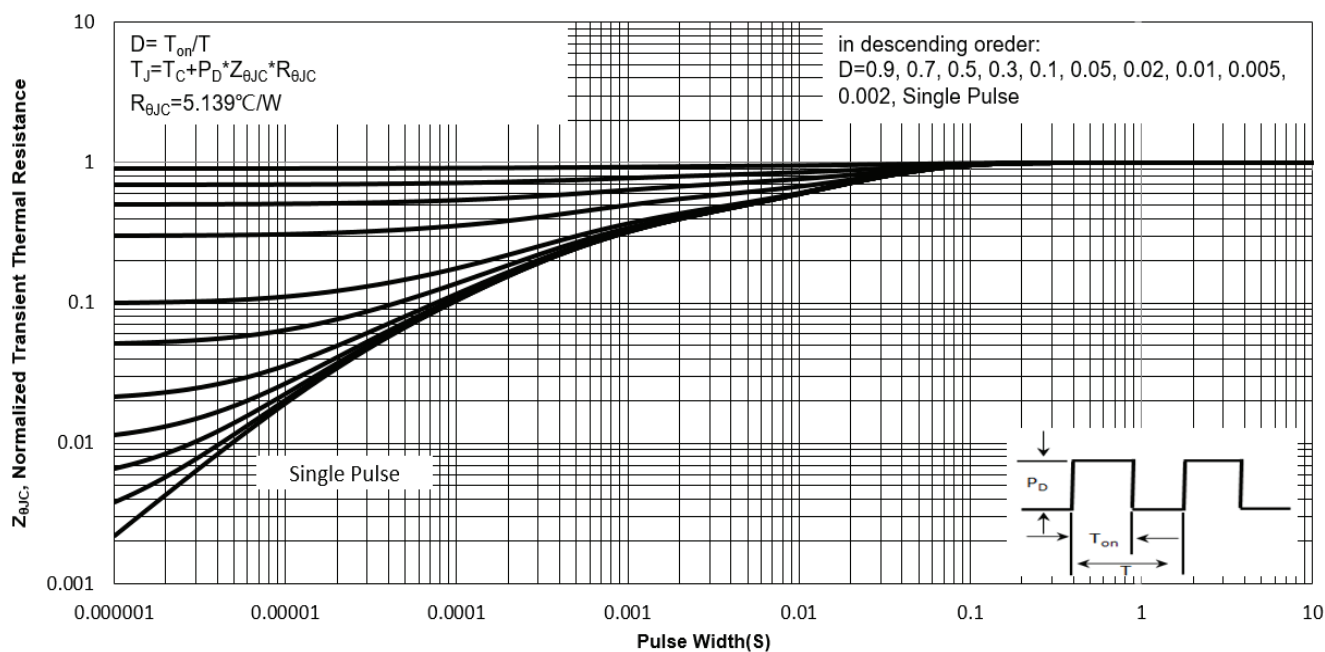
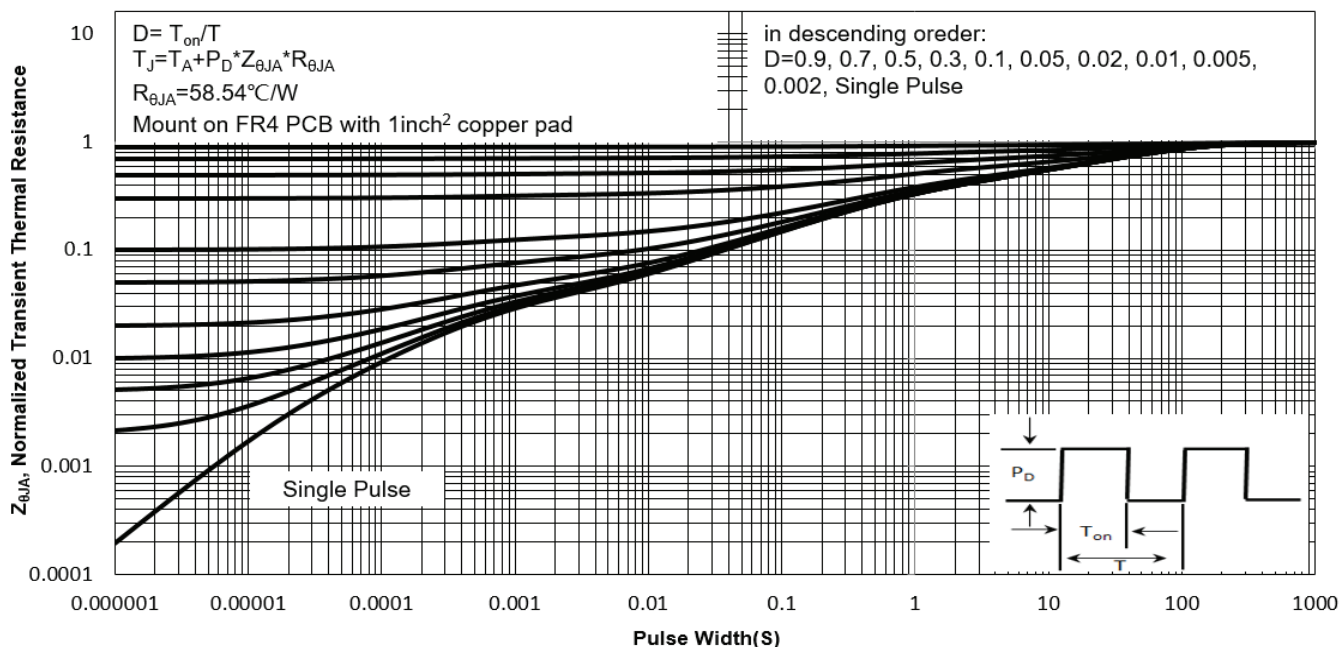


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits(Q1)

Fig.1-1 Switching times test circuit

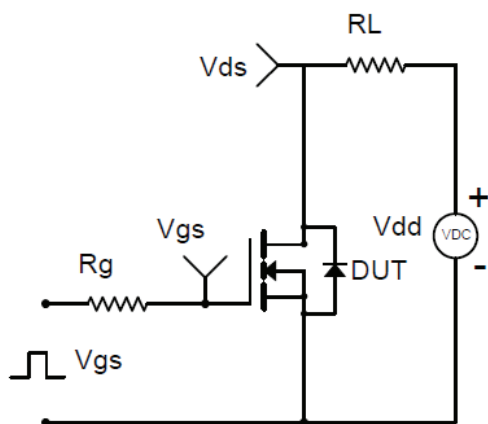


Fig.1-2 Switching Waveform

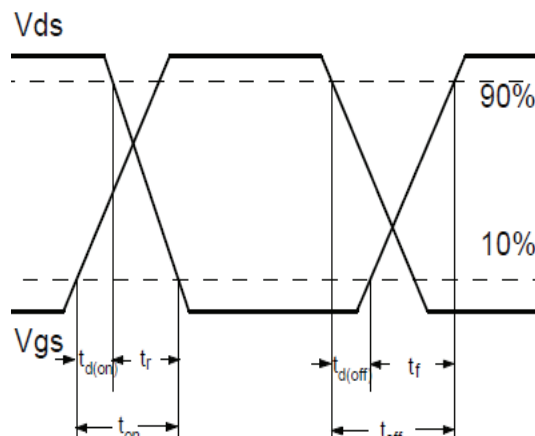


Fig.2-1 Gate charge test circuit

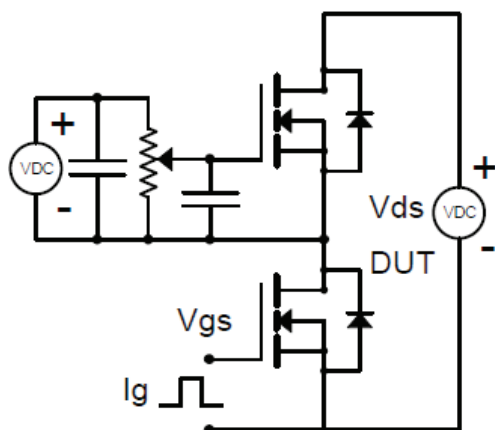


Fig.2-2 Gate charge waveform

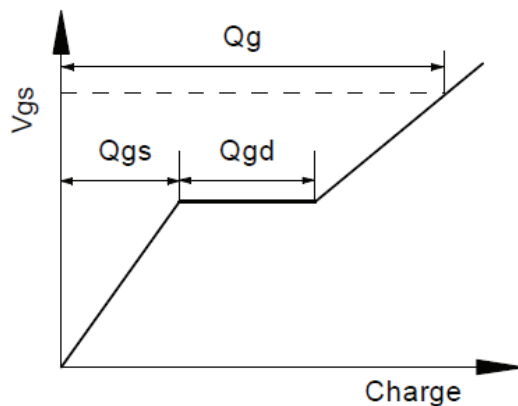


Fig.3-1 Avalanche test circuit

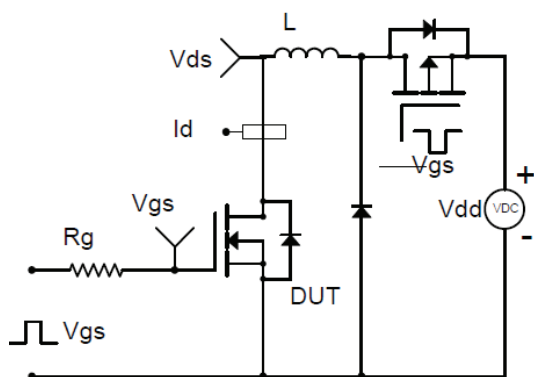
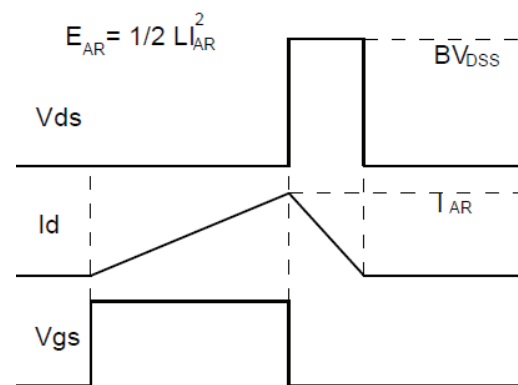


Fig.3-2 Avalanche waveform



Test Circuits(Q2)

Fig.1-1 Switching times test circuit

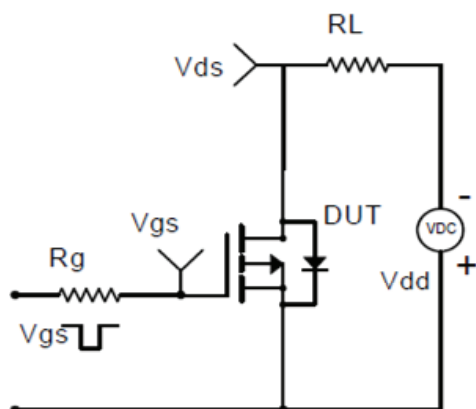


Fig.1-2 Switching Waveform

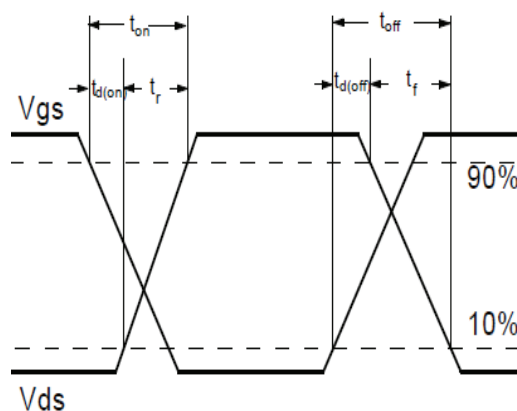


Fig.2-1 Gate charge test circuit

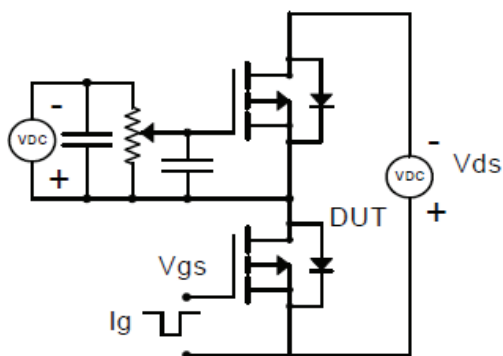


Fig.2-2 Gate charge waveform

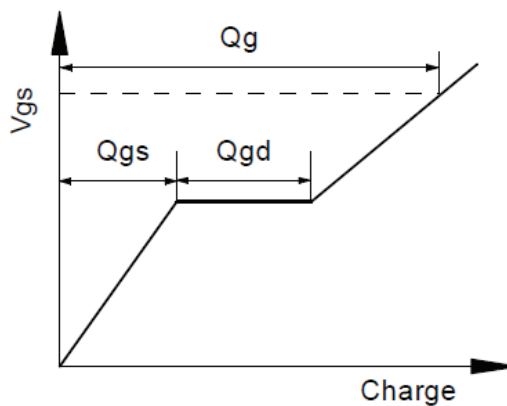


Fig.3-1 Avalanche test circuit

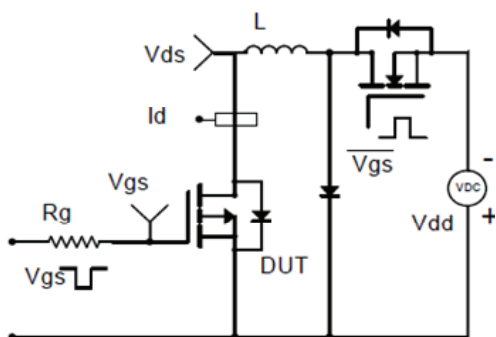
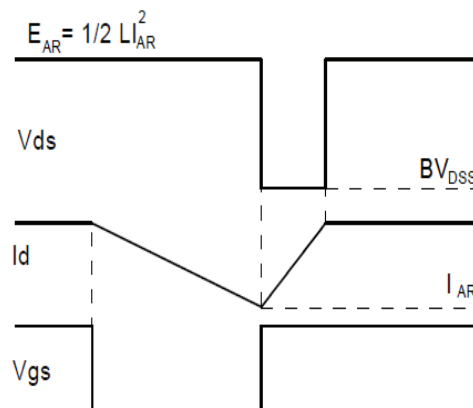
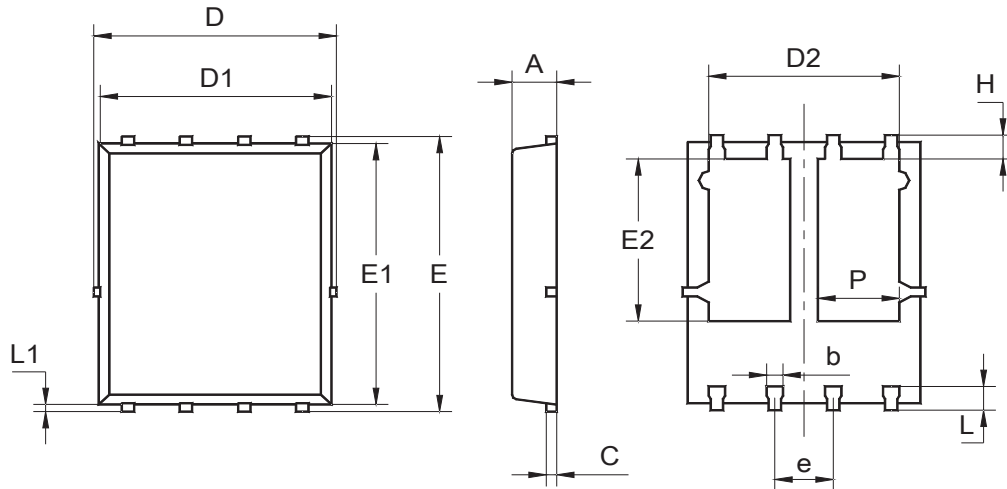


Fig.3-2 Avalanche waveform



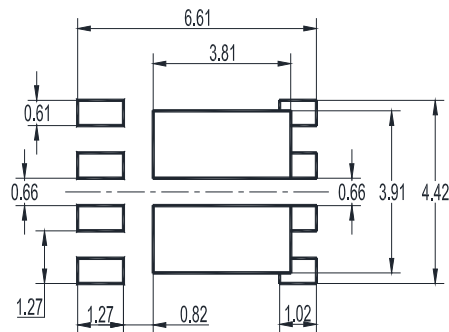
Package Outline Dimensions (Units: mm)

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	2.3 1.7

Recommended Soldering Footprint



Packing information

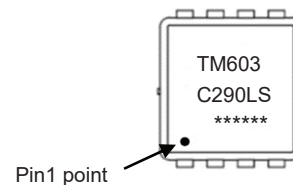
Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
DFN5060	12	8 ± 0.1	0.315 ± 0.004	330	13	5,000

Marking information

" TM603C290LS " = 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.