

WTM604C250L-AH

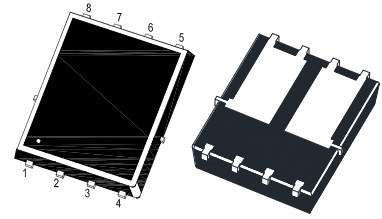
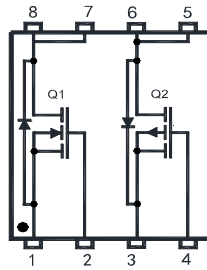
Complementary N/P-Channel Enhancement Mode MOSFET

Features

- AEC-Q101 Qualified
- Fast switching
- Halogen and Antimony Free(HAF),
RoHS compliant

Applications

- CCFL backlighting
- 3 phases BLDC motor



1. Source1 2. Gate1 3. Source2 4. Gate2
5. Drain2 6. Drain2 7. Drain1 8. Drain1
DFN5060 Plastic Package

Key Parameters (Q1)

Parameter	Value	Unit
BV_{DSS}	40	V
$R_{DS(ON)}$ Max	19 @ $V_{GS} = 10$ V	m Ω
	24 @ $V_{GS} = 4.5$ V	
$V_{GS(th)}$ typ	1.6	V
Q_g typ	17 @ $V_{GS} = 10$ V	nC

Key Parameters (Q2)

Parameter	Value	Unit
$-BV_{DSS}$	40	V
$R_{DS(ON)}$ Max	35 @ $-V_{GS} = 10$ V	m Ω
	50 @ $-V_{GS} = 4.5$ V	
$-V_{GS(th)}$ typ	1.5	V
Q_g typ	23 @ $-V_{GS} = 10$ 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}	40	- 40	V
Gate-Source Voltage	V _{GS}	± 20	± 20	V
Continuous Drain Current	I _D	28	- 23	A
T _c = 25°C T _c = 100°C		17.6	- 14	
Peak Drain Current, Pulsed ¹⁾	I _{DM}	80	- 80	A
Avalanche Current	I _{AS}	17	- 25	A
Single Pulse Avalanche Energy ²⁾	E _{AS}	15	31	mJ
Power Dissipation	P _D	25		W
T _c = 25°C T _c = 100°C		10		
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to + 150		°C

Thermal Characteristics (Q1)

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	5	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	95	$^\circ\text{C/W}$

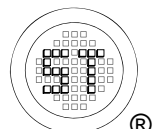
Thermal Characteristics (Q2)

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	5	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	100	$^\circ\text{C/W}$

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.

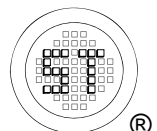
³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



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

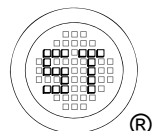
Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	$V_{(BR)DSS}$	40	-	-	V
Drain-Source Leakage Current at $V_{DS} = 32\ \text{V}$	I_{DSS}	-	-	1	μA
Gate-Source Leakage Current at $V_{GS} = \pm 20\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	1.2	-	2.5	V
Gate-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 3\ \text{A}$	$R_{DS(on)}$	- -	15 -	19 24	m Ω
DYNAMIC PARAMETERS					
Forward Transfer Admittance at $V_{DS} = 5\ \text{V}$, $I_D = 5.7\ \text{A}$	g_{fs}	-	10.5	-	S
Gate resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	1.5	-	Ω
Input Capacitance at $V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	921	-	pF
Output Capacitance at $V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	76	-	pF
Reverse Transfer Capacitance at $V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	35	-	pF
Total Gate Charge at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$ at $V_{DS} = 20\ \text{V}$, $V_{GS} = 4.5\ \text{V}$, $I_D = 3\ \text{A}$	Q_g	- -	17 8	- -	nC
Gate-Source Charge at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$	Q_{gs}	-	3	-	nC
Gate-Drain Charge at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$	Q_{gd}	-	2	-	nC
Turn-On Delay Time at $V_{DD} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	10	-	ns
Turn-On Rise Time at $V_{DD} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	t_r	-	2	-	ns
Turn-Off Delay Time at $V_{DD} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	10	-	ns
Turn-Off Fall Time at $V_{DD} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	t_f	-	1	-	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	-	-	28	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	80	A
Body Diode Reverse Recovery Time at $I_S = 10\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	7.6	-	ns
Body Diode Reverse Recovery Charge at $I_S = 10\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	2.8	-	nC



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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 $-I_D = 250\ \mu\text{A}$	$-V_{(BR)DSS}$	40	-	-	V
Drain-Source Leakage Current at $-V_{DS} = 32\ \text{V}$	$-I_{DSS}$	-	-	1	μA
Gate-Source Leakage Current at $V_{GS} = \pm 20\ \text{V}$	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
Gate-Source On-State Resistance at $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$ at $-V_{GS} = 4.5\ \text{V}$, $-I_D = 3\ \text{A}$	$R_{DS(on)}$	- -	28 -	35 50	m Ω
DYNAMIC PARAMETERS					
Forward Transfer Admittance at $-V_{DS} = 5\ \text{V}$, $-I_D = 5.7\ \text{A}$	g_{fs}	-	11.7	-	S
Gate resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	11.8	-	Ω
Input Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1354	-	pF
Output Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	116	-	pF
Reverse Transfer Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	69	-	pF
Total Gate Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$ at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 4.5\ \text{V}$, $-I_D = 3\ \text{A}$	Q_g	- -	23 11	- -	nC
Gate-Source Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$	Q_{gs}	-	4	-	nC
Gate-Drain Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$	Q_{gd}	-	3	-	nC
Turn-On Delay Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	8	-	ns
Turn-On Rise Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	t_r	-	7	-	ns
Turn-Off Delay Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	24	-	ns
Turn-Off Fall Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 3\ \text{A}$, $R_g = 3.3\ \Omega$	t_f	-	4	-	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	$-I_S$	-	-	23	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	80	A
Body Diode Reverse Recovery Time at $-I_S = 10\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	10	-	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 Characteristic

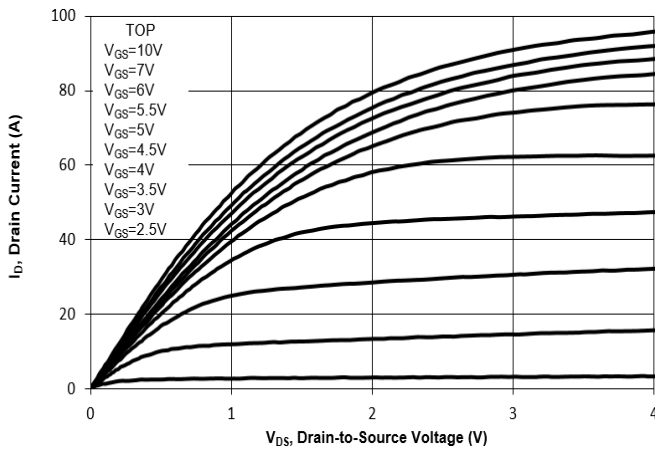


Fig. 2 Typical Transfer Characteristic

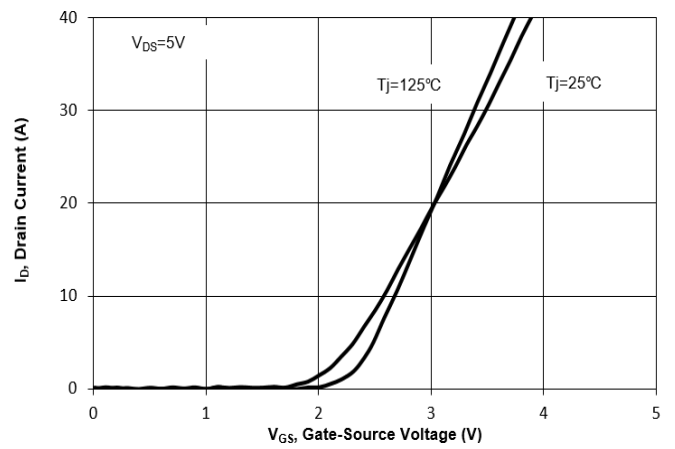


Fig. 3 On-Resistance vs. Drain Current

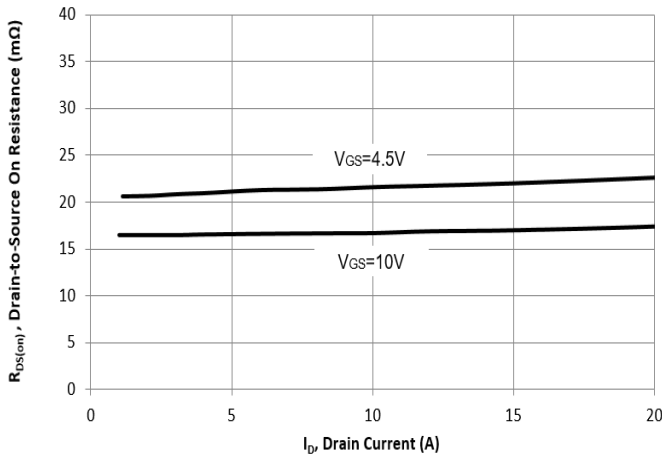


Fig. 4 On-Resistance vs. Gate Voltage

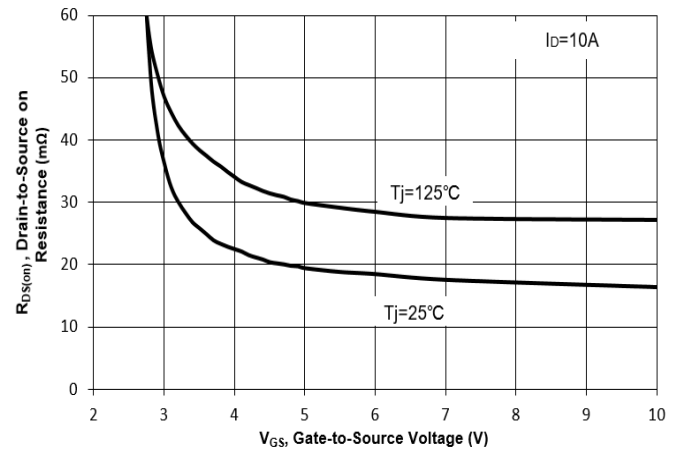


Fig. 5 On-Resistance vs. T_J

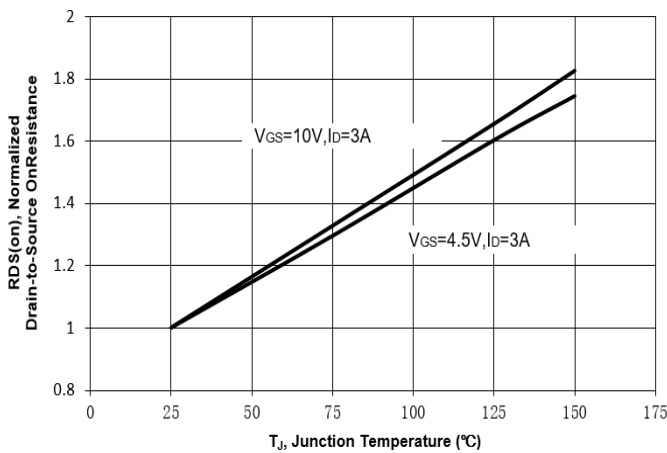
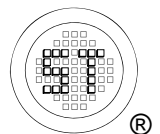
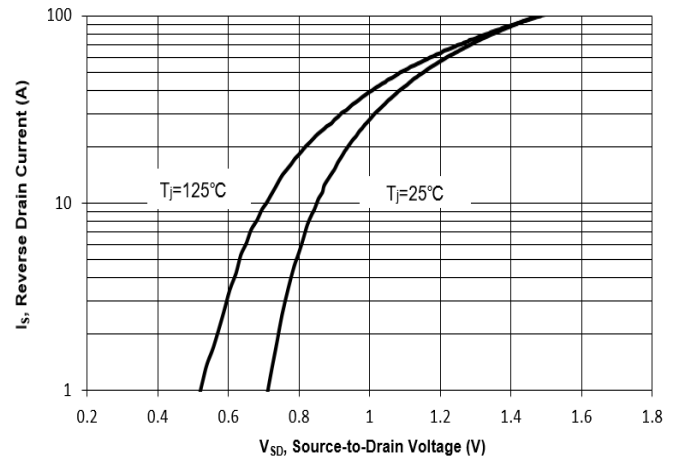


Fig. 6 Typical Forward Characteristic



Electrical Characteristics Curves (Q1)

Fig. 7 Typical Junction Capacitance

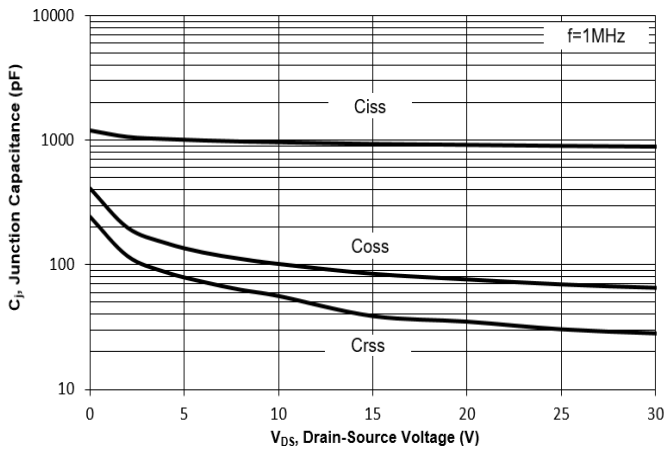


Fig. 8 Drain-Source Leakage Current vs. T_j

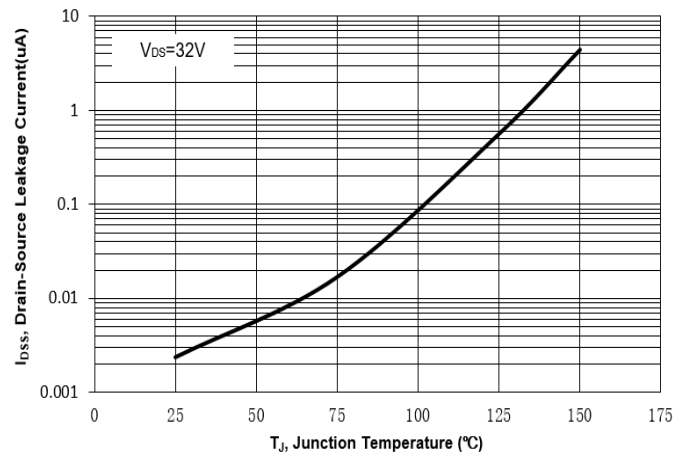


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

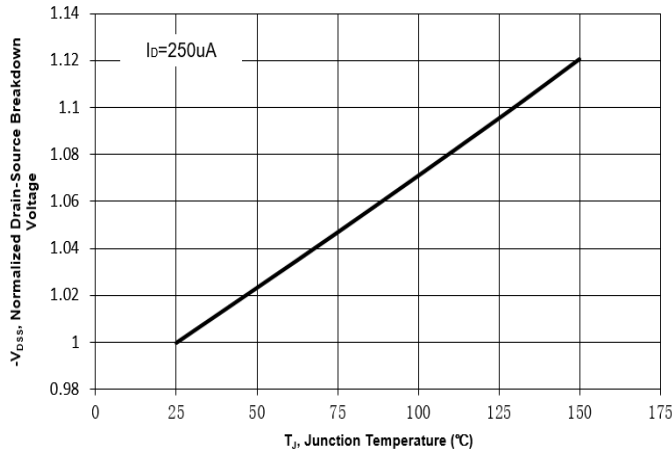


Fig. 10 Gate Threshold Variation vs. T_j

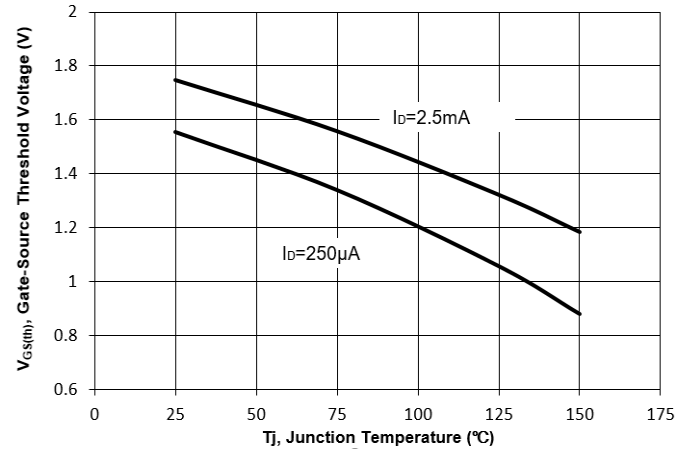


Fig. 11 Gate Charge

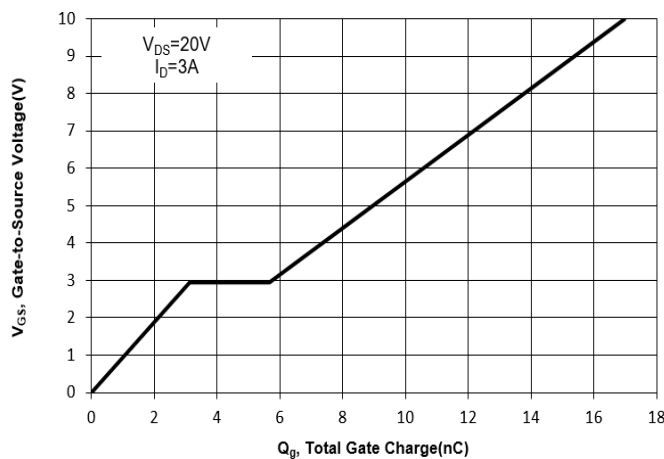
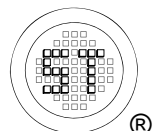
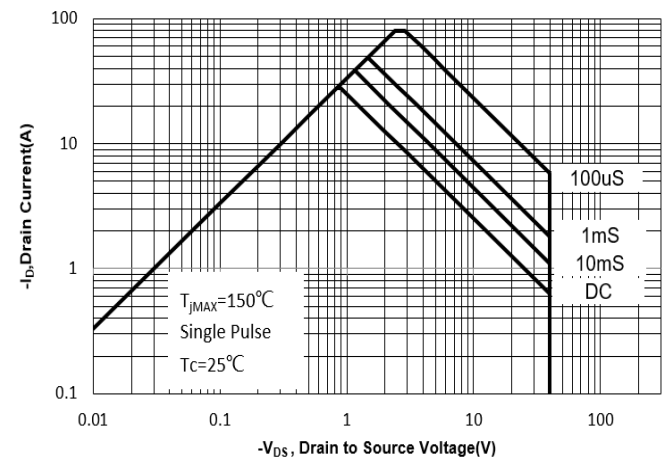


Fig. 12 Safe Operation Area



Electrical Characteristics Curves (Q1)

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

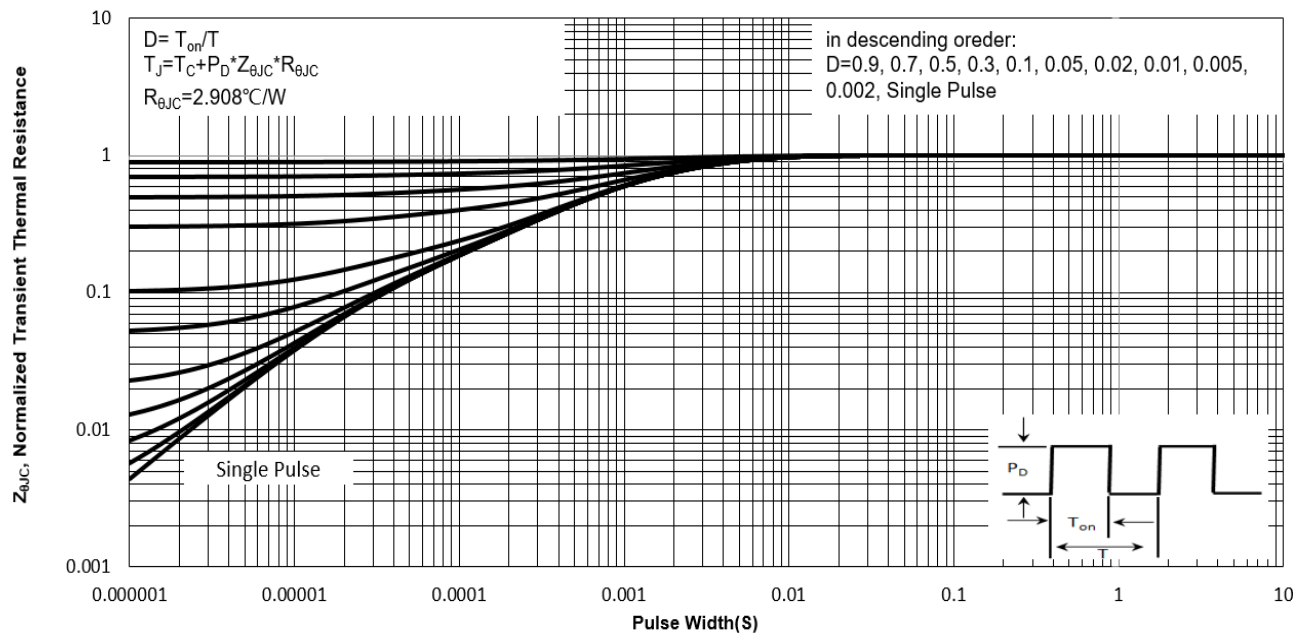
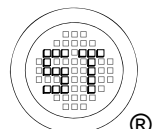
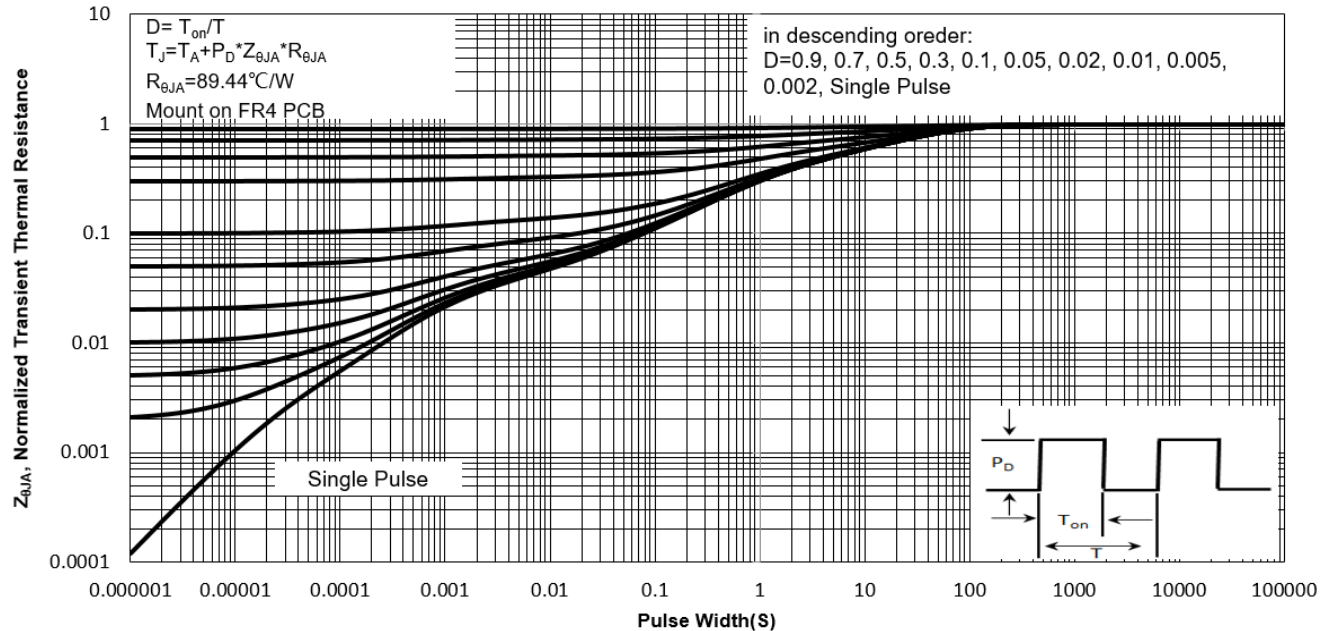


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Electrical Characteristics Curves (Q2)

Fig. 1 Typical Output Characteristic

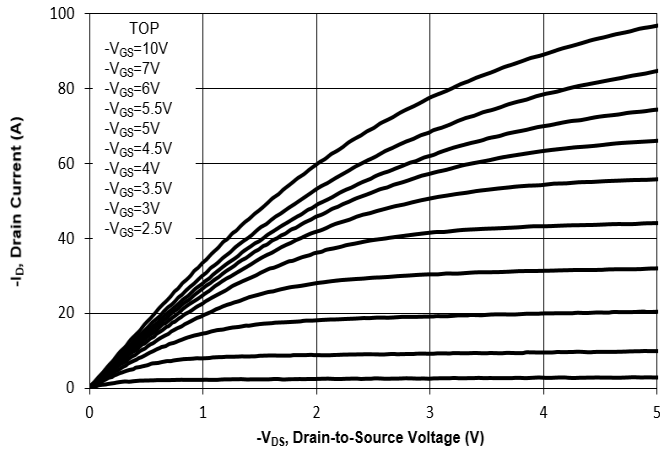


Fig. 2 Typical Transfer Characteristic

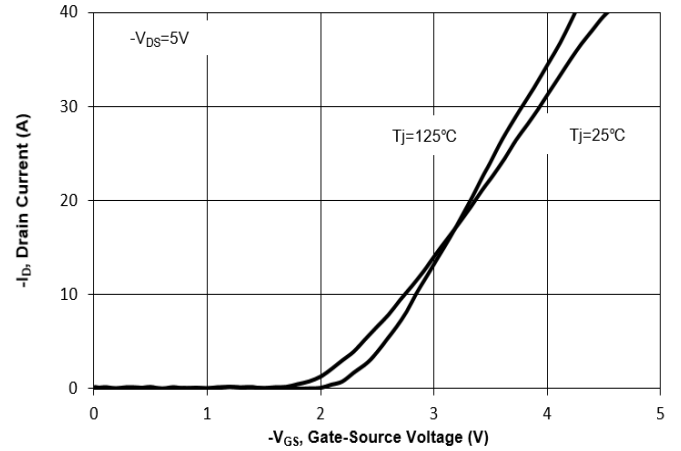


Fig. 3 On-Resistance vs. Drain Current

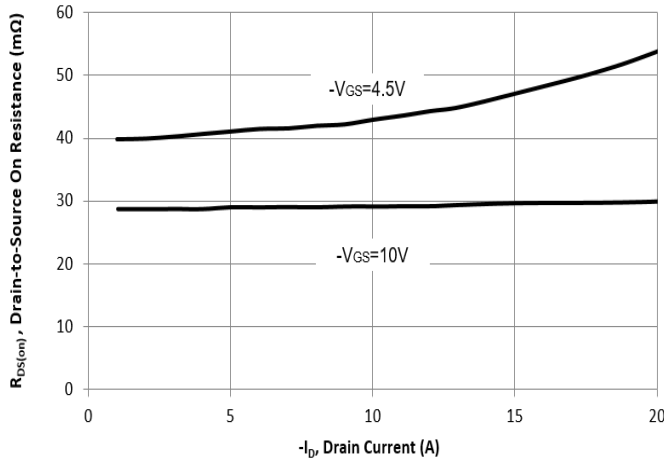


Fig. 4 On-Resistance vs. Gate Voltage

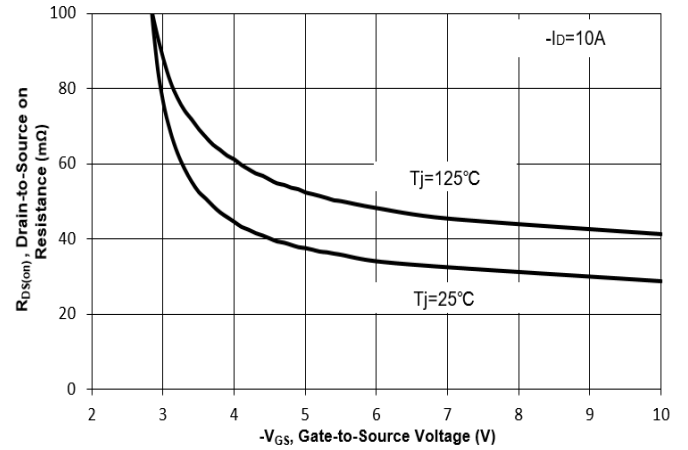


Fig. 5 On-Resistance vs. T_J

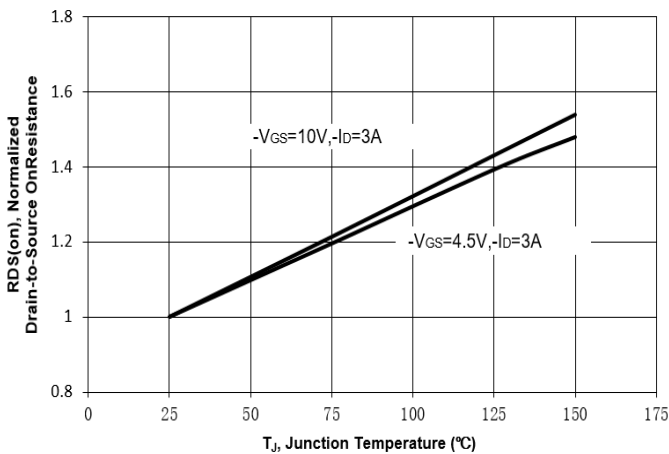
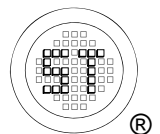
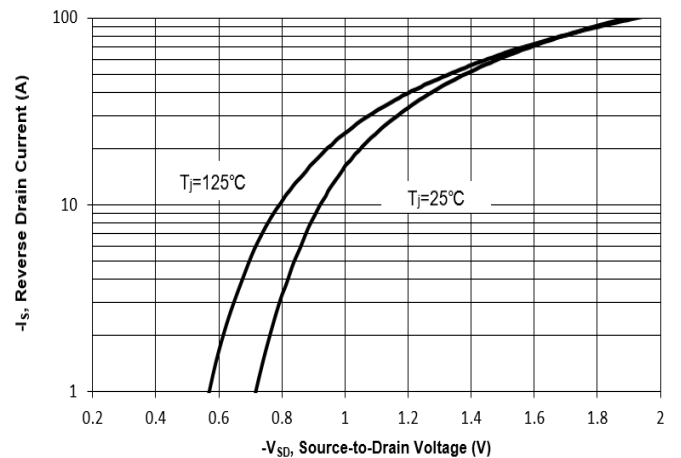


Fig. 6 Typical Forward Characteristic



Electrical Characteristics Curves (Q2)

Fig. 7 Typical Junction Capacitance

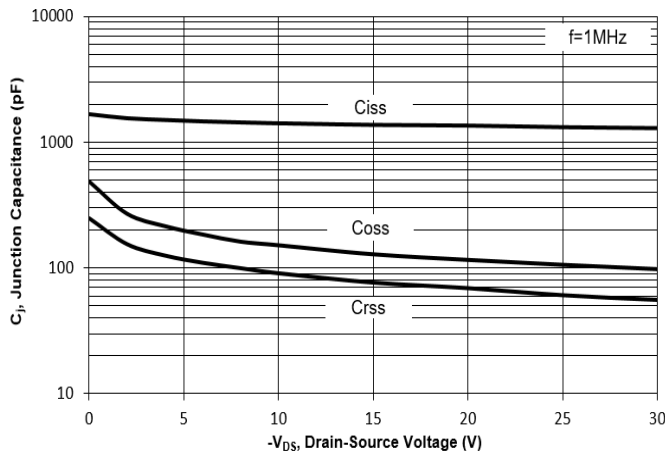


Fig. 8 Drain-Source Leakage Current vs. T_j

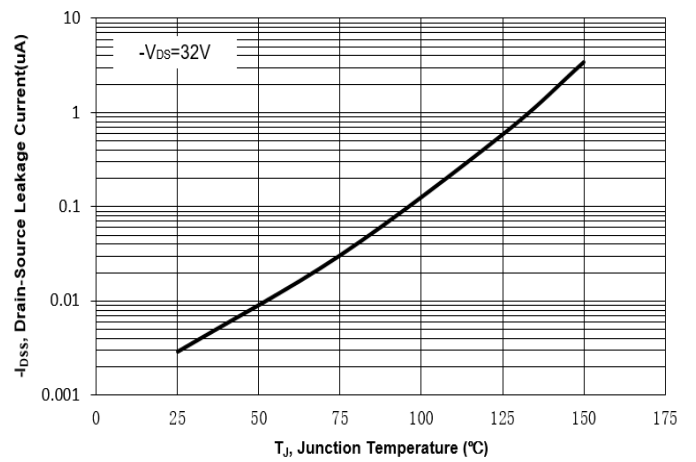


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

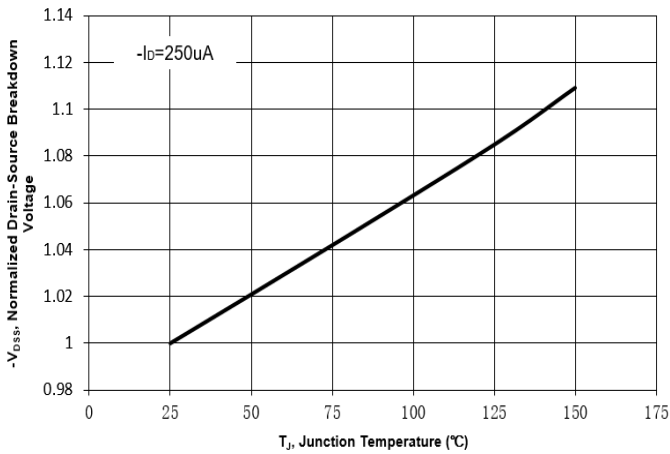


Fig. 10 Gate Threshold Variation vs. T_j

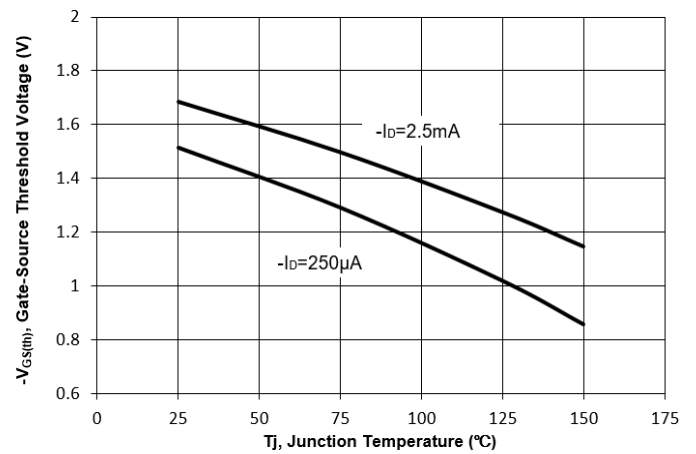


Fig. 11 Gate Charge

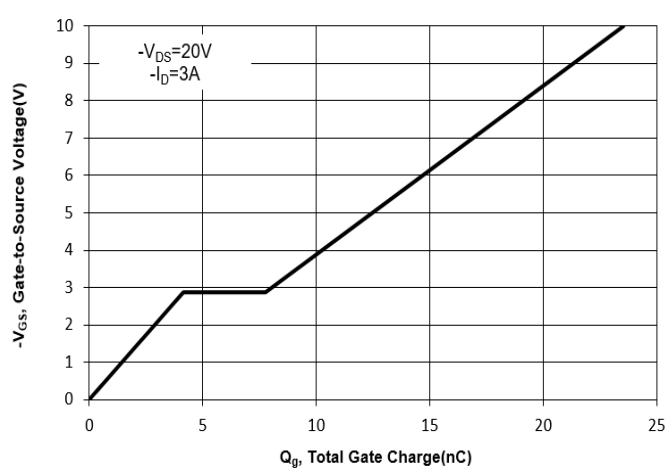
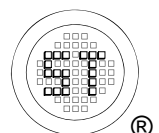
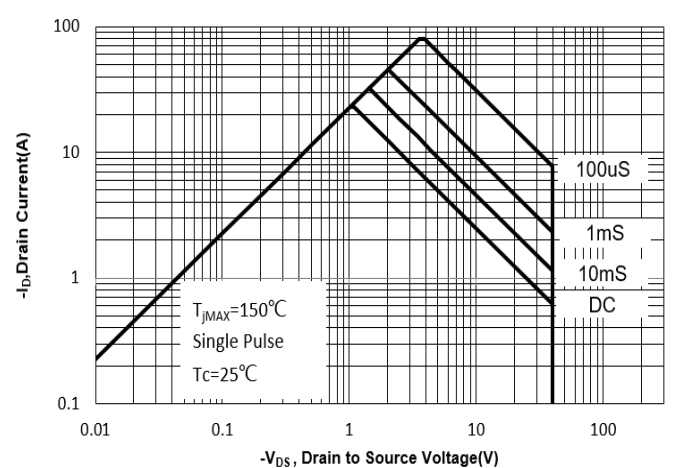


Fig. 12 Safe Operation Area



Electrical Characteristics Curves (Q2)

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

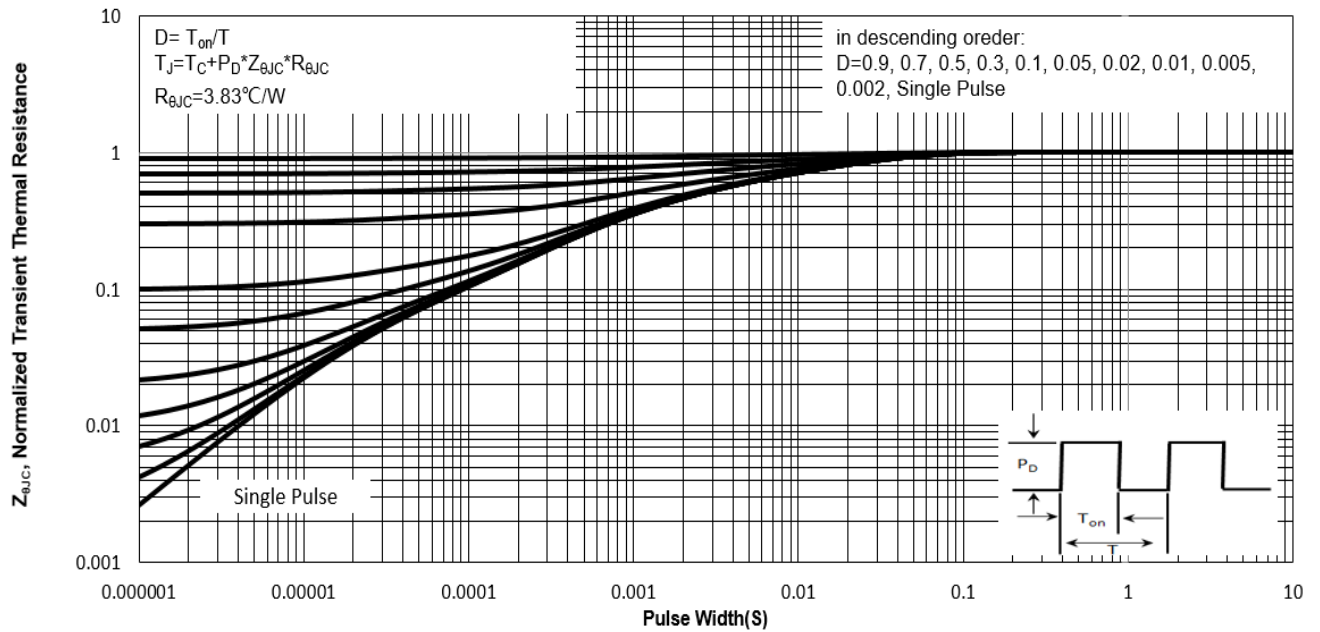
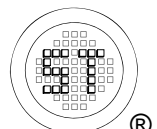
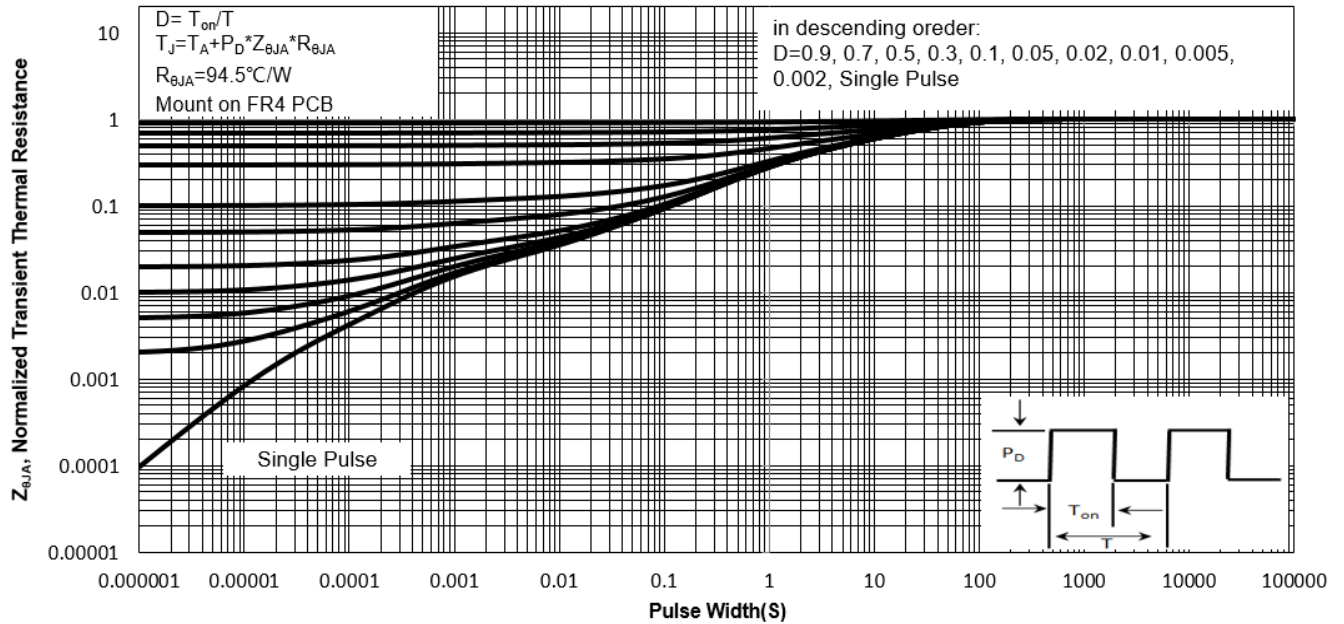


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits (Q1)

Fig.1-1 Switching times test circuit

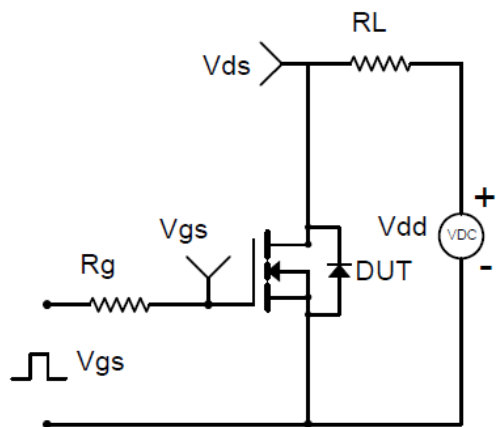


Fig.1-2 Switching Waveform

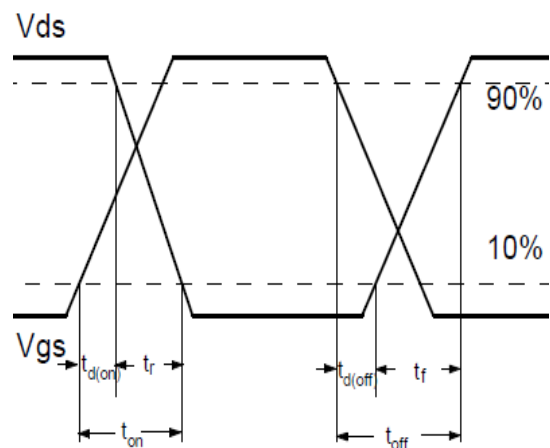


Fig.2-1 Gate charge test circuit

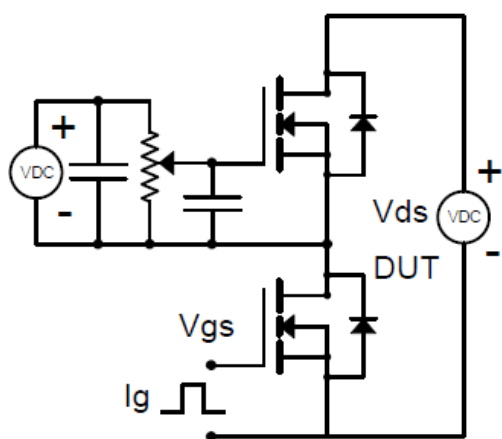


Fig.2-2 Gate charge waveform

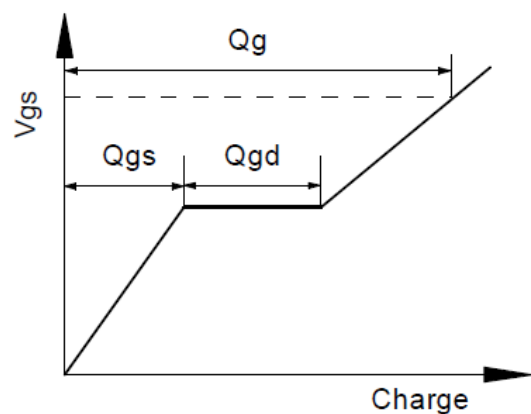


Fig.3-1 Avalanche test circuit

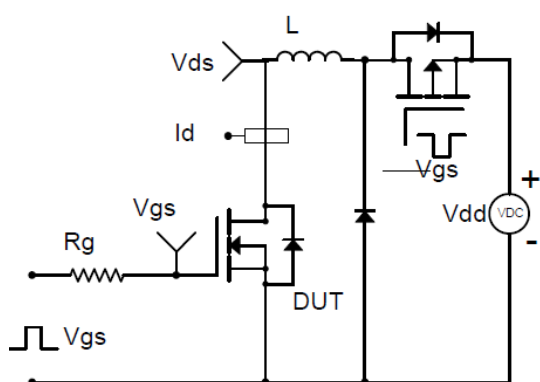
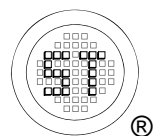
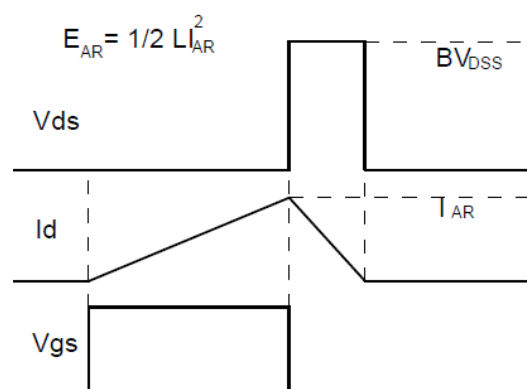


Fig.3-2 Avalanche waveform



Test Circuits(Q2)

Fig.1-1 Switching times test circuit

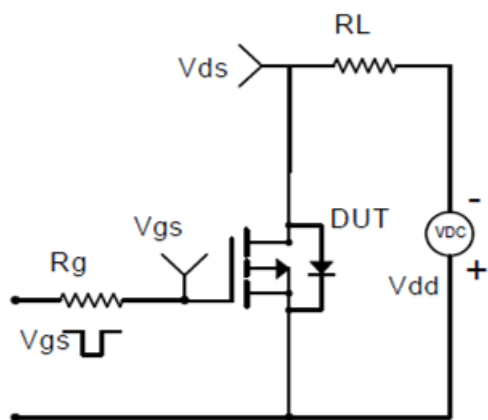


Fig.1-2 Switching Waveform

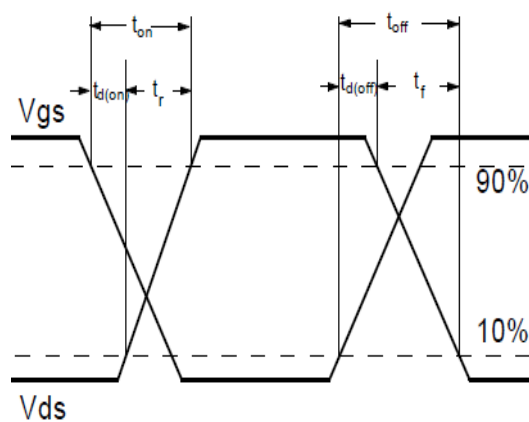


Fig.2-1 Gate charge test circuit

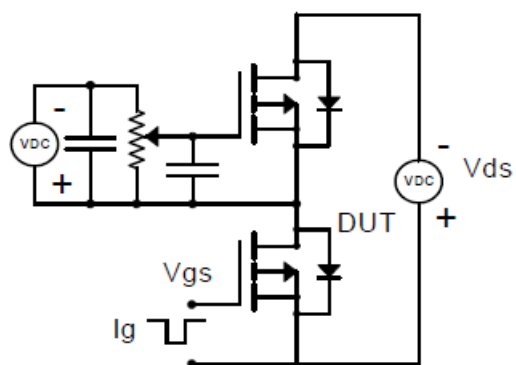


Fig.2-2 Gate charge waveform

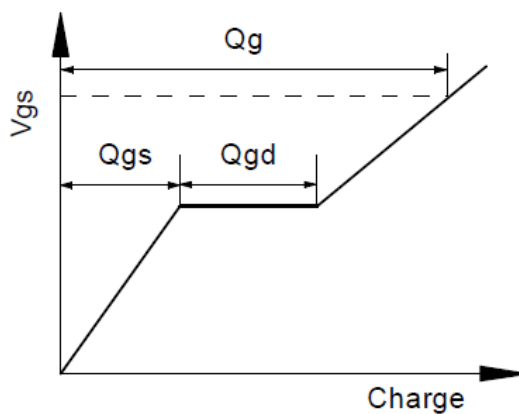


Fig.3-1 Avalanche test circuit

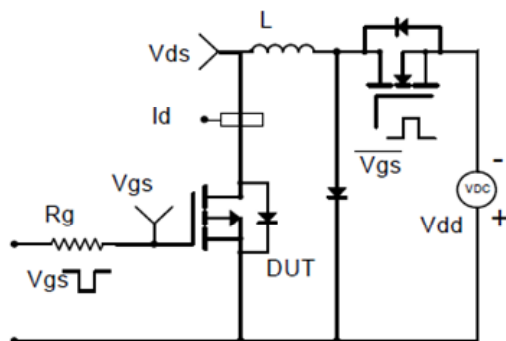
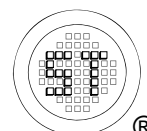
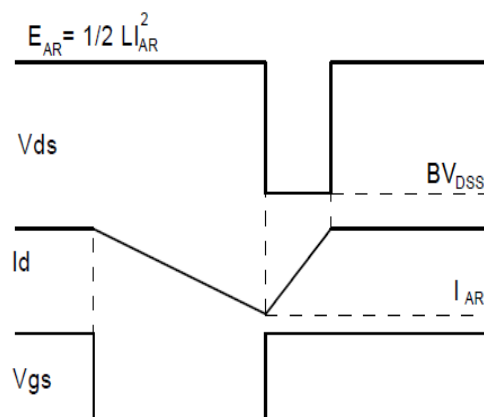


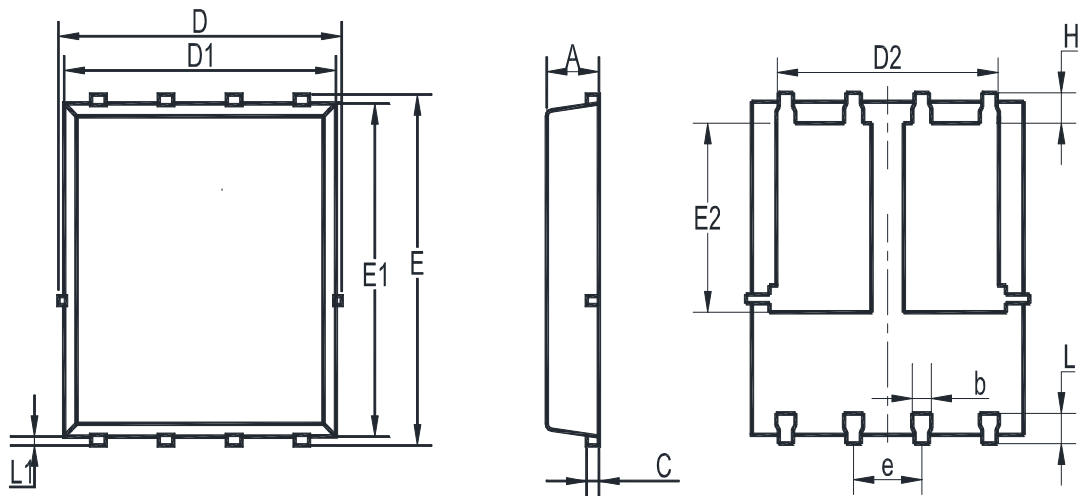
Fig.3-2 Avalanche waveform



WTM604C250L-AH

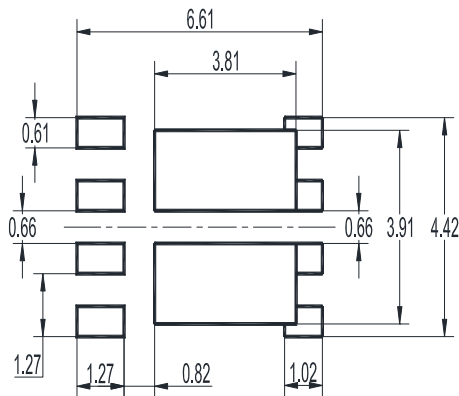
Package Outline Dimensions (Units: mm)

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

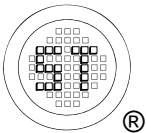
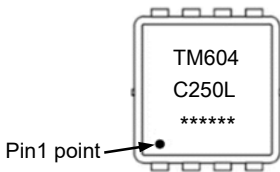


Packing information

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	3,000

Marking information

" TM604C250L " = Part No.
" ***** " = Date Code Marking
Font type: Arial



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