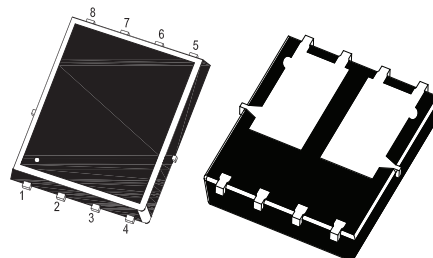
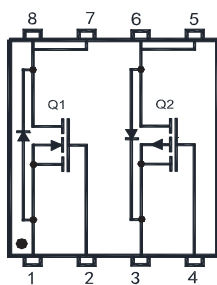


Complementary N/P-Channel Enhancement Mode MOSFET

Features

- AEC-Q101 Qualified
- Surface-mounted package
- Low Gate-Source Threshold Voltage
- Halogen and Antimony Free(HAF), RoHS compliant



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}	40	V
$R_{DS(ON)} \text{ Max}$	20 @ $V_{GS} = 10 \text{ V}$	m Ω
	24 @ $V_{GS} = 4.5 \text{ V}$	
$V_{GS(th)} \text{ typ}$	1.7	V
$Q_g \text{ typ}$	22 @ $V_{GS} = 10 \text{ V}$	nC

Key Parameters(Q2)

Parameter	Value	Unit
$-BV_{DSS}$	40	V
$R_{DS(ON)} \text{ Max}$	44 @ $-V_{GS} = 10 \text{ V}$	m Ω
	59 @ $-V_{GS} = 4.5 \text{ V}$	
$-V_{GS(th)} \text{ typ}$	1.6	V
$Q_g \text{ typ}$	19 @ $-V_{GS} = 10 \text{ V}$	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	26	- 15	A
		16	- 9.4	
Peak Drain Current, Pulsed ¹⁾	I_{DM}	100	- 60	A
Avalanche Current	I_{AS}	9.8	-16.8	A
Single Pulse Avalanche Energy ²⁾	E_{AS}	24	14.1	mJ
Total Power Dissipation	P_{tot}	15.6		W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150		$^\circ\text{C}$

Thermal Characteristics(Q1\Q2)

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	8	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	67	$^\circ\text{C/W}$

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

²⁾ Q1: Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 0.5 \text{ mH}$, $R_g = 25 \Omega$, $I_{AS} = 9.8 \text{ A}$, $V_{GS} = 10 \text{ V}$.

Q2: Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 0.1 \text{ mH}$, $R_g = 25 \Omega$, $-I_{AS} = 16.8 \text{ A}$, $V_{GS} = 10 \text{ V}$.

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

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

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	BV_{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	-	2.5	V
Drain-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 10\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 5\ \text{A}$	$R_{DS(on)}$	- -	16 -	20 24	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 5\ \text{A}$	g_{fs}	-	11.3	-	S
Gate resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	1.2	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1038	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	83	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	52	-	pF
Gate charge total at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$ at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 4.5\ \text{V}$	Q_g	- -	22 10	- -	nC
Gate to Source Charge at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gs}	-	4	-	nC
Gate to Drain Charge at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gd}	-	4	-	nC
Turn-On Delay Time at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	10	-	ns
Turn-On Rise Time at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	t_r	-	21	-	ns
Turn-Off Delay Time at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	10	-	ns
Turn-Off Fall Time at $V_{DS} = 20\ \text{V}$, $I_D = 10\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	t_f	-	1.6	-	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	-	-	26	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	100	A
Body Diode Reverse Recovery Time at $I_S = 10\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$	t_{rr}	-	9	-	ns
Body Diode Reverse Recovery Charge at $I_S = 10\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$	Q_{rr}	-	4	-	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 $-I_D = 250\ \mu\text{A}$	$-BV_{DS}$	40	-	-	V
Drain-Source Leakage Current at $-V_{DS} = 40\ \text{V}$	$-I_{DSS}$	-	-	1	μA
Gate 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	-	2.5	V
Drain-Source On-State Resistance at $-V_{GS} = 10\ \text{V}$, $-I_D = 12\ \text{A}$ at $-V_{GS} = 4.5\ \text{V}$, $-I_D = 10\ \text{A}$	$R_{DS(on)}$	- -	38 -	44 59	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS} = 5\ \text{V}$, $-I_D = 10\ \text{A}$	g_{fs}	-	16	-	S
Gate Resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	6.1	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1083	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	79	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	40	-	pF
Total Gate Charge at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$ at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 4.5\ \text{V}$	Q_g	- -	19 8.8	- -	nC
Gate-Source Charge at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$	Q_{gs}	-	4.5	-	nC
Gate-Drain Charge at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$	Q_{gd}	-	3	-	nC
Turn-On Delay Time at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	8	-	ns
Turn-On Rise Time at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	t_r	-	29	-	ns
Turn-Off Delay Time at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	14	-	ns
Turn-Off Fall Time at $-V_{DS} = 20\ \text{V}$, $-I_D = 12\ \text{A}$, $-V_{GS} = 10\ \text{V}$, $R_g = 3.3\ \Omega$	t_f	-	3	-	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	$-I_S$	-	-	15	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	60	A
Body Diode Reverse Recovery Time at $-I_S = 12\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	10	-	ns
Body Diode Reverse Recovery Charge at $-I_S = 12\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	5	-	nC

Electrical Characteristics Curves(Q1)

Fig. 1 Typical Output Characteristics

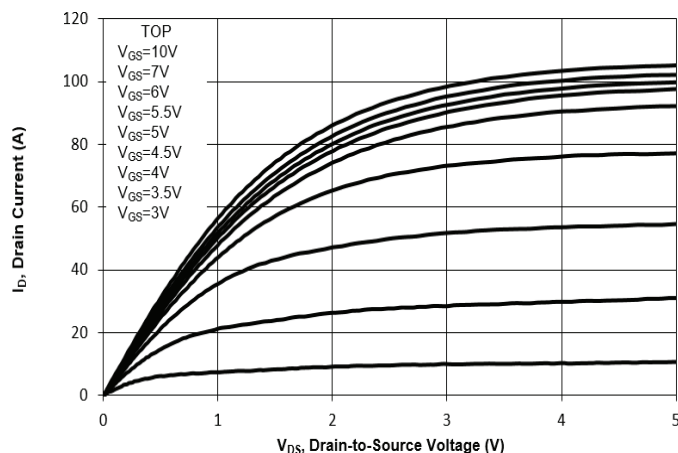


Fig. 2 Typical Transfer Characteristics

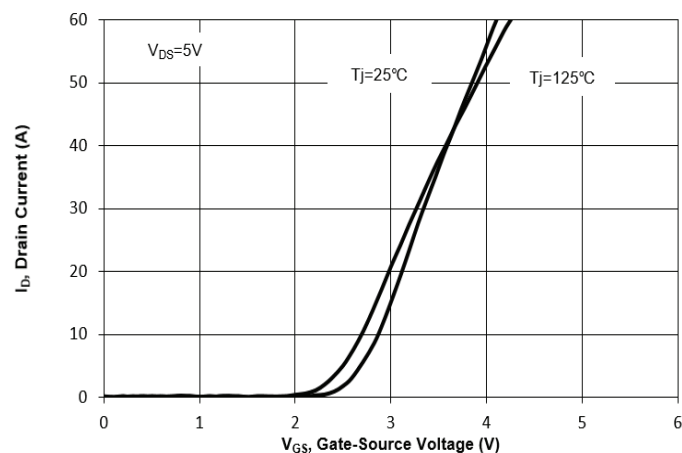


Fig. 3 on-Resistance vs. Drain Current

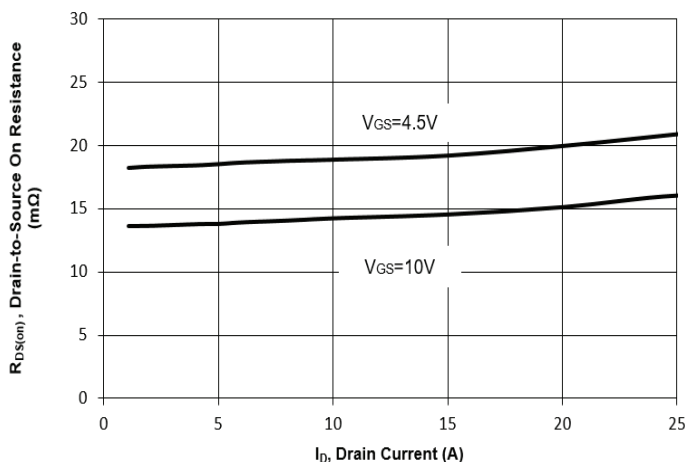


Fig. 4 on-Resistance vs. Gate to Source Voltage

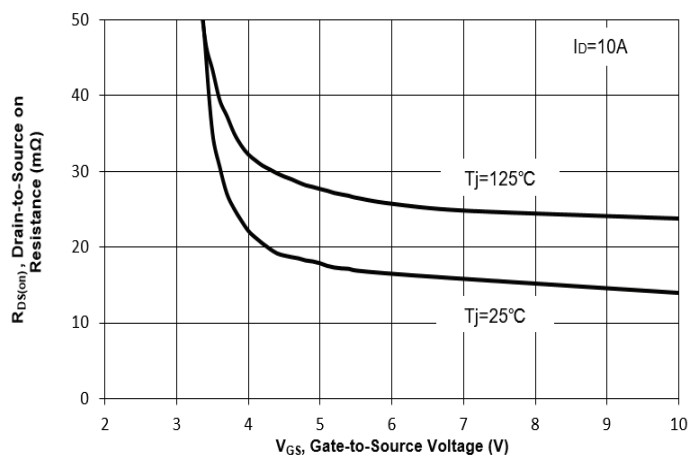


Fig. 5 on-Resistance vs. T_J

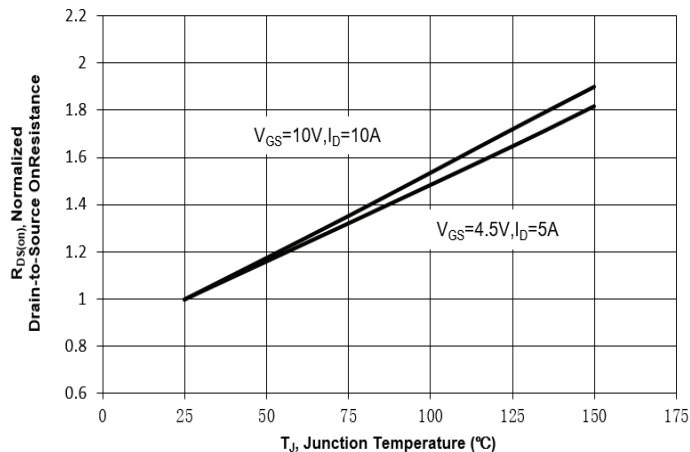
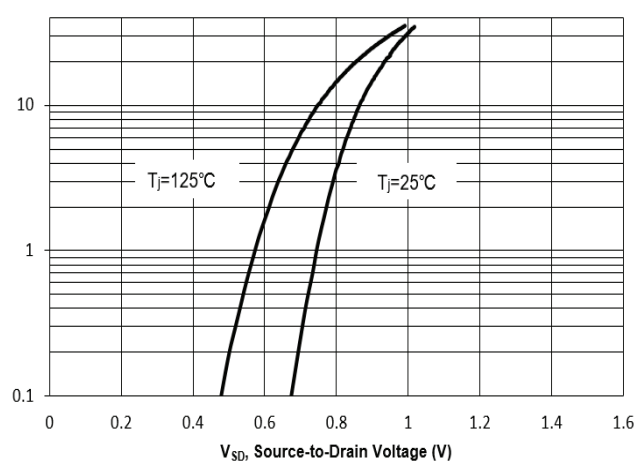


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves(Q1)

Fig. 7 Typical Junction Capacitance

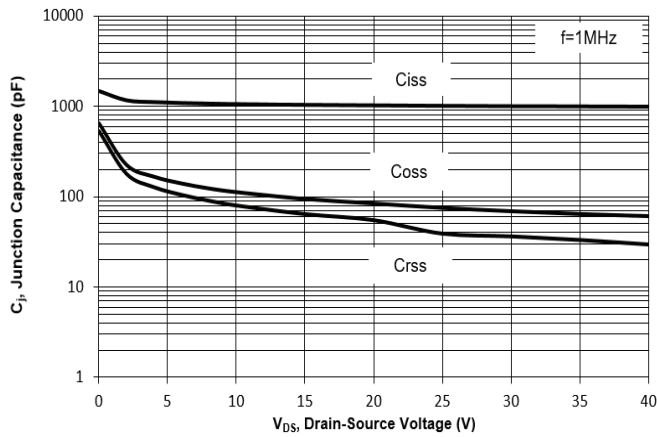


Fig. 8 Drain-Source Leakage Current vs. T_j

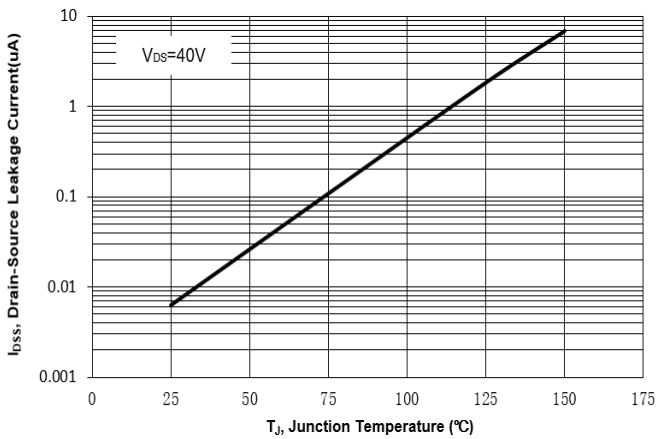


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

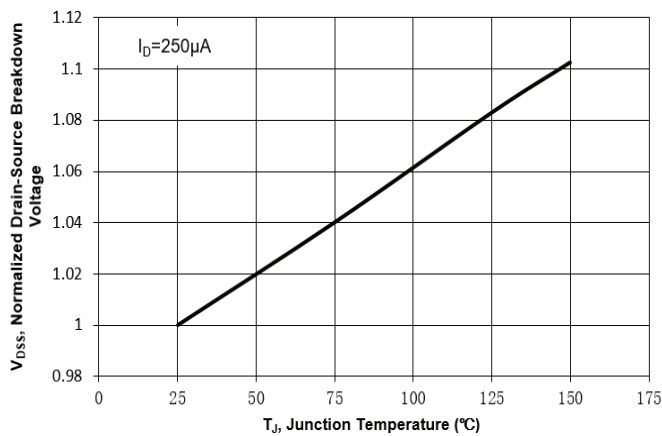


Fig. 10 Gate Threshold Variation vs. T_j

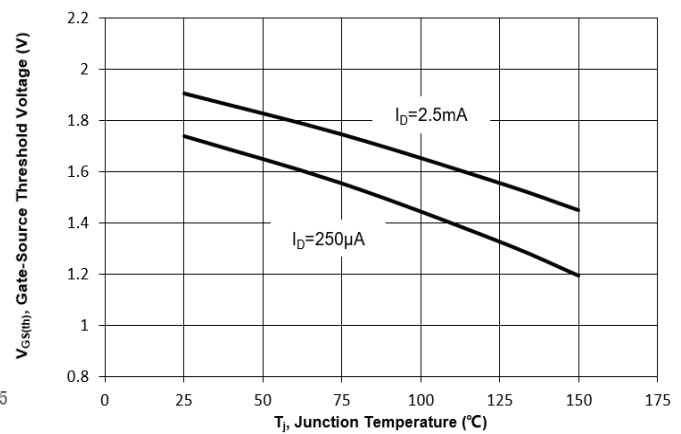


Fig. 11 Gate Charge

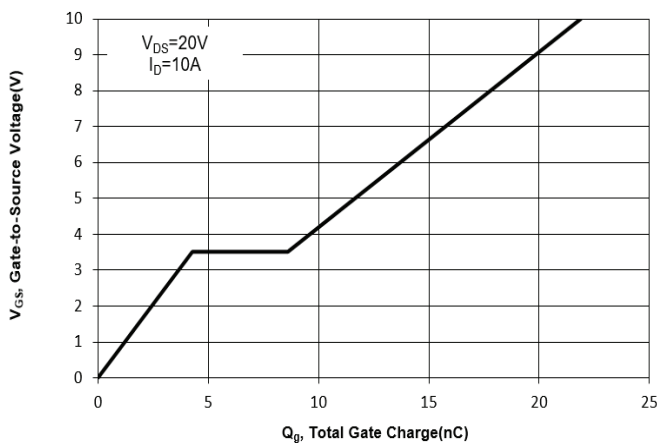
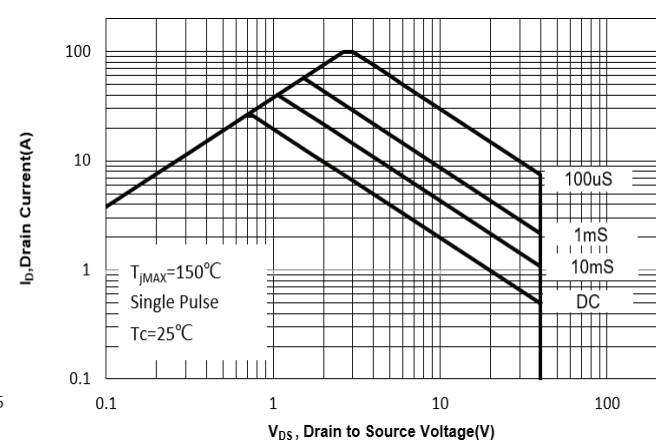


Fig. 12 Safe Operation Area



Electrical Characteristics Curves(Q1)

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

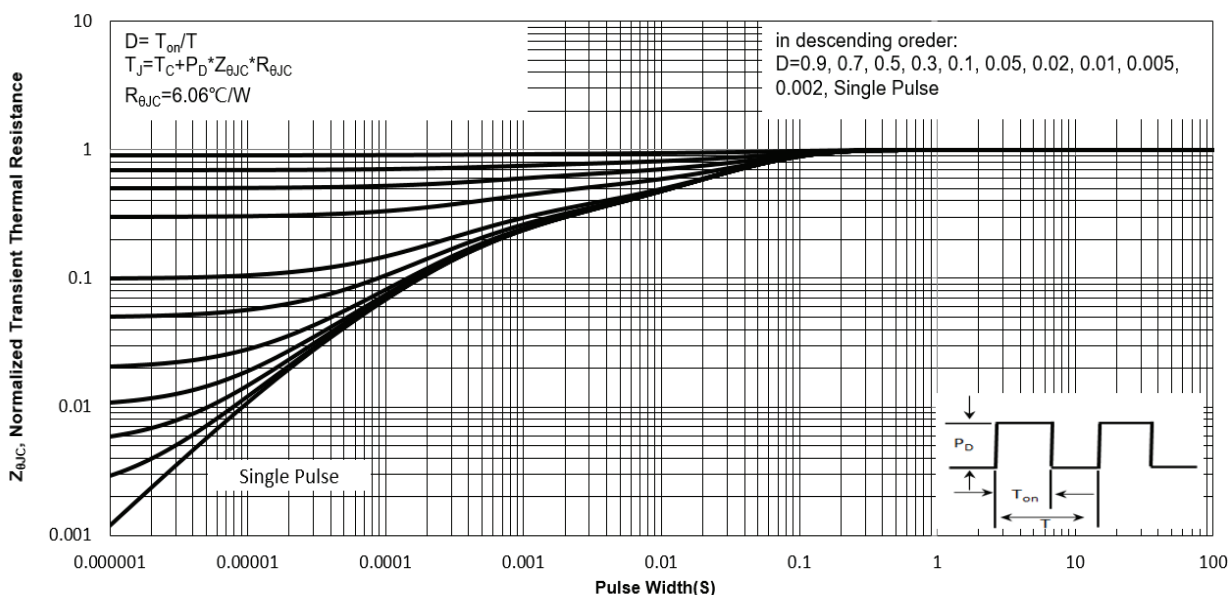
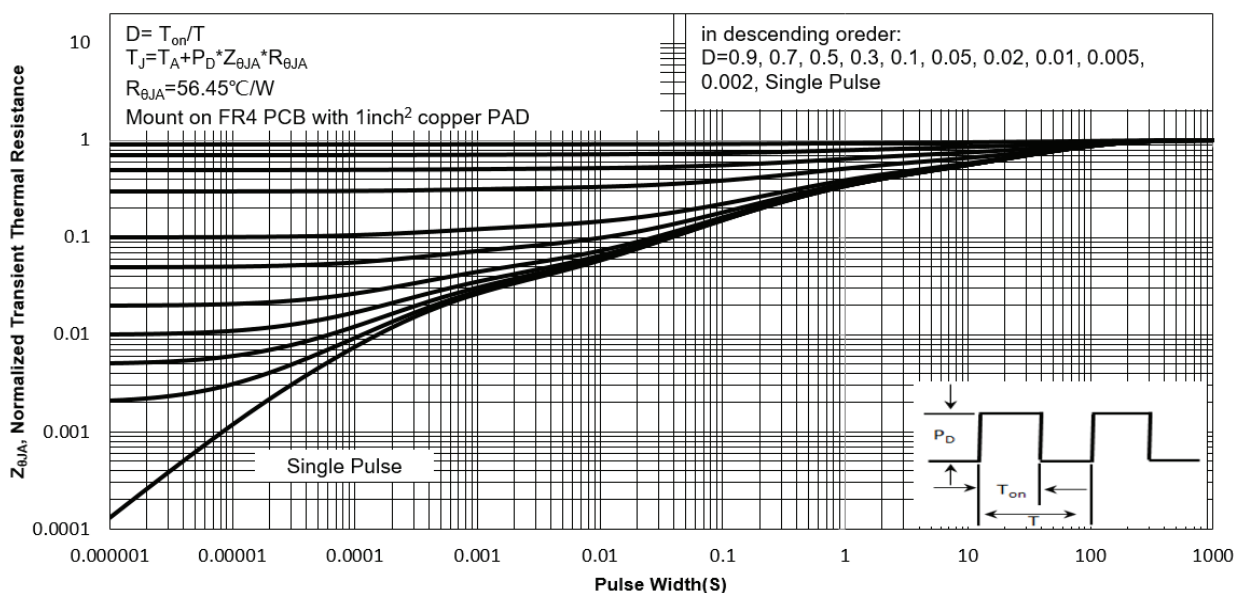


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Electrical Characteristics Curves(Q2)

Fig. 1 Typical Output Characteristics

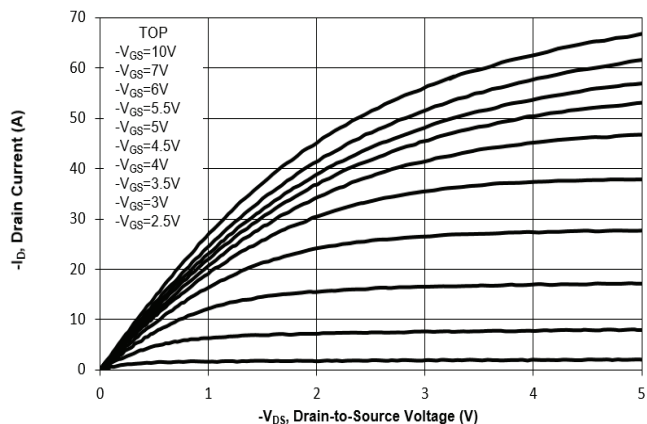


Fig. 2 Typical Transfer Characteristics

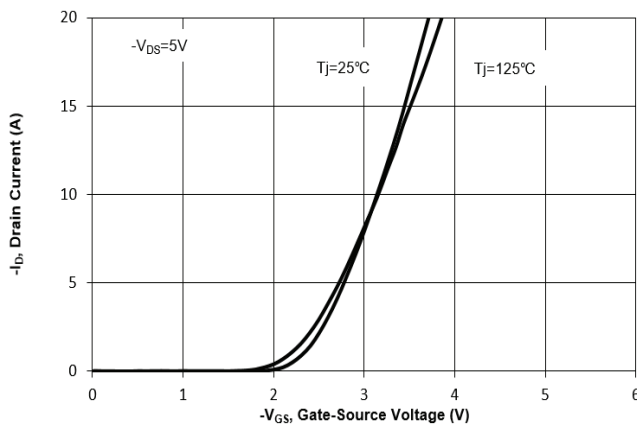


Fig. 3 on-Resistance vs. Drain Current

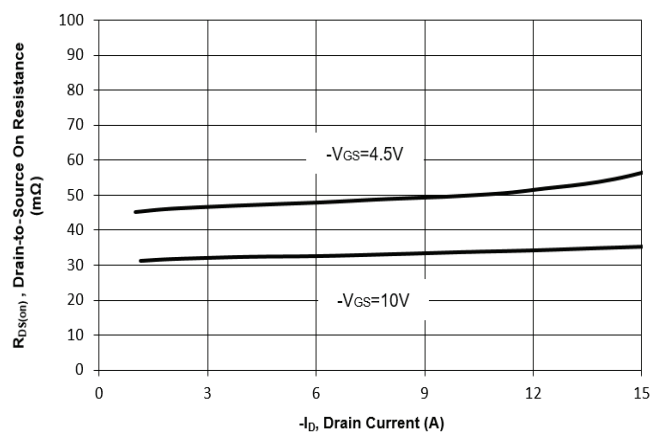


Fig. 4 on-Resistance vs. Gate to Source Voltage

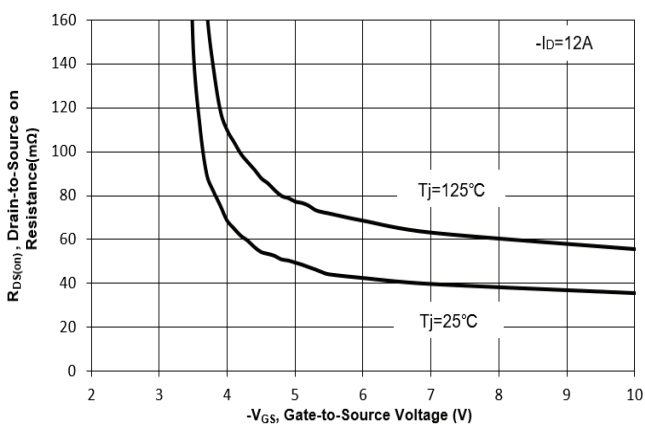


Fig. 5 on-Resistance vs. TJ

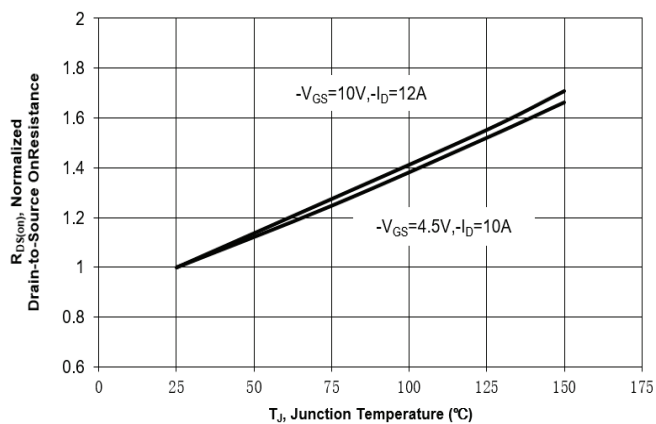


Fig. 6 Typical Body-Diode Forward Characteristics

