



ON Semiconductor®

FDD3510H

Dual N & P-Channel PowerTrench® MOSFET

N-Channel: 80V, 13.9A, 80mΩ P-Channel: -80V, -9.4A, 190mΩ

Features

Q1: N-Channel

■ Max $r_{DS(on)}$ = 80mΩ at V_{GS} = 10V, I_D = 4.3A

■ Max $r_{DS(on)}$ = 88mΩ at V_{GS} = 6V, I_D = 4.1A

Q2: P-Channel

■ Max $r_{DS(on)}$ = 190mΩ at V_{GS} = -10V, I_D = -2.8A

■ Max $r_{DS(on)}$ = 224mΩ at V_{GS} = -4.5V, I_D = -2.6A

■ 100% UIL Tested

■ RoHS Compliant



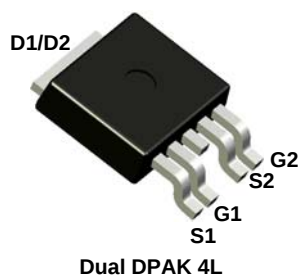
General Description

These dual N and P-Channel enhancement mode Power MOSFETs are produced using ON Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

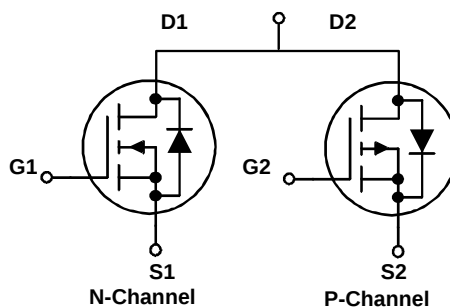
Applications

■ Inverter

■ H-Bridge



Dual DPAK 4L



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Q1	Q2	Units
V _{DS}	Drain to Source Voltage	80	-80	V
V _{GS}	Gate to Source Voltage	±20	±20	V
I _D	Drain Current - Continuous T _C = 25°C	13.9	-9.4	A
	- Continuous T _A = 25°C	4.3	-2.8	
	- Pulsed	20	-10	
P _D	Power Dissipation for Single Operation T _C = 25°C (Note 1)	35	32	W
	T _A = 25°C (Note 1a)	3.1		
	T _A = 25°C (Note 1b)	1.3		
E _{AS}	Single Pulse Avalanche Energy (Note 3)	37	54	mJ
T _J , T _{STG}	Operating and Storage Junction Temperature Range	-55 to +150		°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case, Single Operation for Q1 (Note 1)	3.5	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Single Operation for Q2 (Note 1)	3.9	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD3510H	FDD3510H	TO-252-4L	13"	16mm	2500 units

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$ $I_D = -250\mu\text{A}$, $V_{GS} = 0\text{V}$	Q1 Q2	80 -80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, referenced to 25°C $I_D = -250\mu\text{A}$, referenced to 25°C	Q1 Q2		84 -67	mV	$^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 64\text{V}$, $V_{GS} = 0\text{V}$ $V_{DS} = -64\text{V}$, $V_{GS} = 0\text{V}$	Q1 Q2			1 -1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$, $V_{DS} = 0\text{V}$	Q1 Q2			± 100 ± 100	nA nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu\text{A}$ $V_{GS} = V_{DS}$, $I_D = -250\mu\text{A}$	Q1 Q2	2.0 -1.0	2.6 -1.6	4.0 -3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, referenced to 25°C $I_D = -250\mu\text{A}$, referenced to 25°C	Q1 Q2		-6.7 4.6	mV	$^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}$, $I_D = 4.3\text{A}$ $V_{GS} = 6.0\text{V}$, $I_D = 4.1\text{A}$ $V_{GS} = 10\text{V}$, $I_D = 4.3\text{A}$, $T_J = 125^\circ\text{C}$	Q1		64 70 121	80 88 152	m Ω
		$V_{GS} = -10\text{V}$, $I_D = -2.8\text{A}$ $V_{GS} = -4.5\text{V}$, $I_D = -2.6\text{A}$ $V_{GS} = -10\text{V}$, $I_D = -2.8\text{A}$, $T_J = 125^\circ\text{C}$	Q2		153 184 259	190 224 322	
g_{FS}	Forward Transconductance	$V_{DD} = 10\text{V}$, $I_D = 4.3\text{A}$ $V_{DD} = -5\text{V}$, $I_D = -2.8\text{A}$	Q1 Q2		15 6.8		S

Dynamic Characteristics

C_{iss}	Input Capacitance	Q1 $V_{DS} = 40\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$	Q1 Q2		600 660	800 880	pF
C_{oss}	Output Capacitance	Q2	Q1 Q2		56 50	75 70	pF
C_{rss}	Reverse Transfer Capacitance	$V_{DS} = -40\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$	Q1 Q2		27 25	41 40	pF
R_g	Gate Resistance	$f = 1\text{MHz}$	Q1 Q2		1.7 7.2		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 40\text{V}$, $I_D = 4.3\text{A}$, $V_{GS} = 10\text{V}$, $R_{GEN} = 6\Omega$	Q1 Q2		7 6	13 11	ns
t_r	Rise Time		Q1 Q2		2 3	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2 $V_{DD} = -40\text{V}$, $I_D = -2.8\text{A}$, $V_{GS} = -10\text{V}$, $R_{GEN} = 6\Omega$	Q1 Q2		16 25	29 40	ns
t_f	Fall Time		Q1 Q2		2 5	10 10	ns
$Q_{g(TOT)}$	Total Gate Charge	Q1 $V_{GS} = 10\text{V}$, $V_{DD} = 40\text{V}$, $I_D = 4.3\text{A}$	Q1 Q2		13 14	18 20	nC
Q_{gs}	Gate to Source Charge	Q2	Q1 Q2		2.3 1.9		nC
Q_{gd}	Gate to Drain "Miller" Charge	$V_{GS} = -10\text{V}$, $V_{DD} = -40\text{V}$, $I_D = -2.8\text{A}$	Q1 Q2		3.2 2.9		nC

Electrical Characteristics $T_J = 25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
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Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 2.6\text{A}$ (Note 2)	Q1		0.8	1.2	V
		$V_{GS} = 0\text{V}$, $I_S = -2.6\text{A}$ (Note 2)	Q2		-0.8	-1.2	
t_{rr}	Reverse Recovery Time	Q1 $I_F = 4.3\text{A}$, $di/dt = 100\text{A/s}$	Q1		29	46	ns
			Q2		30	48	
Q_{rr}	Reverse Recovery Charge	Q2 $I_F = -2.8\text{A}$, $di/dt = 100\text{A/s}$	Q1		28	45	nC
			Q2		30	48	

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

Q1



a. 40°C/W when mounted on a 1 in² pad of 2 oz copper

Scale 1 : 1 on letter size paper



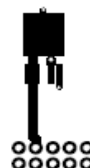
b. 96°C/W when mounted on a minimum pad of 2 oz copper

Q2



a. 40°C/W when mounted on a 1 in² pad of 2 oz copper

Scale 1 : 1 on letter size paper



b. 96°C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

3. Starting $T_J = 25^{\circ}\text{C}$, N-ch: $L = 3\text{mH}$, $I_{AS} = 5\text{A}$, $V_{DD} = 80\text{V}$, $V_{GS} = 10\text{V}$; P-ch: $L = 3\text{mH}$, $I_{AS} = -6\text{A}$, $V_{DD} = -80\text{V}$, $V_{GS} = -10\text{V}$.

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

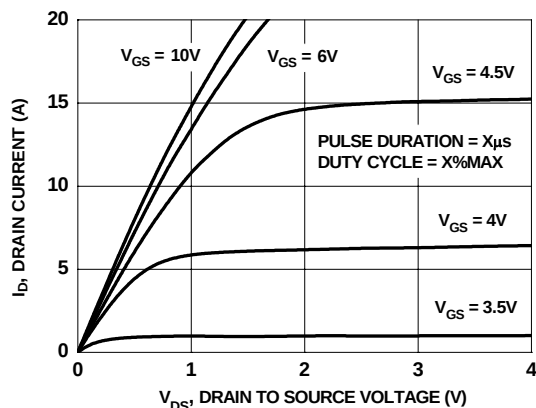


Figure 1. On Region Characteristics

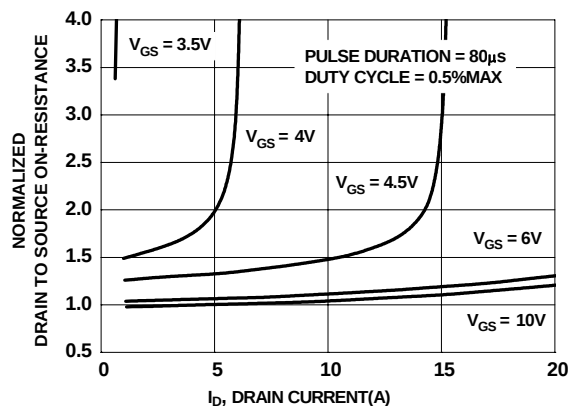


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

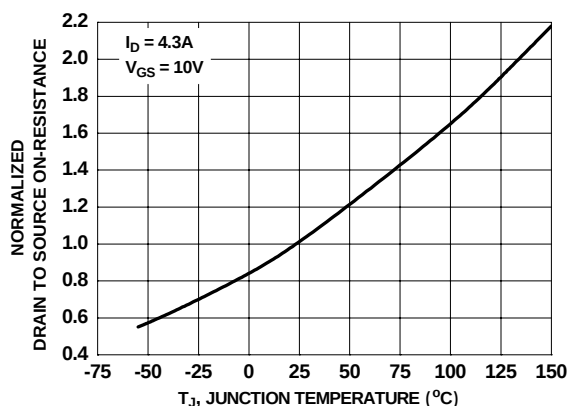


Figure 3. Normalized On Resistance vs Junction Temperature

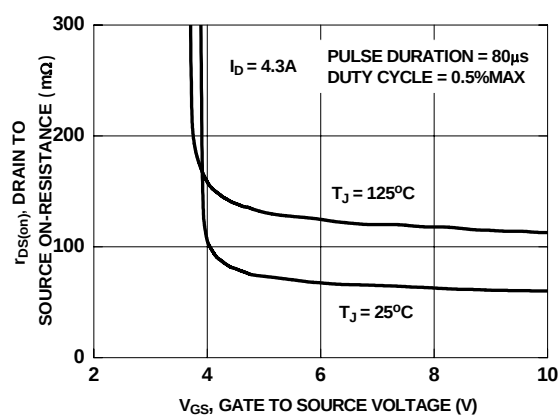


Figure 4. On-Resistance vs Gate to Source Voltage

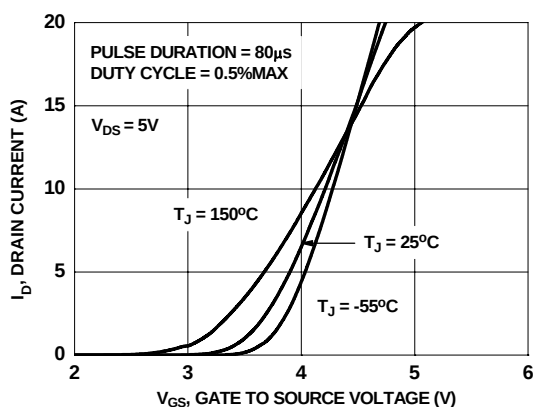


Figure 5. Transfer Characteristics

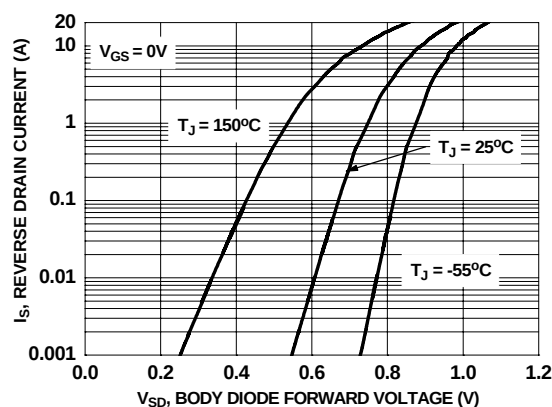


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

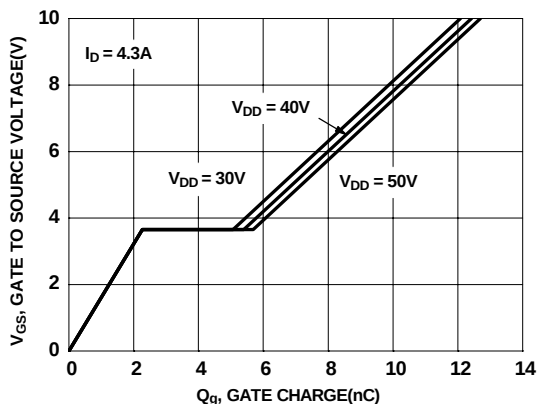


Figure 7. Gate Charge Characteristics

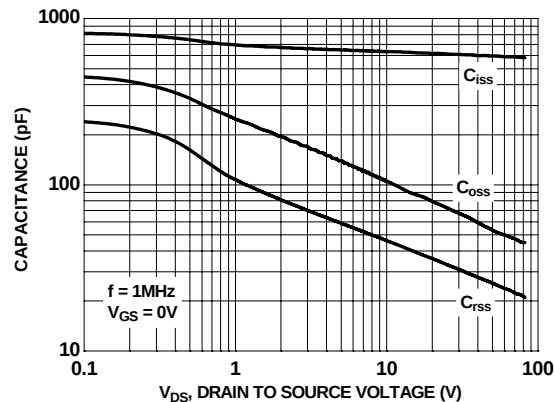


Figure 8. Capacitance vs Drain to Source Voltage

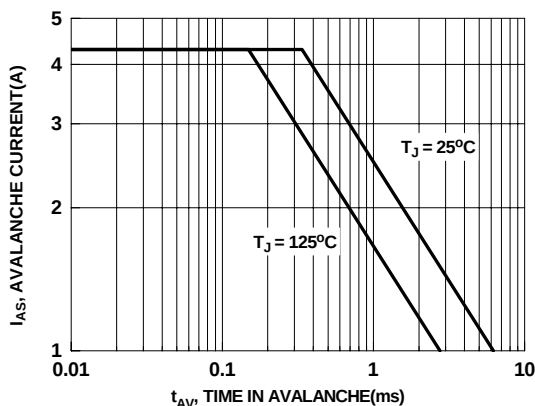


Figure 9. Unclamped Inductive Switching Capability

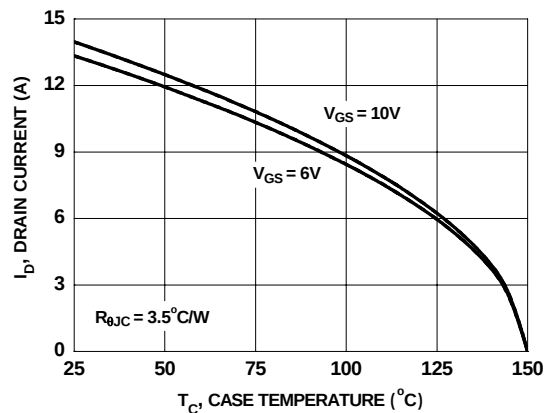


Figure 10. Maximum Continuous Drain Current vs Case Temperature

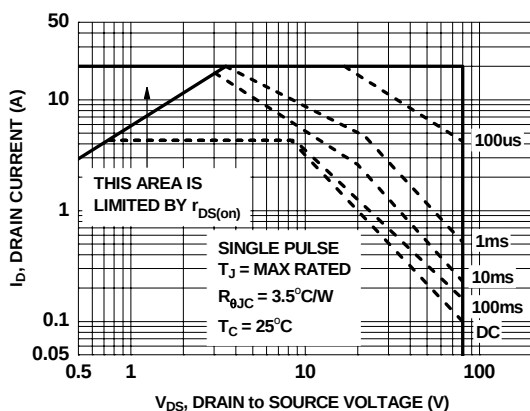


Figure 11. Forward Bias Safe Operating Area

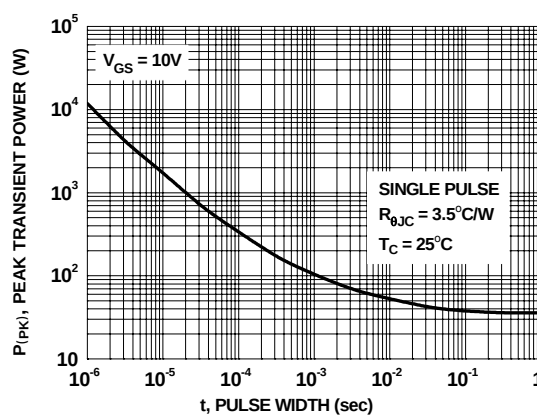


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q1 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

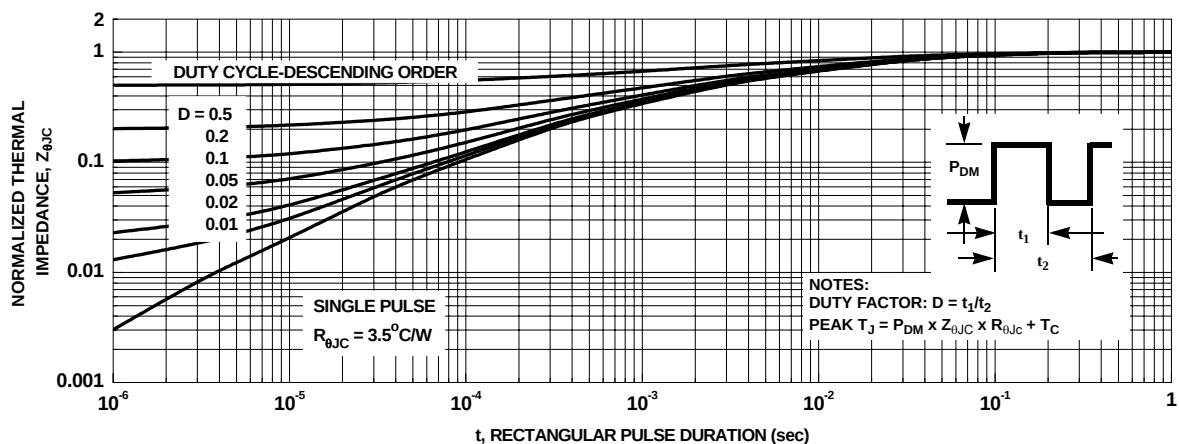


Figure 13. Transient Thermal Response Curve

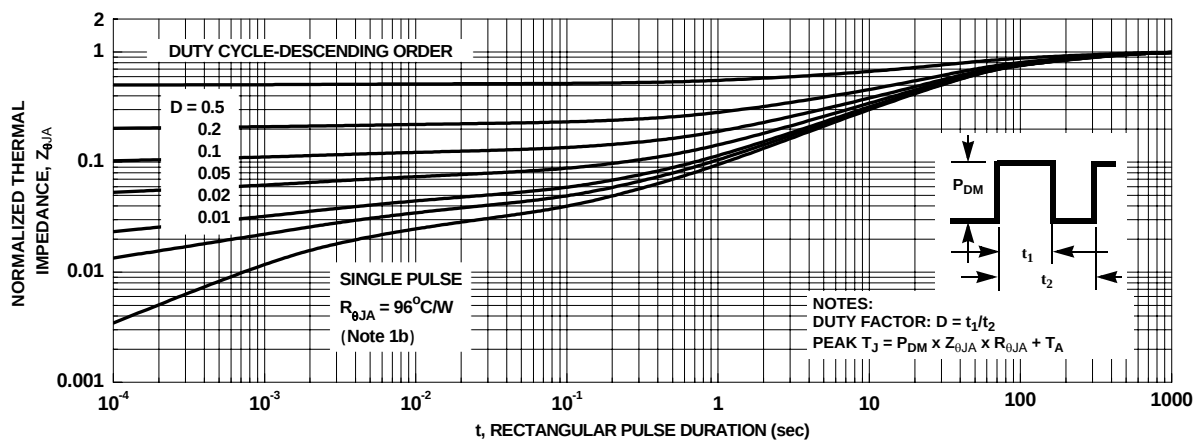


Figure 14. Transient Thermal Response Curve

Typical Characteristics (Q2 P-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

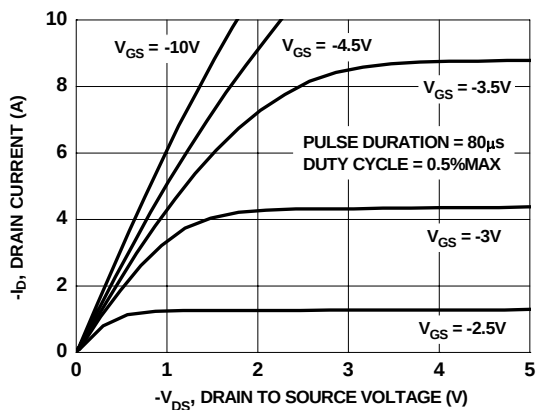


Figure 15. On-Region Characteristics

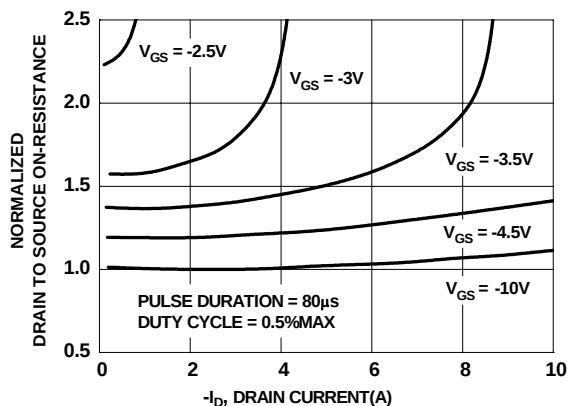


Figure 16. Normalized on-Resistance vs Drain Current and Gate Voltage

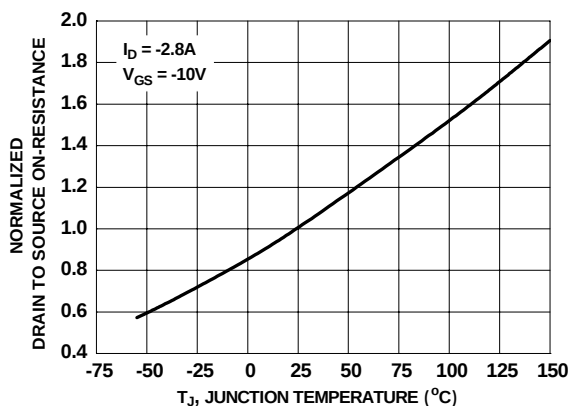


Figure 17. Normalized On-Resistance vs Junction Temperature

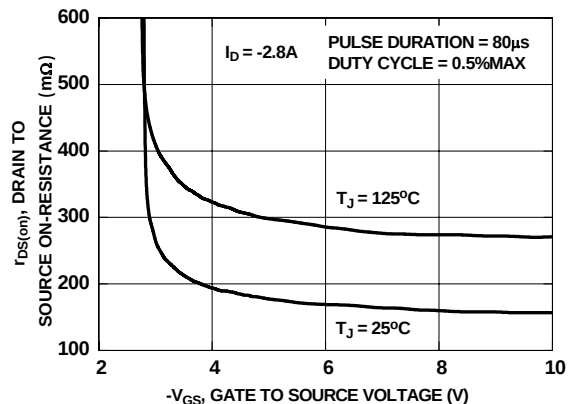


Figure 18. On-Resistance vs Gate to Source Voltage

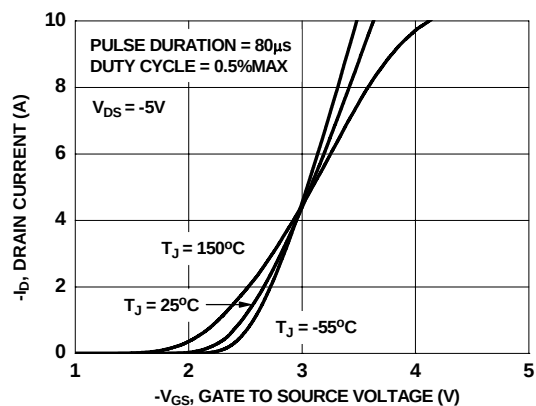


Figure 19. Transfer Characteristics

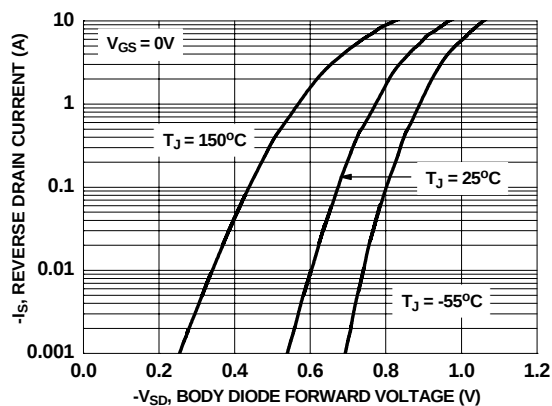


Figure 20. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics (Q2 P-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted

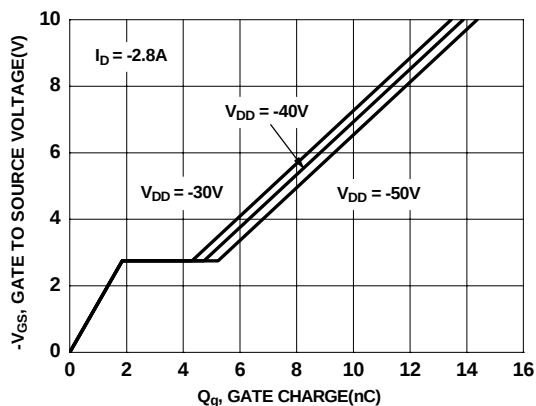


Figure 21. Gate Charge Characteristics

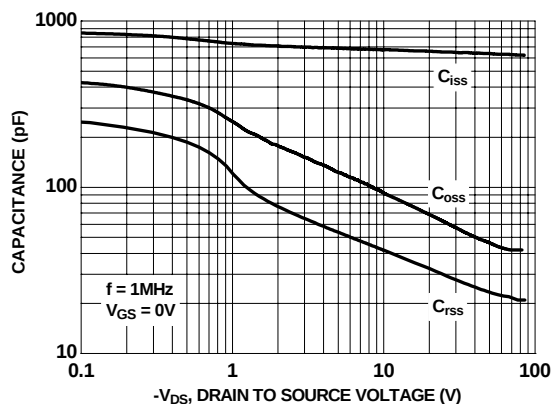


Figure 22. Capacitance vs Drain to Source Voltage

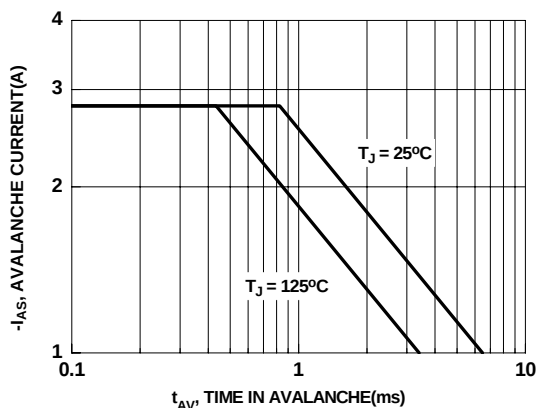


Figure 23. Unclamped Inductive Switching Capability

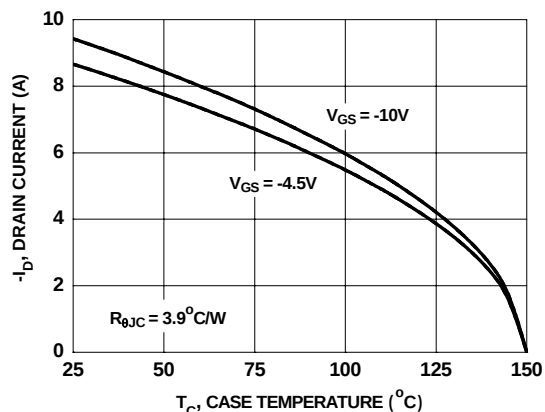


Figure 24. Maximum Continuous Drain Current vs Case Temperature

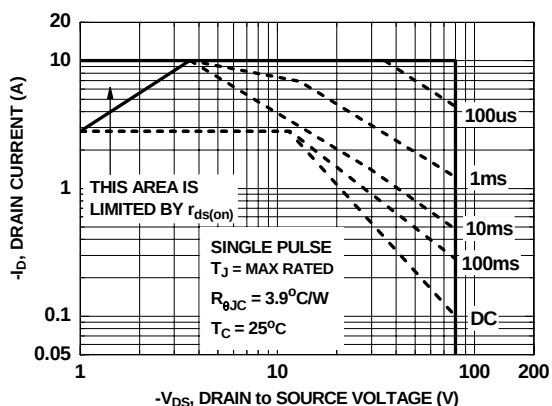


Figure 25. Forward Bias Safe Operating Area

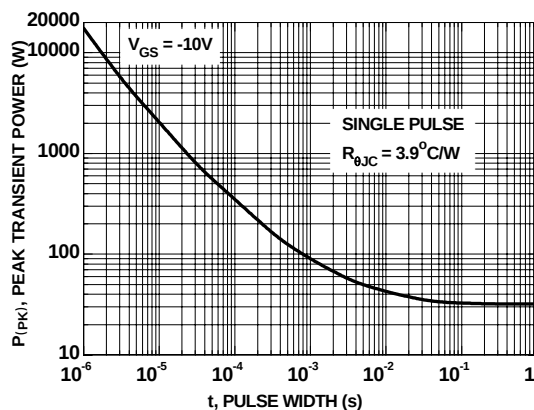
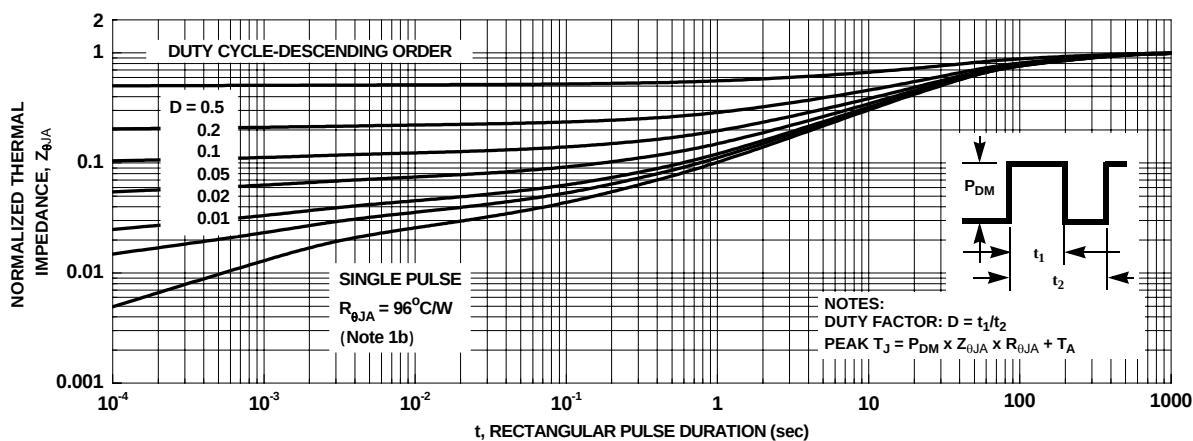
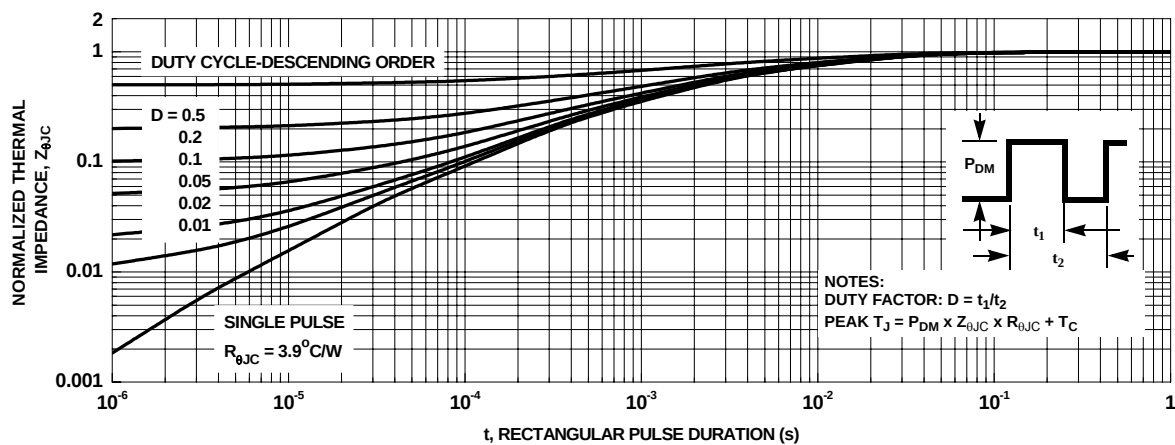


Figure 26. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q2 P-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted



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