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ON Semiconductor®

# FDS8858CZ

## Dual N & P-Channel PowerTrench® MOSFET

N-Channel: 30V, 8.6A, 17.0mΩ P-Channel: -30V, -7.3A, 20.5mΩ

### Features

Q1: N-Channel

- Max  $r_{DS(on)}$  = 17mΩ at  $V_{GS} = 10V$ ,  $I_D = 8.6A$
- Max  $r_{DS(on)}$  = 20mΩ at  $V_{GS} = 4.5V$ ,  $I_D = 7.3A$

Q2: P-Channel

- Max  $r_{DS(on)}$  = 20.5mΩ at  $V_{GS} = -10V$ ,  $I_D = -7.3A$
- Max  $r_{DS(on)}$  = 34.5mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -5.6A$
- High power and handling capability in a widely used surface mount package
- Fast switching speed



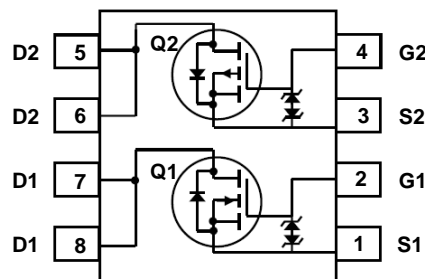
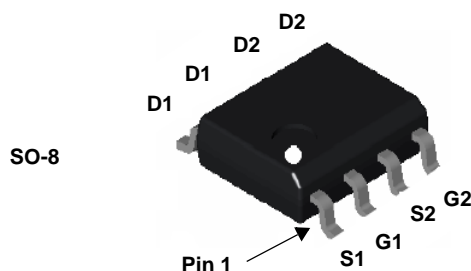
### General Description

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.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Applications

- Inverter
- Synchronous Buck



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

Symbol	Parameter	Q1	Q2	Units
$V_{DS}$	Drain to Source Voltage	30	-30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	$\pm 25$	V
$I_D$	Drain Current - Continuous	8.6	-7.3	A
	- Pulsed	20	-20	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	50	11	mJ
$P_D$	Power Dissipation for Dual Operation	2.0		W
	Power Dissipation for Single Operation	$T_A = 25^\circ\text{C}$ (Note 1a)	1.6	
		$T_A = 25^\circ\text{C}$ (Note 1c)	0.9	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Note 1)	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	78	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDS8858CZ	FDS8858CZ	SO-8	13"	12mm	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	30 -30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$ $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$	Q1 Q2		22 -22		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}$ $V_{DS} = -24\text{V}, V_{GS} = 0\text{V}$	Q1 Q2			1 -1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ $V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$	Q1 Q2			$\pm 10$ $\pm 10$	$\mu\text{A}$

### 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	1 -1	1.6 -2.1	3 -3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$ $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$	Q1 Q2		-5.4 6.0		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 8.6\text{A}$ $V_{GS} = 4.5\text{V}, I_D = 7.3\text{A}$ $V_{GS} = 10\text{V}, I_D = 8.6\text{A}, T_J = 125^\circ\text{C}$	Q1		12.4 15.2 17.7	17.0 20.0 24.3	m $\Omega$
		$V_{GS} = -10\text{V}, I_D = -7.3\text{A}$ $V_{GS} = -4.5\text{V}, I_D = -5.6\text{A}$ $V_{GS} = -10\text{V}, I_D = -7.3\text{A}, T_J = 125^\circ\text{C}$	Q2		17.1 26.5 24.0	20.5 34.5 28.8	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 8.6\text{A}$ $V_{DS} = -5\text{V}, I_D = -7.3\text{A}$	Q1 Q2		27 21		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	Q1 $V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	Q1		905	1205	pF
			Q2		1675	2230	
$C_{oss}$	Output Capacitance	Q2 $V_{DS} = -15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	Q1		180	240	pF
			Q2		290	390	
$C_{riss}$	Reverse Transfer Capacitance	Q1 $V_{DS} = -15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	Q1		110	165	pF
			Q2		260	390	
$R_g$	Gate Resistance	$f = 1\text{MHz}$	Q1		1.3		$\Omega$
			Q2		4.4		

### Switching Characteristics

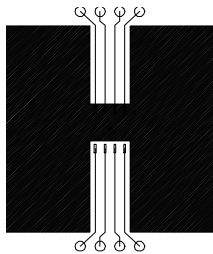
$t_{d(on)}$	Turn-On Delay Time	Q1 $V_{DD} = 15\text{V}, I_D = 8.6\text{A},$ $V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$	Q1		7	14	ns
			Q2		9	18	
$t_r$	Rise Time	Q2 $V_{DD} = -15\text{V}, I_D = -7.3\text{A},$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$	Q1		3	10	ns
			Q2		10	20	
$t_{d(off)}$	Turn-Off Delay Time	Q1 $V_{DD} = 15\text{V}, I_D = 8.6\text{A},$ $V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$	Q1		19	35	ns
			Q2		33	53	
$t_f$	Fall Time	Q2 $V_{DD} = -15\text{V}, I_D = -7.3\text{A},$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$	Q1		3	10	ns
			Q2		16	29	
$Q_{g(TOT)}$	Total Gate Charge	Q1 $V_{GS} = 10\text{V}, V_{DD} = 15\text{V}, I_D = 8.6\text{A}$	Q1		17	24	nC
			Q2		33	46	
$Q_{gs}$	Gate to Source Charge	Q2 $V_{GS} = -10\text{V}, V_{DD} = -15\text{V}, I_D = -7.3\text{A}$	Q1		2.7		nC
			Q2		6.1		
$Q_{gd}$	Gate to Drain "Miller" Charge	Q1 $V_{GS} = 10\text{V}, V_{DD} = 15\text{V}, I_D = 8.6\text{A}$	Q1		3.4		nC
			Q2		8.5		

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

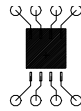
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics</b>							
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 8.6\text{A}$ (Note 2)	Q1		0.8	1.2	V
		$V_{GS} = 0\text{V}, I_S = -7.3\text{A}$ (Note 2)	Q2		0.9	-1.2	
$t_{rr}$	Reverse Recovery Time	Q1 $I_F = 8.6\text{A}, di/dt = 100\text{A/s}$	Q1		25	38	ns
			Q2		28	42	
$Q_{rr}$	Reverse Recovery Charge	Q2 $I_F = -7.3\text{A}, di/dt = 100\text{A/s}$	Q1		19	29	nC
			Q2		22	33	

Notes:

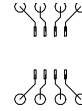
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $78^\circ\text{C/W}$  when mounted on a  $0.5\text{ in}^2$  pad of 2 oz copper



b)  $125^\circ\text{C/W}$  when mounted on a  $0.02\text{ in}^2$  pad of 2 oz copper



c)  $135^\circ\text{C/W}$  when mounted on a minimum pad

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty cycle  $< 2.0\%$ .
- Starting  $T_J = 25^\circ\text{C}$ , N-ch:  $L = 1\text{mH}, I_{AS} = 10\text{A}, V_{DD} = 27\text{V}, V_{GS} = 10\text{V}$ ; P-ch:  $L = 1\text{mH}, I_{AS} = -4.7\text{A}, V_{DD} = -27\text{V}, V_{GS} = -10\text{V}$ .

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

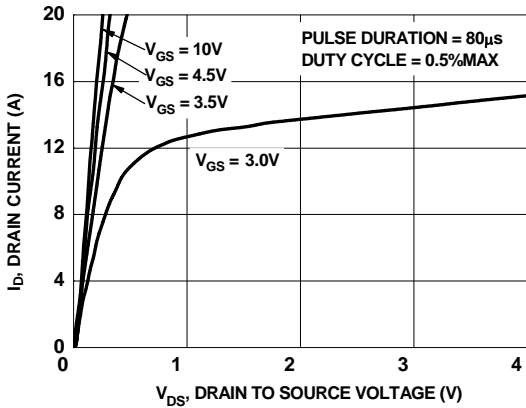


Figure 1. On-Region Characteristics

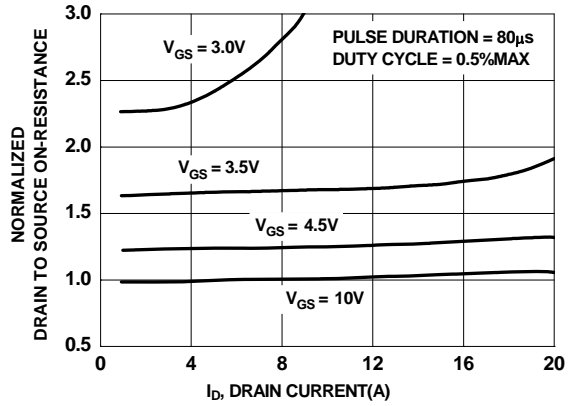


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

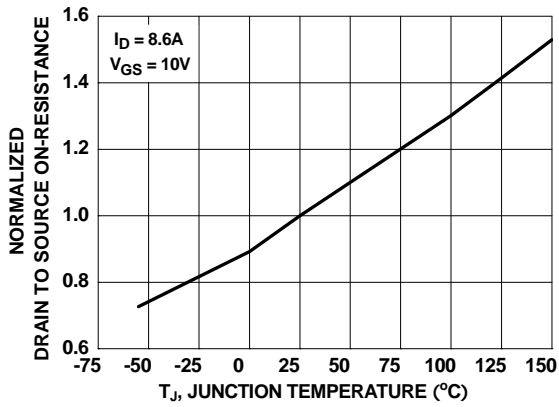


Figure 3. Normalized On-Resistance vs Junction Temperature

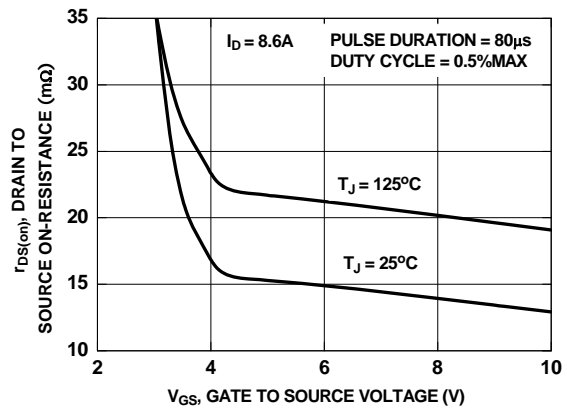


Figure 4. On-Resistance vs Gate to Source Voltage

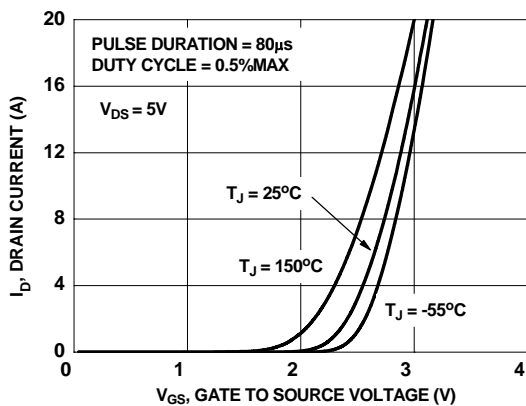


Figure 5. Transfer Characteristics

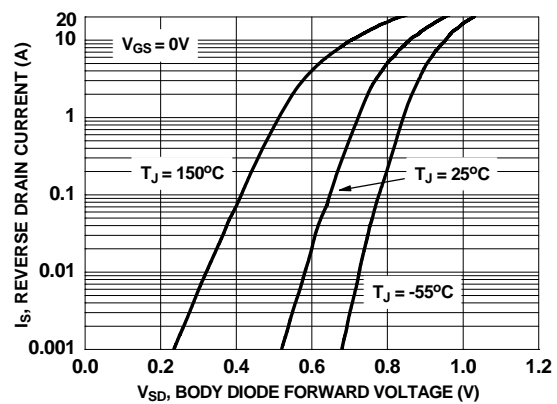
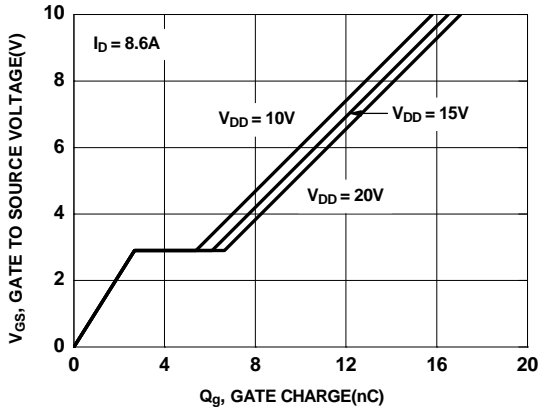
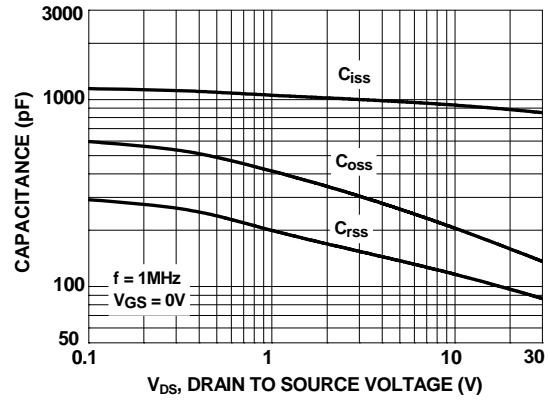


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

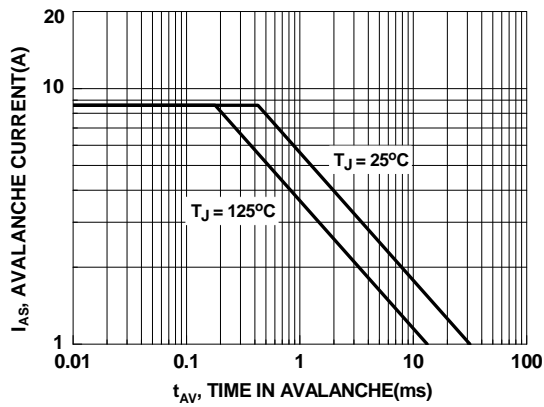
**Typical Characteristics (Q1 N-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



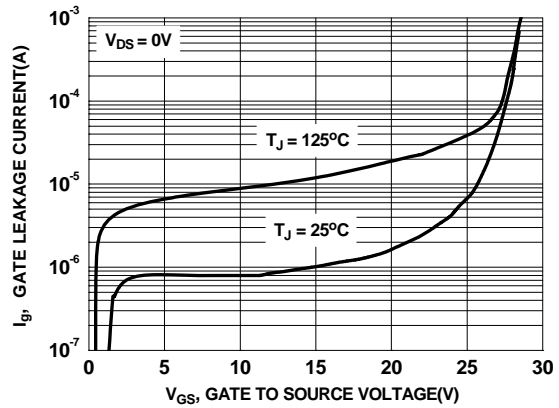
**Figure 7. Gate Charge Characteristics**



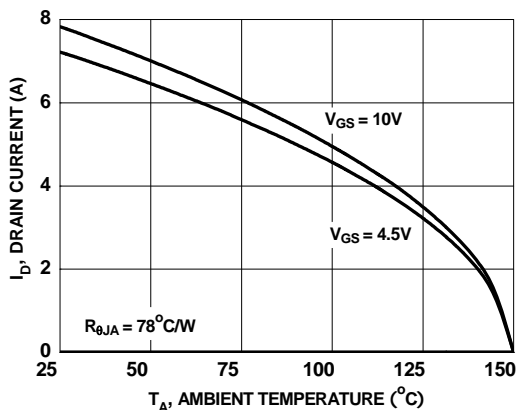
**Figure 8. Capacitance vs Drain to Source Voltage**



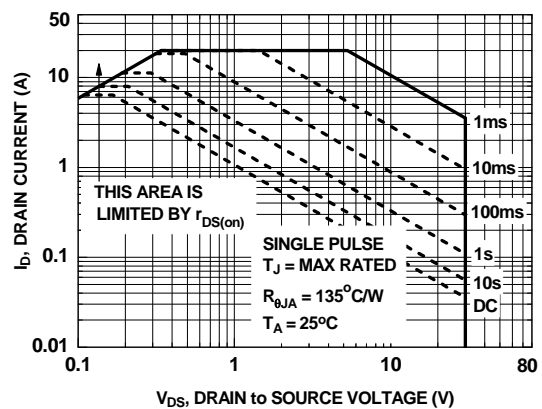
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Gate Leakage Current vs Gate to Source Voltage**



**Figure 11. Maximum Continuous Drain Current vs Ambient Temperature**



**Figure 12. Forward Bias Safe Operating Area**

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

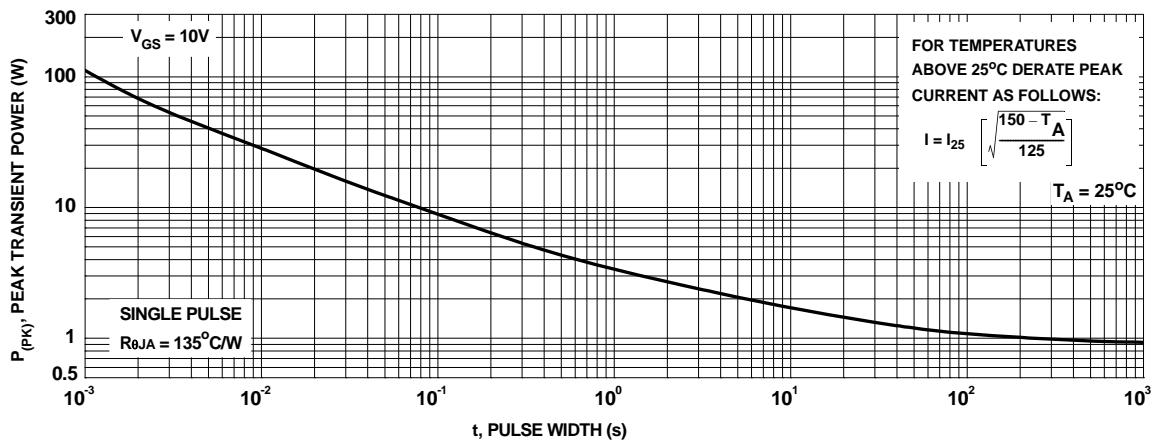


Figure 13. Single Pulse Maximum Power Dissipation

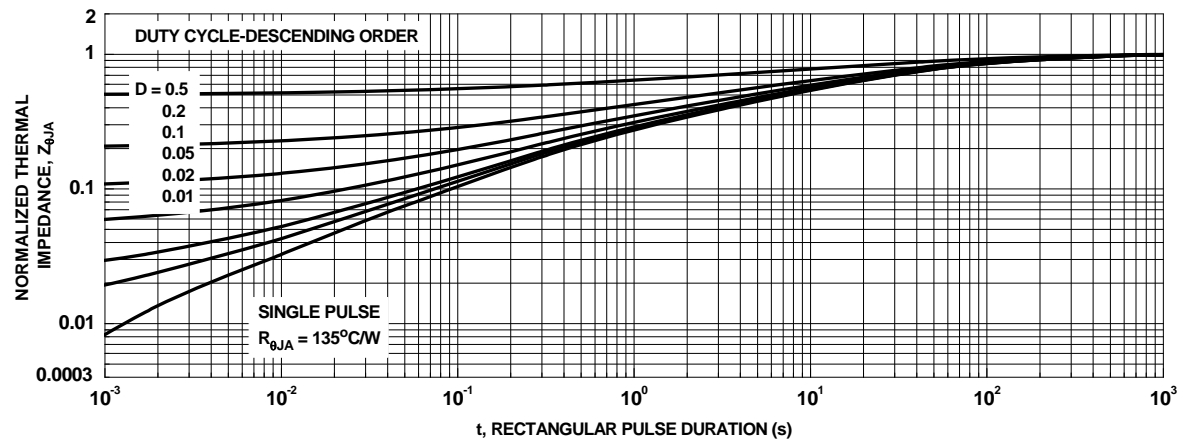


Figure 14. Transient Thermal Response Curve

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

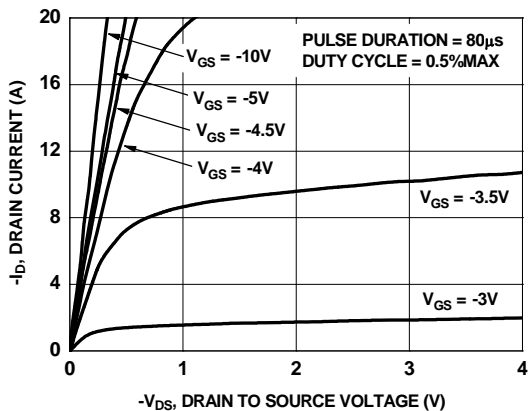


Figure 15. On-Region Characteristics

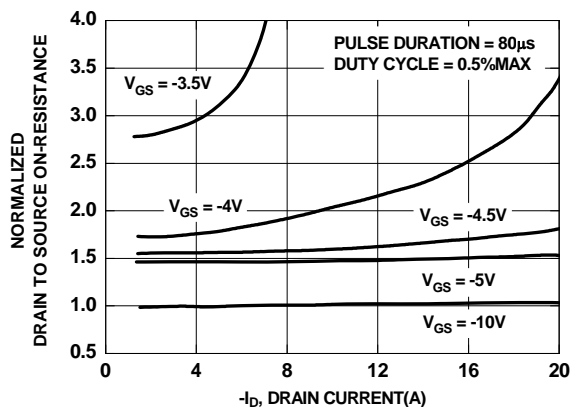


Figure 16. Normalized on-Resistance vs Drain Current and Gate Voltage

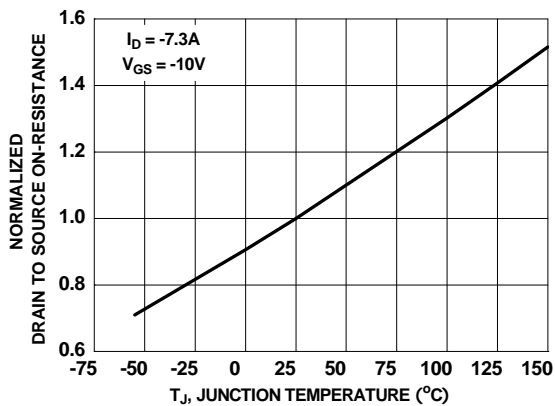


Figure 17. Normalized On-Resistance vs Junction Temperature

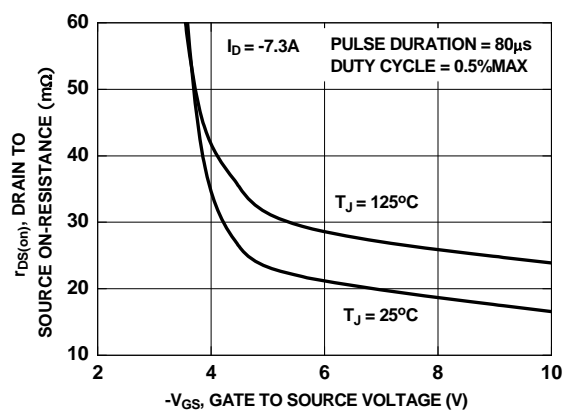


Figure 18. On-Resistance vs Gate to Source Voltage

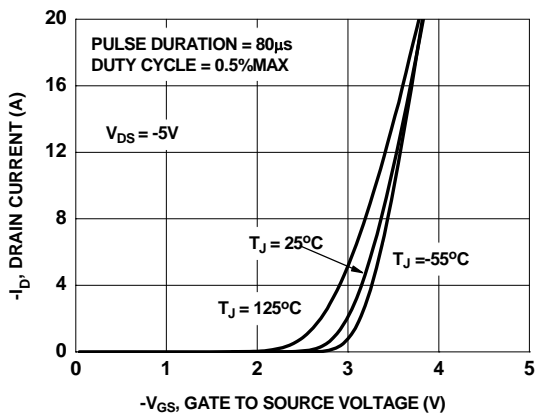


Figure 19. Transfer Characteristics

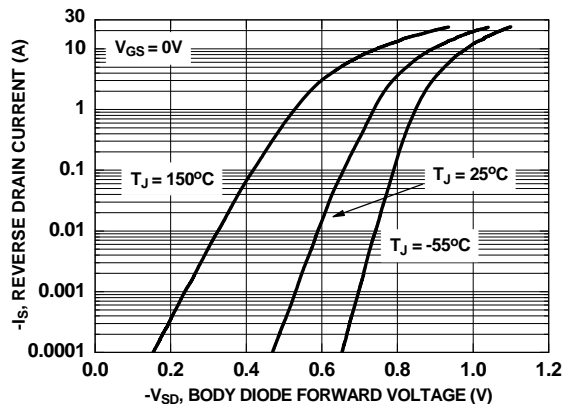
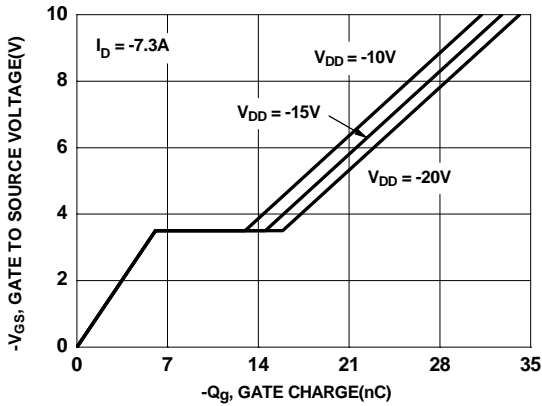


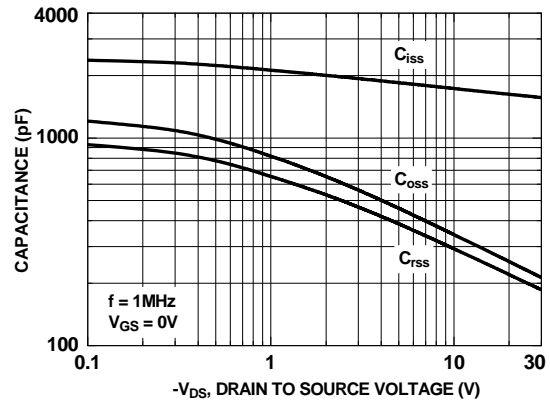
Figure 20. Source to Drain Diode Forward Voltage vs Source Current



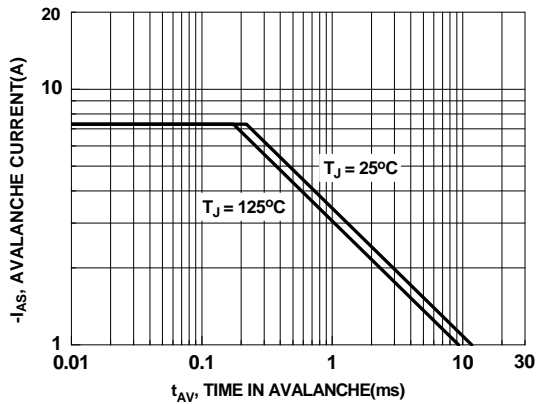
**Typical Characteristics(Q2 P-Channel)**  $T_J = 25^\circ\text{C}$  unless otherwise noted



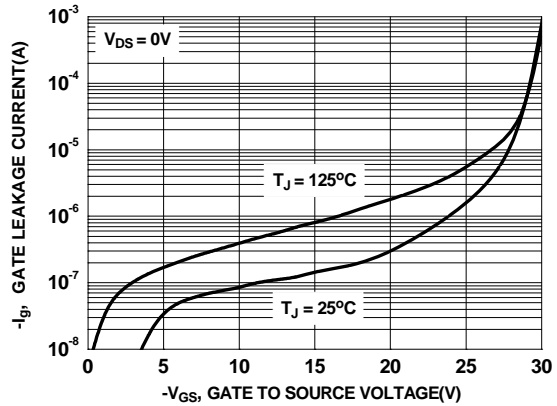
**Figure 21. Gate Charge Characteristics**



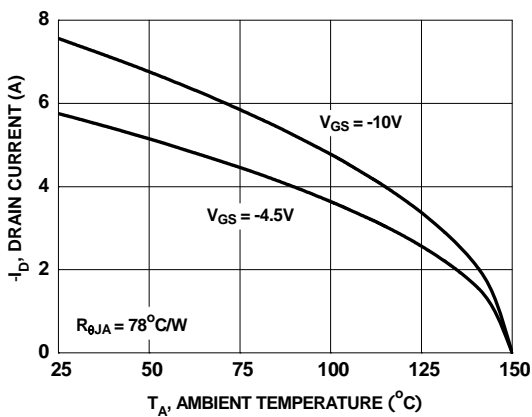
**Figure 22. Capacitance vs Drain to Source Voltage**



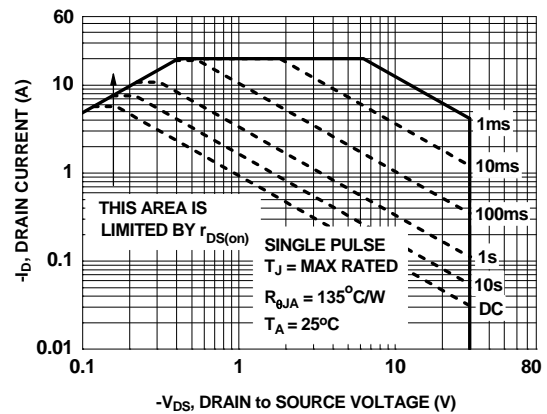
**Figure 23. Unclamped Inductive Switching Capability**



**Figure 24. Gate Leakage Current vs Gate to Source Voltage**

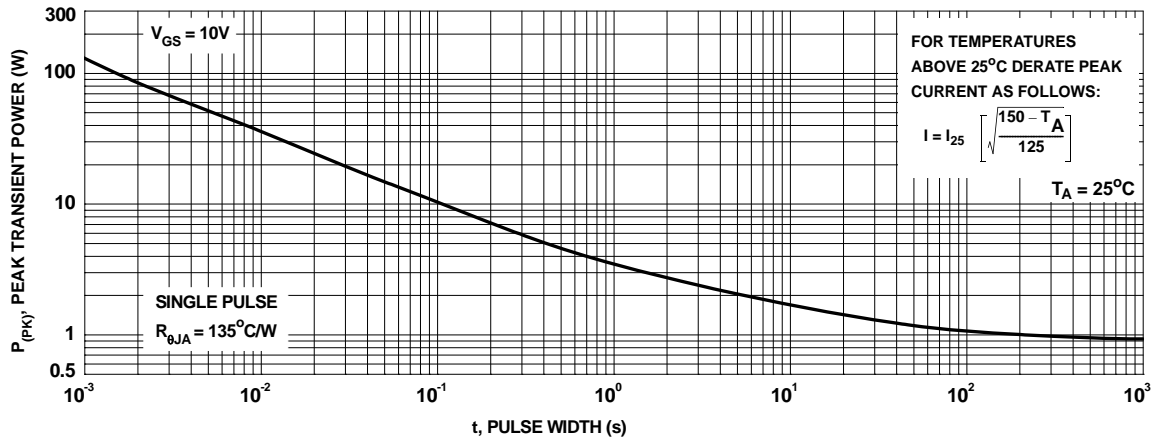


**Figure 25. Maximum Continuous Drain Current vs Ambient Temperature**

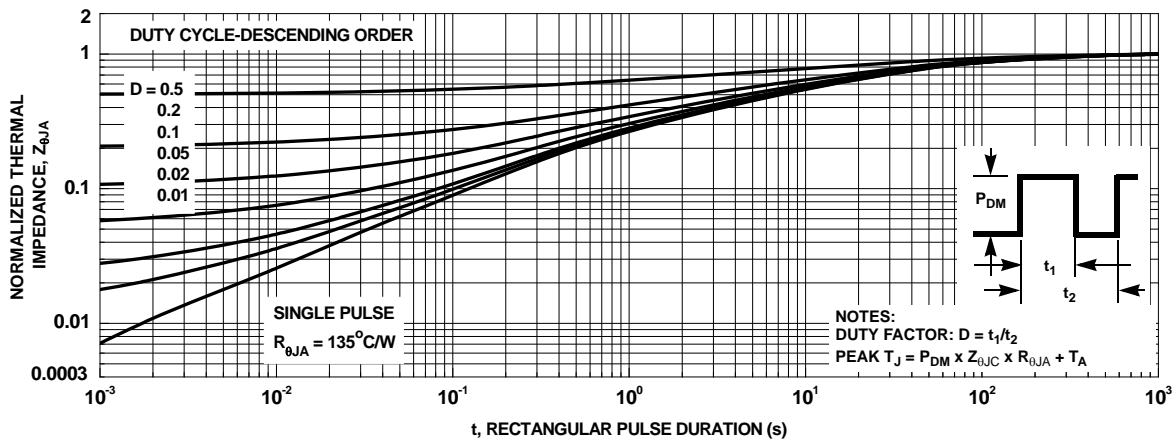


**Figure 26. Forward Bias Safe Operating Area**

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



**Figure 27. Single Pulse Maximum Power Dissipation**



**Figure 28. Transient Thermal Response Curve**

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