

# FDC6420C

## 20V N & P-Channel PowerTrench<sup>®</sup> MOSFETs

### General Description

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

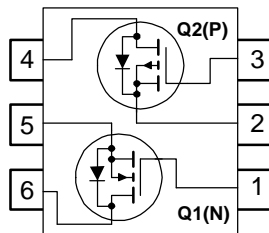
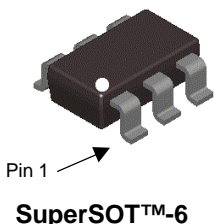
These devices have been designed to offer exceptional power dissipation in a very small footprint for applications where the bigger more expensive SO-8 and TSSOP-8 packages are impractical.

### Applications

- DC/DC converter
- Load switch
- LCD display inverter

### Features

- **Q1** 3.0 A, 20V.  $R_{DS(ON)} = 70\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$   
 $R_{DS(ON)} = 95\text{ m}\Omega @ V_{GS} = 2.5\text{ V}$
- **Q2** -2.2 A, 20V.  $R_{DS(ON)} = 125\text{ m}\Omega @ V_{GS} = -4.5\text{ V}$   
 $R_{DS(ON)} = 190\text{ m}\Omega @ V_{GS} = -2.5\text{ V}$
- Low gate charge
- High performance trench technology for extremely low  $R_{DS(ON)}$ .
- SuperSOT -6 package: small footprint (72% smaller than SO-8); low profile (1mm thick).



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Q1	Q2	Units
V <sub>DSS</sub>	Drain-Source Voltage	20	-20	V
V <sub>GSS</sub>	Gate-Source Voltage	±12	±12	V
I <sub>D</sub>	Drain Current – Continuous (Note 1a)	3.0	-2.2	A
	– Pulsed	12	-6	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	0.96		W
	(Note 1b)	0.9		
	(Note 1c)	0.7		
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150		°C

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	130	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	60	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.420	FDC6420C	7"	8mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units	
<b>Off Characteristics</b>							
$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	<b>Q1</b> 20 <b>Q2</b> –20			V	
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Ref. to $25^\circ\text{C}$ $I_D = -250\ \mu\text{A}$ , Ref. to $25^\circ\text{C}$	<b>Q1</b> <b>Q2</b>	13 –11		mV/ $^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$	<b>Q1</b> <b>Q2</b>		1 –1	$\mu\text{A}$	
$I_{GSSF}$	Gate–Body Leakage, Forward	$V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$ $V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$	<b>Q1</b> <b>Q2</b>		100 100	nA	
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$ $V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$	<b>Q1</b> <b>Q2</b>		–100 –100	nA	
<b>On Characteristics (Note 2)</b>							
$V_{GS(th)}$	Gate Threshold Voltage	<b>Q1</b> $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ <b>Q2</b> $V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$		0.5 –0.6	0.9 –1.0	1.5 –1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	<b>Q1</b> $I_D = 250\ \mu\text{A}$ , Ref. To $25^\circ\text{C}$ <b>Q2</b> $I_D = -250\ \mu\text{A}$ , Ref. to $25^\circ\text{C}$			–3 –3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	<b>Q1</b> $V_{GS} = 4.5\text{ V}, I_D = 3.0\text{ A}$ $V_{GS} = 2.5\text{ V}, I_D = 2.5\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 3.0\text{ A}, T_J = 125^\circ\text{C}$ <b>Q2</b> $V_{GS} = -4.5\text{ V}, I_D = -2.2\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -1.8\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.2\text{ A}, T_J = 125^\circ\text{C}$			50 66 71 100 145 137	70 95 106 125 190 184	m $\Omega$
$I_{D(on)}$	On–State Drain Current	<b>Q1</b> $V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$ <b>Q2</b> $V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$		12 –6			A
$g_{FS}$	Forward Transconductance	<b>Q1</b> $V_{DS} = 5\text{ V}, I_D = 2.5\text{ A}$ <b>Q2</b> $V_{DS} = -5\text{ V}, I_D = -2.0\text{ A}$			10 6		S
<b>Dynamic Characteristics</b>							
$C_{iss}$	Input Capacitance	<b>Q1</b> $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ <b>Q2</b> $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$			324 337		pF
$C_{oss}$	Output Capacitance	<b>Q1</b> $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ <b>Q2</b> $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$			82 88		pF
$C_{rss}$	Reverse Transfer Capacitance	<b>Q1</b> $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ <b>Q2</b> $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$			42 51		pF
<b>Switching Characteristics (Note 2)</b>							
$t_{d(on)}$	Turn–On Delay Time	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 1\text{ A}$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -1\text{ A}$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$			5 9	10 18	ns
$t_r$	Turn–On Rise Time	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 1\text{ A}$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -1\text{ A}$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$			7 12	14 22	ns
$t_{d(off)}$	Turn–Off Delay Time	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 1\text{ A}$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -1\text{ A}$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$			13 10	23 20	ns
$t_f$	Turn–Off Fall Time	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 1\text{ A}$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -1\text{ A}$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$			1.6 5	3 10	ns
$Q_g$	Total Gate Charge	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 3.0\text{ A}$ $V_{GS} = 4.5\text{ V}$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -2.2\text{ A}$ $V_{GS} = -4.5\text{ V}$			3.3 3.7	4.6	nC
$Q_{gs}$	Gate–Source Charge	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 3.0\text{ A}$ $V_{GS} = 4.5\text{ V}$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -2.2\text{ A}$ $V_{GS} = -4.5\text{ V}$			0.95 0.68		nC
$Q_{gd}$	Gate–Drain Charge	<b>Q1</b> For <b>Q1</b> : $V_{DS} = 10\text{ V}, I_{DS} = 3.0\text{ A}$ $V_{GS} = 4.5\text{ V}$ <b>Q2</b> For <b>Q2</b> : $V_{DS} = -10\text{ V}, I_{DS} = -2.2\text{ A}$ $V_{GS} = -4.5\text{ V}$			0.7 1.3		nC

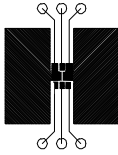
### Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise noted

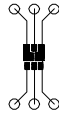
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units	
<b>Drain–Source Diode Characteristics and Maximum Ratings</b>							
$I_S$	Maximum Continuous Drain–Source Diode Forward Current	Q1			0.8	A	
		Q2			-0.8		
$V_{SD}$	Drain–Source Diode Forward Voltage	Q1	$V_{GS} = 0\text{ V}, I_S = 0.8\text{ A}$	(Note 2)	0.7	1.2	V
		Q2	$V_{GS} = 0\text{ V}, I_S = 0.8\text{ A}$	(Note 2)	-0.8	-1.2	

**Notes:**

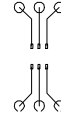
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 130 °C/W when mounted on a 0.125 in<sup>2</sup> pad of 2 oz. copper.



b) 140 °C/W when mounted on a .004 in<sup>2</sup> pad of 2 oz copper



c) 180 C°/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

### Typical Characteristics: N-Channel

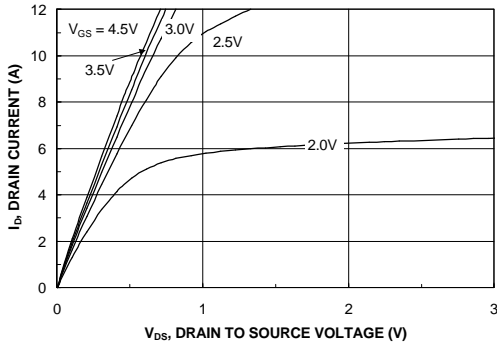


Figure 1. On-Region Characteristics.

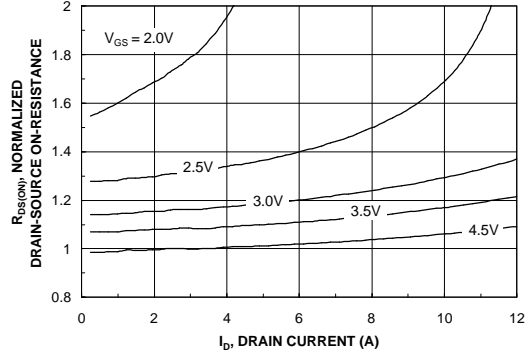


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

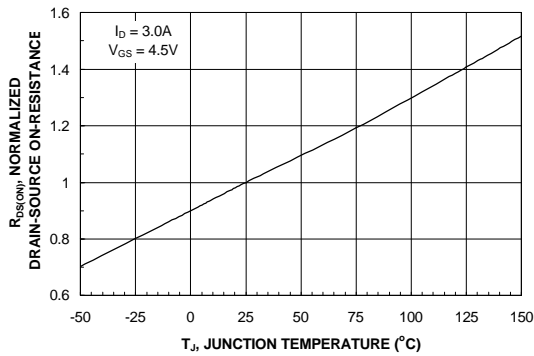


Figure 3. On-Resistance Variation with Temperature.

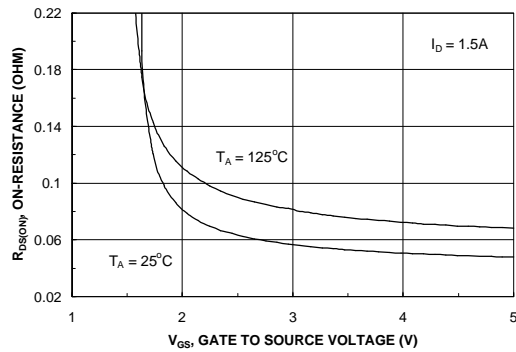


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

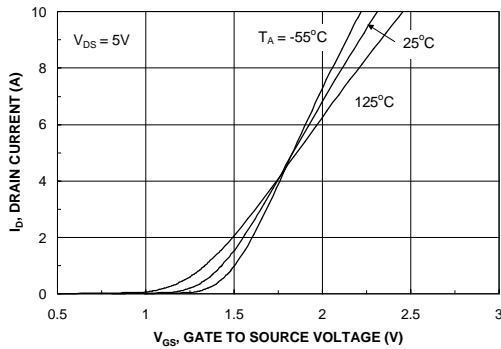


Figure 5. Transfer Characteristics.

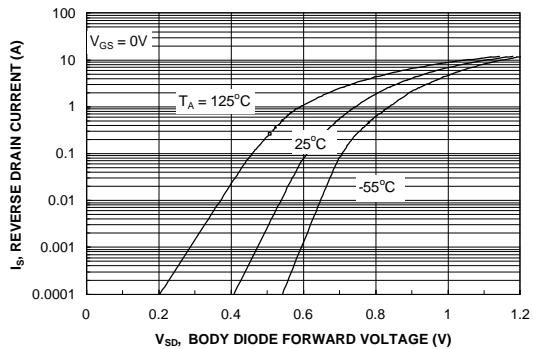


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

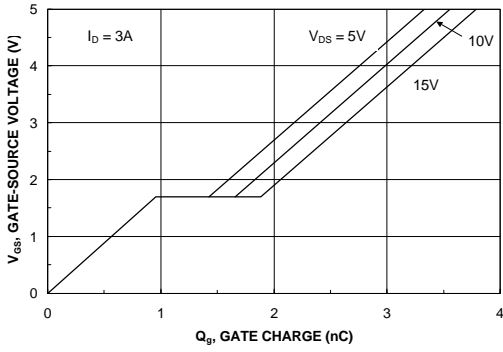


Figure 7. Gate Charge Characteristics.

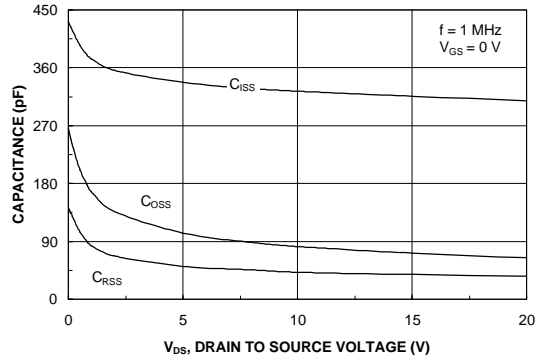


Figure 8. Capacitance Characteristics.

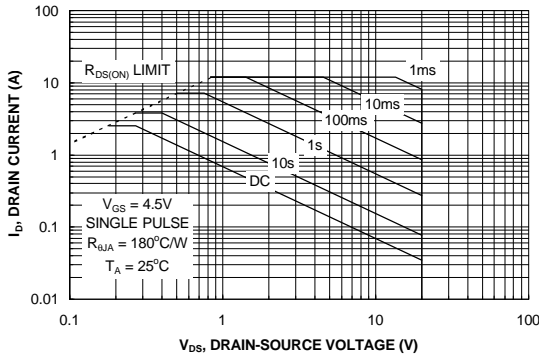


Figure 9. Maximum Safe Operating Area.

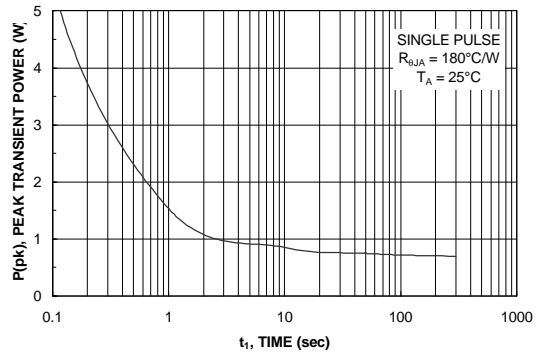


Figure 10. Single Pulse Maximum Power Dissipation.

Typical Characteristics: P-Channel

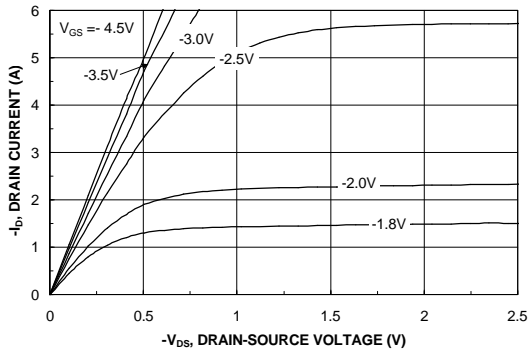


Figure 11. On-Region Characteristics.

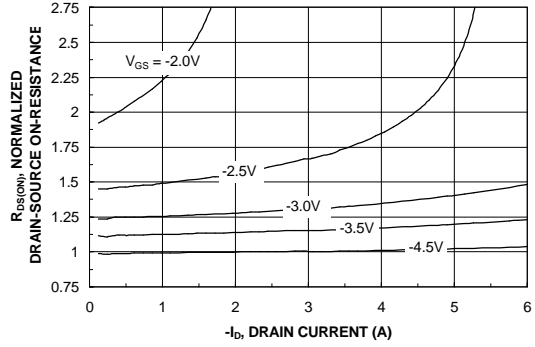


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

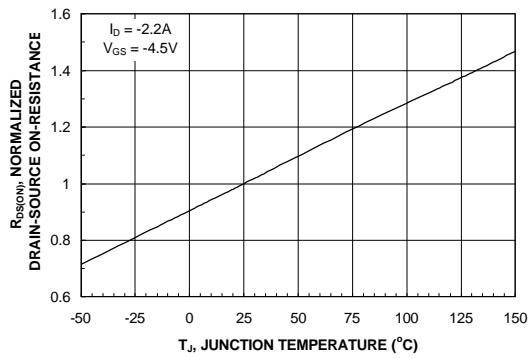


Figure 13. On-Resistance Variation with Temperature.

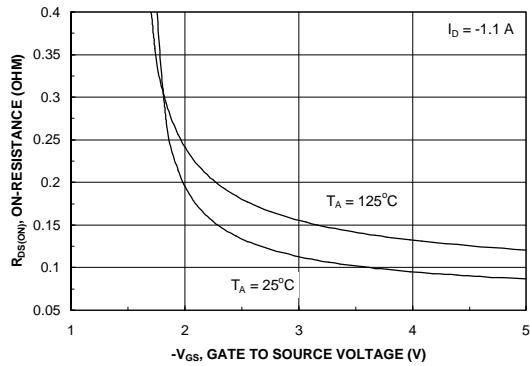


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

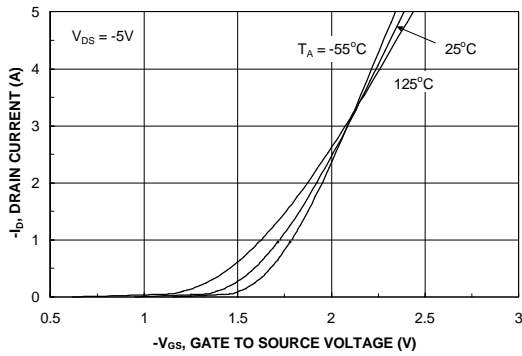


Figure 15. Transfer Characteristics.

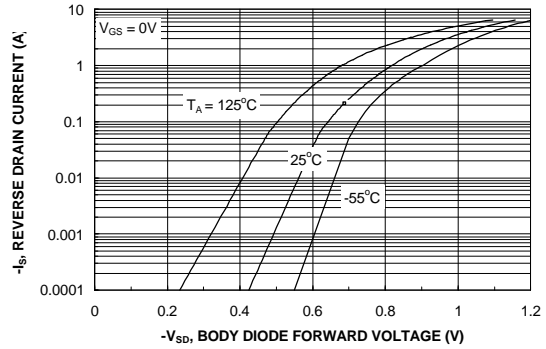


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

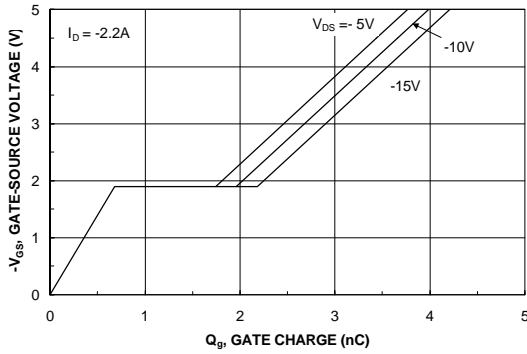


Figure 17. Gate Charge Characteristics.

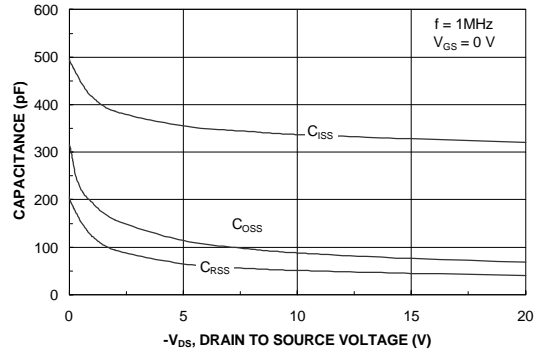


Figure 18. Capacitance Characteristics.

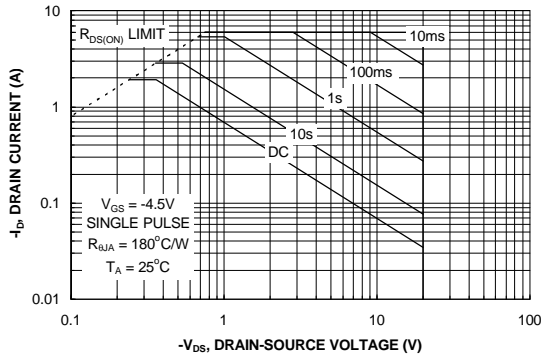


Figure 19. Maximum Safe Operating Area.

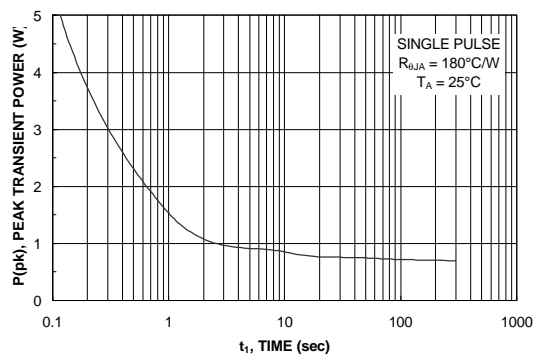


Figure 20. Single Pulse Maximum Power Dissipation.

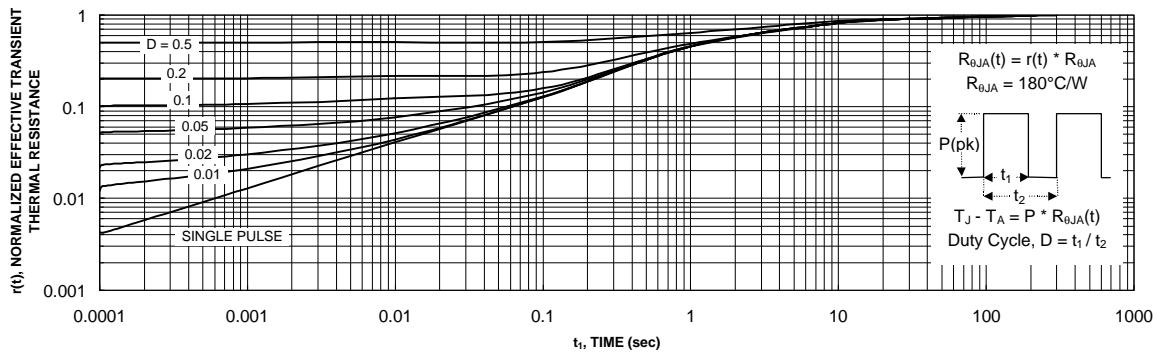


Figure 21. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.

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DenseTrench <sup>TM</sup>	GTO <sup>TM</sup>	Power247 <sup>TM</sup>	SuperSOT <sup>TM</sup> -6	
DOMET <sup>TM</sup>	HiSeC <sup>TM</sup>	PowerTrench <sup>®</sup>	SuperSOT <sup>TM</sup> -8	
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E <sup>2</sup> CMOS <sup>TM</sup>	LittleFET <sup>TM</sup>	QST <sup>TM</sup>	TinyLogic <sup>TM</sup>	
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FACT <sup>TM</sup>	MicroPak <sup>TM</sup>	Quiet Series <sup>TM</sup>	UHC <sup>TM</sup>	
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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