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# NDC7001C

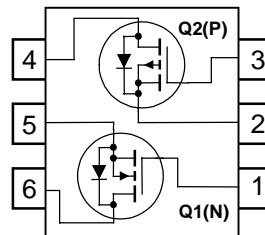
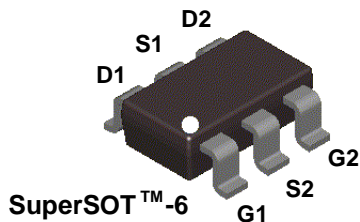
## Dual N & P-Channel Enhancement Mode Field Effect Transistor

### General Description

These dual N & P-Channel Enhancement Mode Field Effect Transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. These device is particularly suited for low voltage, low current, switching, and power supply applications.

### Features

- **Q1** 0.51 A, 60V.  $R_{DS(ON)} = 2 \Omega @ V_{GS} = 10 V$   
 $R_{DS(ON)} = 4 \Omega @ V_{GS} = 4.5 V$
- **Q2** -0.34 A, 60V.  $R_{DS(ON)} = 5 \Omega @ V_{GS} = -10 V$   
 $R_{DS(ON)} = 7.5 \Omega @ V_{GS} = -4.5 V$
- High saturation current
- High density cell design for low  $R_{DS(ON)}$
- Proprietary SuperSOT™-6 package: design using copper lead frame for superior thermal and electrical capabilities



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

Symbol	Parameter	Q1	Q2	Units
V <sub>DSS</sub>	Drain-Source Voltage	60	-60	V
V <sub>GSS</sub>	Gate-Source Voltage	±20	±20	
I <sub>D</sub>	Drain Current – Continuous (Note 1a)	0.51	-0.34	A
	– Pulsed	1.5	-1	
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	

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.01C	NDC7001C	7"	8mm	3000

### 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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	Q1 60 Q2 -60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}, \text{Ref. to } 25^\circ\text{C}$ $I_D = -250\ \mu\text{A}, \text{Ref. to } 25^\circ\text{C}$	Q1 Q2	67 -57		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}$	Q1 Q2		1 -1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	All		100	nA
$I_{GSSR}$	Gate-Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	All		-100	nA

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	Q1	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	2.1	2.5	V
		Q2	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-1	-1.9	-3.5	
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	Q1	$I_D = 250\ \mu\text{A}, \text{Referenced. to } 25^\circ\text{C}$		-3.8		mV/ $^\circ\text{C}$
		Q2	$I_D = -250\ \mu\text{A}, \text{Ref. to } 25^\circ\text{C}$		3.2		
$R_{DS(on)}$	Static Drain-Source On-Resistance	Q1	$V_{GS} = 10\text{ V}, I_D = 0.51\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 0.35\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 0.51\text{ A}, T_J = 125^\circ\text{C}$		1 2 1.7	2 4 3.5	$\Omega$
		Q2	$V_{GS} = -10\text{ V}, I_D = -0.34\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -0.25\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -0.34\text{ A}, T_J = 125^\circ\text{C}$		1.2 1.5 1.9	5 7.5 10	
$I_{D(on)}$	On-State Drain Current	Q1	$V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$	1.5			A
		Q2	$V_{GS} = -10\text{ V}, V_{DS} = -10\text{ V}$	-1			
$g_{FS}$	Forward Transconductance	Q1	$V_{DS} = 10\text{ V}, I_D = 0.51\text{ A}$		380		mS
		Q2	$V_{DS} = -10\text{ V}, I_D = -0.34\text{ A}$		700		

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	Q1	For Q1: $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$		20		pF
		Q2			66		
$C_{oss}$	Output Capacitance	Q1	f = 1.0MHz		11		pF
		Q2		For Q2:		13	
$C_{riss}$	Reverse Transfer Capacitance	Q1	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}$ f = 1.0MHz		4.3		pF
		Q2			6		
$R_G$	Gate Resistance	Q1	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		11.2		$\Omega$
		Q2			11.2		

### Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	Q1	For Q1: $V_{DS} = 25\text{ V}, I_{DS} = 1\text{ A}$		2.8	5.6	ns
		Q2			3.2	6.4	
$t_r$	Turn-On Rise Time	Q1	$V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		8	16	ns
		Q2		For Q2:		10	
$t_{d(off)}$	Turn-Off Delay Time	Q1	$V_{DS} = -25\text{ V}, I_{DS} = -1\text{ A}$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$		14	26	ns
		Q2			8	16	
$t_f$	Turn-Off Fall Time	Q1			4	8	ns
		Q2			1	2	
$Q_g$	Total Gate Charge	Q1	For Q1: $V_{DS} = 25\text{ V}, I_{DS} = 0.51\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		1.1	1.5	nC
		Q2			1.6	2.2	
$Q_{gs}$	Gate-Source Charge	Q1	For Q2: $V_{DS} = -25\text{ V}, I_{DS} = -0.35\text{ A}$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$		0.2		nC
		Q2			0.3		
$Q_{gd}$	Gate-Drain Charge	Q1			0.4		nC
		Q2			0.3		

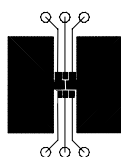
### Electrical Characteristics

$T_A = 25^\circ\text{C}$  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			0.51	A	
		Q2			-0.34		
$V_{SD}$	Drain–Source Diode Forward Voltage	Q1	$V_{GS} = 0\text{ V}, I_S = 0.51\text{ A}$ (Note 2)		0.8	1.2	V
		Q2	$V_{GS} = 0\text{ V}, I_S = -0.34\text{ A}$ (Note 2)		-0.8	-1.4	
$t_{rr}$	Diode Reverse Recovery Time	Q1	$I_F = 0.51\text{ A}, d_I/d_t = 100\text{ A}/\mu\text{s}$		18		nS
		Q2	$I_F = -0.34\text{ A}, d_I/d_t = 100\text{ A}/\mu\text{s}$		16		
$Q_{rr}$	Diode Reverse Recovery Charge	Q1	$I_F = 0.51\text{ A}, d_I/d_t = 100\text{ A}/\mu\text{s}$		16		nC
		Q2	$I_F = -0.34\text{ A}, d_I/d_t = 100\text{ A}/\mu\text{s}$		11		

**Notes:**

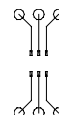
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $130^\circ\text{C}/\text{W}$  when mounted on a  $0.125\text{ in}^2$  pad of 2 oz. copper.



b)  $140^\circ\text{C}/\text{W}$  when mounted on a  $.005\text{ in}^2$  pad of 2 oz copper



c)  $180^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty Cycle < 2.0%

## Typical Characteristics: N-Channel

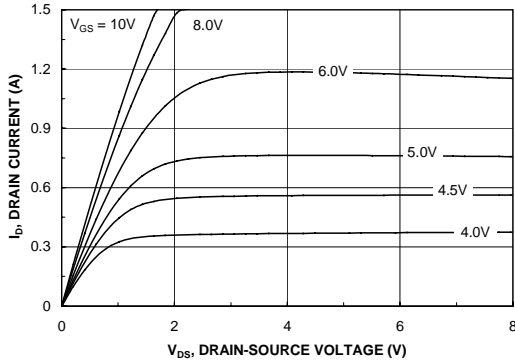


Figure 1. On-Region Characteristics.

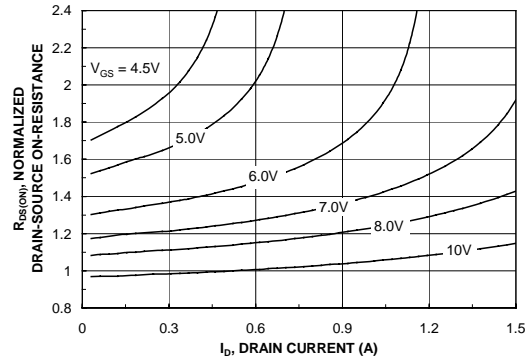


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

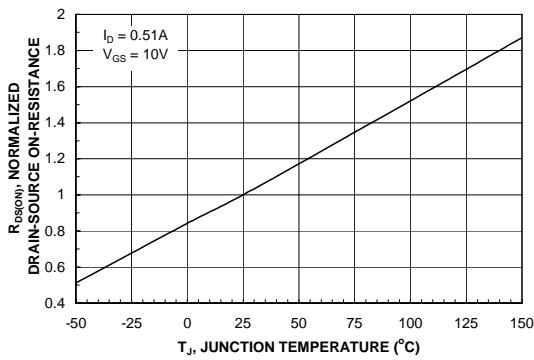


Figure 3. On-Resistance Variation with Temperature.

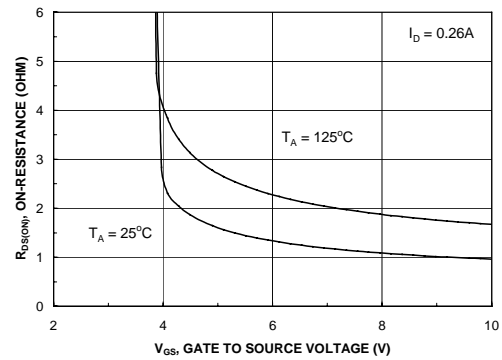


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

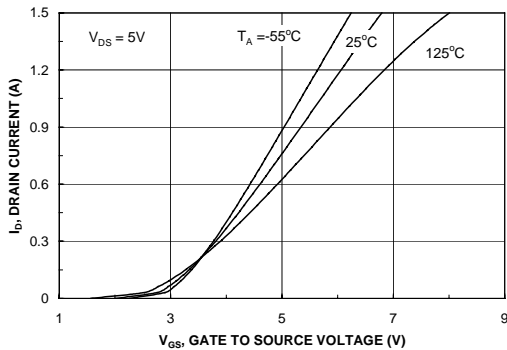


Figure 5. Transfer Characteristics.

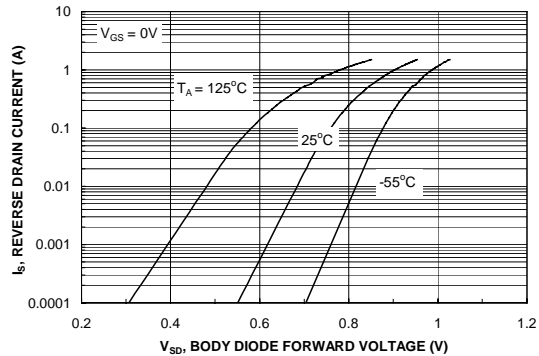


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: N-Channel (continued)

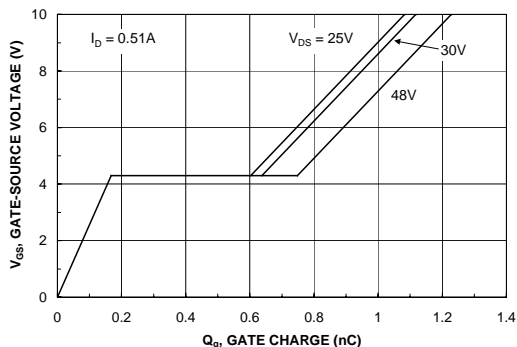


Figure 7. Gate Charge Characteristics.

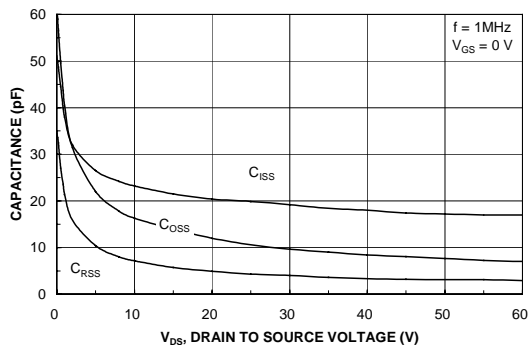


Figure 8. Capacitance Characteristics.

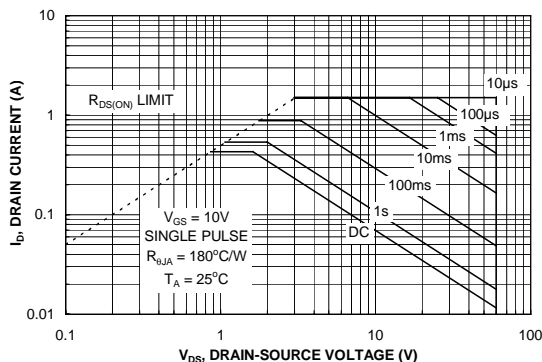


Figure 9. Maximum Safe Operating Area.

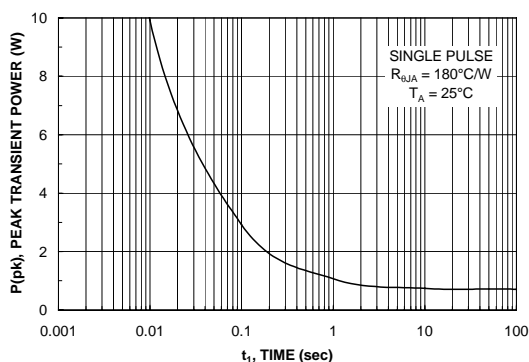


Figure 10. Single Pulse Maximum Power Dissipation.

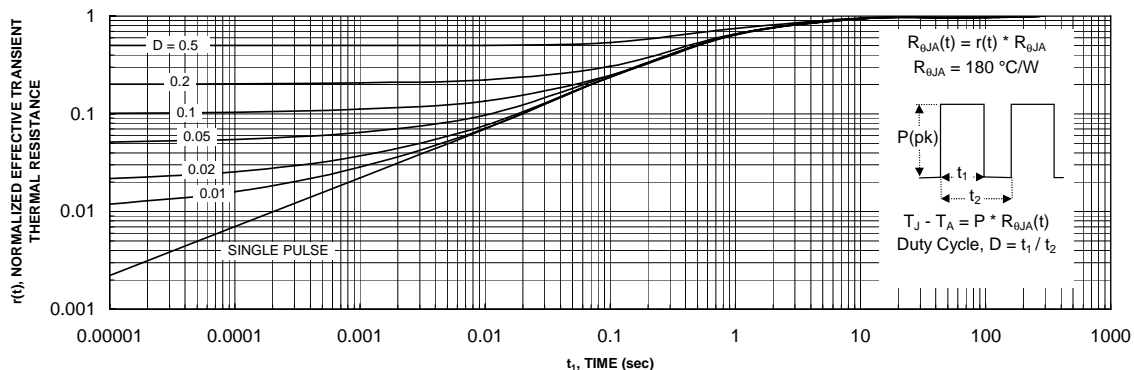


Figure 21. Transient Thermal Response Curve.

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

### Typical Characteristics: P-Channel

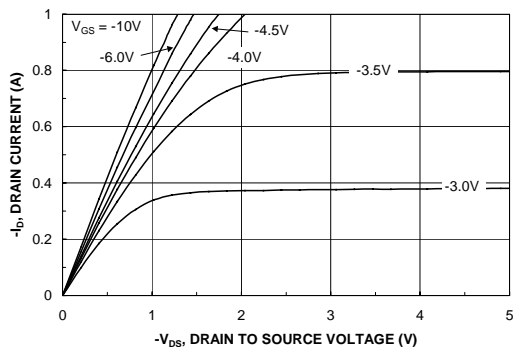


Figure 11. On-Region Characteristics.

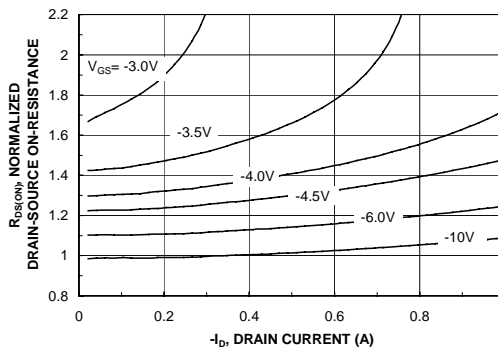


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

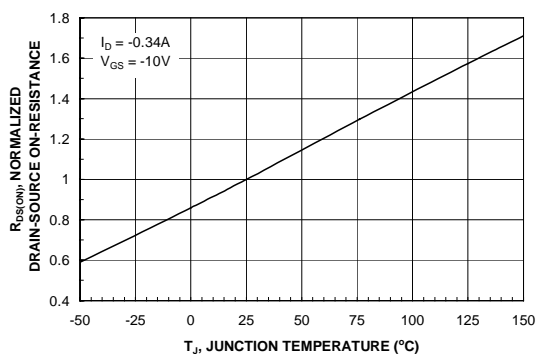


Figure 13. On-Resistance Variation with Temperature.

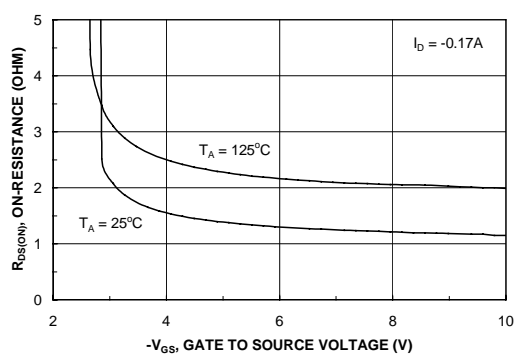


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

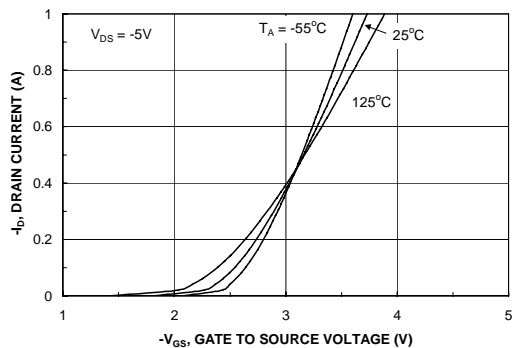


Figure 15. Transfer Characteristics.

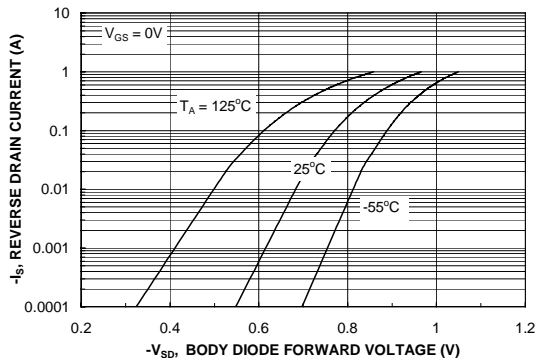
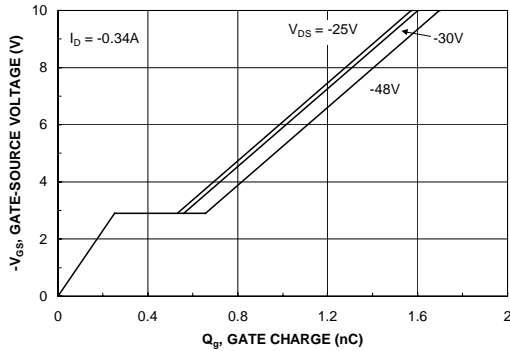
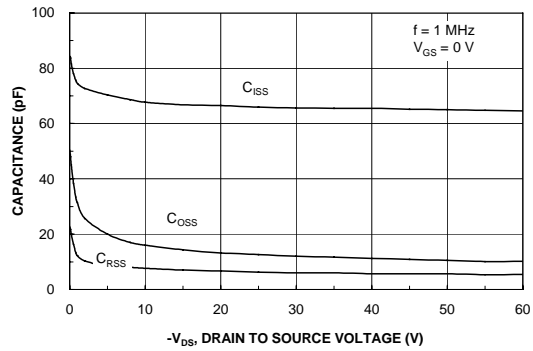


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

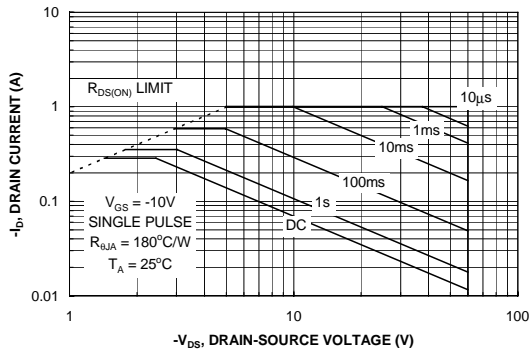
**Typical Characteristics: P-Channel** (continued)



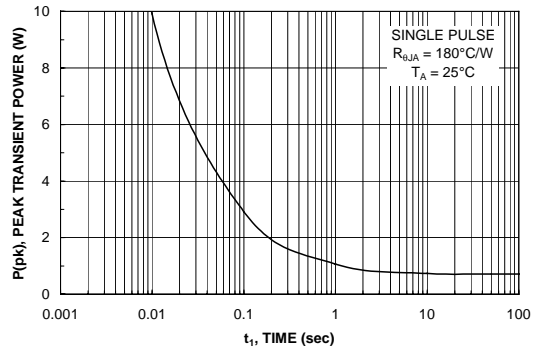
**Figure 17. Gate Charge Characteristics.**



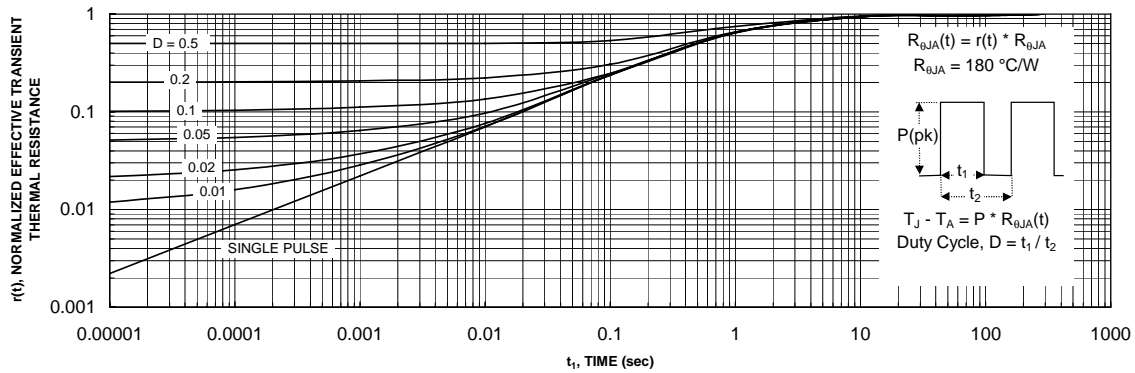
**Figure 18. Capacitance Characteristics.**



**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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