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FAIRCHILD SEMICONDUCTOR

May 2002

NDC7001C

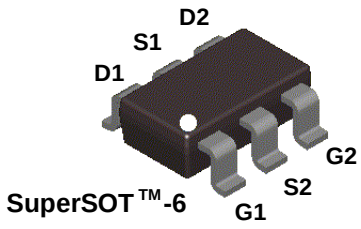
Dual N & P-Channel Enhancement Mode Field Effect Transistor

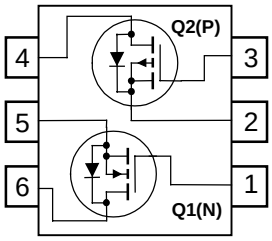
General Description

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 Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 4 Ω @ V_{GS} = 4.5 V
- **Q2** –0.34 A, 60V. $R_{DS(ON)}$ = 5 Ω @ V_{GS} = –10 V
  $R_{DS(ON)}$ = 7.5Ω @ 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_A=25°C unless otherwise noted

Symbol	Parameter		Q1	Q2	Units
V_{DSS}	Drain-Source Voltage		60	–60	V
V_{GSS}	Gate-Source Voltage		±20	±20	
I_D	Drain Current – Continuous	(Note 1a)	0.51	–0.34	A
	– Pulsed		1.5	–1	
P_D	Power Dissipation for Single Operation	(Note 1a)	0.96		W
		(Note 1b)	0.9		
		(Note 1c)	0.7		
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150		°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	130	°C/W
$R_{\theta JC}$	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°C unless otherwise noted

Symbol	Parameter		Test Conditions		Min	Typ	Max	Units
Off Characteristics								
BV_{DSS}	Drain–Source Breakdown Voltage		V_{GS} = 0 V, I_D = 250 µA V_{GS} = 0 V, I_D = –250 µA	**Q1** **Q2**	60 –60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient		I_D = 250 µA,Ref. to 25°C I_D = –250 µA,Ref. to 25°C	**Q1** **Q2**		67 –57		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current		V_{DS} = 48 V, V_{GS} = 0 V V_{DS} = –48 V, V_{GS} = 0 V	**Q1** **Q2**			1 –1	µA
I_{GSSF}	Gate–Body Leakage, Forward		V_{GS} = 20 V, V_{DS} = 0 V	**All**			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse		V_{GS} = –20 V, V_{DS} = 0 V	**All**			–100	nA
On Characteristics (Note 2)								
$V_{GS(th)}$	Gate Threshold Voltage	**Q1**	V_{DS} = V_{GS}, I_D = 250 µA		1	2.1	2.5	V
		Q2	V_{DS} = V_{GS}, I_D = –250 µA		–1	–1.9	–3.5	
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	**Q1**	I_D = 250 µA,Referenced. to 25°C			–3.8		mV/°C
		Q2	I_D = –250 µA,Ref. to 25°C			3.2		
$R_{DS(on)}$	Static Drain–Source On–Resistance	**Q1**	V_{GS} = 10 V, I_D = 0.51 A V_{GS} = 4.5 V, I_D = 0.35 A V_{GS} = 10 V, I_D = 0.51 A,T_J=125°C			1 2 1.7	2 4 3.5	Ω
		Q2	V_{GS} = –10 V, I_D = –0.34 A V_{GS} = – 4.5 V,I_D = –0.25 A V_{GS} = –10V,I_D= –0.34A,T_J=125°C			1.2 1.5 1.9	5 7.5 10	
$I_{D(on)}$	On-State Drain Current	**Q1**	V_{GS} = 10 V V_{DS} = 10 V		1.5			A
		Q2	V_{GS} = –10 V V_{DS} = –10 V		–1			
g_{FS}	Forward Transconductance	**Q1**	V_{DS} = 10 V I_D = 0.51 A			380		mS
		Q2	V_{DS} = –10 V I_D = –0.34A			700		
Dynamic Characteristics								
C_{iss}	Input Capacitance	**Q1**	For **Q1**: V_{DS} = 25 V, V_{GS} = 0 V f = 1.0MHz For **Q2**: V_{DS} = –25 V, V_{GS} = 0 V f = 1.0MHz			20		pF
		Q2				66		
C_{oss}	Output Capacitance	**Q1**				11		pF
		Q2				13		
C_{rss}	Reverse Transfer Capacitance	**Q1**				4.3		pF
		Q2				6		
R_G	Gate Resistance	**Q1**	V_{GS} = 15 mV, f = 1.0 MHz			11.2		Ω
		Q2				11.2		
Switching Characteristics (Note 2)								
$t_{d(on)}$	Turn–On Delay Time	**Q1**	For **Q1**: V_{DS} =25 V, I_{DS}= 1 A V_{GS}= 10 V, R_{GEN} = 6 Ω For **Q2**: V_{DS} =–25 V, I_{DS}= –1 A V_{GS}= –10 V, R_{GEN} = 6 Ω			2.8	5.6	ns
		Q2				3.2	6.4	
t_r	Turn–On Rise Time	**Q1**				8	16	ns
		Q2				10	20	
$t_{d(off)}$	Turn–Off Delay Time	**Q1**				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 V, I_{DS}= 0.51 A V_{GS}= 10 V, R_{GEN} = 6 Ω For **Q2**: V_{DS} =–25 V, I_{DS}= –0.35 A V_{GS}= –10 V, R_{GEN} = 6 Ω			1.1	1.5	nC
		Q2				1.6	2.2	
Q_{gs}	Gate–Source Charge	**Q1**				0.2		nC
		Q2				0.3		
Q_{gd}	Gate–Drain Charge	**Q1**				0.4		nC
		Q2				0.3		

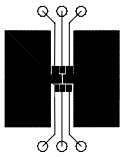
Electrical Characteristics

T_A = 25°C unless otherwise noted

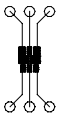
Symbol	Parameter		Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics and Maximum Ratings							
I_S	Maximum Continuous Drain–Source Diode Forward Current	**Q1**				0.51	A
		Q2				–0.34	
V_{SD}	Drain–Source Diode Forward Voltage	**Q1**	V_{GS} = 0 V, I_S = 0.51 A (Note 2)		0.8	1.2	V
		Q2	V_{GS} = 0 V, I_S = –0.34 A (Note 2)		–0.8	–1.4	
t_{rr}	Diode Reverse Recovery Time	**Q1**	I_F = 0.51 A, d_{iF}/d_t = 100 A/µs		18		nS
		Q2	I_F = –0.34 A, d_{iF}/d_t = 100 A/µs		16		
Q_{rr}	Diode Reverse Recovery Charge	**Q1**	I_F = 0.51 A, d_{iF}/d_t = 100 A/µs		16		nC
		Q2	I_F = –0.34 A, d_{iF}/d_t = 100 A/µs		11		

Notes:

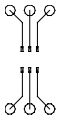
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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



b) 140°C/W when mounted on a .005 in^2 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

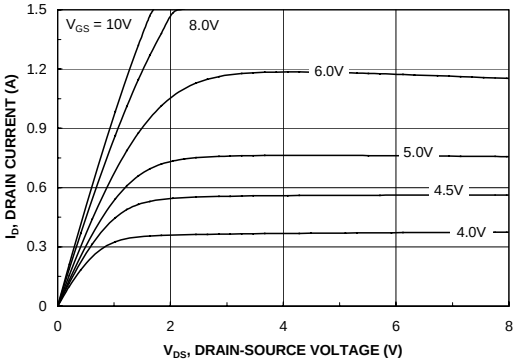


Figure 1. On-Region Characteristics.

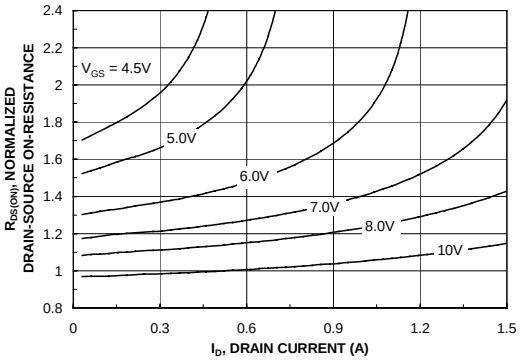


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

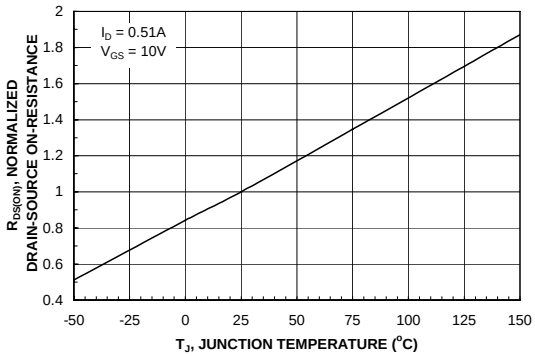


Figure 3. On-Resistance Variation withTemperature.

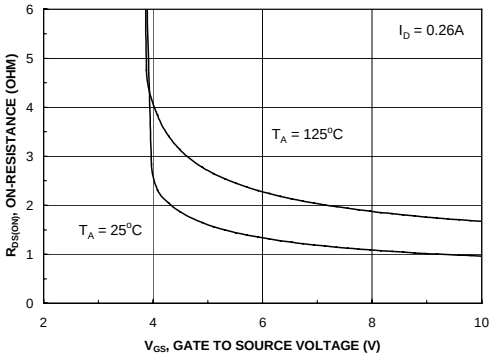


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

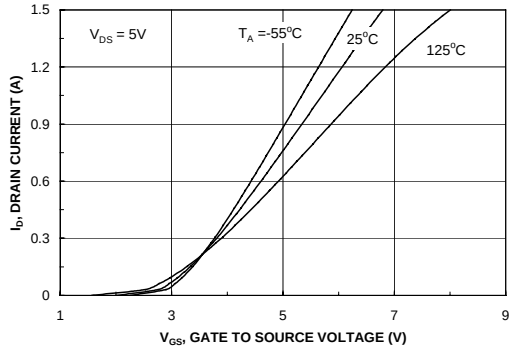


Figure 5. Transfer Characteristics.

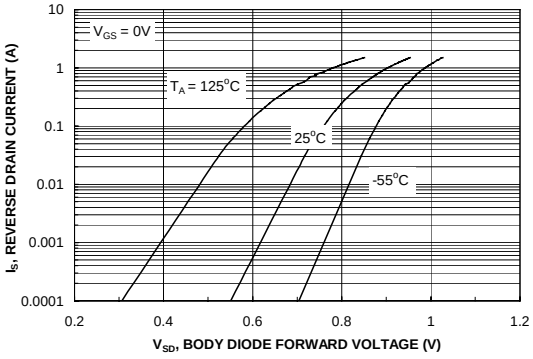


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: N-Channel (continued)

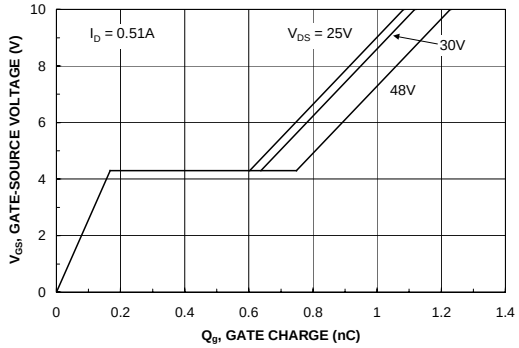


Figure 7. Gate Charge Characteristics.

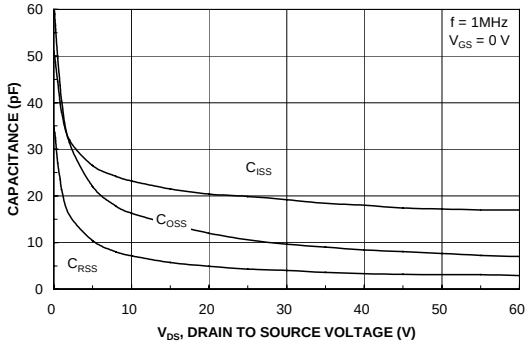


Figure 8. Capacitance Characteristics.

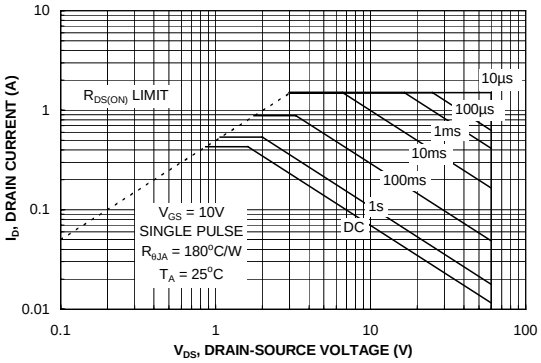


Figure 9. Maximum Safe Operating Area.

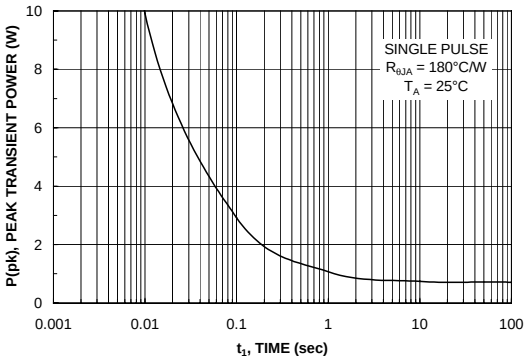


Figure 10. Single Pulse Maximum Power Dissipation.

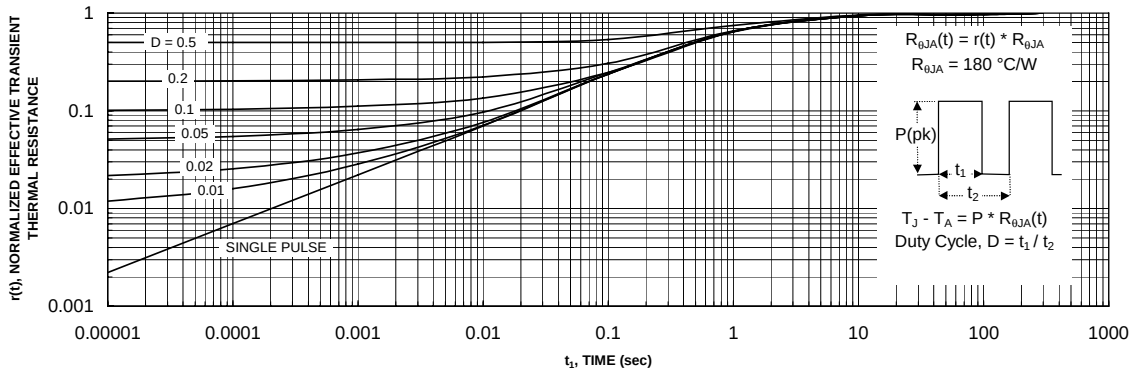


Figure 21. Transient Thermal Response Curve.

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

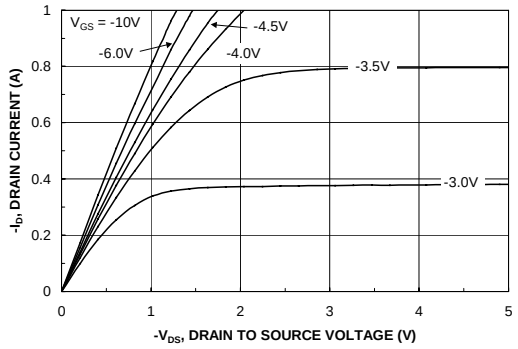


Figure 11. On-Region Characteristics.

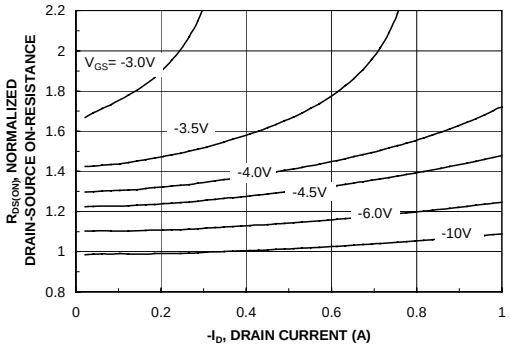


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

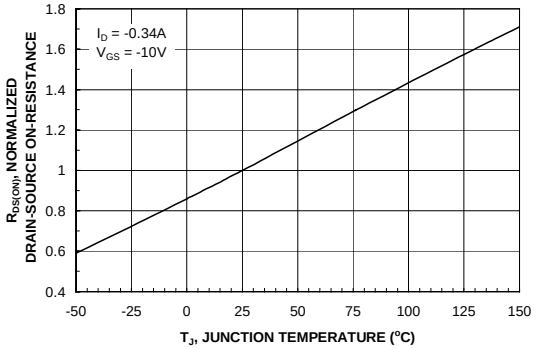


Figure 13. On-Resistance Variation withTemperature.

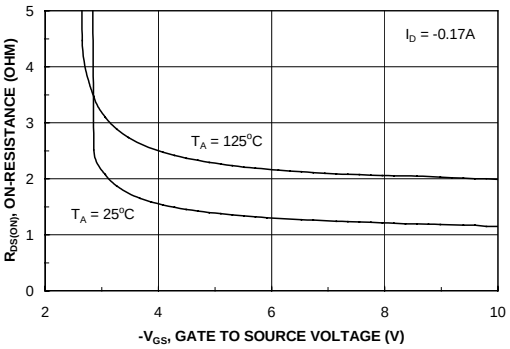


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

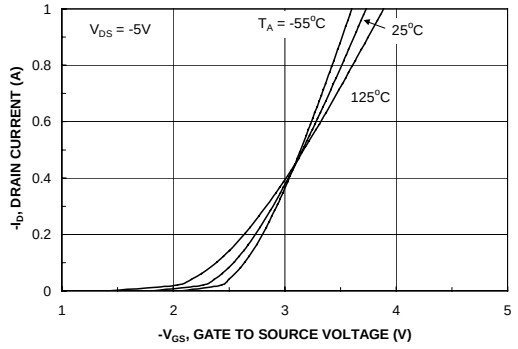


Figure 15. Transfer Characteristics.

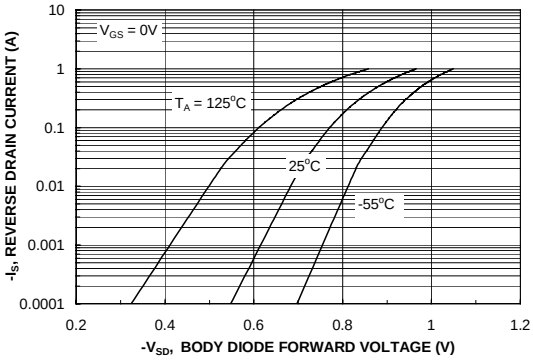


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: P-Channel (continued)

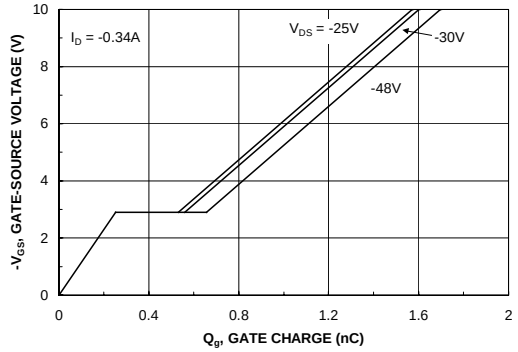


Figure 17. Gate Charge Characteristics.

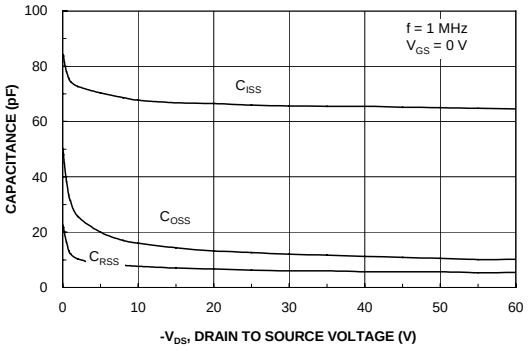


Figure 18. Capacitance Characteristics.

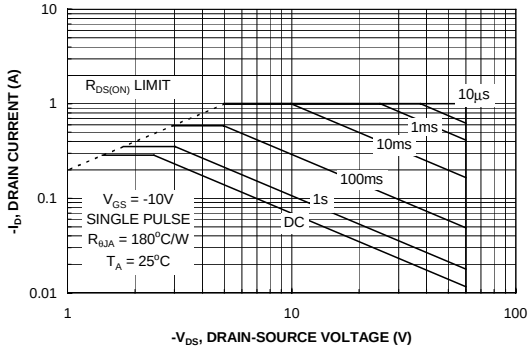


Figure 19. Maximum Safe Operating Area.

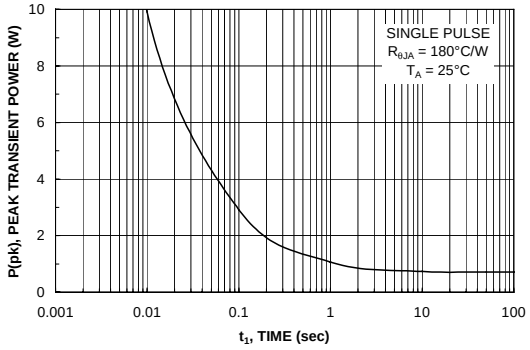


Figure 20. Single Pulse Maximum Power Dissipation.

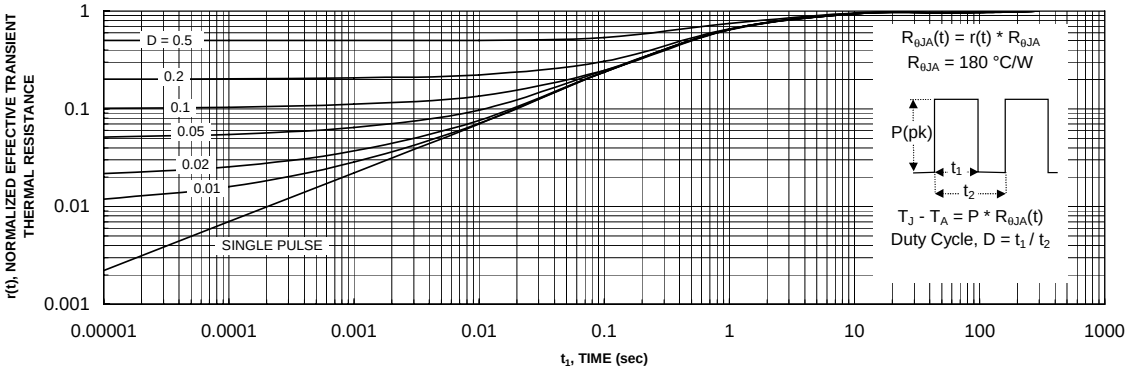


Figure 21. Transient Thermal Response Curve.

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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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.

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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.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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