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FAIRCHILD SEMICONDUCTOR TM

March 1996

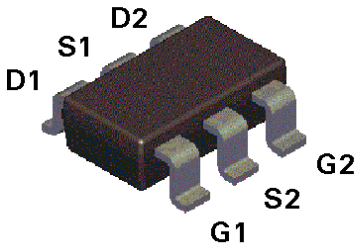
NDC7002N
Dual N-Channel Enhancement Mode Field Effect Transistor

General Description

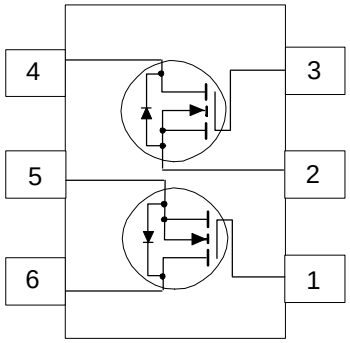
These dual N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. These devices is particularly suited for low voltage applications requiring a low current high side switch.

Features

- 0.51A, 50V, $R_{DS(ON)}$ = 2Ω @ V_{GS}=10V
- High density cell design for low $R_{DS(ON)}$.
- Proprietary SuperSOT™-6 package design using copper lead frame for superior thermal and electrical capabilities.
- High saturation current.



SOT-6 (SuperSOT™-6)



Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		NDC7002N	Units
V_{DSS}	Drain-Source Voltage		50	V
V_{GSS}	Gate-Source Voltage - Continuous		20	V
I_D	Drain Current - Continuous	(Note 1a)	0.51	A
	- Pulsed		1.5	
P_D	Maximum Power Dissipation	(Note 1a)	0.96	W
		(Note 1b)	0.9	
		(Note 1c)	0.7	
T_J,T_{STG}	Operating and Storage 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	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	50			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 40 V, V_{GS} = 0 V			1	µA
		T_J = 125°C			500	
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.9	2.5	V
		T_J = 125°C	0.8	1.5	2.2	
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 0.51 A		1	2	Ω
		T_J = 125°C		1.7	3.5	
		V_{GS} = 4.5 V, I_D = 0.35 A		1.6	4	
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V	1.5			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 0.51 A		400		mS
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		20		pF
C_{oss}	Output Capacitance			13		pF
C_{rss}	Reverse Transfer Capacitance			5		pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 25 V, I_D = 0.25 A, V_{GS} = 10 V, R_{GEN} = 25 Ω		6	20	nS
t_r	Turn - On Rise Time			6	20	
$t_{D(off)}$	Turn - Off Delay Time			11	20	
t_f	Turn - Off Fall Time			5	20	
Q_g	Total Gate Charge	V_{DS} = 25 V, I_D = 0.51 A, V_{GS} = 10 V		1		nC
Q_{gs}	Gate-Source Charge			0.19		nC
Q_{gd}	Gate-Drain Charge			0.33		nC

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DRAIN-SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source Current				0.51	A
I_{SM}	Maximum Pulse Source Current (Note 2)				1.5	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.51 A (Note 2)		0.8	1.2	V

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.

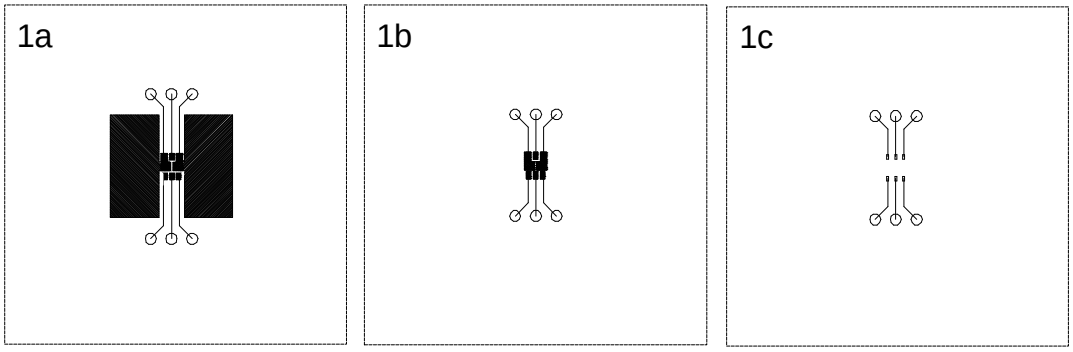
$$P_D(t) = \frac{T_J - T_A}{R_{\theta JA}(t)} = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CA}(t)} = I_D^2(t) \times R_{DS(ON)@T_J}$$

Typical $R_{\theta JA}$ for single device operation using the board layouts shown below on 4.5"x5" FR-4 PCB in a still air environment:

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

b. 140°C/W when mounted on a 0.005 in^2 pad of 2oz cpper.

c. 180°C/W when mounted on a 0.0015 in^2 pad of 2oz cpper.



Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

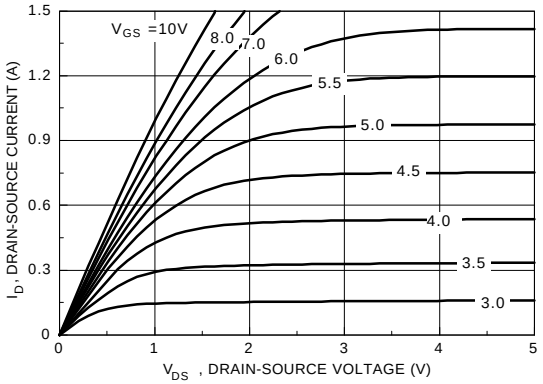


Figure 1. On-Region Characteristics.

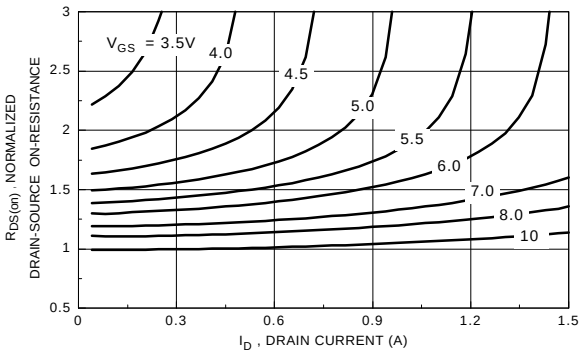


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

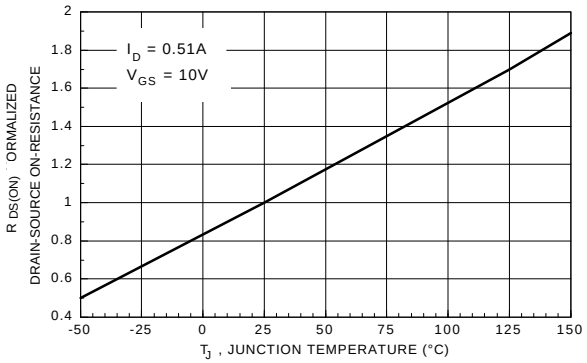


Figure 3. On-Resistance Variation with Temperature.

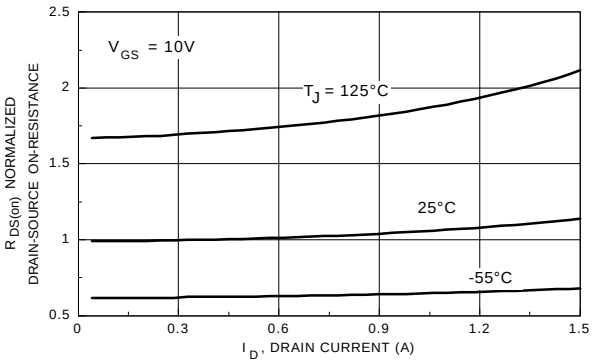


Figure 4. On-Resistance Variation with Drain Current and Temperature.

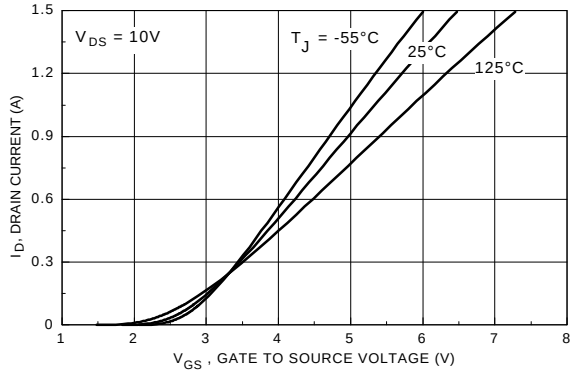


Figure 5. Transfer Characteristics.

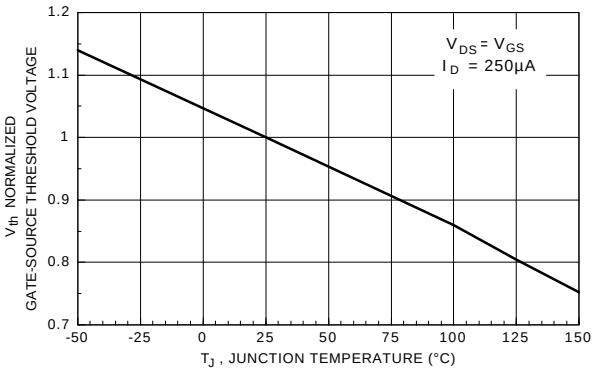


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

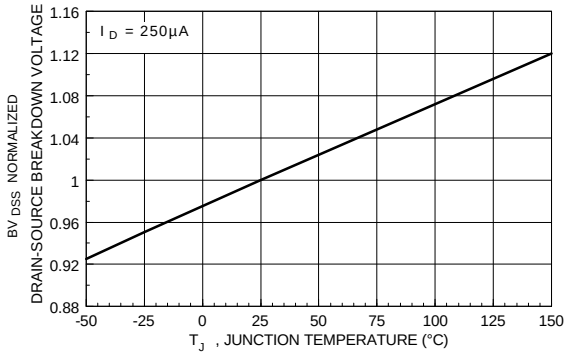


Figure 7. Breakdown Voltage Variation with Temperature.

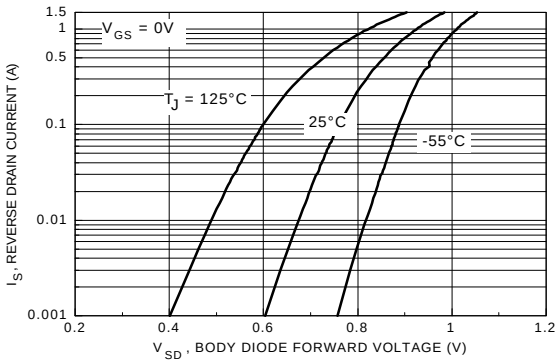


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

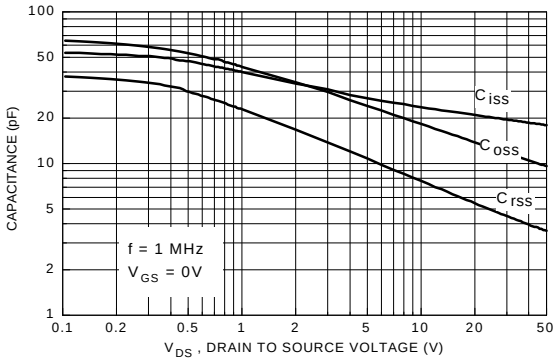


Figure 9. Capacitance Characteristics.

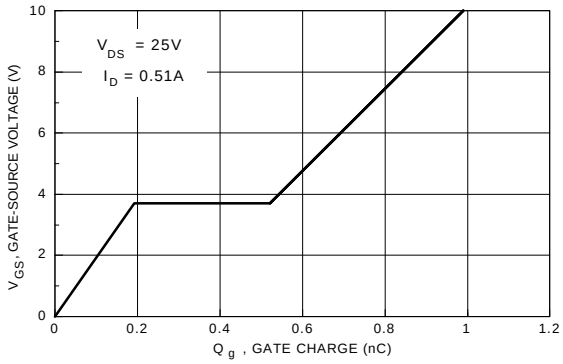


Figure 10. Gate Charge Characteristics.

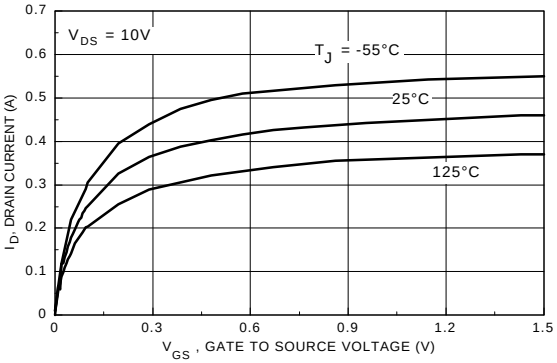


Figure 11. Transconductance Variation with Drain Current and Temperature.

Typical Thermal Characteristics

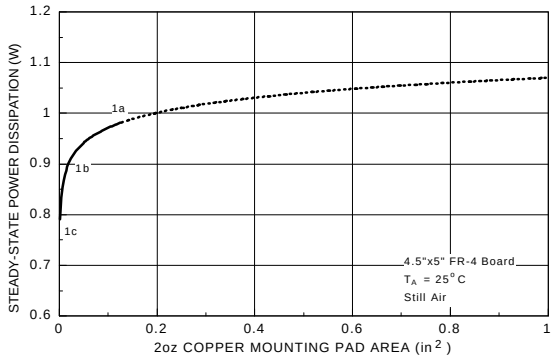


Figure 12. SOT-6 Dual Package Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.

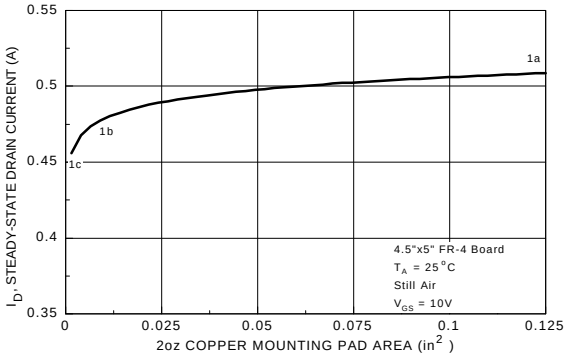


Figure 13. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

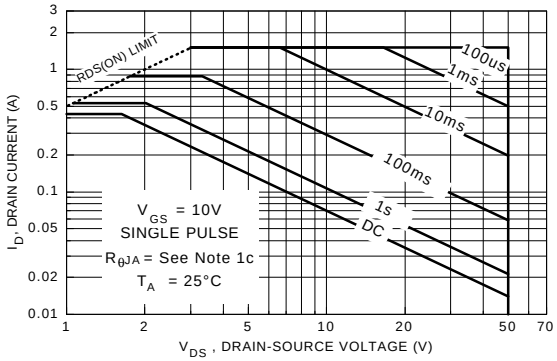


Figure 14. Maximum Safe Operating Area.

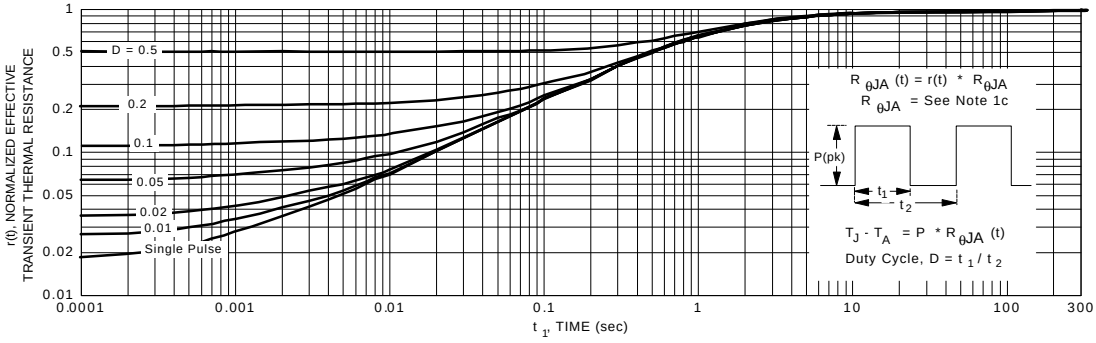


Figure 15. Transient Thermal Response Curve.

Note: 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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