

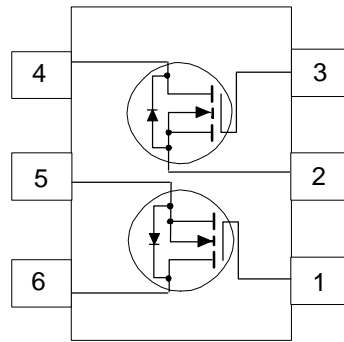
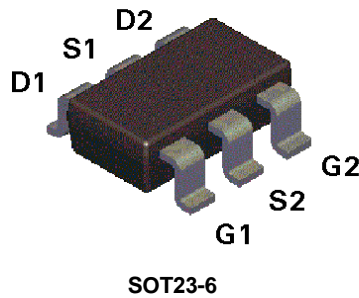
SOT23-6 Dual N-Channel Enhancement Mode Field Effect Transistor

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,  $R_{DS(ON)} = 2\Omega @ V_{GS}=10V$
- High density cell design for low  $R_{DS(ON)}$
- Proprietary SOT23-6 package design using copper lead frame for superior thermal and electrical capabilities.
- High saturation current.



Absolute Maximum Ratings  $T_A = 25^\circ\text{C}$  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	$^\circ\text{C}$	

THERMAL CHARACTERISTICS

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	130	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	60	$^\circ\text{C/W}$

## SOT23-6 Dual N-Channel Enhancement Mode Field Effect Transistor

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

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

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**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
$I_S$	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	$V_{GS} = 0\text{ V}, I_S = 0.51\text{ A}$ (Note 2)		0.8	1.2	V

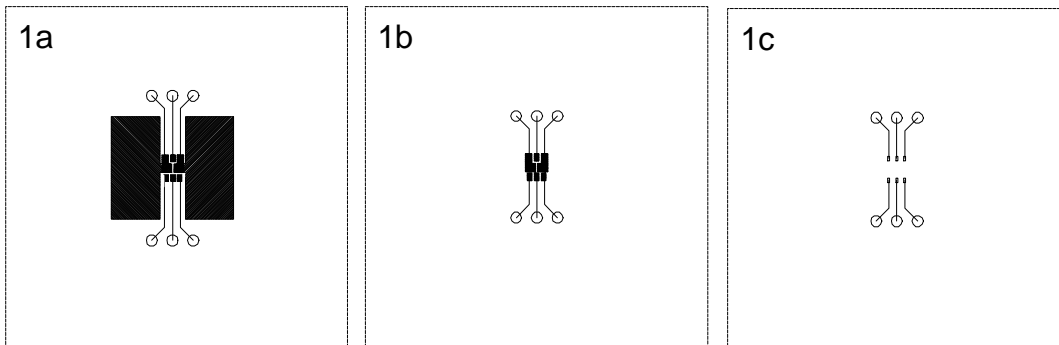
Notes:

- $R_{\theta_{JA}}$  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.

$$P_D(t) = \frac{T_J - T_A}{R_{\theta_{JA}}} = \frac{T_J - T_A}{R_{\theta_{JC}} + R_{\theta_{CA}}} = I_D^2(t) \times R_{DS(on)} \theta_{TJ}$$

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:

- 130°C/W when mounted on a 0.125 in<sup>2</sup> pad of 2oz copper.
- 140°C/W when mounted on a 0.005 in<sup>2</sup> pad of 2oz copper.
- 180°C/W when mounted on a 0.0015 in<sup>2</sup> pad of 2oz copper.



Scale 1 : 1 on letter size paper

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

SOT23-6 Dual N-Channel Enhancement Mode Field Effect Transistor

Typical Electrical Characteristics

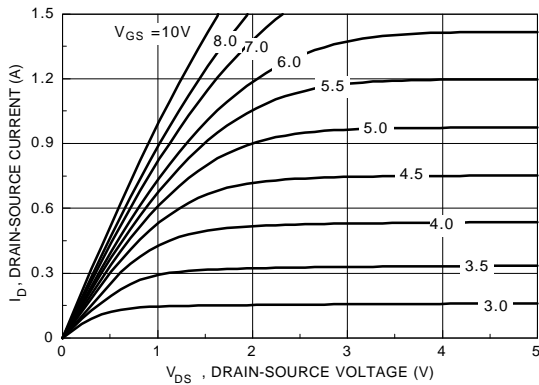


Figure 1. On-Region Characteristics.

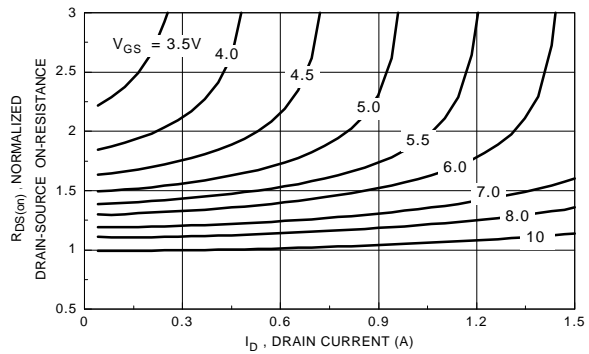


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

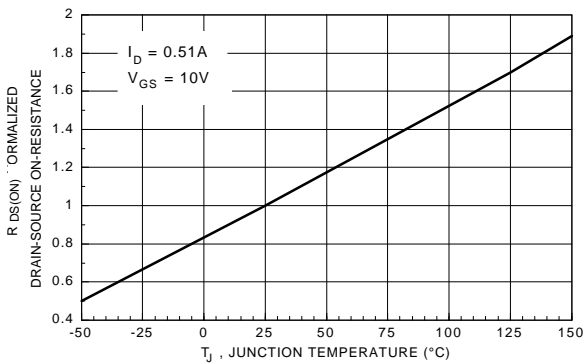


Figure 3. On-Resistance Variation with Temperature.

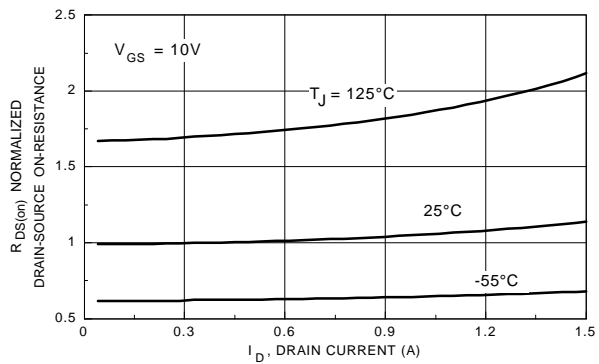


Figure 4. On-Resistance Variation with Drain Current and Temperature.

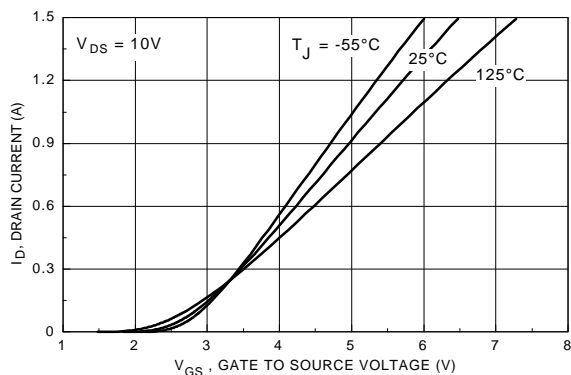


Figure 5. Transfer Characteristics.

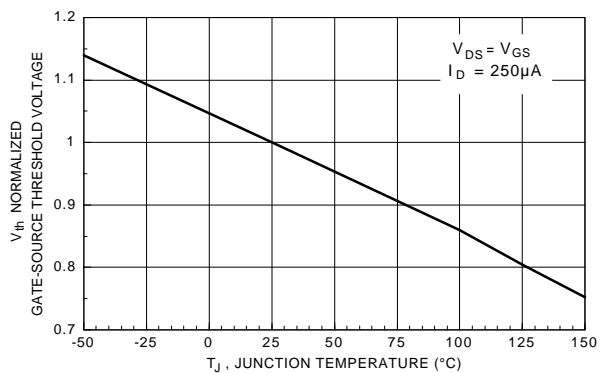


Figure 6. Gate Threshold Variation with Temperature.

SOT23-6 Dual N-Channel Enhancement Mode Field Effect Transistor

Typical Electrical Characteristics (continued)

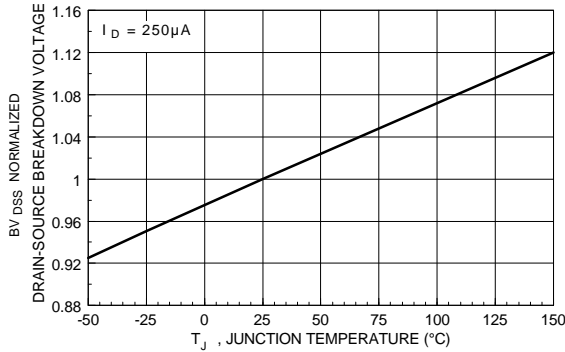


Figure 7. Breakdown Voltage Variation with Temperature.

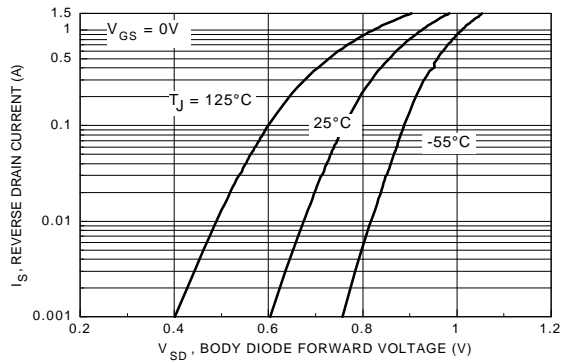


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

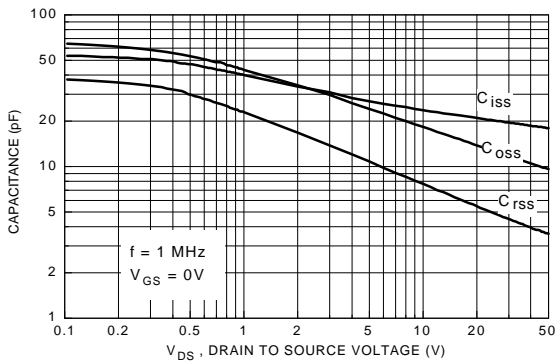


Figure 9. Capacitance Characteristics.

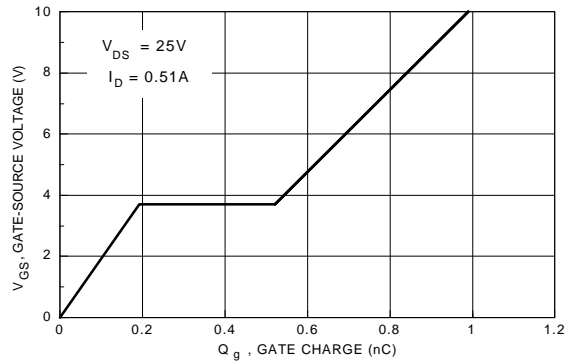


Figure 10. Gate Charge Characteristics.

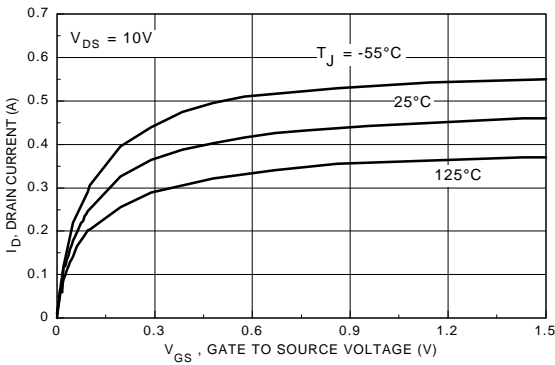


Figure 11. Transconductance Variation with Drain Current and Temperature.

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Typical Thermal Characteristics

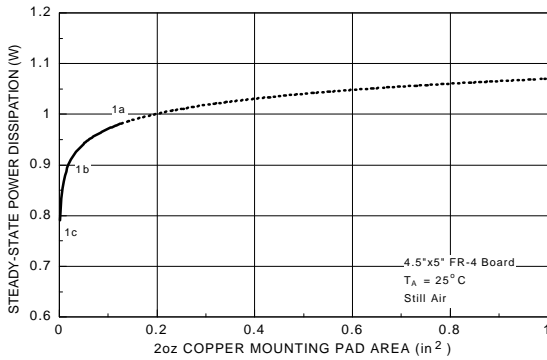


Figure 12. SOT23-6 Dual Package Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.

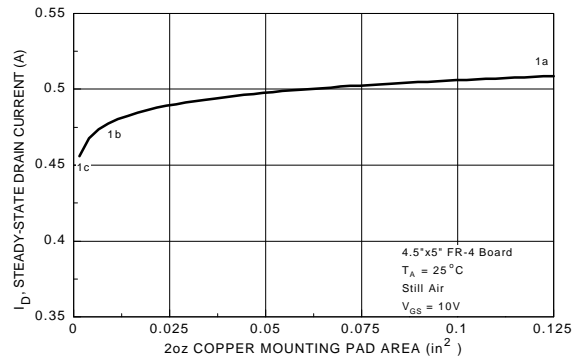


Figure 13. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

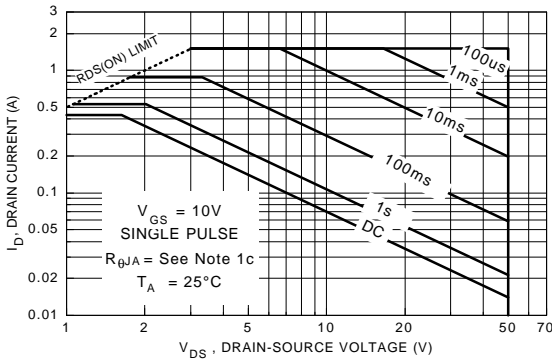
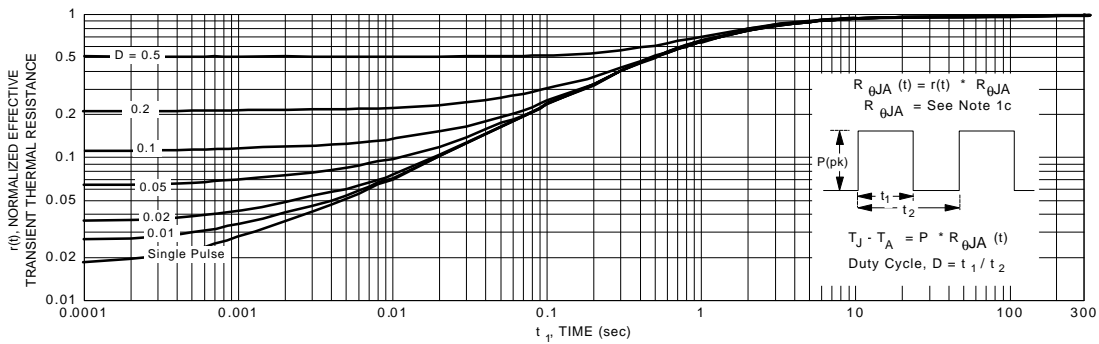
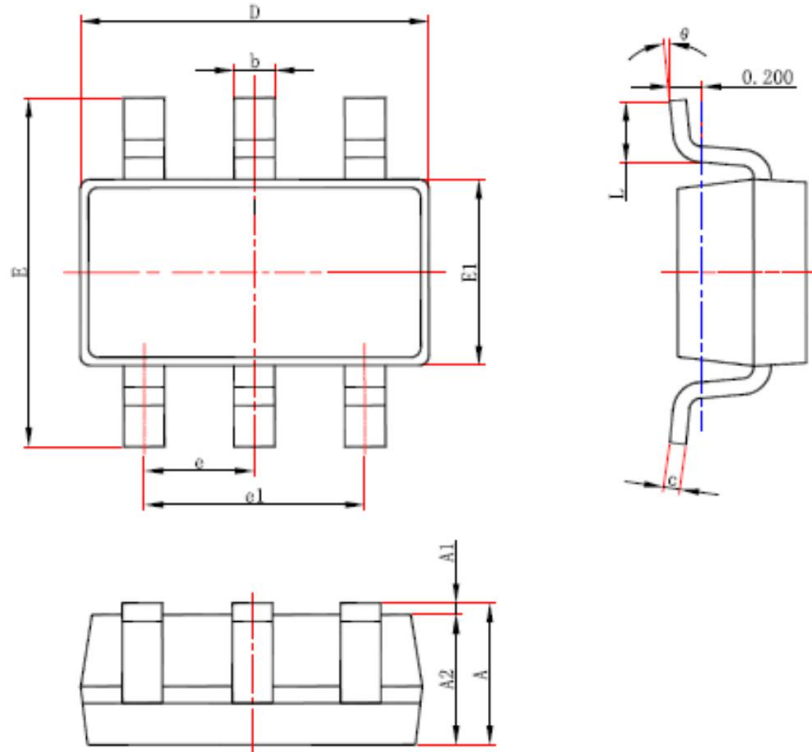


Figure 14. Maximum Safe Operating Area.



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SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°