FAIRCHILD
SEMICONDUCTOR TM

April 1995

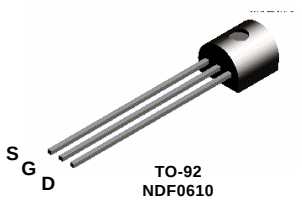
NDF0610 / NDS0610
P-Channel Enhancement Mode Field Effect Transistor

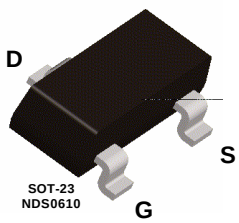
General Description

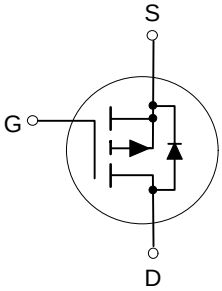
These P-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. They can be used, with a minimum of effort, in most applications requiring up to 180mA DC and can deliver pulsed currents up to 1A. This product is particularly suited to low voltage applications requiring a low current high side switch.

Features

- -0.18 and -0.12A, -60V. $R_{DS(ON)}$ = 10Ω
- Voltage controlled p-channel small signal switch
- High density cell design for low $R_{DS(ON)}$
- TO-92 and SOT-23 packages for both through hole and surface mount applications
- High saturation current







Absolute Maximum Ratings

T_A = 25°C unless otherwise noted

Symbol	Parameter	NDF0610	NDS0610	Units
V_{DSS}	Drain-Source Voltage	-60		V
V_{DGR}	Drain-Gate Voltage (R_{GS} ≤ 1 MΩ)	-60		V
V_{GSS}	Gate-Source Voltage - Continuous	±20		V
	- Nonrepetitive (t_P < 50 µs)	±30		V
I_D	Drain Current - Continuous	-0.18	-0.12	A
	- Pulsed	-1		
P_D	Maximum Power Dissipation T_A = 25°C	0.8	0.36	W
	Derate above 25°C	5	2.9	mW/°C
T_J,T_{STG}	Operating and Storage Temperature Range	-55 to 150		°C
T_L	Maximum lead temperature for soldering purposes, 1/16" from case for 10 seconds	300		°C
THERMAL CHARACTERISTICS				
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	200	350	°C/W

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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 = -10 µA		-60			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -48 V, V_{GS} = 0 V				-1	µA
			T_J = 125°C			-200	µA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V				10	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V				-10	nA
ON CHARACTERISTICS (Note 1)							
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = -1 mA		-1	-2.4	-3.5	V
			T_J = 125°C	-0.6	-2.1	-3.2	
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = -10 V, I_D = -0.5 A			3.6	10	Ω
			T_J = 125°C		5.9	16	
		V_{GS} = -4.5 V, I_D = -0.25 A			5.2	20	
			T_J = 125°C		7.9	30	
$I_{D(on)}$	On-State Drain Current	V_{GS} = -10 V, V_{DS} = -10 V		-0.6	-1.6		A
		V_{GS} = -4.5 V, V_{DS} = -10 V			-0.35		
g_{FS}	Forward Transconductance	V_{DS} = -10 V, I_D = -0.1 A		70	170		mS
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	V_{DS} = -25 V, V_{GS} = 0 V, f = 1.0 MHz			40	60	pF
C_{oss}	Output Capacitance				11	25	pF
C_{rss}	Reverse Transfer Capacitance				3.2	5	pF
SWITCHING CHARACTERISTICS (Note 1)							
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = -25 V, I_D = -0.18 A, V_{GS} = -10 V, R_{GEN} = 25 Ω			7	10	nS
t_r	Turn - On Rise Time				5	15	nS
$t_{D(off)}$	Turn - Off Delay Time				13	15	nS
t_f	Turn - Off Fall Time				10	20	nS
Q_g	Total Gate Charge	V_{DS} = -48 V, I_D = -0.5 A, V_{GS} = -10 V			1.43		nC
Q_{gs}	Gate-Source Charge				0.6		nC
Q_{gd}	Gate-Drain Charge				0.25		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
I_S	Maximum Continuous Source Current					-0.18	A
I_{SM}	Maximum Pulse Source Current (Note 1)					-1	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = -0.5 A (Note 1)			-1.2	-1.5	V
			T_J = 125°C		-0.98	-1.3	
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = -0.5 A, dI_F/dt = 100 A/µs			40		ns
I_{rr}	Reverse Recovery Current				2.8		A

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

Typical Electrical Characteristics

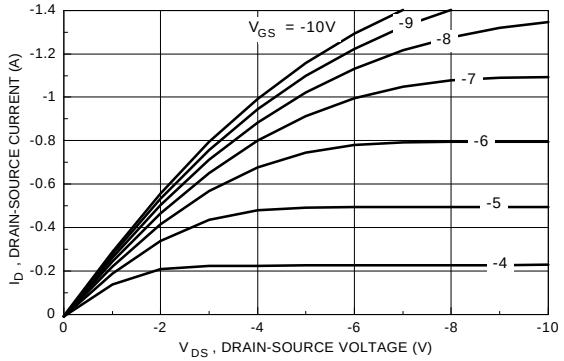

Figure 1. On-Region Characteristics

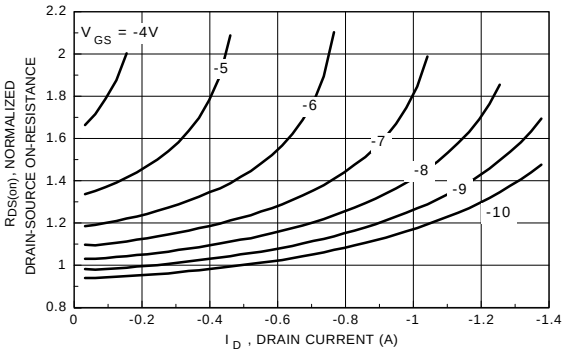

Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

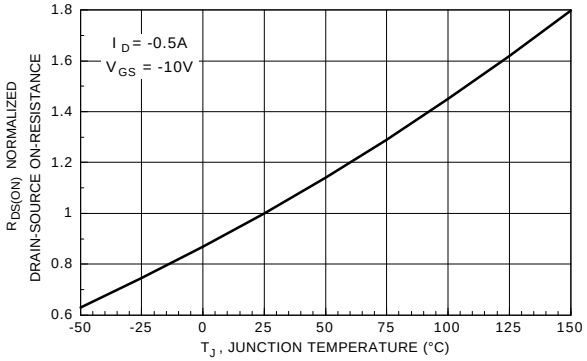

Figure 3. On-Resistance Variation with Temperature

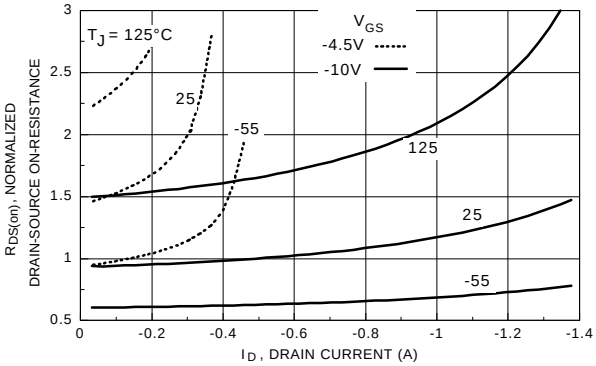

Figure 4. On-Resistance Variation with Drain Current and Temperature

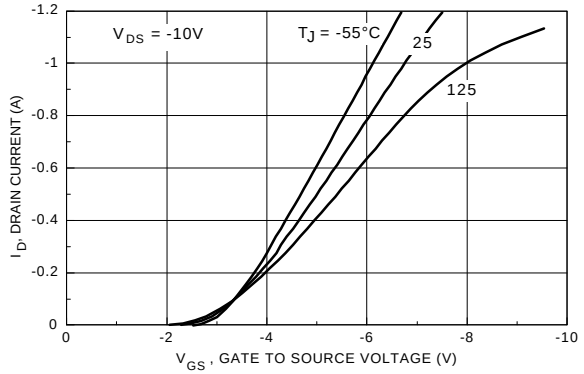

Figure 5. Transfer Characteristics

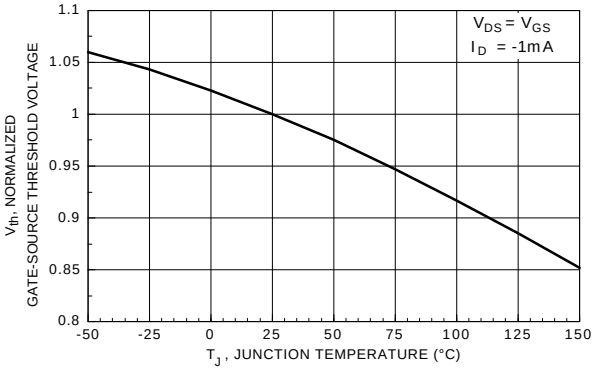

Figure 6. Gate Threshold Variation with Temperature

Typical Electrical Characteristics (continued)

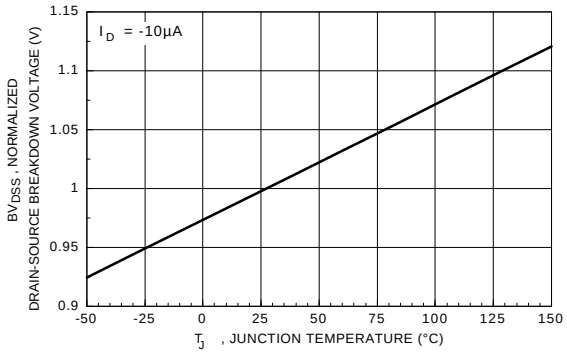

Figure 7. Breakdown Voltage Variation with Temperature

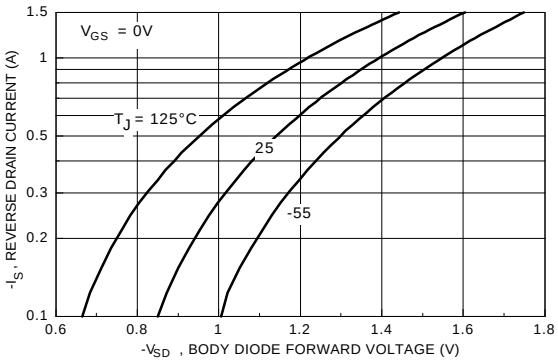

Figure 8. Body Diode Forward Voltage Variation with Current and Temperature

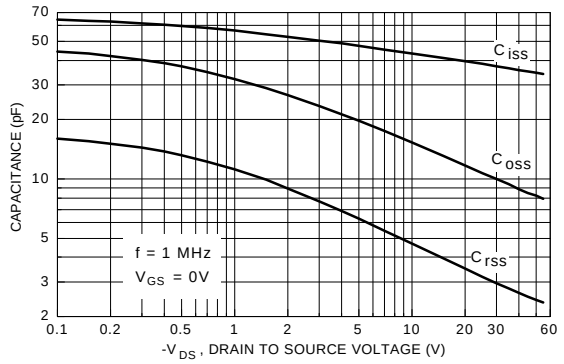

Figure 9. Capacitance Characteristics

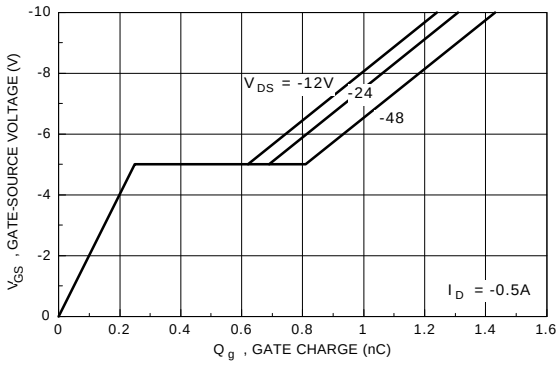

Figure 10. Gate Charge Characteristics

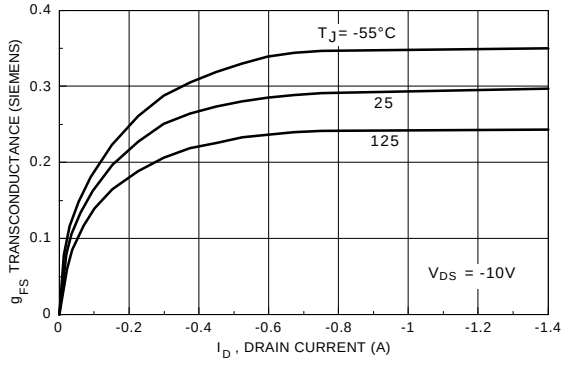

Figure 11. Transconductance Variation with Drain Current and Temperature

Typical Electrical Characteristics (continued)

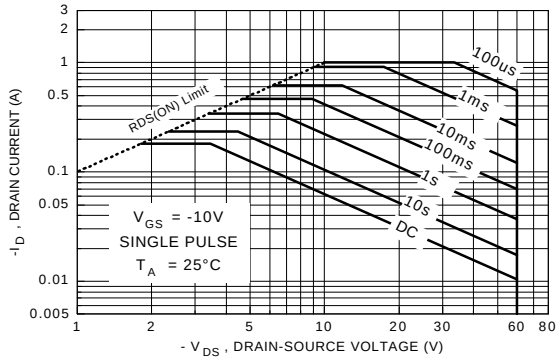

Figure 12. NDF0610 (TO-92) Maximum Safe Operating Area

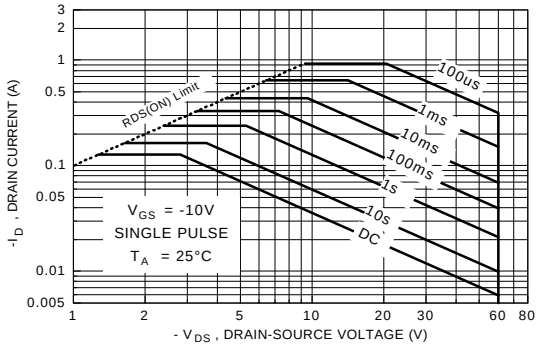

Figure 13. NDS0610 (SOT-23) Maximum Safe Operating Area

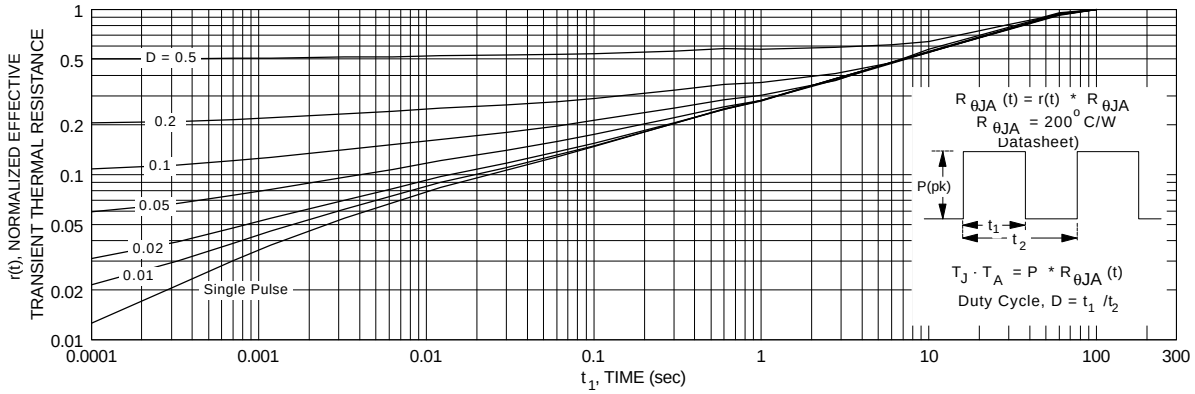

Figure 14. NDF0610 (TO-92) Transient Thermal Response Curve.

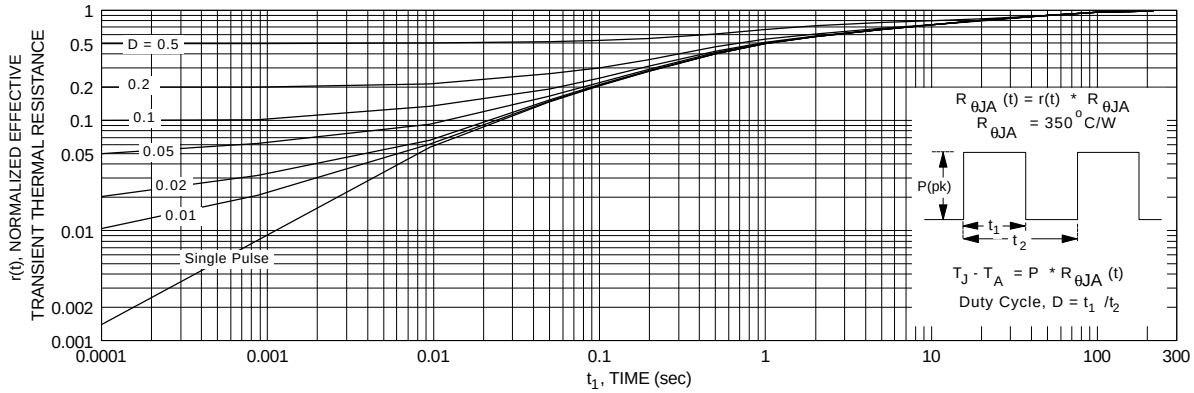

Figure 15. NDS0610 (SOT-23) Transient Thermal Response Curve.