

**NDF0610 / NDS0610**

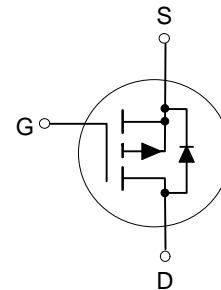
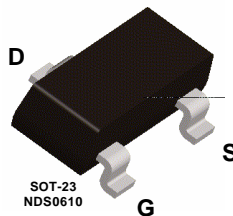
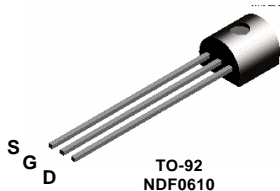
**P-Channel Enhancement Mode Field Effect Transistor**

**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.  $R_{DS(ON)} = 10\Omega$
- 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**

$T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	NDF0610	NDS0610	Units
$V_{DSS}$	Drain-Source Voltage	-60	-60	V
$V_{DGR}$	Drain-Gate Voltage ( $R_{GS} \leq 1\text{ M}\Omega$ )	-60	-60	V
$V_{GSS}$	Gate-Source Voltage - Continuous - Nonrepetitive ( $t_p < 50\ \mu\text{s}$ )	$\pm 20$	$\pm 20$	V
		$\pm 30$	$\pm 30$	V
$I_D$	Drain Current - Continuous - Pulsed	-0.18	-0.12	A
		-1		
$P_D$	Maximum Power Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	0.8	0.36	W
		5	2.9	mW/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150		$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/16" from case for 10 seconds	300		$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	200	350	$^\circ\text{C}/\text{W}$
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**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	$V_{GS} = 0\text{ V}, I_D = -10\ \mu\text{A}$	-60			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$T_J = 125^\circ\text{C}$			-200	$\mu\text{A}$
$I_{GSSF}$	Gate - Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			10	nA
$I_{GSSR}$	Gate - Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-10	nA
<b>ON CHARACTERISTICS</b> (Note 1)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -1\text{ mA}$	-1	-2.4	-3.5	V
		$T_J = 125^\circ\text{C}$	-0.6	-2.1	-3.2	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -0.5\text{ A}$		3.6	10	$\Omega$
		$T_J = 125^\circ\text{C}$		5.9	16	
		$V_{GS} = -4.5\text{ V}, I_D = -0.25\text{ A}$		5.2	20	
		$T_J = 125^\circ\text{C}$		7.9	30	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -10\text{ V}$	-0.6	-1.6		A
		$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}$		-0.35		
$g_{FS}$	Forward Transconductance	$V_{DS} = -10\text{ V}, I_D = -0.1\text{ A}$	70	170		mS
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		40	60	pF
$C_{oss}$	Output Capacitance			11	25	pF
$C_{rss}$	Reverse Transfer Capacitance			3.2	5	pF
<b>SWITCHING CHARACTERISTICS</b> (Note 1)						
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = -25\text{ V}, I_D = -0.18\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 25\ \Omega$		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	$V_{DS} = -48\text{ V},$ $I_D = -0.5\text{ A}, V_{GS} = -10\text{ V}$		1.43		nC
$Q_{gs}$	Gate-Source Charge			0.6		nC
$Q_{gd}$	Gate-Drain Charge			0.25		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
$I_S$	Maximum Continuous Source Current				-0.18	A
$I_{SM}$	Maximum Pulse Source Current (Note 1)				-1	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -0.5\text{ A}$ (Note 1)		-1.2	-1.5	V
		$T_J = 125^\circ\text{C}$		-0.98	-1.3	
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = -0.5\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$		40		ns
$I_{rr}$	Reverse Recovery Current			2.8		A

Note:

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

## Typical Electrical Characteristics

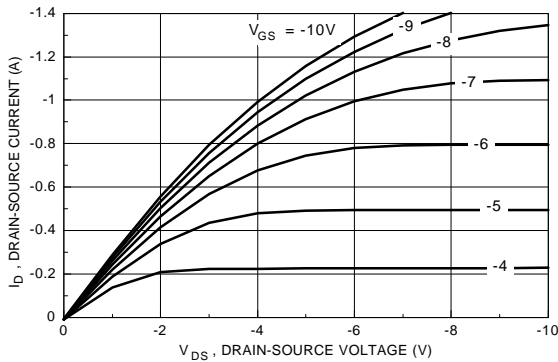


Figure 1. On-Region Characteristics

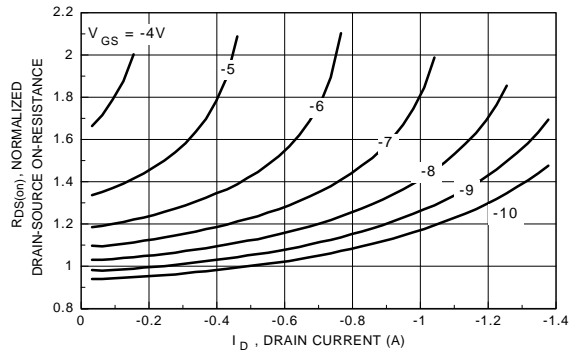


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

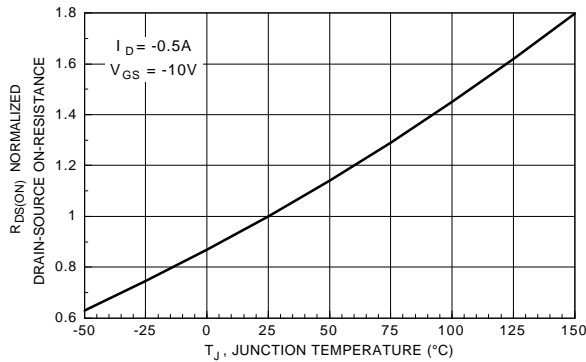


Figure 3. On-Resistance Variation with Temperature

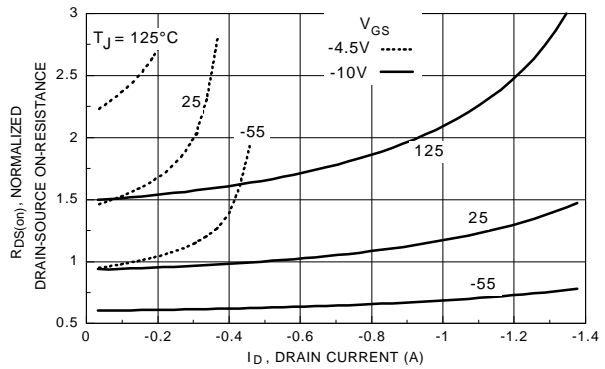


Figure 4. On-Resistance Variation with Drain Current and Temperature

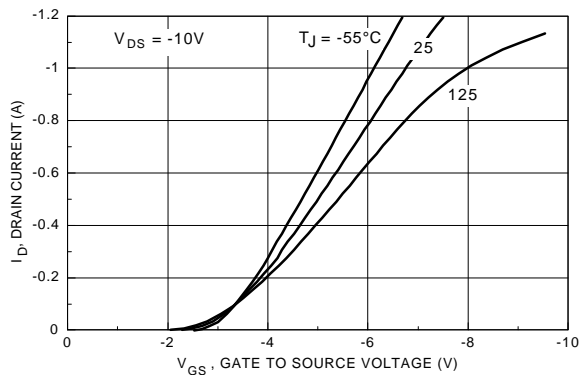


Figure 5. Transfer Characteristics

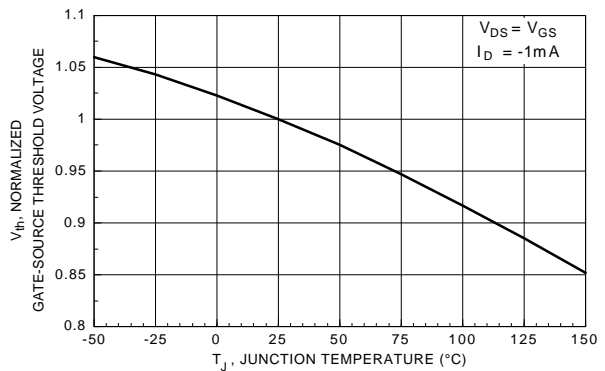
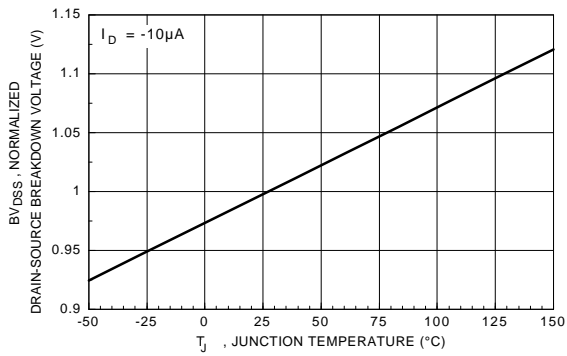
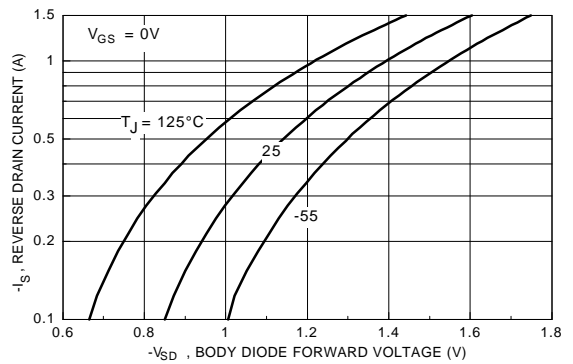


Figure 6. Gate Threshold Variation with Temperature

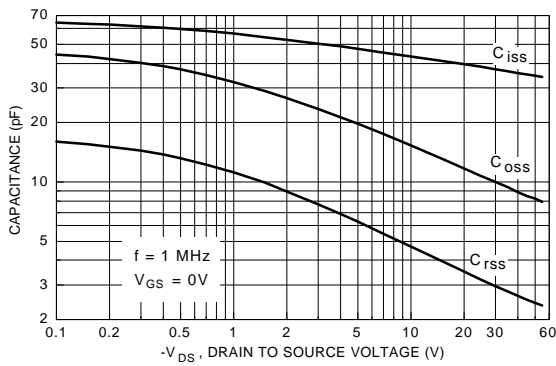
## Typical Electrical Characteristics (continued)



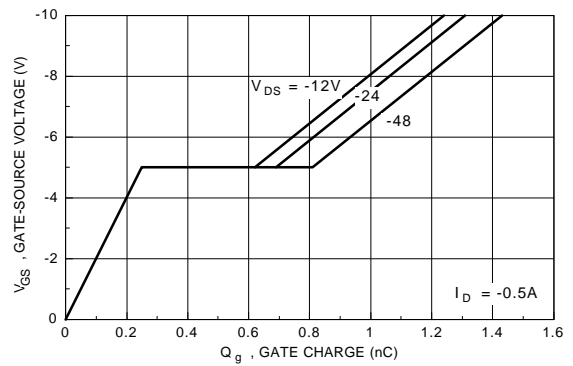
**Figure 7. Breakdown Voltage Variation with Temperature**



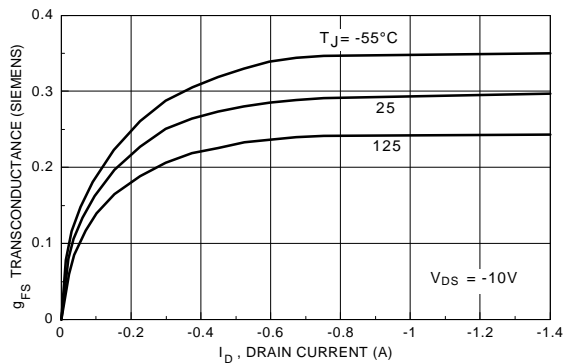
**Figure 8. Body Diode Forward Voltage Variation with Current and Temperature**



**Figure 9. Capacitance Characteristics**



**Figure 10. Gate Charge Characteristics**



**Figure 11. Transconductance Variation with Drain Current and Temperature**

Typical Electrical Characteristics (continued)

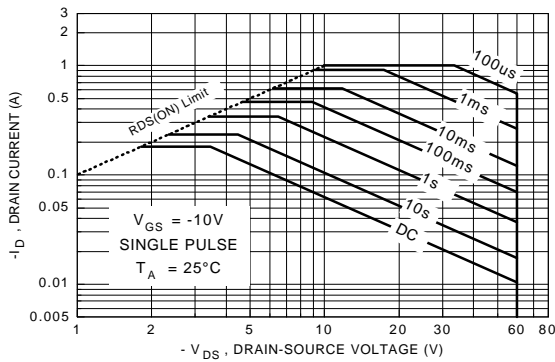


Figure 12. NDF0610 (TO-92) Maximum Safe Operating Area

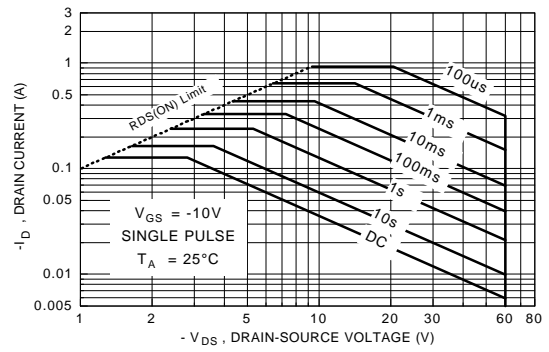


Figure 13. NDS0610 (SOT-23) Maximum Safe Operating Area

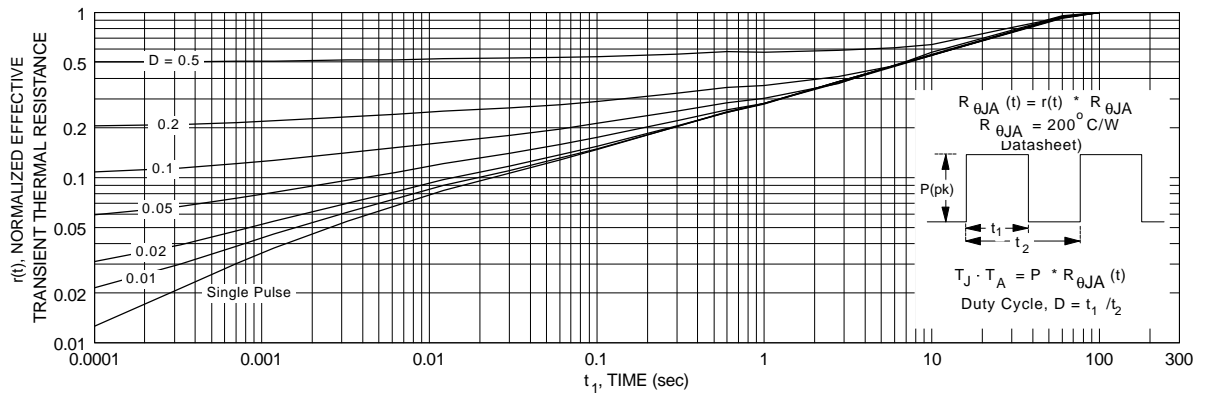


Figure 14. NDF0610 (TO-92) Transient Thermal Response Curve.

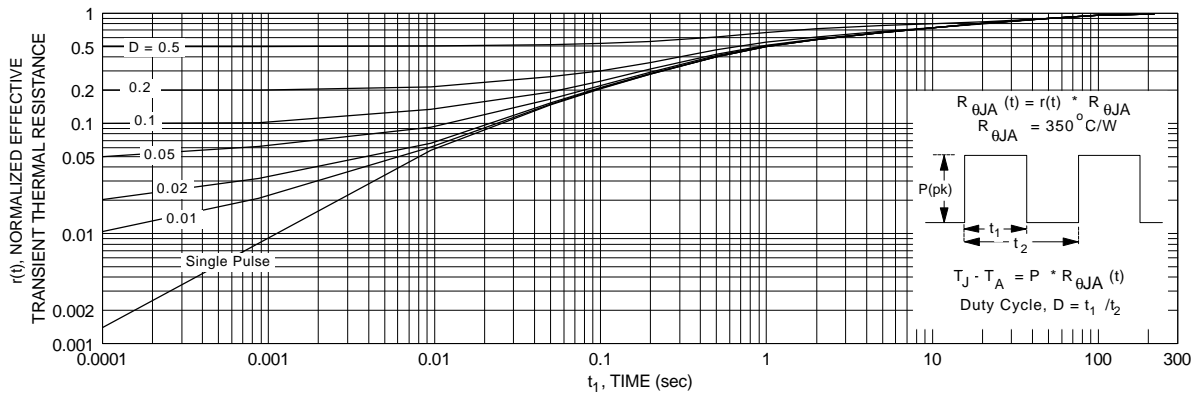


Figure 15. NDS0610 (SOT-23) Transient Thermal Response Curve.