FAIRCHILD
SEMICONDUCTOR TM

May 1994

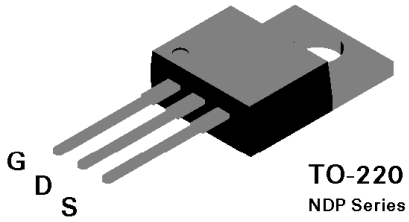
NDP610A / NDP610AE / NDP610B / NDP610BE
NDB610A / NDB610AE / NDB610B / NDB610BE
N-Channel Enhancement Mode Field Effect Transistor

General Description

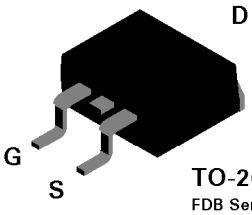
These N-channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulses in the avalanche and commutation modes. These devices are particularly suited for low voltage applications such as automotive, DC/DC converters, PWM motor controls, and other battery powered circuits where fast switching, low in-line power loss, and resistance to transients are needed.

Features

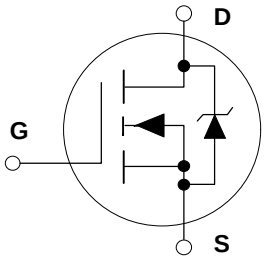
- 26 and 24A, 100V. $R_{DS(ON)}$ = 0.065 and 0.080Ω.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- 175°C maximum junction temperature rating.
- High density cell design (3 million/in²) for extremely low $R_{DS(ON)}$.
- TO-220 and TO-263 (D^2PAK) package for both through hole and surface mount applications.



TO-220
NDP Series



TO-263AB
FDB Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	NDP610A NDP610AE NDB610A NDB610AE	NDP610B NDP610BE NDB610B NDB610BE	Units
V_{DSS}	Drain-Source Voltage	100		V
V_{DGR}	Drain-Gate Voltage (R_{GS} ≤ 1 MΩ)	100		V
V_{GSS}	Gate-Source Voltage - Continuous	±20		V
	- Nonrepetitive (t_P < 50 µs)	±40		V
I_D	Drain Current - Continuous	26	24	A
	- Pulsed	104	96	A
P_D	Total Power Dissipation @ T_C = 25°C	100		W
	Derate above 25°C	0.67		W/°C
T_J,T_{STG}	Operating and Storage Temperature Range	-65 to 175		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	275		°C

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
DRAIN-SOURCE AVALANCHE RATINGS (Note 1)							
E_{AS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 25 V, I_D = 26 A	NDP610AE NDP610BE NDB610AE NDB610BE			250	mJ
I_{AR}	Maximum Drain-Source Avalanche Current					26	A
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	ALL	100			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 100 V, V_{GS} = 0 V	ALL			250	µA
		T_J = 125°C				1	mA
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	V_{DS} = V_{GS}, I_D = 250 µA	ALL	2	3	4	V
		T_J = 125°C		1.4	2.3	3.2	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 13 A	NDP610A NDP610AE NDB610A		0.048	0.065	Ω
		T_J = 125°C	NDB610AE		0.086	0.13	Ω
		V_{GS} = 10 V, I_D = 12 A	NDP610B NDP610BE NDB610B			0.08	Ω
		T_J = 125°C	NDB610BE			0.16	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V	NDP610A NDP610AE NDB610A NDB610AE	26			A
			NDP610B NDP610BE NDB610B NDB610BE	24			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 13 A	ALL	10	16		S
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	ALL		1430	1800	pF
C_{oss}	Output Capacitance		ALL		280	500	pF
C_{rss}	Reverse Transfer Capacitance		ALL		85	200	pF

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS (Note 2)							
$t_{D(ON)}$	Turn - On Delay Time	V_{DD} = 50 V, I_D = 26 A, V_{GS} = 10 V, R_{GEN} = 7.5 Ω	ALL		11	20	nS
t_r	Turn - On Rise Time		ALL		72	120	nS
$t_{D(OFF)}$	Turn - Off Delay Time		ALL		40	65	nS
t_f	Turn - Off Fall Time		ALL		52	85	nS
Q_g	Total Gate Charge	V_{DS} = 80 V, I_D = 26 A, V_{GS} = 10V	ALL		47	65	nC
Q_{gs}	Gate-Source Charge		ALL		8		nC
Q_{gd}	Gate-Drain Charge		ALL		22		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
I_S	Maximum Continuos Drain-Source Diode Forward Current		NDP610A NDP610AE NDB610A NDB610AE			26	A
			NDP610B NDP610BE NDB610B NDB610BE			24	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		NDP610A NDP610AE NDB610A NDB610AE			104	A
			NDP610B NDP610BE NDB610B NDB610BE			96	A
V_{SD} (Note 2)	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 13 A	ALL		0.88	1.3	V
		T_J = 125°C			0.83	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 26 A, dI_S/dt = 100 A/µs	ALL		108	155	ns
I_{rr}	Reverse Recovery Current		ALL		7.4	11	A
THERMAL CHARACTERISTICS							
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		ALL			1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient		ALL			62.5	°C/W

Notes:
1. NDP610A/610B and NDB610A/610B are not rated for operation in avalanche mode.
2. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

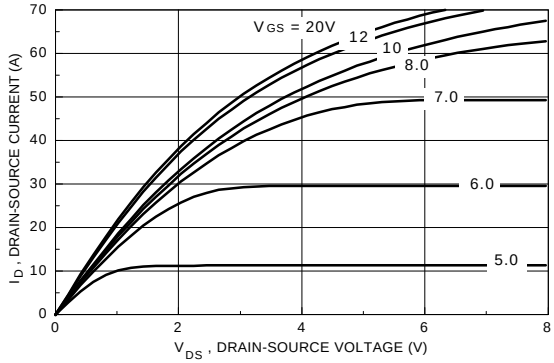


Figure 1. On-Region Characteristics.

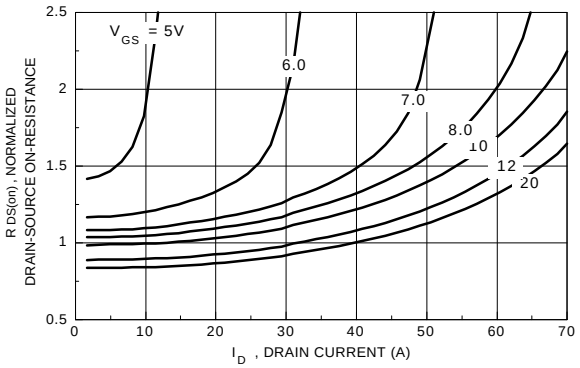


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

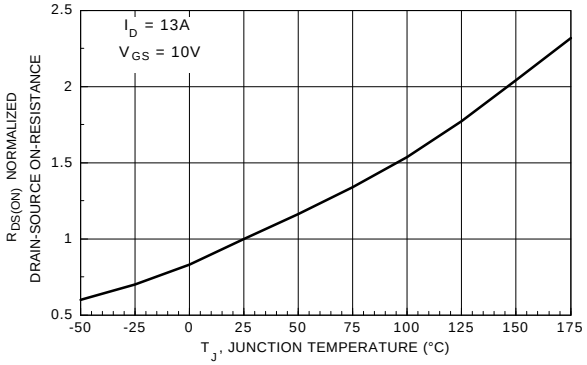


Figure 3. On-Resistance Variation with Temperature.

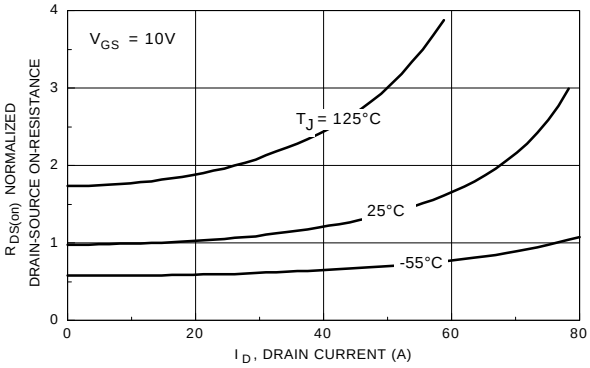


Figure 4. On-Resistance Variation with Drain Current and Temperature.

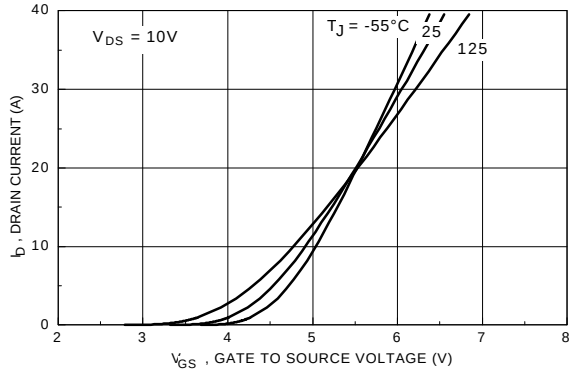


Figure 5. Transfer Characteristics.

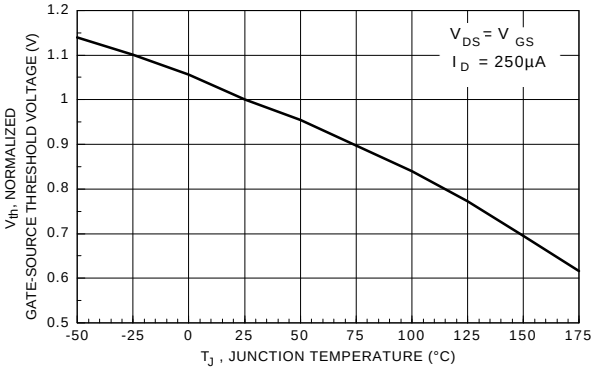


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

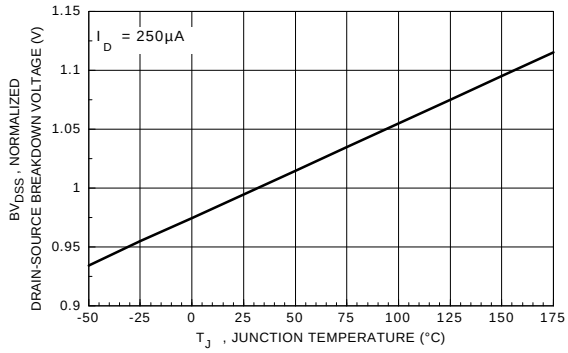


Figure 7. Breakdown Voltage Variation with Temperature.

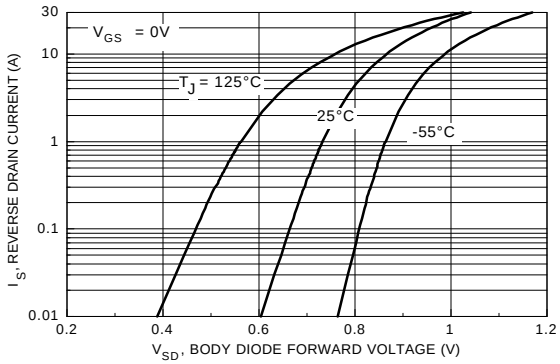


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

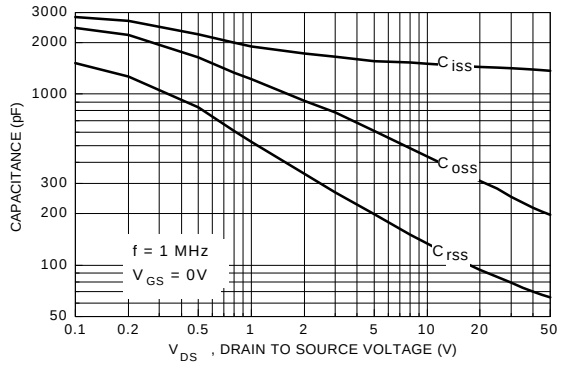


Figure 9. Capacitance Characteristics.

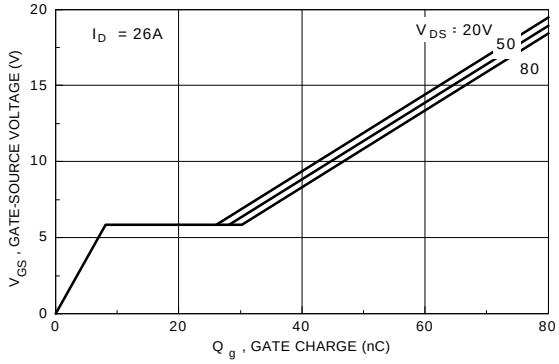


Figure 10. Gate Charge Characteristics.

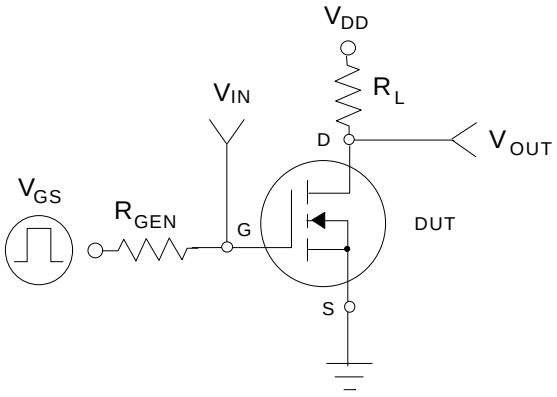


Figure 36. Switching Test Circuit.

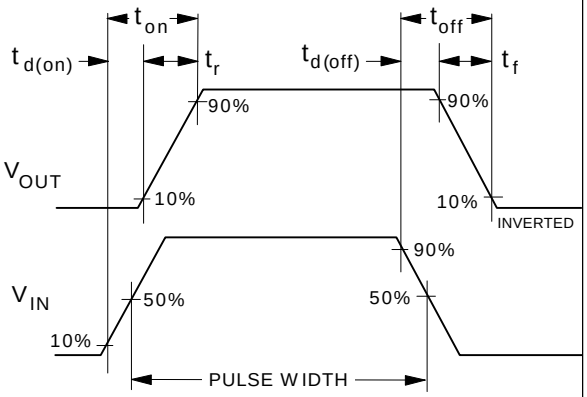


Figure 12. Switching Waveforms.

Typical Electrical Characteristics (continued)

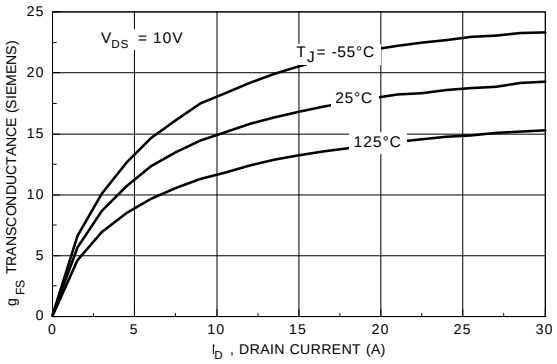


Figure 13. Transconductance Variation with Drain Current and Temperature.

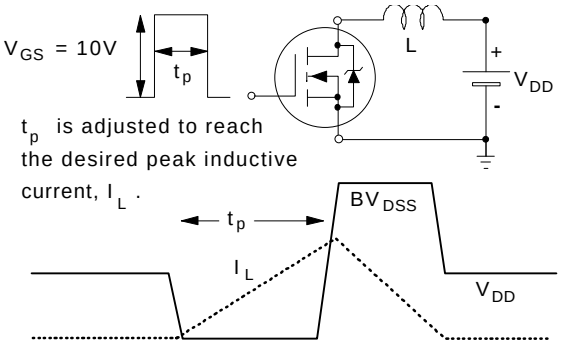


Figure 14. Unclamped Inductive Load Circuit and Waveforms.

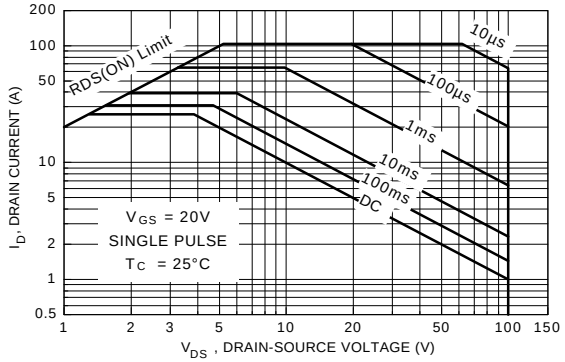


Figure 15. Maximum Safe Operating Area.

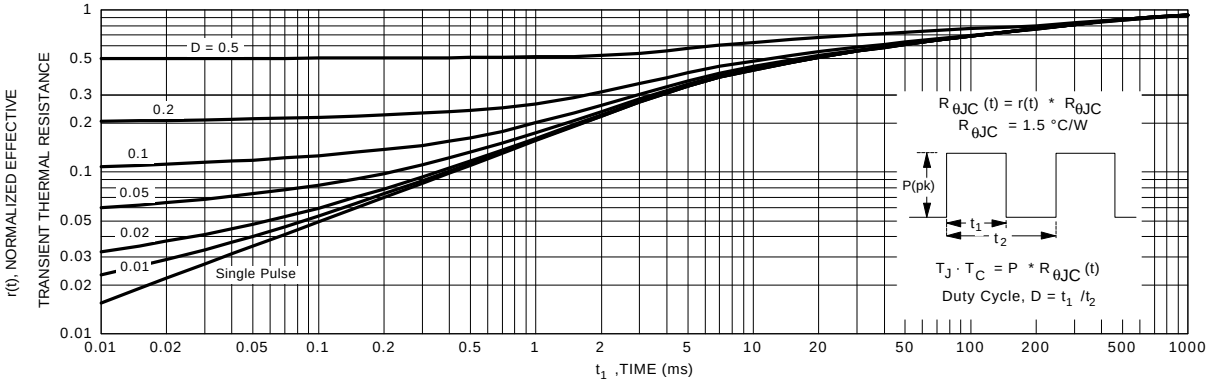


Figure 16. Transient Thermal Response Curve.