**FAIRCHILD**

SEMICONDUCTOR ™

NDP603AL / NDB603AL
N-Channel Logic Level Enhancement Mode Field Effect Transistor

General Description

These N-Channel logic level enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. These devices are particularly suited for low voltage applications such as DC/DC converters and high efficiency switching circuits where fast switching, low in-line power loss, and resistance to transients are needed.

Features

- 25A, 30V. $R_{DS(ON)}$ = 0.022Ω @ V_{GS}=10V.

- Critical DC electrical parameters specified at elevated temperature.

- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.

- High density cell design for extremely low $R_{DS(ON)}$.

- 175°C maximum junction temperature rating.

TO-220
NDP Series

TO-263AB
FDB Series

D

G

S
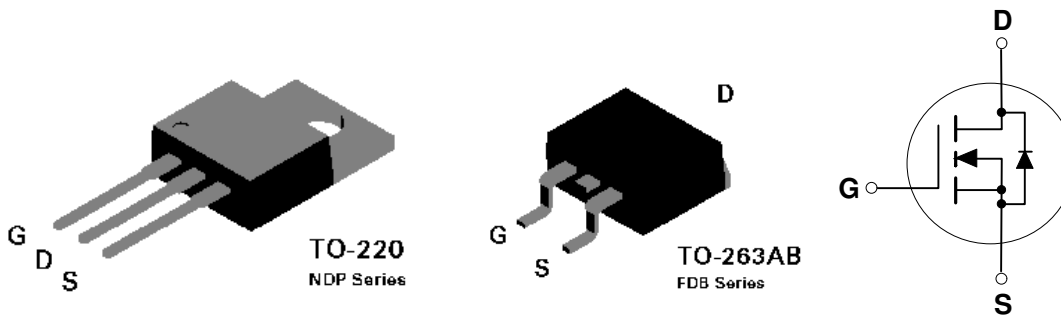
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	NDP603AL	NDB603AL	Units
V_{DSS}	Drain-Source Voltage	30		V
V_{GSS}	Gate-Source Voltage - Continuous	± 20		V
I_D	Drain Current - Continuous	25 (Note 1)		A
	- Pulsed	100		
P_D	Total Power Dissipation @ T_C = 25°C	50		W
	Derate above 25°C	0.4		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
THERMAL CHARACTERISTICS				
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.5		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5		°C/W

Electrical Characteristics (T$_C$ = 25°C unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DRAIN-SOURCE AVALANCHE RATINGS (Note 2)							
W$_{DSS}$	Single Pulse Drain-Source Avalanche Energy	V$_{DD}$ = 15 V, I$_D$ = 25 A				100	mJ
I$_{AR}$	Maximum Drain-Source Avalanche Current					25	A
OFF CHARACTERISTICS							
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$ = 0 V, I$_D$ = 250 µA		30			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$ = 24 V, V$_{GS}$ = 0 V				10	µA
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	1.5	3	V
			T$_J$ = 125°C	0.7	1.1	2.2	
		V$_{DS}$ = V$_{GS}$, I$_D$ = 10 mA		1.4	1.85	3	
			T$_J$ = 125°C	1	1.5	2.2	
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$ = 10 V, I$_D$ = 25 A			0.019	0.022	Ω
			T$_J$ = 125°C		0.028	0.045	
		V$_{GS}$ = 4.5 V, I$_D$ = 10 A			0.031	0.04	
I$_{D(on)}$	On-State Drain Current	V$_{GS}$ = 10 V, V$_{DS}$ = 10 V		60			A
		V$_{GS}$ = 4.5 V, V$_{DS}$ = 10 V		15			
g$_{FS}$	Forward Transconductance	V$_{DS}$ = 10 V, I$_D$ = 25 A			18		S
DYNAMIC CHARACTERISTICS							
C$_{iss}$	Input Capacitance	V$_{DS}$ = 15 V, V$_{GS}$ = 0 V, f = 1.0 MHz			1100		pF
C$_{oss}$	Output Capacitance				540		pF
C$_{rss}$	Reverse Transfer Capacitance				175		pF
SWITCHING CHARACTERISTICS (Note 2)							
t$_{D(on)}$	Turn - On Delay Time	V$_{DD}$ = 15 V, I$_D$ = 25 A, V$_{GS}$ = 10 V, R$_{GEN}$ = 24 Ω			15	30	ns
t$_r$	Turn - On Rise Time				70	110	ns
t$_{D(off)}$	Turn - Off Delay Time				90	150	ns
t$_f$	Turn - Off Fall Time				80	130	ns
Q$_g$	Total Gate Charge	V$_{DS}$ = 10 V, I$_D$ = 25 A, V$_{GS}$ = 10 V			28	40	nC
Q$_{gs}$	Gate-Source Charge				5	7	nC
Q$_{gd}$	Gate-Drain Charge				7	10	nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
I$_S$	Maximum Continuous Drain-Source Diode Forward Current					25	A
V$_{SD}$	Drain-Source Diode Forward Voltage	V$_{GS}$ = 0 V, I$_S$ = 25 A (Note 2)				1.3	V

Note:
1. Maximum DC current limited by the package.
2. Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2.0%.
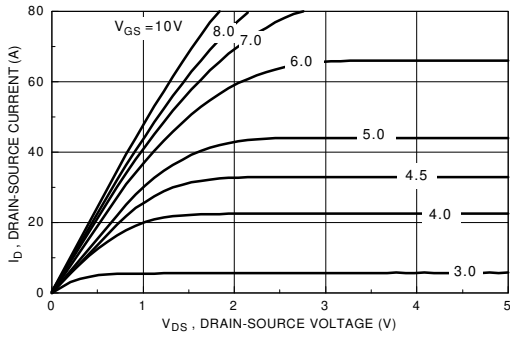
Typical Electrical Characteristics

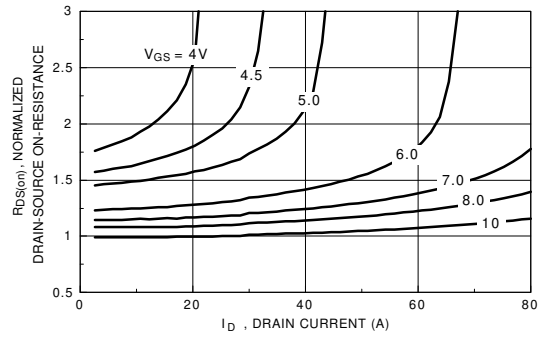Figure 1. On-Region Characteristics.

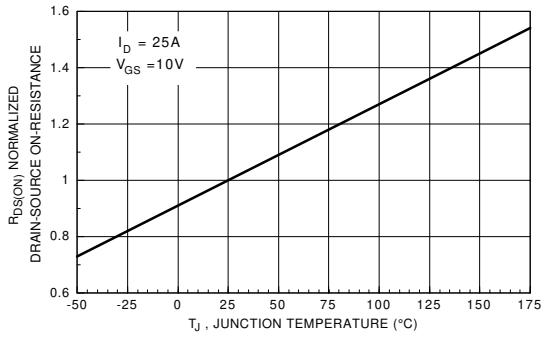Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

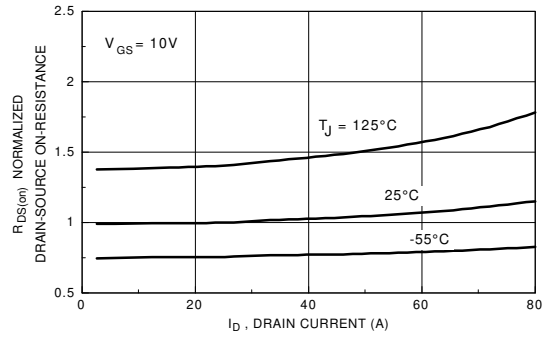Figure 3. On-Resistance Variation with Temperature.

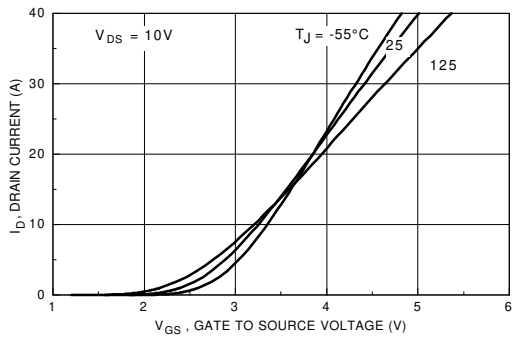Figure 4. On-Resistance Variation with Drain Current and Temperature.

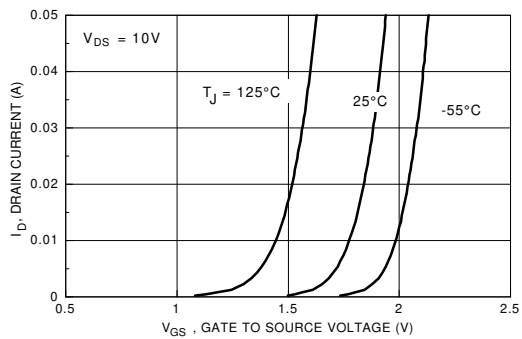Figure 5.   Drain Current Variation with Gate Voltage and Temperature.

Figure 6.   Sub-threshold Drain Current Variation with Gate Voltage and Temperature.

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Typical Electrical Characteristics (continued)
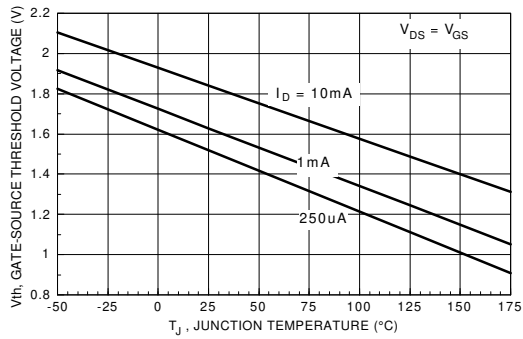
Figure 7. Gate Threshold Variation with Temperature
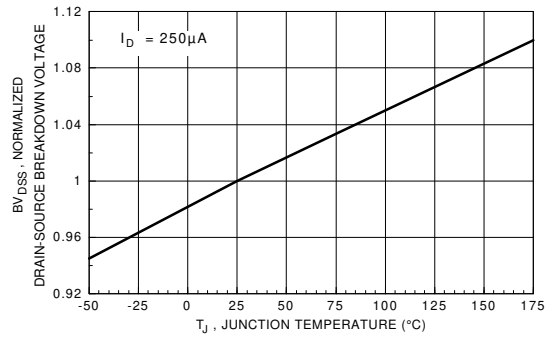
Figure 8. Breakdown Voltage Variation with Temperature.
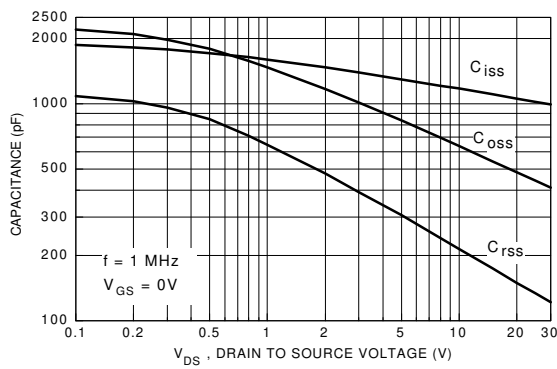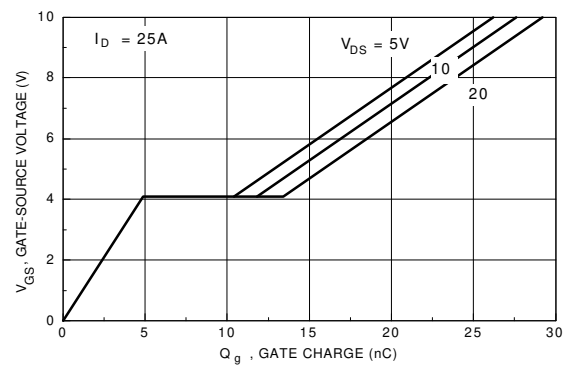

Figure 9. Capacitance Characteristics.
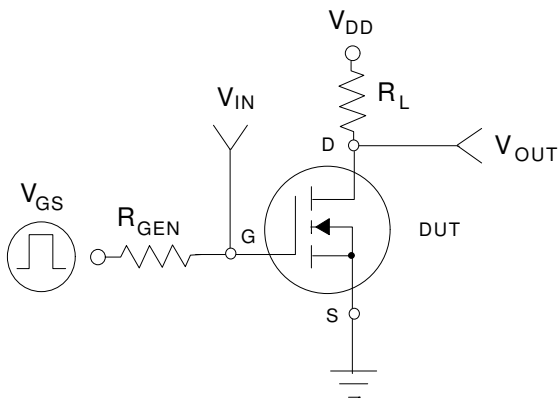

Figure 10. Gate Charge Characteristics.

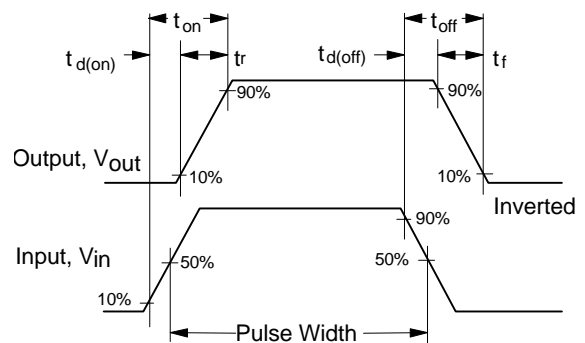**Figure 11. Switching Test Circuit**

Figure 12. Switching Waveforms

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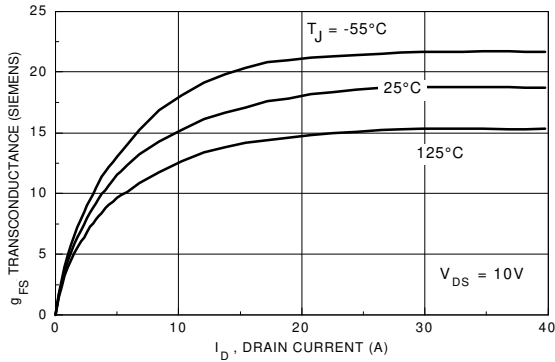## Typical Electrical Characteristics (continued)

Figure 13. Transconductance Variation with Drain Current and Temperature

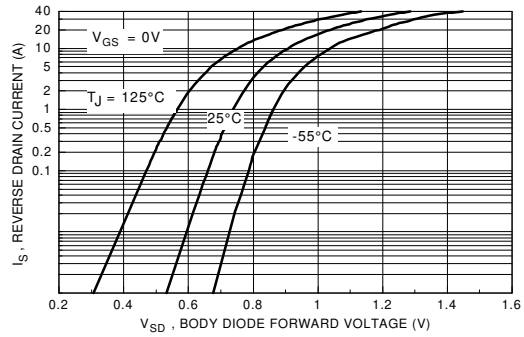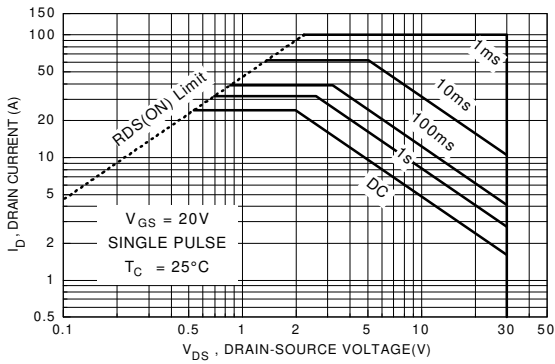**Figure 14. Body Diode Forward Voltage Variation with Current and Temperature**

Figure 15. Maximum Safe Operating Area

$$R_{\theta JC}(t) = r(t) * R_{\theta JC}$$
$$R_{\theta JC} = 2.5 \ °C/W$$

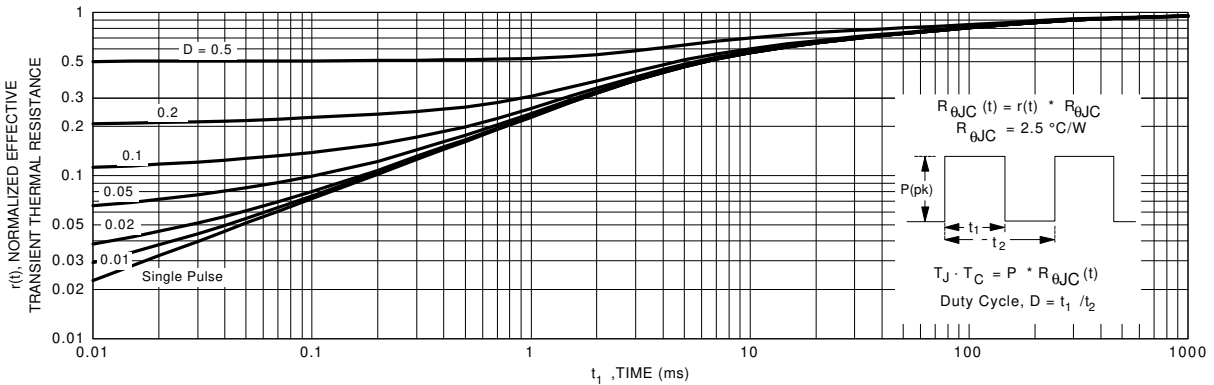$$T_J \cdot T_C = P * R_{\theta JC}(t)$$
$$\text{Duty Cycle, } D = t_1 / t_2$$

Figure 16. Transient Thermal Response Curve

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