FAIRCHILD
SEMICONDUCTOR™

May 1997

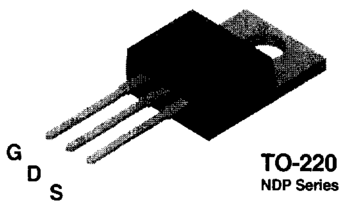
NDP7052L / NDB7052L
N-Channel Logic Level Enhancement Mode Field Effect Transistor

General Description

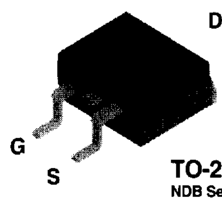
These logic level N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand 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

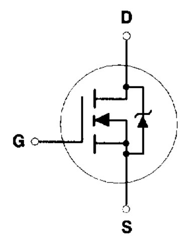
- 75 A, 50 V. $R_{DS(ON)} = 0.010\ \Omega$ @ $V_{GS}= 5$ V
  $R_{DS(ON)} = 0.0075\ \Omega$ @ $V_{GS}= 10$ V.
- Low drive requirements allowing operation directly from logic drivers. $V_{GS(TH)} < 2.0$V.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- 175°C maximum junction temperature rating.
- High density cell design 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
NDB Series



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

Symbol	Parameter	NDP7052L	NDB7052L	Units
V_{DSS}	Drain-Source Voltage	50		V
V_{DGR}	Drain-Gate Voltage ($R_{GS} \leq 1$ MΩ)	50		V
V_{GSS}	Gate-Source Voltage - Continuous	±16		V
	- Nonrepetitive ($t_p < 50$ µs)	±25		
I_D	Drain Current - Continuous	75		A
	- Pulsed	225		
P_D	Maximum Power Dissipation @ $T_C = 25°C$	150		W
	Derate above 25°C	1		W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to 175		°C
THERMAL CHARACTERISTICS				
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1		°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	Unit
DRAIN-SOURCE AVALANCHE RATINGS (Note)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 25 V, I_D = 75 A			550	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				75	A
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	50			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C		0.075		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			250	µA
		T_J = 125°C			1	mA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 16 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -16 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS (Note)						
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold VoltageTemp.Coefficient	I_D = 250 µA, Referenced to 25 °C		-0.005		V/°C
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250 µA	1	1.3	2	V
		T_J = 125°C	0.8	0.85	1.6	
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 5 V, I_D = 37.5 A		0.0085	0.01	Ω
		T_J = 150°C		0.014	0.018	
		V_{GS} = 10 V, I_D = 37.5 A		0.0065	0.0075	
$I_{D(on)}$	On-State Drain Current	V_{GS} = 5 V, V_{DS} = 10 V	60			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 37.5 A		69		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		4030		pF
C_{oss}	Output Capacitance			1260		pF
C_{rss}	Reverse Transfer Capacitance			450		pF
SWITCHING CHARACTERISTICS (Note)						
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 25 V, I_D = 37.5 A, V_{GS} = 5 V, R_{GEN} = 10 Ω, R_{GS} = 10 Ω		25	50	nS
t_r	Turn - On Rise Time			215	400	nS
$t_{D(off)}$	Turn - Off Delay Time			110	200	nS
t_f	Turn - Off Fall Time			170	300	nS
Q_g	Total Gate Charge	V_{DS}= 24 V, I_D = 75 A, V_{GS} = 5 V		92	130	nC
Q_{gs}	Gate-Source Charge			15		nC
Q_{gd}	Gate-Drain Charge			45		nC
DRAIN-SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuos Drain-Source Diode Forward Current				75	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current				180	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 37.5 A (Note)		0.9	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_F = 37.5 A, dI_F/dt = 100 A/µs	40		150	ns
I_{rr}	Reverse Recovery Current		2		10	A

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

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Typical Electrical Characteristics

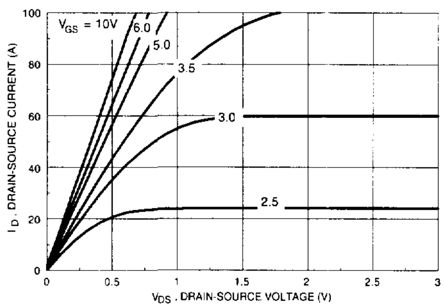

Figure 1. On-Region Characteristics.

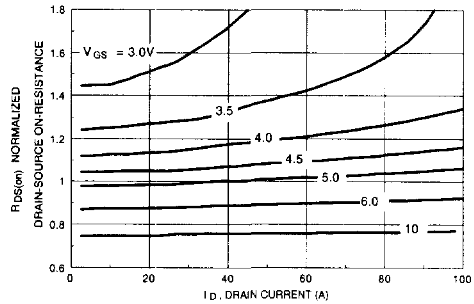

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

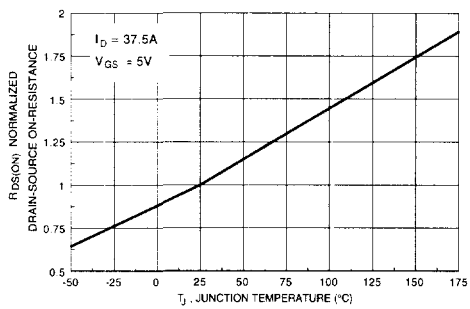

Figure 3. On-Resistance Variation with Temperature.

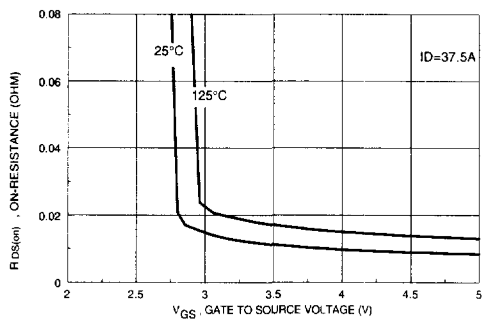

Figure 4. On Resistance Variation with Gate-To- Source Voltage.

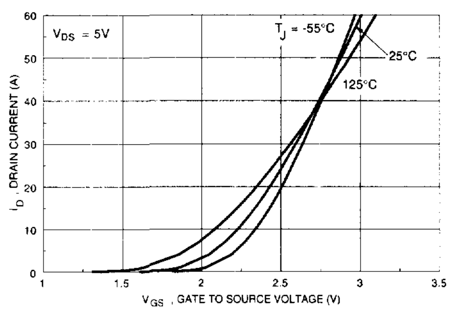

Figure 5. Transfer Characteristics.

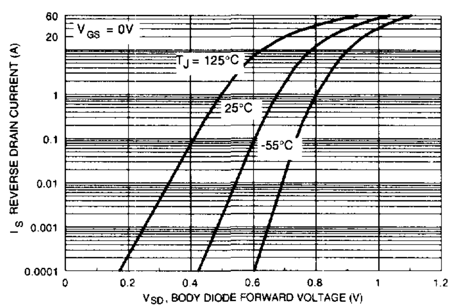

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics (continued)

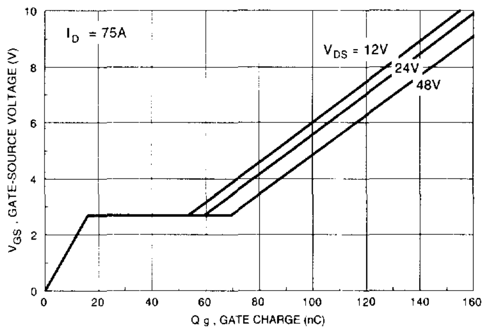

Figure 7. Gate Charge Characteristics.

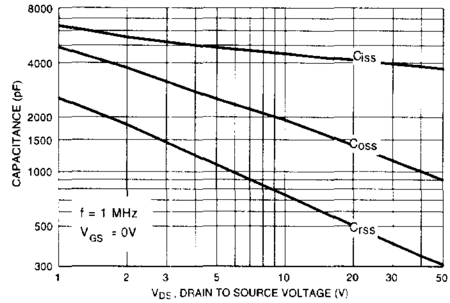

Figure 8.Capacitance Characteristics.

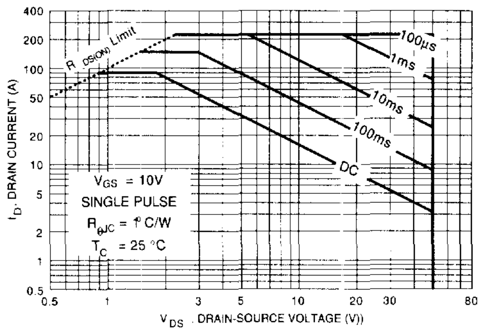

Figure 9. Maximum Safe Operating Area.

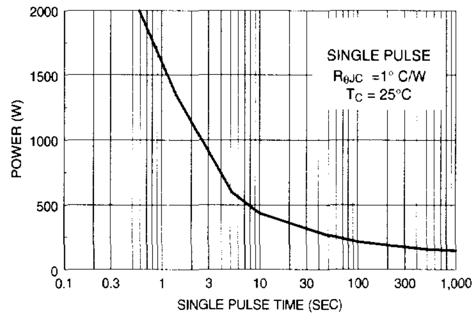

Figure 10. Single Pulse Maximum Power Dissipation.

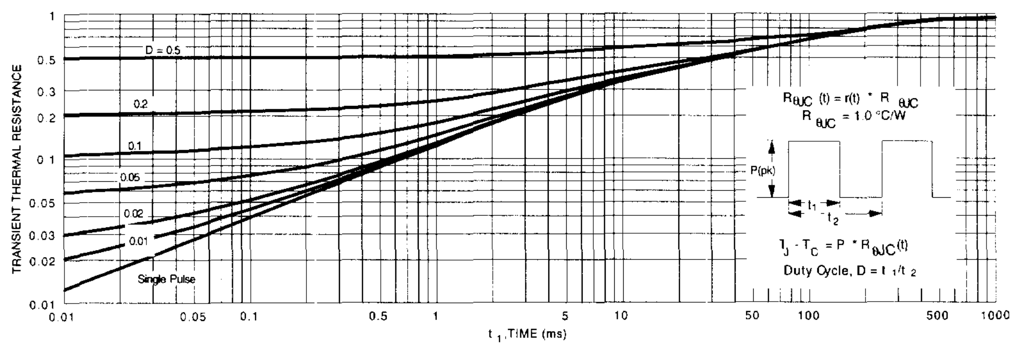

Figure 11. Transient Thermal Response Curve.