

NDP606A / NDP606B

NDB606A / NDB606B

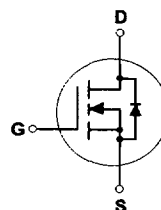
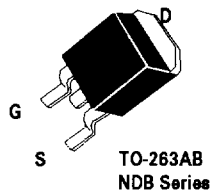
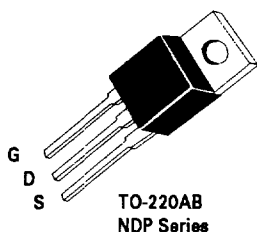
N-Channel Enhancement Mode Field Effect Transistor

General Description

These N-channel enhancement mode power field effect transistors are produced using National'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

- 48 and 42A, 60V. $R_{DS(ON)} = 0.025$ and 0.028Ω .
- 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 for extremely low $R_{DS(ON)}$.
- TO-220 and TO-263 (D²PAK) package for both through hole and surface mount applications.



Absolute Maximum Ratings $T_c = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	NDP606A NDB606A	NDP606B NDB606B	Units
V _{DS}	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)	±40		
I _b	Drain Current - Continuous	48	42	A
	- Pulsed	144	126	
P _D	Total Power Dissipation @ T _C = 25°C	100		W
	Derate above 25°C	0.67		
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 ($T_c = 25^\circ\text{C}$ unless otherwise noted)							
Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	All	60			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 125^\circ\text{C}$	All			250	μA
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	All			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	All			-100	nA
ON CHARACTERISTICS (Note 1)							
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ $T_J = 125^\circ\text{C}$	All	2 1.4	2.6 2	4 3.6	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 24\text{ A}$ $T_J = 125^\circ\text{C}$ $V_{GS} = 10\text{ V}, I_D = 21\text{ A}$ $T_J = 125^\circ\text{C}$	NDP606A NDB606A NDP606B NDB606B		0.022 0.035	0.025 0.04 0.028 0.045	Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$	NDP606A NDB606A NDP606B NDB606B	48 42			A
g_{fs}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 24\text{ A}$	All	10	20		S
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	All		1340	1800	pF
C_{oss}	Output Capacitance		All		550	800	pF
C_{rss}	Reverse Transfer Capacitance		All		225	400	pF

Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise noted)							
Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS (Note 1)							
t_{Don}	Turn - On Delay Time	$V_{\text{DD}} = 30\text{ V}, I_{\text{D}} = 48\text{ A}$ $V_{\text{GS}} = 10\text{ V}, R_{\text{GEN}} = 7.5\ \Omega$	All		11	20	nS
t_r	Turn - On Rise Time		All		143	300	nS
t_{Doff}	Turn - Off Delay Time		All		30	60	nS
t_f	Turn - Off Fall Time		All		75	150	nS
Q_g	Total Gate Charge	$V_{\text{DS}} = 48\text{ V},$ $I_{\text{D}} = 48\text{ A}, V_{\text{GS}} = 10\text{ V}$	All		47	70	nC
Q_{gs}	Gate-Source Charge		All		8		nC
Q_{gd}	Gate-Drain Charge		All		29		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
I_s	Maximum Continuous Drain-Source Diode Forward Current	NDP606A NDB606A				48	A
		NDP606B NDB606B				42	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	NDP606A NDB606A				144	A
		NDP606B NDB606B				126	
V_{SD} (Note 1)	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0\text{ V}, I_s = 24\text{ A}$ $T_j = 125^\circ\text{C}$	All		0.96	1.3	V
					0.85	1.2	
t_{rr}	Reverse Recovery Time	$V_{\text{GS}} = 0\text{ V}, I_r = 48\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}$	All	35	70	140	ns
I_{rr}	Reverse Recovery Current		All	2	4.3	8	A
THERMAL CHARACTERISTICS							
$R_{\theta\text{JC}}$	Thermal Resistance, Junction-to-Case		All			1.5	$^\circ\text{C}/\text{W}$
$R_{\theta\text{JA}}$	Thermal Resistance, Junction-to-Ambient		All			62.5	$^\circ\text{C}/\text{W}$
Note: 1. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.							

Typical Electrical Characteristics

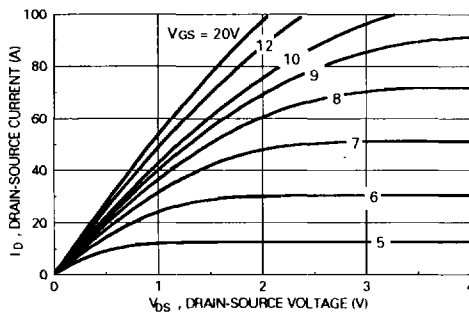


Figure 1. On-Region Characteristics.

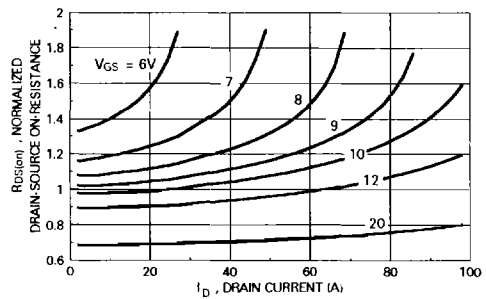


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

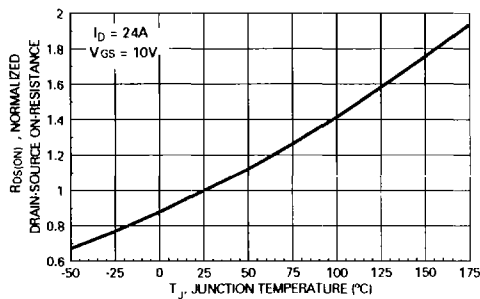


Figure 3. On-Resistance Variation with Temperature.

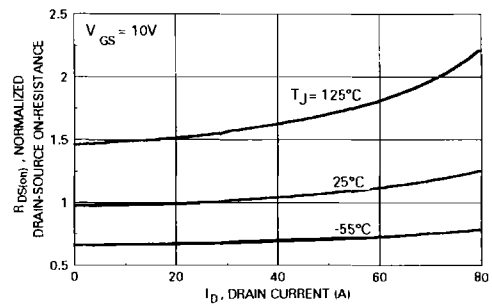


Figure 4. On-Resistance Variation with Drain Current and Temperature.

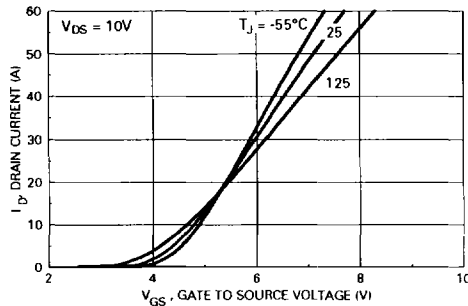


Figure 5. Transfer Characteristics.

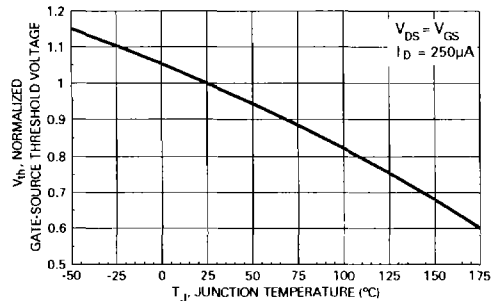


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

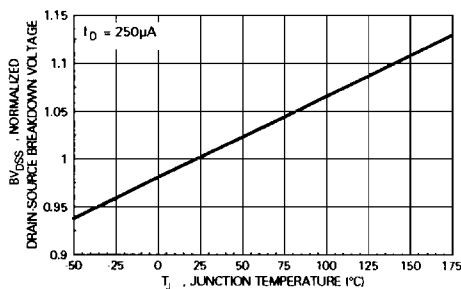


Figure 7. Breakdown Voltage Variation with Temperature.

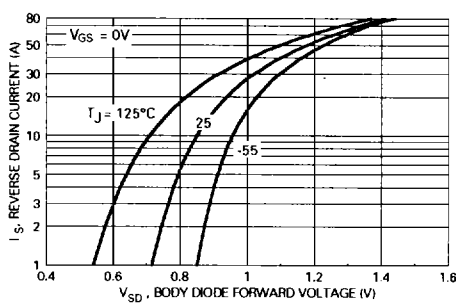


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

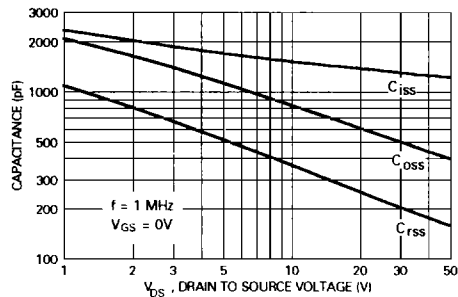


Figure 9. Capacitance Characteristics.

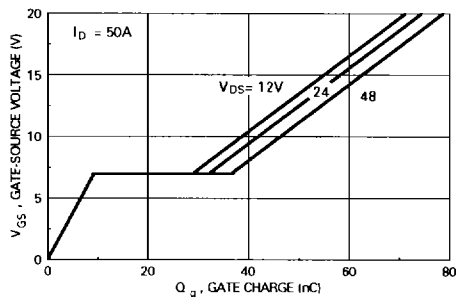


Figure 10. Gate Charge Characteristics.

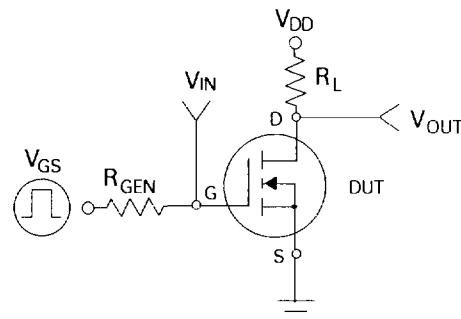


Figure 11. Switching Test Circuit

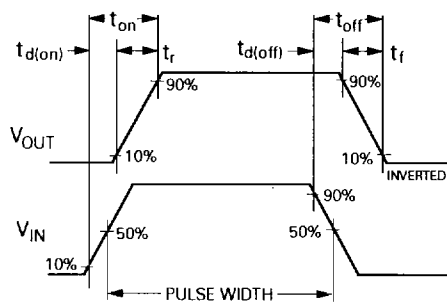


Figure 12. Switching Waveforms.

Typical Electrical Characteristics (continued)

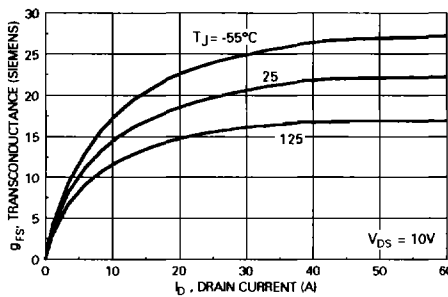


Figure 13. Transconductance Variation with Drain Current and Temperature.

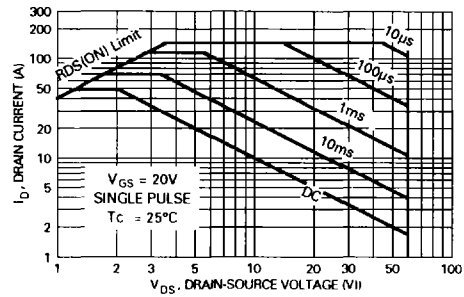


Figure 14. Maximum Safe Operating Area.

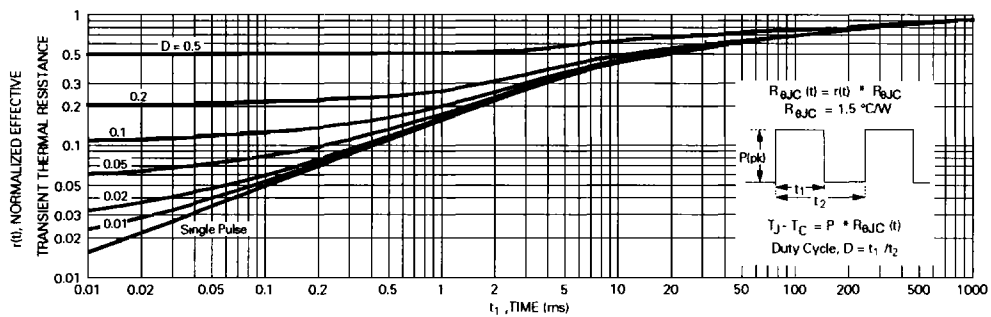


Figure 15. Transient Thermal Response Curve.