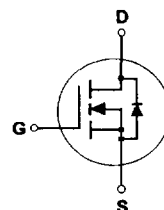
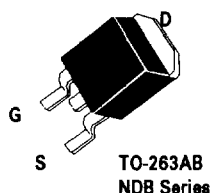
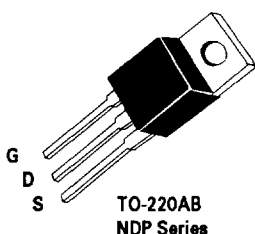


NDP606AL / NDP606BL
NDB606AL / NDB606BL
N-Channel Logic Level Enhancement Mode Field Effect Transistor
General Description

These logic level N-channel enhancement mode power field effect transistors are produced using 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 44A, 60V. $R_{DS(ON)} = 0.025$ and 0.028Ω .
- Low drive requirements allowing operation directly from logic drivers. $V_{GS(TH)} < 2.0V$.
- 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	NDP606AL NDB606AL	NDP606BL NDB606BL	Units
V _{DSS}	Drain-Source Voltage	60		V
V _{DGR}	Drain-Gate Voltage (R _{GS} ≤ 1 MΩ)	60		V
V _{GSS}	Gate-Source Voltage - Continuous	±10		V
	- Nonrepetitive (t _p < 50 μs)	±20		
I _D	Drain Current - Continuous	48	44	A
	- Pulsed	144	132	
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	-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
						1	mA
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 10\text{ V}, V_{DS} = 0\text{ V}$	All			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	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	1	1.4	2	V
				0.65	1	1.5	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 5\text{ V}, I_D = 24\text{ A}$ $T_J = 125^\circ\text{C}$	NDP606AL		0.022	0.025	Ω
			NDB606AL		0.033	0.04	
		$V_{GS} = 5\text{ V}, I_D = 21\text{ A}$ $T_J = 125^\circ\text{C}$	NDP606BL			0.028	
			NDB606BL			0.045	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, I_D = 24\text{ A}$	NDP606AL		0.013	0.018	A
			NDB606AL				
			NDB606BL				
g_{fs}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 24\text{ A}$	All	10	28		S
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	All		1780	2000	pF
C_{oss}	Output Capacitance		All		550	800	pF
C_{rss}	Reverse Transfer Capacitance		All		240	400	pF

Electrical Characteristics (T _c = 25°C unless otherwise noted)							
Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS (Note 1)							
t _{D(on)}	Turn - On Delay Time	V _{DD} = 30 V, I _b = 48 A, V _{GS} = 5 V, R _{GEN} = 15 Ω, R _{GS} = 15 Ω	All		16	30	nS
t _r	Turn - On Rise Time		All		330	500	nS
t _{D(off)}	Turn - Off Delay Time		All		61	100	nS
t _f	Turn - Off Fall Time		All		170	300	nS
Q _g	Total Gate Charge	V _{DS} = 48 V, I _b = 48 A, V _{GS} = 5 V	All		48	60	nC
Q _{gs}	Gate-Source Charge		All		6.6		nC
Q _{gd}	Gate-Drain Charge		All		34		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
I _S	Maximum Continuous Drain-Source Diode Forward Current	NDP606AL				48	A
		NDB606AL					
		NDP606BL				44	
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current	NDP606AL				144	A
		NDB606AL					
		NDP606BL				132	
V _{SD} (Note 1)	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 24 A T _J = 125°C	All		0.95	1.3	V
					0.84	1.2	
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _f = 48 A, di/dt = 100 A/μs	All	35	70	140	ns
I _{rr}	Reverse Recovery Current		All	2	4.4	8	A
THERMAL CHARACTERISTICS							
R _{θJC}	Thermal Resistance, Junction-to-Case		All			1.5	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient		All			62.5	°C/W
Note: 1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.							

Typical Electrical Characteristics

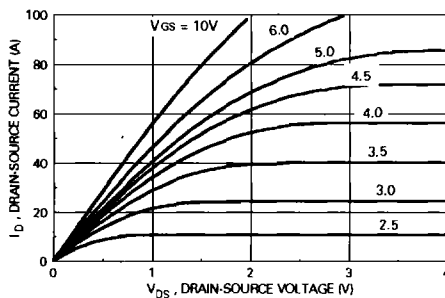


Figure 1. On-Region Characteristics.

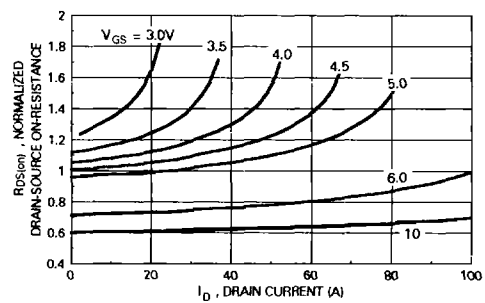


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

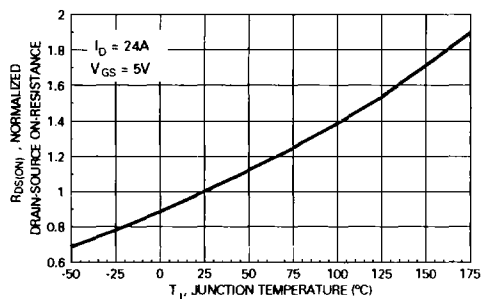


Figure 3. On-Resistance Variation with Temperature.

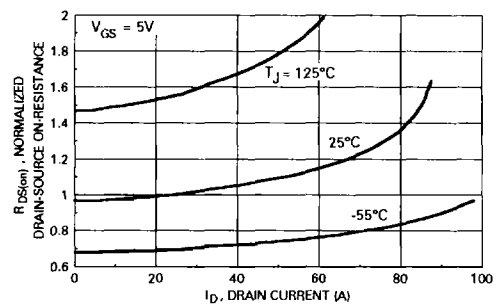


Figure 4. On-Resistance Variation with Drain Current and Temperature.

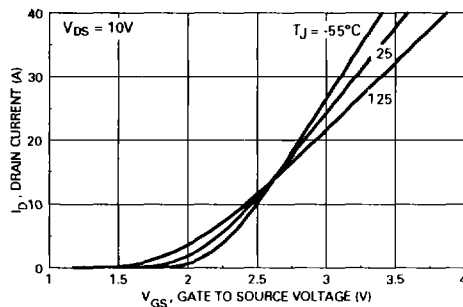


Figure 5. Transfer Characteristics.

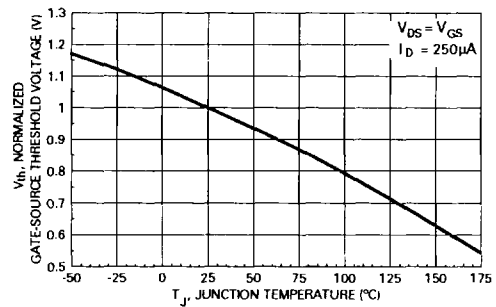


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

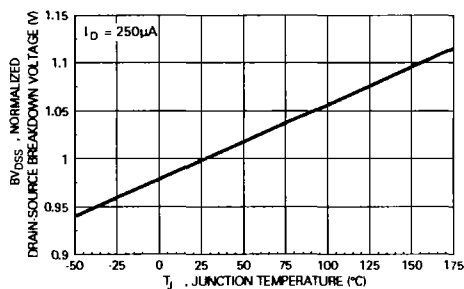


Figure 7. Breakdown Voltage Variation with Temperature.

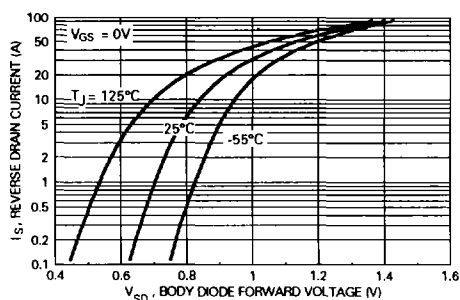


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

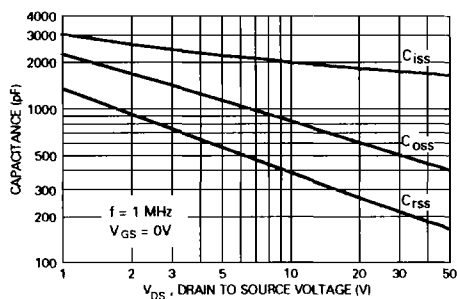


Figure 9. Capacitance Characteristics.

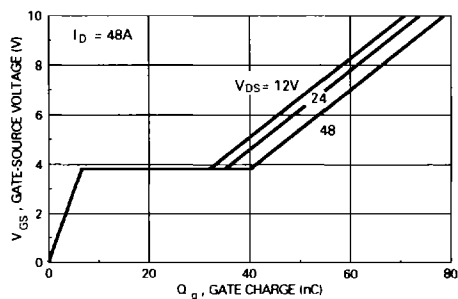


Figure 10. Gate Charge Characteristics.

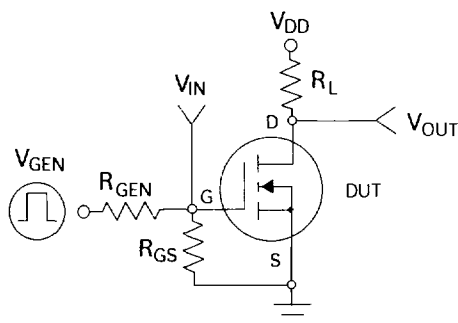


Figure 11. Switching Test Circuit.

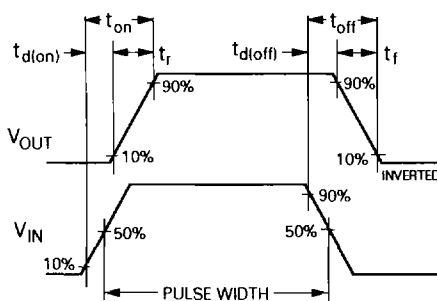


Figure 12. Switching Waveforms.

Typical Electrical Characteristics (continued)

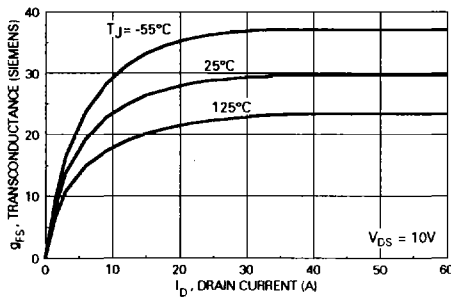


Figure 13. Transconductance Variation with Drain Current and Temperature.

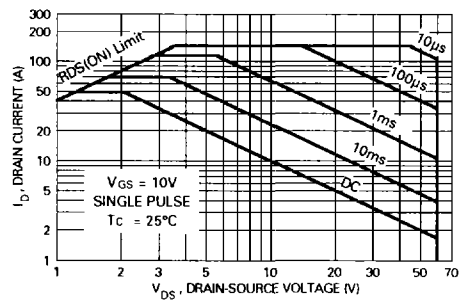


Figure 14. Maximum Safe Operating Area.

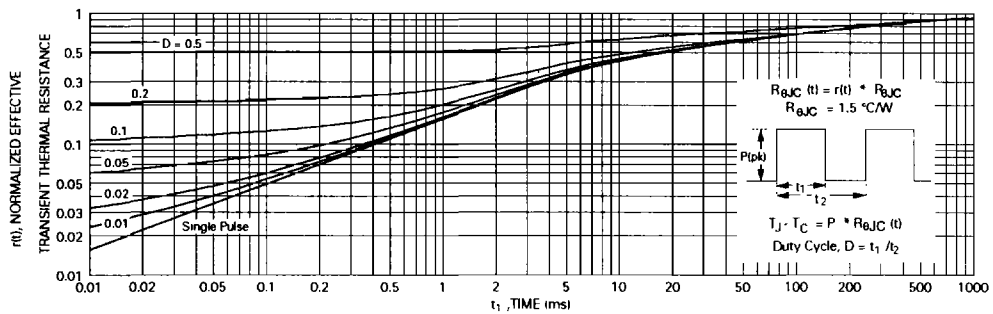


Figure 15. Transient Thermal Response Curve.