

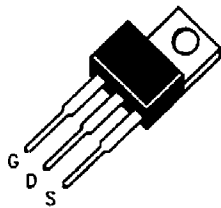
## NDP605A/NDP605B, NDP606A/NDP606B N-Channel Enhancement Mode Power Field Effect Transistor

### General Description

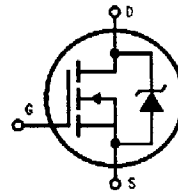
These n-channel enhancement mode power field effect transistors are produced using National's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy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

### Features

- 48 and 42 Amp, 50V and 80V,  $R_{DS(on)} = 0.025\Omega$  and  $0.028\Omega$
- Critical DC electrical parameters specified at elevated temperature
- Rugged internal source-drain diode eliminates the need for external Zener Diode Transient Suppressor
- 175°C maximum junction temperature rating
- Easily paralleled for higher current applications
- High density cell design (3 million/in<sup>2</sup>) for extremely low  $R_{DS(on)}$
- Lower  $R_{DS(on)}$  temperature coefficient



TO-220AB



### Absolute Maximum Ratings

Symbol	Parameter	NDP606A	NDP605A	NDP606B	NDP605B	Units
$V_{DSS}$	Drain-Source Voltage	60	50	60	50	V
$V_{DGR}$	Drain-Gate Voltage ( $R_{GS} = 1\text{ M}\Omega$ )	60	50	60	50	V
$V_{GSS}$	Gate-Source Voltage—Continuous —Non Repetitive ( $t_p < 50\ \mu\text{s}$ )	$\pm 20$ $\pm 40$				V
$I_D$	Drain Current—Continuous —Pulsed	48 144		42 126		A
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	100 0.67				W W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-65 to 175				$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purposes, $\frac{1}{16}$ " from Case for 5 sec.	275				$^\circ\text{C}$



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**Electrical Characteristics**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250 μA	NDP605A NDP605B	50			V
			NDP606A NDP606B	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = Rated Voltage, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C	All			250	μA
		V <sub>DS</sub> = Rated Voltage, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C	All			1.0	mA
I <sub>GSSF</sub>	Gate-Body Leakage, Forward	V <sub>GS</sub> = 20V	All			100	nA
I <sub>GSSR</sub>	Gate-Body Leakage, Reverse	V <sub>GS</sub> = -20V	All			-100	nA
<b>ON CHARACTERISTICS</b>							
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 μA	All	T <sub>J</sub> = 25°C	2.0	4.0	V
				T <sub>J</sub> = 125°C	1.4	3.6	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	T <sub>J</sub> = 25°C V <sub>GS</sub> = 10V	I <sub>D</sub> = 24A	NDP605A NDP606A	0.020	0.025	Ω
			I <sub>D</sub> = 21A	NDP605B NDP606B		0.028	Ω
		T <sub>J</sub> = 125°C V <sub>GS</sub> = 10V	I <sub>D</sub> = 24A	NDP605A NDP606A	0.030	0.038	Ω
			I <sub>D</sub> = 21A	NDP605B NDP606B		0.048	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5 Rated I <sub>D</sub>	All	10	18		mhos
<b>DYNAMIC CHARACTERISTICS</b>							
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V f = 1 MHz	All		1375	1800	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		All		300	400	pF
C <sub>oss</sub>	Output Capacitance		All		620	800	pF
<b>SWITCHING CHARACTERISTICS</b>							
t <sub>D(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 25V, I <sub>D</sub> = 0.5 Rated I <sub>D</sub> , R <sub>GEN</sub> = 7.5Ω V <sub>GS</sub> = 10V	All		16	30	ns
t <sub>r</sub>	Rise Time		All		80	120	ns
t <sub>D(off)</sub>	Turn-Off Delay Time		All		30	60	ns
t <sub>f</sub>	Fall Time		All		55	100	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 0.8 Rated V <sub>DSS</sub> , I <sub>D</sub> = Rated I <sub>D</sub> , V <sub>GS</sub> = 10V	All		60		nC
Q <sub>gs</sub>	Gate-Source Charge		All		6		nC
Q <sub>gd</sub>	Gate-Drain Charge		All		32		nC

### Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted (Continued)

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>SOURCE-DRAIN DIODE CHARACTERISTICS</b>							
$I_S$	Maximum Continuous Source Current		NDP605A NDP606A			48	A
			NDP605B NDP606B			42	A
$I_{SM}$	Maximum Pulsed Source Current		NDP605A NDP606A			144	A
			NDP605B NDP606B			126	A
$V_{SD}$	Diode Forward Voltage	$I_S = 0.5 \text{ Rated } I_S$ $V_{GS} = 0V$	$T_J = 25^\circ\text{C}$	All		1.3	V
			$T_J = 125^\circ\text{C}$	All		1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0V, I_S = 0.5 \text{ Rated } I_S$ $di_S/dt = 100 \text{ A}/\mu\text{s}$	All		85		ns
$I_{rr}$	Reverse Recovery Current		All		4.8		A
<b>THERMAL CHARACTERISTICS</b>							
$R_{\theta JC}$	Thermal Resistance, Junction to Case					1.50	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient					62.5	$^\circ\text{C}/\text{W}$

### Typical Electrical Characteristics

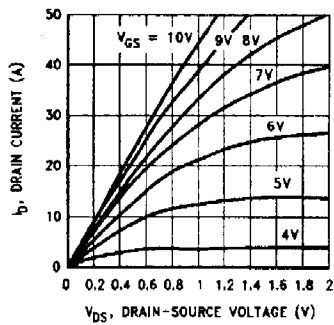


FIGURE 1. On-Region Characteristics

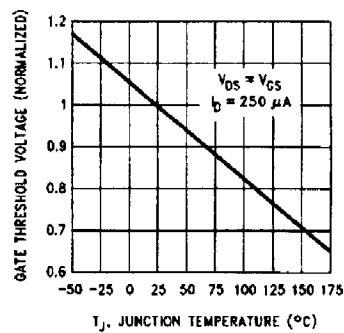


FIGURE 2. Gate Threshold Variation with Temperature