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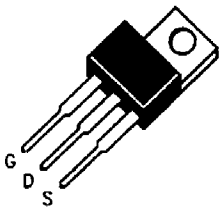
NDP605A/NDP605B, NDP606A/NDP606B
N-Channel Enhancement Mode Power Field Effect Transistor

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 60V, $R_{DS(on)}$ = 0.025Ω and 0.028Ω
- 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/in²) for extremely low $R_{DS(on)}$
- Lower $R_{DS(on)}$ temperature coefficient



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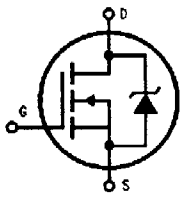

Absolute Maximum Ratings

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 MΩ)	60	50	60	50	V
V_{GSS}	Gate-Source Voltage—Continuous —Non Repetitive (t_p < 50 μs)	±20 ±40				V
I_D	Drain Current—Continuous —Pulsed	48 144		42 126		A
P_D	Total Power Dissipation @ T_C = 25°C Derate Above 25°C	100 0.67				W 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 sec.	275				°C

Electrical Characteristics T_C = 25°C unless otherwise noted

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

Electrical Characteristics T_C = 25°C unless otherwise noted (Continued)

Symbol	Parameter	Test Conditions		Type	Min	Typ	Max	Units
SOURCE-DRAIN DIODE CHARACTERISTICS								
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 Rated I_S, V_{GS} = 0V	T_J = 25°C	All			1.3	V
			T_J = 125°C	All			1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 0.5 Rated I_S, dI_S/dt = 100 A/μs		All		85		ns
I_{rr}	Reverse Recovery Current			All		4.8		A
THERMAL CHARACTERISTICS								
$R_{\theta JC}$	Thermal Resistance, Junction to Case						1.50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient						62.5	°C/W

Typical Electrical Characteristics

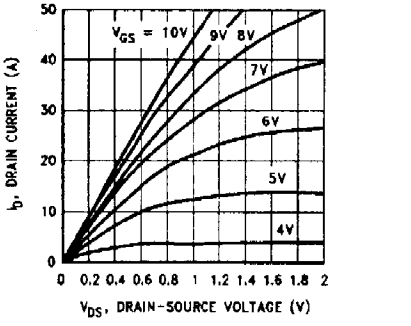

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FIGURE 1. On-Region Characteristics

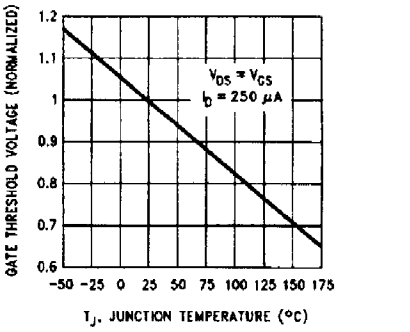

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FIGURE 2. Gate Threshold Variation with Temperature