

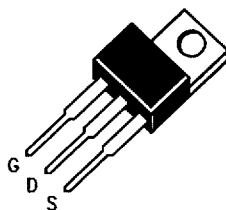
NDP505A/NDP505B, NDP506A/NDP506B N-Channel Enhancement Mode Power Field Effect Transistor

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.

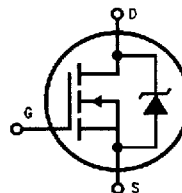
Features

- 26 and 24 Amp, 50V and 60V, $R_{DS(on)} = 0.050\Omega$ and 0.060Ω
- 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



TO-220AB

TL/G/11113-1



TL/G/11113-2

Absolute Maximum Ratings

Symbol	Parameter	NDP506A	NDP505A	NDP506B	NDP505B	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 ($t_p < 50\text{ }\mu\text{s}$)	± 20 ± 40				V
I_D	Drain Current—Continuous Pulsed	26 78		24 72		A
P_D	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above 25°C	60 0.40				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, $1/8$ " from Case for 5 sec.	275				$^\circ\text{C}$

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

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/
Distributors for availability and specifications.

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units	
OFF CHARACTERISTICS								
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250 μA	NDP505A NDP505B	50			V	
			NDP506A NDP506B	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 = 13A	NDP505A NDP506A		0.040	0.050	Ω
			I _D = 12A	NDP505B NDP506B			0.060	Ω
		T _J = 125°C V _{GS} = 10V	I _D = 13A	NDP505A NDP506A		0.060	0.075	Ω
			I _D = 12A	NDP505B NDP506B			0.090	Ω
g _{FS}	Forward Transconductance	V _{GS} = 10V, I _D = 0.5 Rated I _D	All	6	8		mhos	
DYNAMIC CHARACTERISTICS								
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 25V f = 1 MHz	All		690	900	pF	
C _{rss}	Reverse Transfer Capacitance		All		150	200	pF	
C _{oss}	Output Capacitance		All		310	400	pF	
SWITCHING CHARACTERISTICS								
t _{D(on)}	Turn-On Delay Time	V _{DD} = 25V, I _D = 0.5 Rated I _D , R _{GEN} = 15Ω V _{GS} = 10V	All		13	30	ns	
t _r	Rise Time		All		60	100	ns	
t _{D(off)}	Turn-Off Delay Time		All		27	60	ns	
t _f	Fall Time		All		46	80	ns	
Q _g	Total Gate Charge	V _{DS} = 0.8 Rated V _{DSS} , I _D = Rated I _D , V _{GS} = 10V	All		30		nC	
Q _{gs}	Gate-Source Charge		All		4		nC	
Q _{gd}	Gate-Drain Charge		All		16		nC	

6501130 0039629 775

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

Symbol	Parameter	Test Conditions		Type	Min	Typ	Max	Units
SOURCE-DRAIN DIODE CHARACTERISTICS								
I _S	Maximum Continuous Source Current			NDP505A NDP506A			26	A
				NDP505B NDP506B			24	A
I _{SM}	Maximum Pulsed Source Current			NDP505A NDP506A			78	A
				NDP505B NDP506B			72	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		80		ns
I _{rr}	Reverse Recovery Current			All		4.4		A
THERMAL CHARACTERISTICS								
R _{θJC}	Thermal Resistance, Junction to Case						2.50	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient						62.5	°C/W

Typical Electrical Characteristics

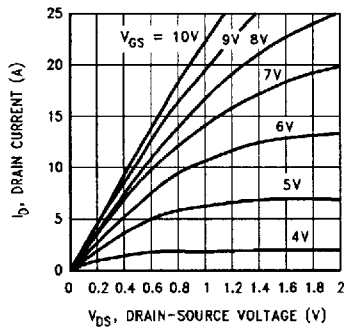


FIGURE 1. On-Region Characteristics

TL/G/11113-3

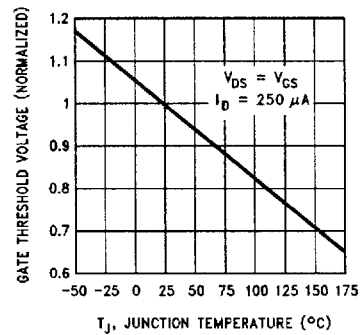
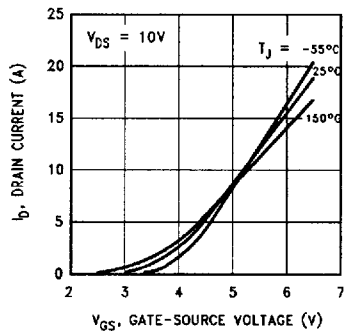


FIGURE 2. Gate Threshold Variation with Temperature

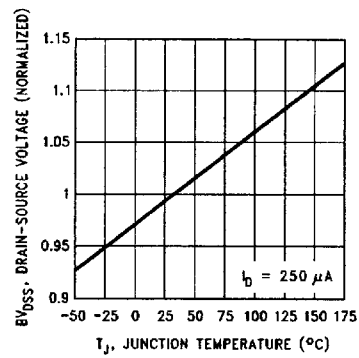
TL/G/11113-04

Typical Electrical Characteristics (Continued)



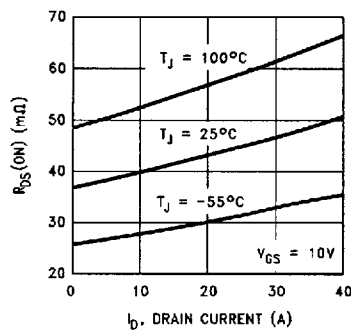
TL/G/11113-5

FIGURE 3. Transfer Characteristics



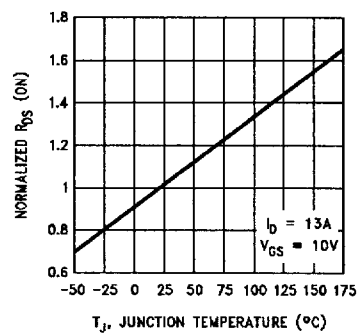
TL/G/11113-6

FIGURE 4. Breakdown Voltage Variation with Temperature



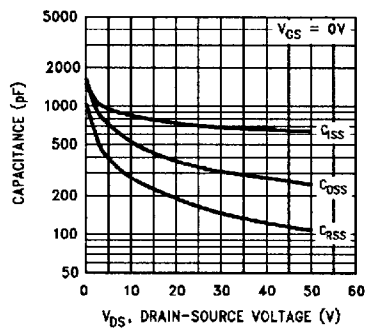
TL/G/11113-7

FIGURE 5. On-Resistance versus Drain Current



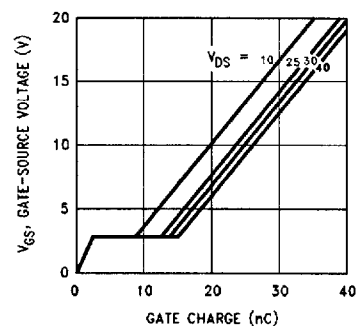
TL/G/11113-8

FIGURE 6. On-Resistance Variation with Temperature



TL/G/11113-9

FIGURE 7. Capacitance versus Drain-Source Voltage



TL/G/11113-10

FIGURE 8. Gate Charge versus Gate-Source Voltage

Typical Electrical Characteristics (Continued)

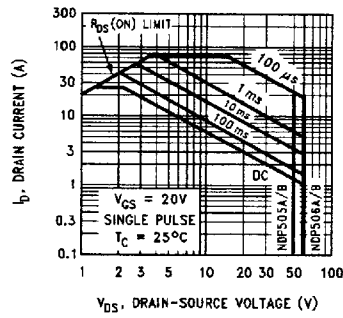


FIGURE 9. Maximum Rated Forward Biased Safe Operating Area

TL/G/11113-11

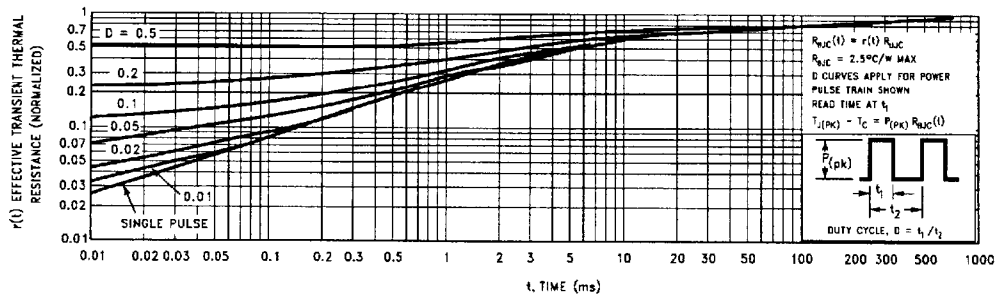


FIGURE 10. Thermal Response

TL/G/11113-12

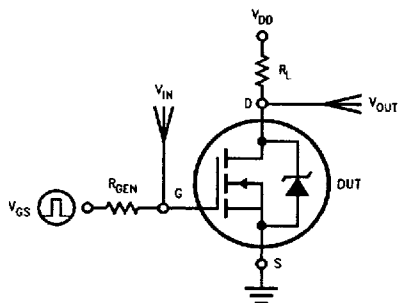


FIGURE 11. Switching Test Circuit

TL/G/11113-13

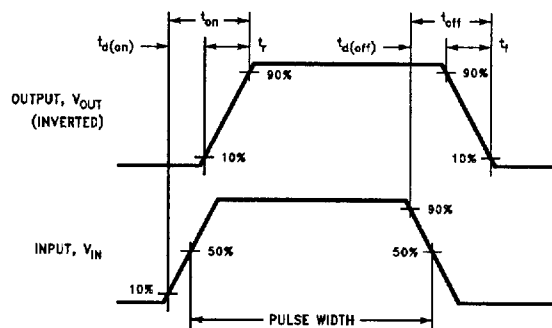
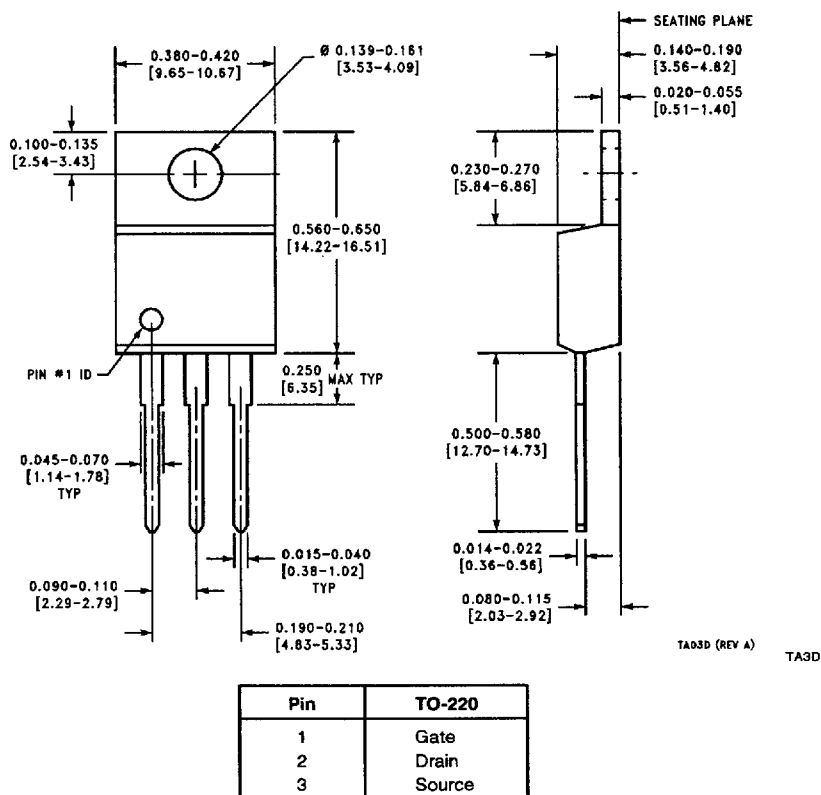


FIGURE 12. Switching Waveforms

TL/G/11113-14

NDP505A/NDP505B, NDP506A/NDP506B N-Channel Enhancement Mode Power Field Effect Transistor

Package Information



LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

6501130 0039633 4T6