

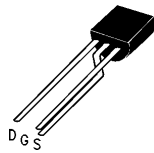
BS270/NDS7002A N-Channel Enhancement Mode Field Effect Transistor

General Description

These N-channel enhancement mode field effect transistors are produced using National's very high cell density third generation DMOS technology. These products have been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. They can be used, with a minimum of effort, in most applications requiring up to 400 mA DC and can deliver pulsed currents up to 2A. This product is particularly suited to low voltage, low current applications, such as small servo motor controls, power MOSFET gate drivers, and other switching applications.

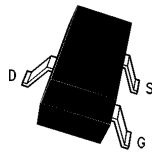
Features

- Efficient high density cell design approaching (3 million/in²)
- Voltage controlled small signal switch
- Rugged
- High saturation current
- Low R_{DS(on)}



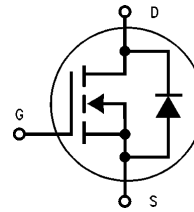
TO-92
BS270

TL/G/11380-1



TO-236AB
(SOT-23)
NDS7002A

TL/G/11380-2



TL/G/11380-3

Absolute Maximum Ratings

Symbol	Parameter	BS270	NDS7002A	Units
V _{DSS}	Drain-Source Voltage	60		V
V _{DGR}	Drain-Gate Voltage (R _{GS} ≤ 1 MΩ)	60		V
V _{GSS}	Gate-Source Voltage	± 40		V
I _D	Drain Current—Continuous —Pulsed	400	280	mA
		2000	1500	mA
P _D	Total Power Dissipation @ T _A = 25°C Derate above 25°C	625	300	mW
		5	2.4	mW/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-65 to +150		°C
T _L	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300		°C

BS270/NDS7002A

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 10 \mu A$	60			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 60V, V_{GS} = 0V$			1	μA
					500	μA
I_{GSSF}	Gate-Body Leakage, Forward	$V_{GS} = 20V$			10	nA
I_{GSSR}	Gate-Body Leakage, Reverse	$V_{GS} = -20V$			-10	nA
ON CHARACTERISTICS (Note 1)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1	2.1	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 500 \text{ mA}$		1.2	2	Ω
				2	3.5	Ω
				1.8	3	Ω
$V_{DS(on)}$	Drain-Source On-Voltage	$V_{GS} = 10V, I_D = 500 \text{ mA}$		0.6	1	V
				0.14	0.225	V
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10V, V_{DS} \geq 2V_{DS(on)}$	2000	2700		mA
			400	600		mA
g_{FS}	Forward Transconductance	$V_{DS} \geq 2V_{DS(on)}, I_D = 200 \text{ mA}$	100	320		mS
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0 \text{ MHz}$		20	50	pF
C_{iss}	Output Capacitance			11	25	pF
C_{rss}	Reverse Transfer Capacitance			4	5	pF
SWITCHING CHARACTERISTICS (Note 1)						
t_{on}	Turn-On Time	$V_{DD} = 30V, I_D = 500 \text{ mA}, V_{GS} = 10V, R_G = 25\Omega$			10	ns
t_{off}	Turn-Off Time				10	ns
THERMAL CHARACTERISTICS						
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	BS270			200	$^\circ\text{C/W}$
		NDS7002A			417	$^\circ\text{C/W}$
BODY-DRAIN DIODE RATINGS						
I_S	Maximum Continuous Drain-Source Diode Forward Current	BS270			400	mA
		NDS7002A			280	mA
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	BS270			2000	mA
		NDS7002A			1500	mA
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 400 \text{ mA}$ (Note 1)		0.88	1.2	V

Note 1: Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Typical Electrical Characteristics

BS270/NDS7002A

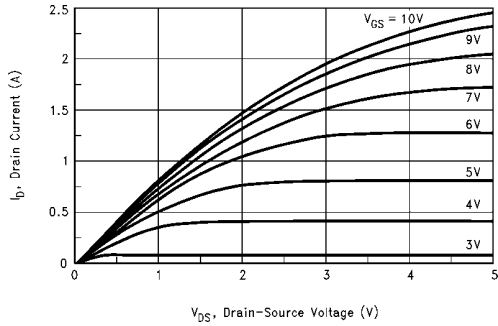


FIGURE 1. On-Region Characteristics

TL/G/11380-6

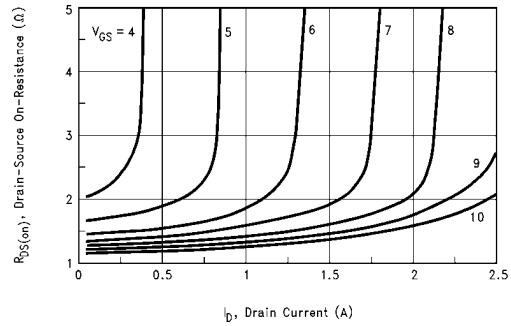


FIGURE 2. $R_{DS(on)}$ Variation with Drain Current and Gate Voltage

TL/G/11380-7

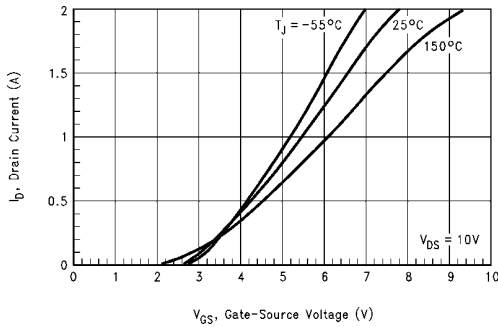


FIGURE 3. Transfer Characteristics

TL/G/11380-8

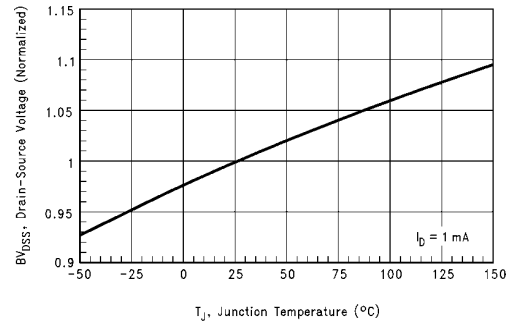


FIGURE 4. Breakdown Voltage Variation with Temperature

TL/G/11380-9

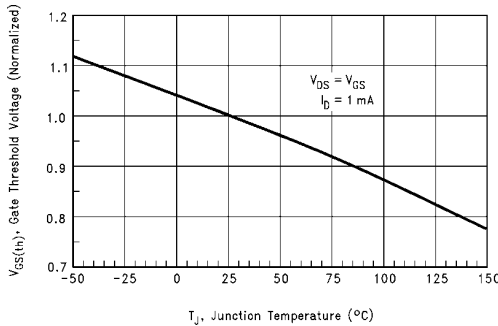


FIGURE 5. Gate Threshold Variation with Temperature

TL/G/11380-10

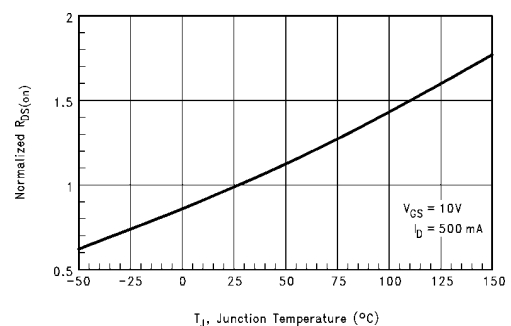
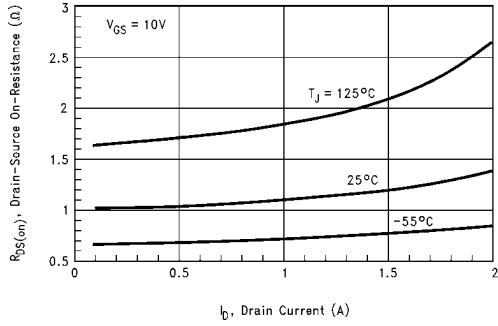


FIGURE 6. On-Resistance Variation with Temperature

TL/G/11380-11

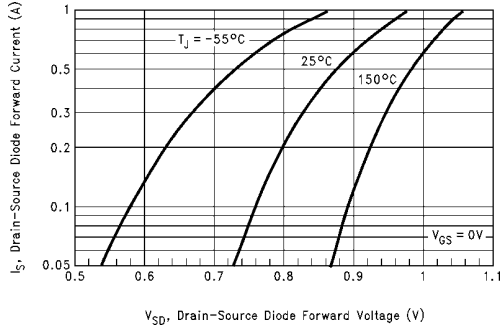
Typical Electrical Characteristics (Continued)

BS270/NDS7002A (Continued)



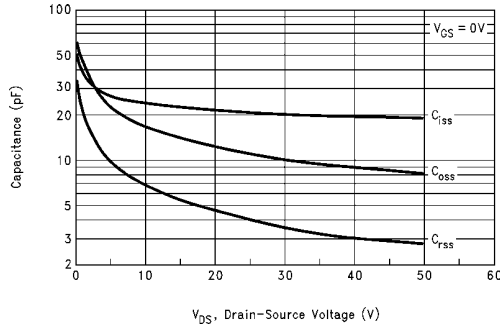
TL/G/11380-12

FIGURE 7. On-Resistance vs Drain Current



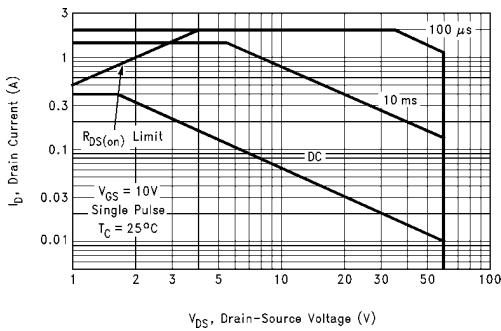
TL/G/11380-13

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



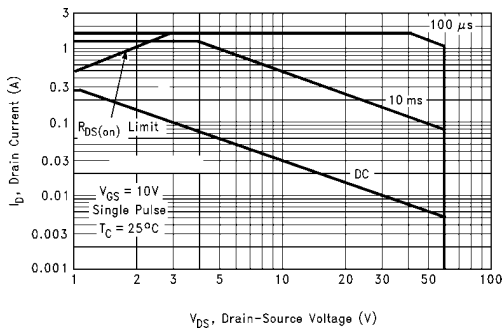
TL/G/11380-14

FIGURE 9. Capacitance vs Drain-Source Voltage



TL/G/11380-15

FIGURE 10. BS270 Safe Operating Area



TL/G/11380-16

FIGURE 11. NDS7002A Safe Operating Area

Typical Electrical Characteristics (Continued)

BS270/NDS7002A (Continued)

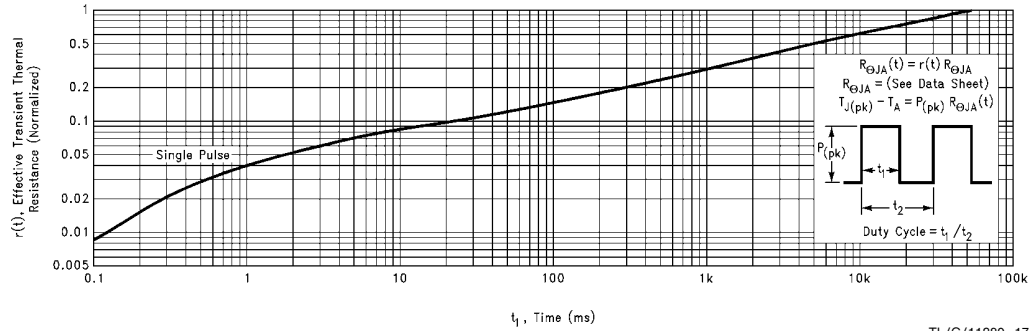


FIGURE 12. TO-92 Transient Thermal Response

TL/G/11380-17

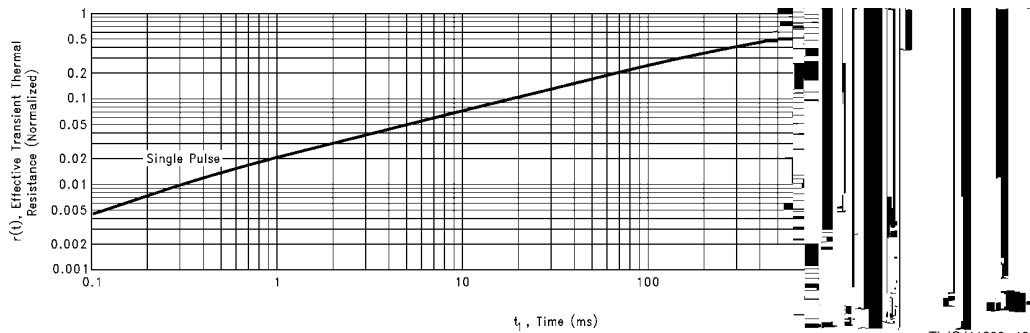
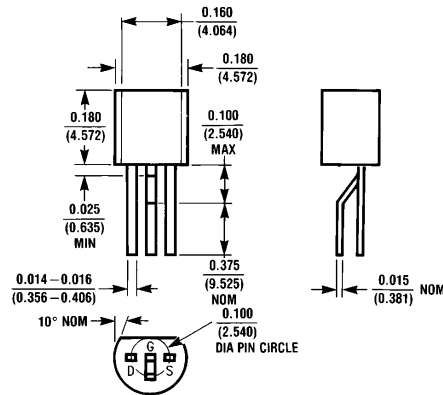


FIGURE 13. SOT-23 Transient Thermal Response

TL/G/11380-18

Physical Dimensions inches (millimeters)

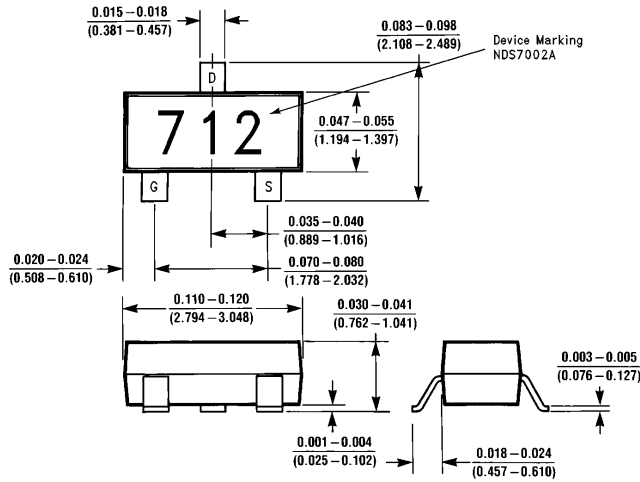


TL/G/11380-4

Note: All transistors are load formed to this configuration prior to bulk shipment.

**TO-92
TO-18 Lead Form STD***

Physical Dimensions inches (millimeters) (Continued)



TL/G/11380-5

Note 1: Meets all JEDEC dimensional requirements for TO-236AB.

Note 2: Controlling dimension: millimeters.

Note 3: Available also in TO-236AA. Contact your local National Semiconductor representative for delivery and ordering information.

Note 4: Tape and reel is the standard packing method for TO-236.

**TO236AB
(SOT-23) (Notes 3,4)**

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.
19th 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.