

MOS FIELD EFFECT TRANSISTOR NP36N055HLE, NP36N055ILE

SWITCHING N-CHANNEL POWER MOS FET INDUSTRIAL USE

DESCRIPTION

These products are N-Channel MOS Field Effect Transistor designed for high current switching applications.

FEATURES

- · Channel temperature 175 degree rated
- Super low on-state resistance

 $R_{DS(on)1} = 13 \text{ m}\Omega \text{ MAX.} \text{ (Vgs} = 10 \text{ V, ID} = 18 \text{ A)}$ $R_{DS(on)2}$ = 16 m Ω MAX. (Vgs = 5 V, ID = 18 A)

- Low C_{iss} : C_{iss} = 2900 pF TYP.
- Built-in gate protection diode

ORDERING INFORMATION

PART NUMBER	PACKAGE		
NP36N055HLE	TO-251		
NP36N055ILE	TO-252		

ABSOLUTE MAXIMUM RATINGS (TA = 25 °C)

	•	•	
Drain to Source Voltage	Voss	55	V
Gate to Source Voltage	Vgss	±20	V
Drain Current (DC)	ID(DC)	±36	Α
Drain Current (Pulse) Note1	ID(pulse)	±144	Α
Total Power Dissipation (T _A = 25 °C)	Рт	1.2	W
Total Power Dissipation (Tc = 25 °C)	Рт	120	W
Single Avalanche Current Note2	las	36 / 33	Α
Single Avalanche Energy Note2	Eas	12 / 108	mJ
Channel Temperature	Tch	175	°C
Storage Temperature	Tstg	-55 to + 175	°C

Notes 1. PW \leq 10 μ s, Duty cycle \leq 1 %

2. Starting T_{ch} = 25 °C, R_G = 25 Ω , V_{GS} = 20 V \rightarrow 0 V (see Figure 4.)

THERMAL RESISTANCE

Channel to Case	Rth(ch-C)	1.25	°C/W
Channel to Ambient	Rth(ch-A)	125	°C/W

(TO-251)





The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

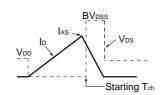


ELECTRICAL CHARACTERISTICS (TA = 25 °C)

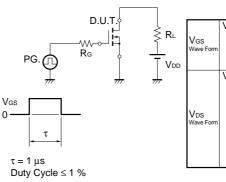
		· · · · · · · · · · · · · · · · · · ·				
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain to Source On-state Resistance	RDS(on)1	V _{GS} = 10 V, I _D = 18 A		10	13	mΩ
	RDS(on)2	V _{GS} = 5 V, I _D = 18 A		12	16	mΩ
	RDS(on)3	V _{GS} = 4.5 V, I _D = 18 A		13	18	mΩ
Gate to Source Threshold Voltage	V _{GS(th)}	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1.5	2	2.5	٧
Forward Transfer Admittance	y fs	V _{DS} = 10 V, I _D = 18 A	11	23		S
Drain Leakage Current	IDSS	V _{DS} = 55 V, V _{GS} = 0 V			10	μΑ
Gate to Source Leakage Current	Igss	V _{GS} = ±20 V, V _{DS} = 0 V			±10	μΑ
Input Capacitance	Ciss	V _{DS} = 25 V		2900	4400	pF
Output Capacitance	Coss	V _{GS} = 0 V		370	560	pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		180	330	pF
Turn-on Delay Time	t _{d(on)}	I _D = 18 A		22	48	ns
Rise Time	t r	V _{GS(on)} = 10 V		14	36	ns
Turn-off Delay Time	td(off)	V _{DD} = 28 V		69	140	ns
Fall Time	t f	R _G = 1 Ω		12	29	ns
Total Gate Charge	Q _{G1}	I _D = 18 A, V _{DD} = 44 V, V _{GS} = 10 V		53	80	nC
	Q _{G2}	I _D = 18 A		30	45	nC
Gate to Source Charge	Qgs	V _{DD} = 44 V		9		nC
Gate to Drain Charge	Q _{GD}	V _{GS} = 5 V		15		nC
Body Diode Forward Voltage	V _{F(S-D)}	I _F = 36 A, V _{GS} = 0 V		1.0		V
Reverse Recovery Time	trr	I _F = 36 A, V _{GS} = 0 V		42		ns
Reverse Recovery Charge	Qrr	di/dt = 100 A/μs		60		nC

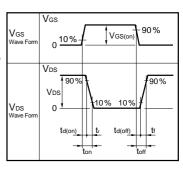
TEST CIRCUIT 1 AVALANCHE CAPABILITY

$\begin{array}{c|c} D.U.T. \\ \hline R_G = 25 \ \Omega \\ \hline V_{GS} = 20 \rightarrow 0 \ V \end{array} \begin{array}{c} D.U.T. \\ \hline V_{DD} \\ \hline \end{array}$



TEST CIRCUIT 2 SWITCHING TIME

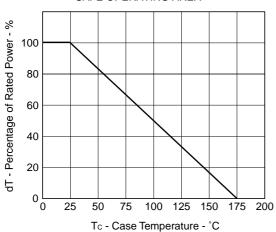


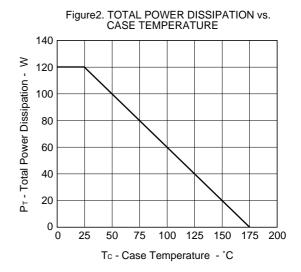


TEST CIRCUIT 3 GATE CHARGE

TYPICAL CHARACTERISTICS (TA = 25°C)

Figure 1. DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA





★ Figure3. FORWARD BIAS SAFE OPERATING AREA

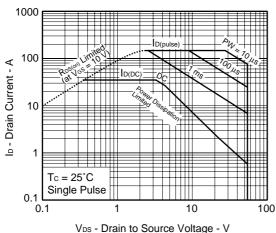


Figure4. SINGLE AVALANCHE ENERGY DERATING FACTOR

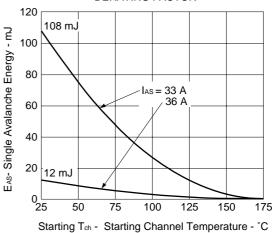


Figure 5. TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

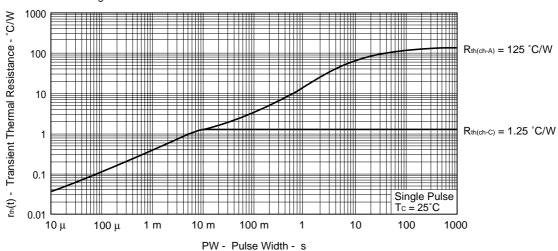


Figure 6. FORWARD TRANSFER CHARACTERISTICS

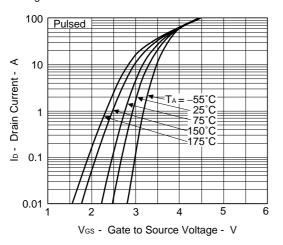


Figure 8. FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

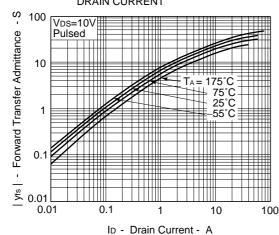


Figure 10. DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

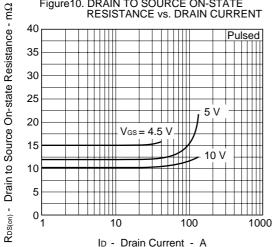
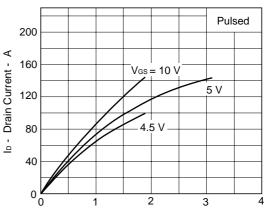


Figure 7. DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



V_{DS} - Drain to Source Voltage - V

Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

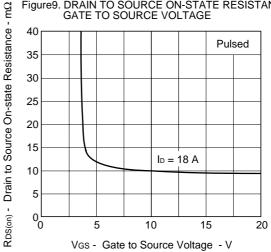
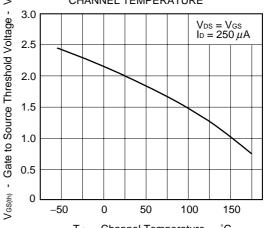


Figure 11. GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



Tch - Channel Temperature - °C



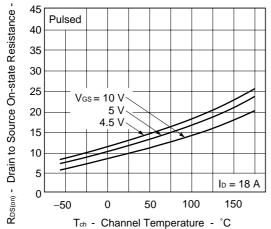


Figure14. CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

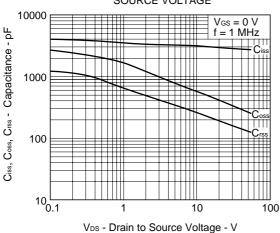


Figure 16. REVERSE RECOVERY TIME vs. DRAIN CURRENT

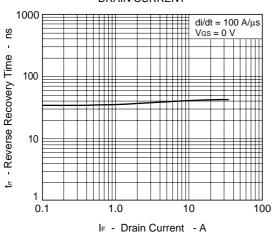


Figure 13. SOURCE TO DRAIN DIODE

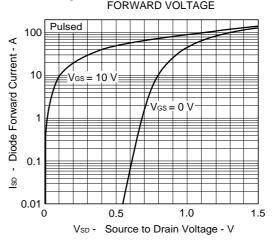


Figure 15. SWITCHING CHARACTERISTICS

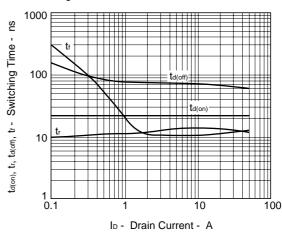
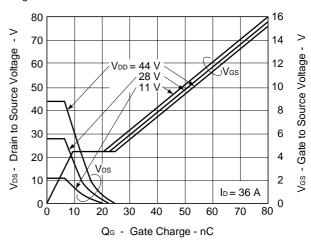
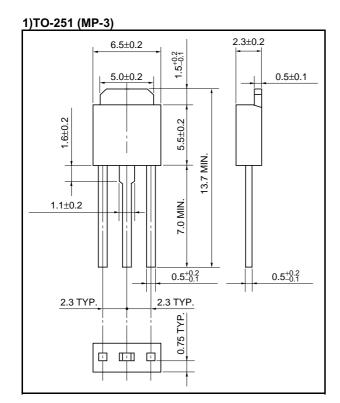
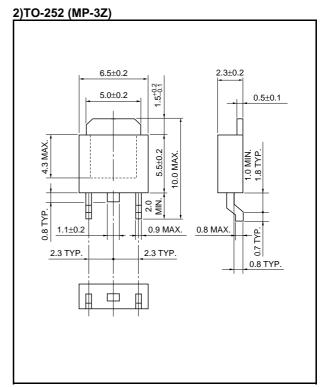


Figure 17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

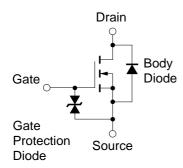


PACKAGE DRAWINGS (Unit: mm)





EQUIVALENT CIRCUIT



Remark The diode connected between the gate and source of the transistor serves as a protector against ESD.

When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

[MEMO]

- The information in this document is current as of March, 2001. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of
 third parties by or arising from the use of NEC semiconductor products listed in this document or any other
 liability arising from the use of such products. No license, express, implied or otherwise, is granted under any
 patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative
 purposes in semiconductor product operation and application examples. The incorporation of these
 circuits, software and information in the design of customer's equipment shall be done under the full
 responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third
 parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers
 agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize
 risks of damage to property or injury (including death) to persons arising from defects in NEC
 semiconductor products, customers must incorporate sufficient safety measures in their design, such as
 redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
 - "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
 - "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 - "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 - "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

(Note)

- $(1) \ "NEC" \ as \ used \ in \ this \ statement \ means \ NEC \ Corporation \ and \ also \ includes \ its \ majority-owned \ subsidiaries.$
- (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4