

# MOS FIELD EFFECT TRANSISTOR NP80N03EDE, NP80N03KDE NP80N03CDE, NP80N03DDE, NP80N03MDE, NP80N03NDE

## SWITCHING N-CHANNEL POWER MOS FET

DATA SHEET

#### DESCRIPTION

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

#### <R> ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE		
NP80N03EDE-E1-AY Note1, 2					
NP80N03EDE-E2-AY Note1, 2			TO-263 (MP-25ZJ) typ. 1.4 g		
NP80N03KDE-E1-AY Note1	Pure Sn (Tin)	Tape 800 p/reel			
NP80N03KDE-E2-AY Note1			TO-263 (MP-25ZK) typ. 1.5 g		
NP80N03CDE-S12-AZ Note1, 2	Sn-Ag-Cu		TO-220 (MP-25) typ. 1.9 g		
NP80N03DDE-S12-AY Note1, 2			TO-262 (MP-25 Fin Cut) typ. 1.8 g		
NP80N03MDE-S18-AY Note1	Pure Sn (Tin)	Tube 50 p/tube	TO-220 (MP-25K) typ. 1.9 g		
NP80N03NDE-S18-AY Note1			TO-262 (MP-25SK) typ. 1.8 g		

Notes 1. Pb-free (This product does not contain Pb in the external electrode.)

2. Not for new design

#### FEATURES

- Channel Temperature 175 degree rated
- Super Low on-state Resistance

 $R_{DS(on)1} = 7.0 \text{ m}\Omega$  MAX. (VGs = 10 V, ID = 40 A)

 $R_{DS(on)2}$  = 9.0 m $\Omega$  MAX. (V<sub>GS</sub> = 5 V, I<sub>D</sub> = 40 A)

 $R_{DS(on)3}$  = 11 m $\Omega$  MAX. (V<sub>GS</sub> = 4.5 V, I<sub>D</sub> = 40 A)

- Low input capacitance
- Ciss = 2600 pF TYP.

(TO-220)







(TO-263)



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The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:"

#### ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

Drain to Source Voltage (VGs = 0 V)	VDSS	30	V
Gate to Source Voltage (VDs = 0 V)	Vgss	±20	V
Drain Current (DC) (Tc = 25°C) Note1	D(DC)	±80	А
Drain Current (pulse) Note2	D(pulse)	±320	А
Total Power Dissipation (Tc = $25^{\circ}$ C)	PT1	120	W
Total Power Dissipation (T <sub>A</sub> = $25^{\circ}$ C)	PT2	1.8	W
Channel Temperature	Tch	175	°C
Storage Temperature	Tstg	–55 to +175	°C
Single Avalanche Current Note3	las	50/40/9	А
Single Avalanche Energy <sup>Note3</sup>	Eas	2.5/160/400	mJ

Notes 1. Calculated constant current according to MAX. allowable channel temperature.

- **2.** PW  $\leq$  10  $\mu$ s, Duty cycle  $\leq$  1%
- **3.** Starting T<sub>ch</sub> = 25°C, R<sub>G</sub> = 25  $\Omega$ , V<sub>GS</sub> = 20  $\rightarrow$  0 V (See Figure 4.)

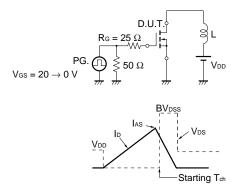
#### THERMAL RESISTANCE

Channel to Case Thermal Resistance	Rth(ch-C)	1.25	°C/W
Channel to Ambient Thermal Resistance	Rth(ch-A)	83.3	°C/W

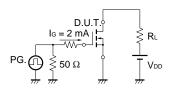
#### ELECTRICAL CHARACTERISTICS (TA = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	IDSS	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	lgss	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate to Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 µA	1.5	2.0	2.5	V
Forward Transfer Admittance	<b>y</b> fs	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 40 A	20	41		S
Drain to Source On-state Resistance	RDS(on)1	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 40 A		5.3	7.0	mΩ
	RDS(on)2	V <sub>GS</sub> = 5 V, I <sub>D</sub> = 40 A		6.8	9.0	mΩ
	RDS(on)3	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 40 A		7.5	11	mΩ
Input Capacitance	Ciss	V <sub>DS</sub> = 25 V,		2600	3900	pF
Output Capacitance	Coss	V <sub>GS</sub> = 0 V,		590	890	pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		270	490	pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 40 A,		20	44	ns
Rise Time	tr	V <sub>GS</sub> = 10 V,		12	31	ns
Turn-off Delay Time	td(off)	R <sub>G</sub> = 1 Ω		60	120	ns
Fall Time	tr			14	35	ns
Total Gate Charge	Q <sub>G1</sub>	$I_D$ = 80 A, $V_{DD}$ = 24 V, $V_{GS}$ = 10 V		48	72	nC
	Q <sub>G2</sub>	V <sub>DD</sub> = 24 V,		28	42	nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 5 V,		10		nC
Gate to Drain Charge	Qgd	I <sub>D</sub> = 80 A		14		nC
Body Diode Forward Voltage	VF(S-D)	IF = 80 A, VGS = 0 V		1.0		V
Reverse Recovery Time	trr	IF = 80 A, VGS = 0 V,		34		ns
Reverse Recovery Charge	Qrr	di/dt = 100 A/ <i>µ</i> s		22		nC

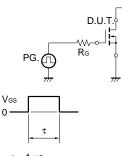
#### TEST CIRCUIT 1 AVALANCHE CAPABILITY



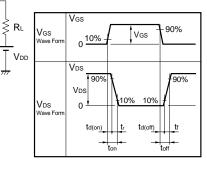
#### TEST CIRCUIT 3 GATE CHARGE



#### TEST CIRCUIT 2 SWITCHING TIME

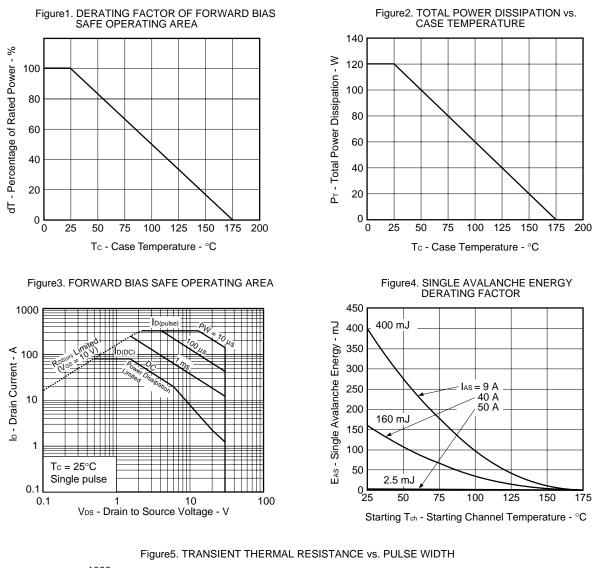


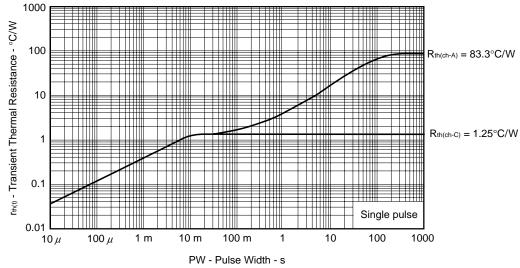
 $\begin{array}{l} \tau = 1 \; \mu s \\ \text{Duty Cycle} \leq 1\% \end{array}$ 



Data Sheet D15310EJ3V0DS

#### TYPICAL CHARACTERISTICS (TA = 25°C)

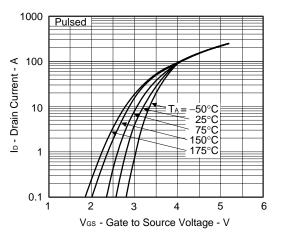




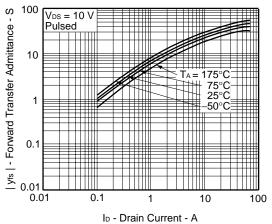
Data Sheet D15310EJ3V0DS

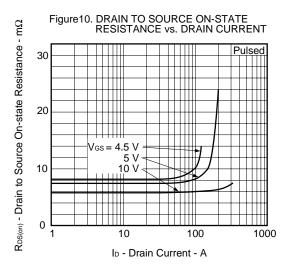
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Figure6. FORWARD TRANSFER CHARACTERISTICS









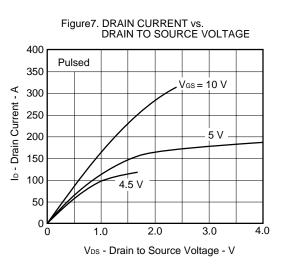


Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

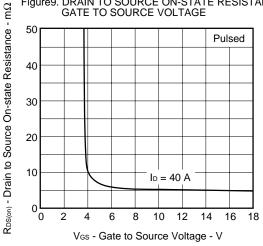
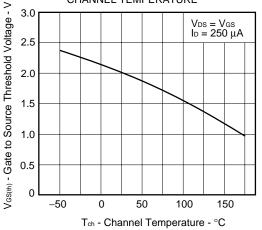
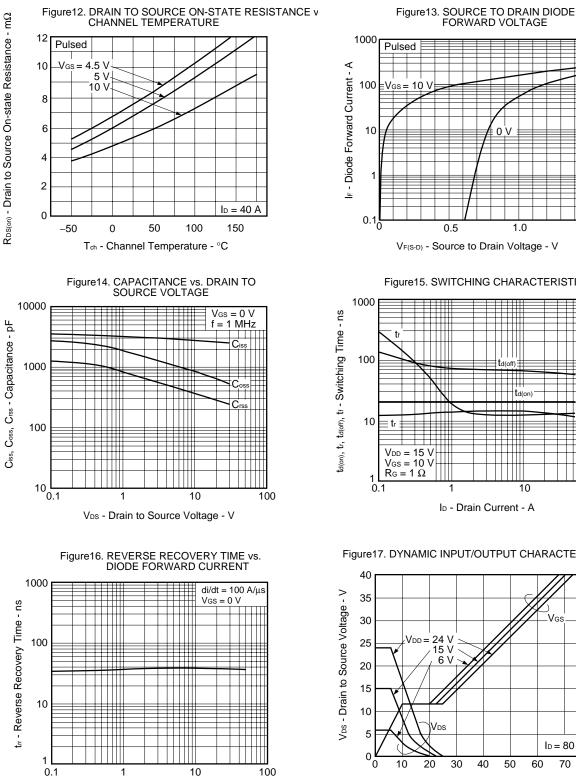


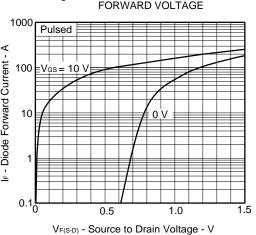
Figure11. GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



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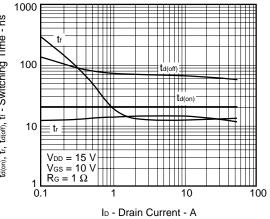
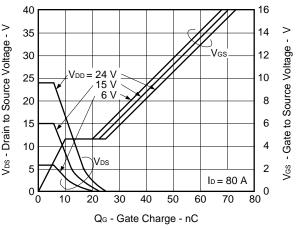
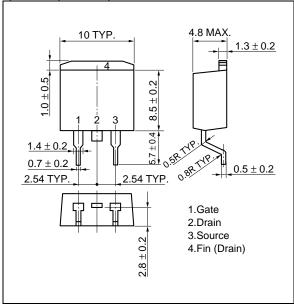


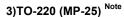
Figure17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

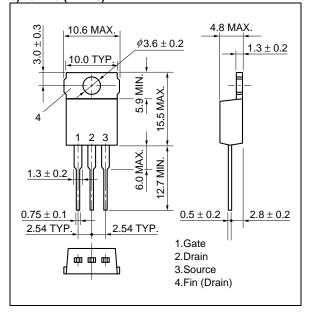


#### <R> PACKAGE DRAWINGS (Unit: mm)

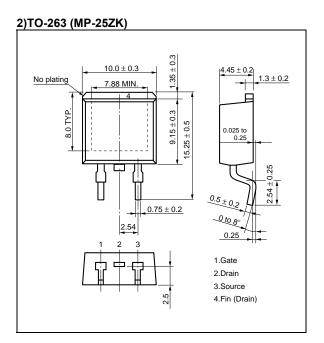




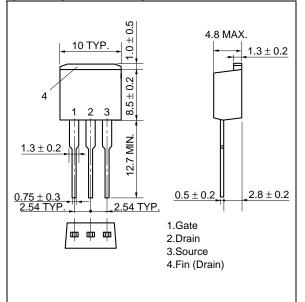


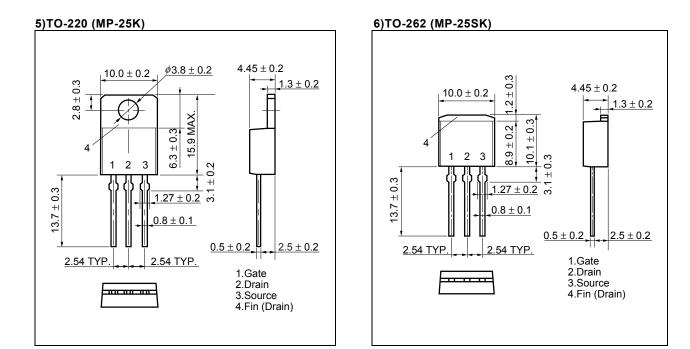


Note Not for new design

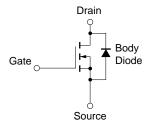


### 4)TO-262 (MP-25 Fin Cut) Note





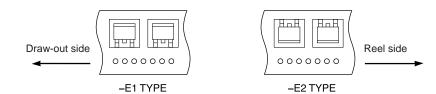
#### **EQUIVALENT CIRCUIT**



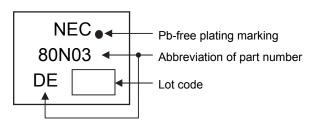
**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

#### <R> TAPE INFORMATION

There are two types (-E1, -E2) of taping depending on the direction of the device.



#### <R> MARKING INFORMATION



#### <R> RECOMMENDED SOLDERING CONDITIONS

These products should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, please contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)

Soldering Method	Soldering Conditions	Recommended Condition Symbol	
Infrared reflow	Maximum temperature (Package's surface temperature): 260°C or below		
MP-25ZJ, MP-25ZK	Time at maximum temperature: 10 seconds or less		
	Time of temperature higher than 220°C: 60 seconds or less		
	Preheating time at 160 to 180°C: 60 to 120 seconds	IR60-00-3	
	Maximum number of reflow processes: 3 times		
	Maximum chlorine content of rosin flux (percentage mass): 0.2% or less		
Wave soldering	Maximum temperature (Solder temperature): 260°C or below		
MP-25, MP-25K, MP-25SK,	Time: 10 seconds or less	THDWS	
MP-25 Fin Cut	Maximum chlorine content of rosin flux: 0.2% (wt.) or less		
Partial heating	Maximum temperature (Pin temperature): 350°C or below		
MP-25ZJ, MP-25ZK,	Time (per side of the device): 3 seconds or less	P350	
MP-25K, MP-25SK	Maximum chlorine content of rosin flux: 0.2% (wt.) or less		
Partial heating	Maximum temperature (Pin temperature): 300°C or below		
MP-25, MP-25 Fin Cut	Time (per side of the device): 3 seconds or less	P300	
	Maximum chlorine content of rosin flux: 0.2% (wt.) or less		

Caution Do not use different soldering methods together (except for partial heating).

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