



## N-Channel Enhancement-Mode Vertical DMOS FET

### Features

- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low  $C_{ISS}$  and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain

### Applications

- Motor controls
- Converters
- Amplifiers
- Switches
- Power supply circuits
- Drivers (relays, hammers, solenoids, lamps, memories, displays, bipolar transistors, etc.)

### Ordering Information

Device	Package	Wafer / Die Options		
	TO-92	NW (Die in wafer form)	NJ (Die on adhesive tape)	ND (Die in waffle pack)
VN0109	VN0109N3-	VN1509NW	VN1509NJ	VN1509ND

### Product Summary

$BV_{DSS}/BV_{DGS}$ (V)	$R_{DS(ON)}$ (max) ( $\Omega$ )	$I_{D(ON)}$ (min) (A)
90	3.0	2.0

### Pin Configuration

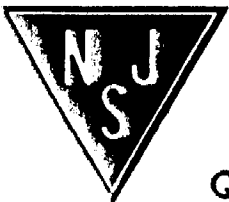


DRAIN  
SOURCE  
GATE  
TO-92 (N3)

### Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	$BV_{DSS}$
Drain-to-gate voltage	$BV_{DGS}$
Gate-to-source voltage	$\pm 20V$
Operating and storage temperature	$-55^{\circ}C$ to $+150^{\circ}C$

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### Thermal Characteristics

Package	$I_D$ (continuous) <sup>†</sup> (mA)	$I_D$ (pulsed) (A)	Power Dissipation @ $T_C = 25^\circ\text{C}$ (W)	$\theta_{jc}$ ( $^\circ\text{C}/\text{W}$ )	$\theta_{ja}$ ( $^\circ\text{C}/\text{W}$ )	$I_{DR}^{\dagger}$ (mA)	$I_{DRM}$ (A)
TO-92	350	2.0	1.0	125	170	350	2.0

**Notes:**

<sup>†</sup>  $I_D$  (continuous) is limited by max rated  $T_J$ .

### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Sym	Parameter	Min	Typ	Max	Units	Conditions
$BV_{DSS}$	Drain-to-source breakdown voltage	90	-	-	V	$V_{GS} = 0V, I_D = 1.0\text{mA}$
$V_{GS(th)}$	Gate threshold voltage	0.8	-	2.4	V	$V_{GS} = V_{DS}, I_D = 1.0\text{mA}$
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-3.8	-5.5	mV/ $^\circ\text{C}$	$V_{GS} = V_{DS}, I_D = 1.0\text{mA}$
$I_{GSS}$	Gate body leakage	-	-	100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
$I_{DSS}$	Zero gate voltage drain current	-	-	1.0	$\mu\text{A}$	$V_{GS} = 0V, V_{DS} = \text{Max Rating}$
		-	-	100		$V_{DS} = 0.8 \text{ Max Rating}, V_{GS} = 0V, T_A = 125^\circ\text{C}$
$I_{D(ON)}$	On-state drain current	0.5	1.0	-	A	$V_{GS} = 5.0V, V_{DS} = 25V$
		2.0	2.5	-		$V_{GS} = 10V, V_{DS} = 25V$
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	3.0	5.0	$\Omega$	$V_{GS} = 5.0V, I_D = 250\text{mA}$
		-	2.5	3.0		$V_{GS} = 10V, I_D = 1.0A$
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	0.70	1.0	%/ $^\circ\text{C}$	$V_{GS} = 10V, I_D = 1.0A$
$G_{FS}$	Forward transconductance	300	450	-	mmho	$V_{DS} = 25V, I_D = 500\text{mA}$
$C_{ISS}$	Input capacitance	-	55	65	pF	$V_{GS} = 0V, V_{DS} = 25V, f = 1.0\text{MHz}$
$C_{OSS}$	Common source output capacitance	-	20	25		
$C_{RSS}$	Reverse transfer capacitance	-	5.0	8.0		
$t_{d(ON)}$	Turn-on delay time	-	3.0	5.0	ns	$V_{DD} = 25V, I_D = 1.0A, R_{GEN} = 25\Omega$
$t_r$	Rise time	-	5.0	8.0		
$t_{d(OFF)}$	Turn-off delay time	-	6.0	9.0		
$t_f$	Fall time	-	5.0	8.0		
$V_{SD}$	Diode forward voltage drop	-	1.2	1.8	V	$V_{GS} = 0V, I_{SD} = 1.0A$
$t_{rr}$	Reverse recovery time	-	400	-	ns	$V_{GS} = 0V, I_{SD} = 1.0A$

**Notes:**

- All D.C. parameters 100% tested at  $25^\circ\text{C}$  unless otherwise stated. (Pulse test:  $300\mu\text{s}$  pulse, 2% duty cycle.)
- All A.C. parameters sample tested.

### Switching Waveforms and Test Circuit

