

# NP90N04VUK-VB Datasheet N-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY					
V <sub>DS</sub> (V)	$R_{DS(on)}(\Omega)$	I <sub>D</sub> (A) <sup>a, c</sup>	Q <sub>g</sub> (Typ.)		
40	0.0050 at V <sub>GS</sub> = 10 V	85	80 nC		
40	0.0065 at V <sub>GS</sub> = 4.5 V	70	00 HC		

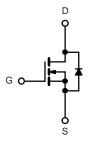
#### **FEATURES**

- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested



#### **APPLICATIONS**

- Synchronous Rectification
- Power Supplies



N-Channel MOSFET

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ABSOLUTE MAXIMUM RATING	<b>S</b> T <sub>A</sub> = 25 °C, unle	ss otherwise n	oted		
Parameter	Symbol	Limit	Unit		
Drain-Source Voltage	V <sub>DS</sub>	40	V		
Gate-Source Voltage		V <sub>GS</sub>	± 25	]	
	T <sub>C</sub> = 25 °C		85 <sup>a, c</sup>		
Continuous Drain Current (T, = 175 °C)	T <sub>C</sub> = 70 °C		70 <sup>c</sup>		
Continuous Diain Curient (1) = 175 C)	T <sub>A</sub> = 25 °C	I <sub>D</sub>	59 <sup>b</sup>	A	
	T <sub>A</sub> = 70 °C		53 <sup>b</sup>		
Pulsed Drain Current	I <sub>DM</sub>	250			
Avalanche Current Pulse L = 0.1 mH		I <sub>AS</sub>	80		
Single Pulse Avalanche Energy	L=0.11IIII	E <sub>AS</sub>	320	mJ	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I-	110 <sup>a, c</sup>	А	
Continuous Source-Diain Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	2.6 <sup>b</sup>	] ^	
	T <sub>C</sub> = 25 °C		312 <sup>a</sup>		
Maniana Pana Pisaisatian	T <sub>C</sub> = 70 °C		200	10/	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	$P_{D}$	3.13 <sup>b</sup>	W	
	T <sub>A</sub> = 70 °C		2.0 <sup>b</sup>		
Operating Junction and Storage Temperature R	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C		

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b</sup>	Steady State	R <sub>thJA</sub>	32	40	°C/W	
Maximum Junction-to-Case	Steady State	$R_{thJC}$	0.33	0.4	] 5/**	

#### Notes:

- a. Based on  $T_C = 25$  °C.
- b. Surface Mounted on 1" x 1" FR4 board.
- c. Calculated based on maximum junction temperature. Package limitation current is 110  $\,\mathrm{A.}$



Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	40			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	$_{S}/T_{J}$ $I_{D} = 250 \mu\text{A}$		41		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	10 = 200 μΛ		- 8		IIIV/ C	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1.2		2.5	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA	
Zoro Coto Voltago Drain Current	l	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$			1		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 ^{\circ}\text{C}$			10	μA	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	120			Α	
David Common Con Otata Basista and	D	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A		0.0050			
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	$V_{GS} = 4.5 \text{ V}, I_D = 20 \text{ A}$		0.0065		Ω	
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A		180		S	
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>			2380			
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		550		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>			250			
Total Gate Charge	$Q_g$			80	120	nC	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 20 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 20 \text{ A}$		20			
Gate-Drain Charge	Q <sub>gd</sub>			12			
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.85	1.3	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			20	30		
Rise Time	t <sub>r</sub>	$V_{DD}$ = 20 V, $R_L$ = 1.0 $\Omega$		11	17		
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong 20$ A, $V_{GEN}$ = 10 V, $R_g$ = 1 $\Omega$		77	115		
Fall Time	t <sub>f</sub>			10	15		
Turn-On Delay Time	t <sub>d(on)</sub>			102	155	ns	
Rise Time	t <sub>r</sub>	$V_{DD}$ = 20 V, $R_L$ = 1.0 $\Omega$		62	95		
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 20 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$		180	270		
Fall Time	t <sub>f</sub>			60	90		
<b>Drain-Source Body Diode Characteristic</b>	s					1	
Continuous Source-Drain Diode Current	Is	T <sub>C</sub> = 25 °C			110	۸	
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				200	A	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 20 A		0.8	1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>			50	75	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	1 20 A di/d+ 100 A/vo T 25 °C		70	105	nC	
Reverse Recovery Fall Time	t <sub>a</sub>	$I_F = 20 \text{ A}, \text{ di/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$		30			
Reverse Recovery Rise Time	t <sub>b</sub>	7		20		ns	

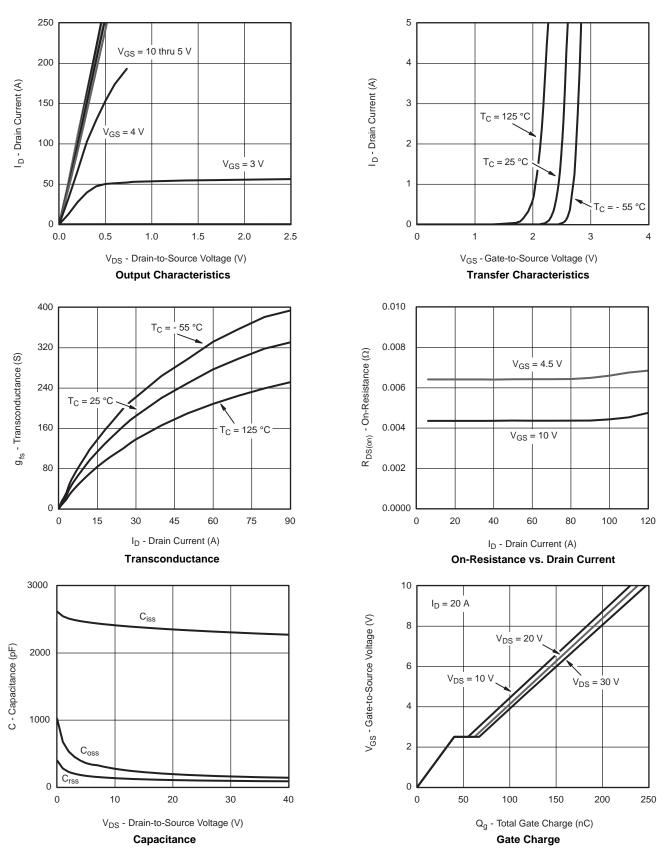
#### Notes:

- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%.$
- b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

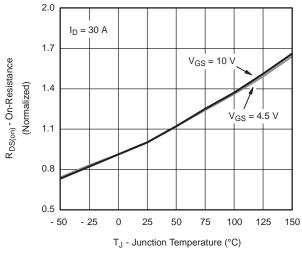


#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

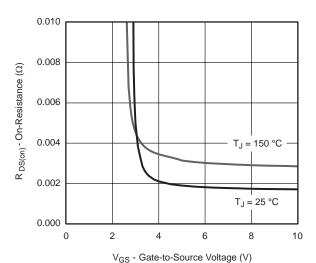




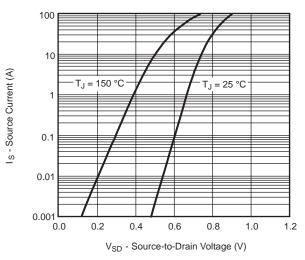
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#### On-Resistance vs. Junction Temperature



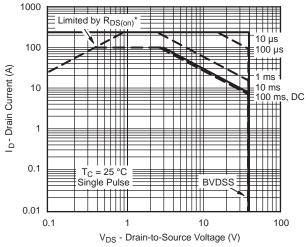
On-Resistance vs. Gate-to-Source Voltage



#### Forward Diode Voltage vs. Temperature



#### Threshold Voltage



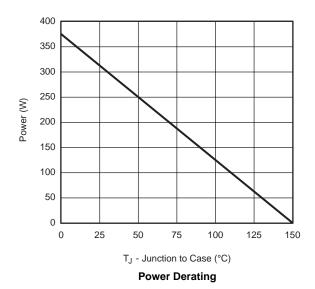
 $^{\star}$  V  $_{GS}$  > minimum V  $_{GS}$  at which R  $_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Ambient

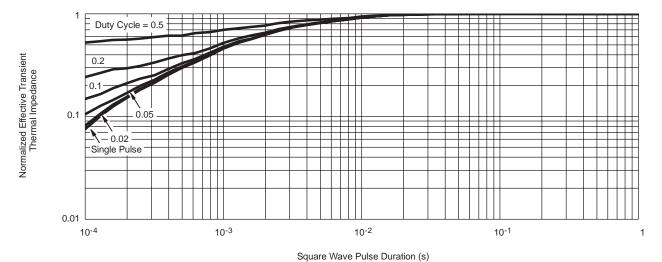


#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted





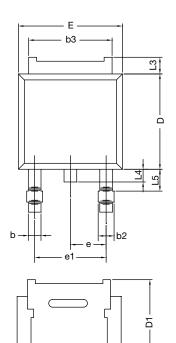
<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)}$  = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

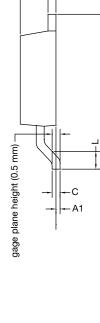


Normalized Thermal Transient Impedance, Junction-to-Case



## **TO-252AA CASE OUTLINE**





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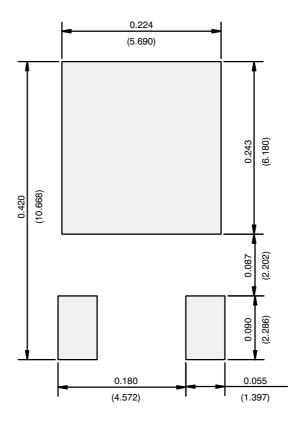
	MILLIMETERS		INCHES		
DIM.	MIN.	MAX.	MIN.	MAX.	
А	2.18	2.38	0.086	0.094	
A1	-	0.127	-	0.005	
b	0.64	0.88	0.025	0.035	
b2	0.76	1.14	0.030	0.045	
b3	4.95	5.46	0.195	0.215	
С	0.46	0.61	0.018	0.024	
C2	0.46	0.89	0.018	0.035	
D	5.97	6.22	0.235	0.245	
D1	5.21	=	0.205	-	
Е	6.35	6.73	0.250	0.265	
E1	4.32	-	0.170	-	
Н	9.40	10.41	0.370	0.410	
е	2.28	BSC	0.090 BSC		
e1	4.56 BSC		0.180 BSC		
L	1.40	1.78	0.055	0.070	
L3	0.89	1.27	0.035	0.050	
L4	-	1.02	-	0.040	
L5	1.14	1.52	0.045	0.060	
ECN: X12-0247-Rev. M, 24-Dec-12 DWG: 5347					

#### Note

• Dimension L3 is for reference only.



#### **RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)**



Recommended Minimum Pads Dimensions in Inches/(mm)



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