

## NP84N04NHE-VB Datasheet

### N-Channel 40-V (D-S) 175 °C MOSFET

#### PRODUCT SUMMARY

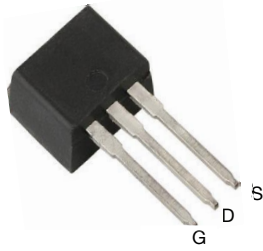
$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
40	0.005 at $V_{GS} = 10$ V	100	95

#### FEATURES

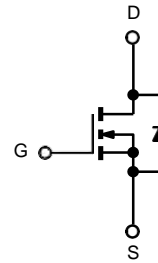
- Trench Power MOSFET
- 175 °C Junction Temperature
- High Threshold Voltage at High Temperature



TO-262



Top View



N-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V <sub>DS</sub>	40	V
Gate-Source Voltage		V <sub>GS</sub>	20	
Continuous Drain Current (T <sub>J</sub> = 175 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	110	A
	T <sub>C</sub> = 125 °C		70	
Pulsed Drain Current		I <sub>DM</sub>	300	
Avalanche Current		I <sub>AR</sub>	50	
Repetitive Avalanche Energy <sup>a</sup>	L = 0.1 mH	E <sub>AR</sub>	125	mJ
Maximum Power Dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	150 <sup>b</sup>	W
	T <sub>A</sub> = 25 °C <sup>c</sup>		3.75	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient	$R_{thJA}$	40	°C/W
Junction-to-Case	$R_{thJC}$	1	

Notes:

a. Duty cycle  $\leq 1$  %.

b. See SOA curve for voltage derating.

c. When Mounted on 1" square PCB (FR-4 material).

SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>DS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
Gate-Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.0	2.0	4.0	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			250	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	120			A
Drain-Source On-State Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.005		Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A, T <sub>J</sub> = 125 °C		0.008		
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A, T <sub>J</sub> = 175 °C		0.0106		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 15 A	20	50		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz		3200		pF
Output Capacitance	C <sub>oss</sub>			600		
Reverse Transfer Capacitance	C <sub>rss</sub>			320		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		95		nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			37		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			21		
Gate Resistance	R <sub>g</sub>	f = 1.0 MHz		1.7		Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 0.4 Ω I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		20	30	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			95	145	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			50	75	
Fall Time <sup>c</sup>	t <sub>f</sub>			12	20	
Source-Drain Diode Ratings and Characteristics T <sub>C</sub> = 25 °C <sup>b</sup>						
Continuous Current	I <sub>S</sub>				100	A
Pulsed Current	I <sub>SM</sub>				300	
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V		0.90	1.50	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, di/dt = 100 A/μs		40	60	ns

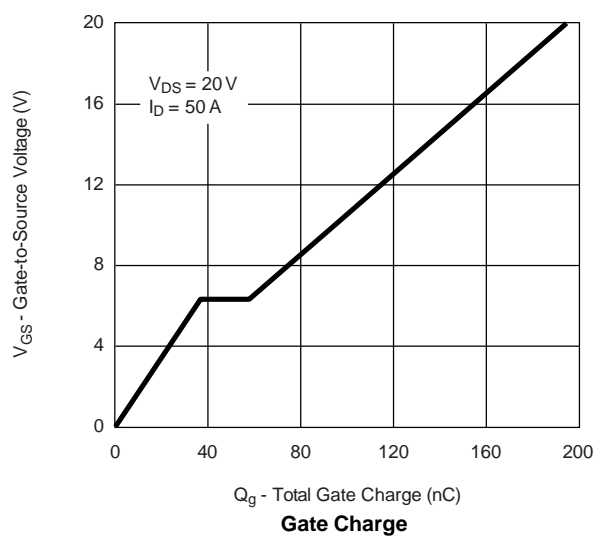
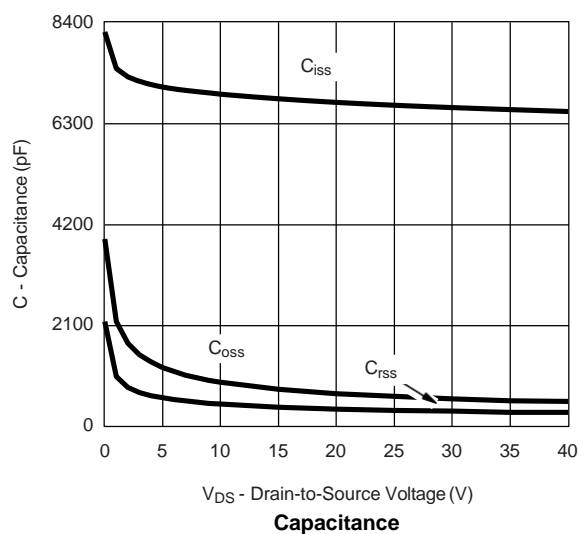
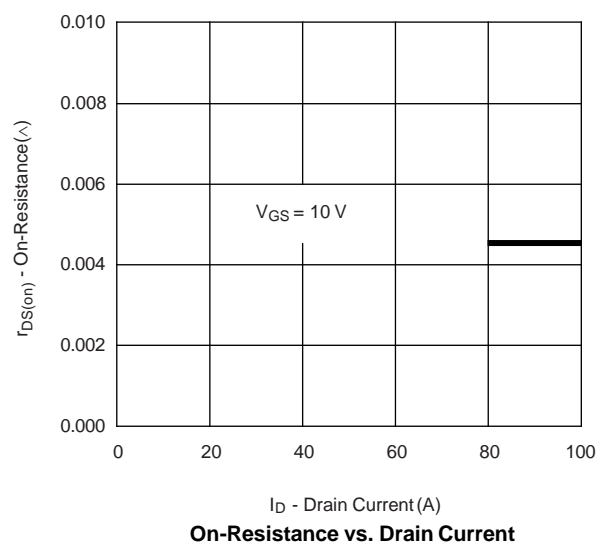
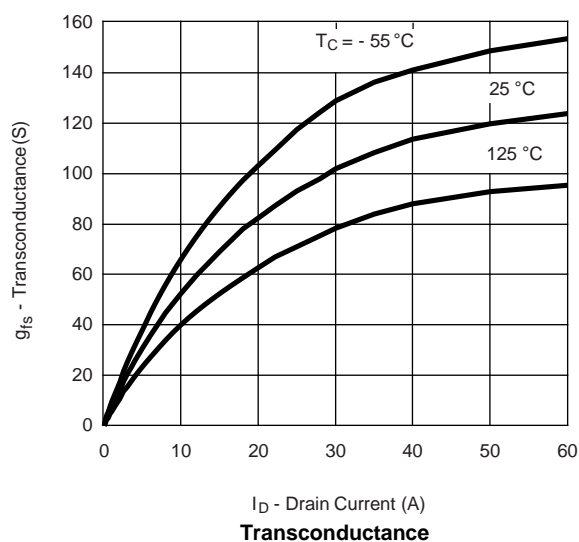
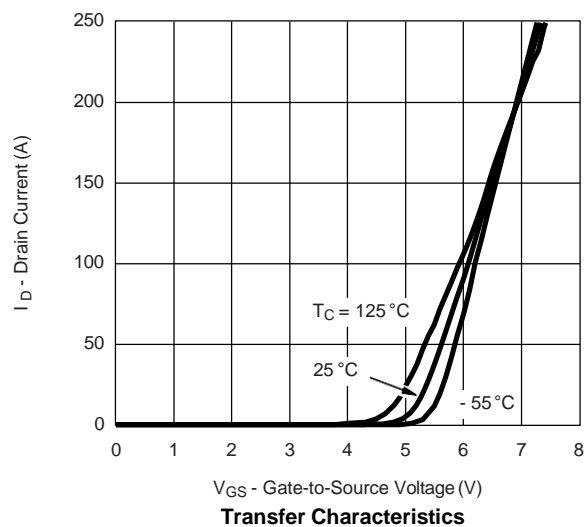
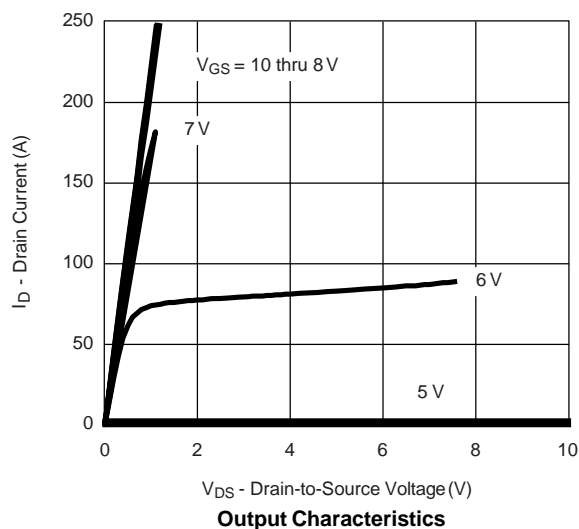
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

c. Independent of operating temperature.

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



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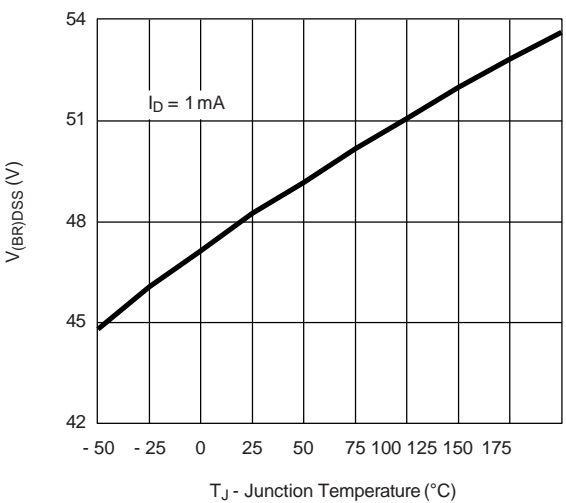
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



Avalanche Current vs. Time

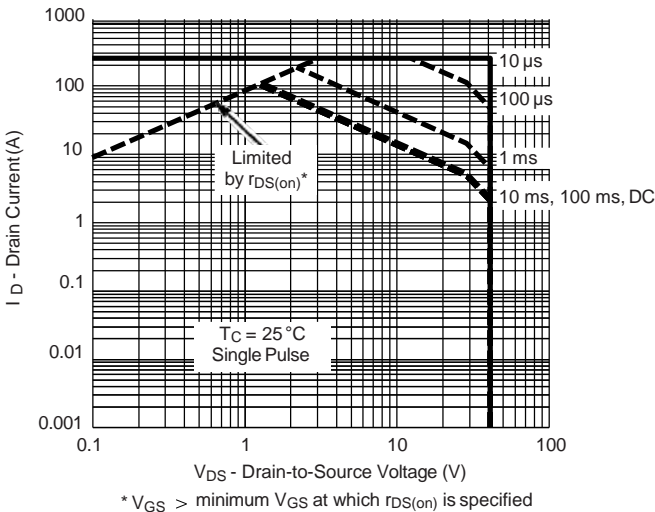


Drain Source Breakdown vs. Junction Temperature

THERMAL RATINGS



Maximum Avalanche and Drain Current  
vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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