

RoHS

COMPLIANT HALOGEN

FREE

## NTR4501NT1G-VB Datasheet

## N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$\mathbf{R}_{DS(on)}$ (Ω) $\mathbf{I}_{D}$ (A) <sup>e</sup>		Q <sub>g</sub> (Typ.)			
	0.028 at V <sub>GS</sub> = 4.5 V	6 <sup>a</sup>				
20	0.042 at V <sub>GS</sub> = 2.5 V	6 <sup>a</sup>	8.8 nC			
	0.050 at V <sub>GS</sub> = 1.8 V	5.6				

#### **FEATURES**

- Halogen-free According to IEC 61249-2-21
  Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC

#### **APPLICATIONS**

- DC/DC Converters
- Load Switch for Portable Applications

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	20 ± 12	V	
Gate-Source Voltage				V <sub>GS</sub>
	T <sub>C</sub> = 25 °C		6 <sup>a</sup>	
Continuous Drain Current ( $T_1 = 150 \ ^{\circ}C$ )	T <sub>C</sub> = 70 °C	1 , [	5.1	
Continuous Drain Current $(T_j = 150 \text{ C})$	T <sub>A</sub> = 25 °C		5 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		4 <sup>b, c</sup>	A
Pulsed Drain Current		I <sub>DM</sub>	20	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C		1.75	
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	l I <sub>S</sub>	1.04 <sup>b, c</sup>	
	T <sub>C</sub> = 25 °C		2.1	
Maximum Bower Dissinction	T <sub>C</sub> = 70 °C		1.3	w
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	1.25 <sup>b, c</sup>	VV
	T <sub>A</sub> = 70 °C		0.8 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	⊃°C
Soldering Recommendations (Peak Tempera		260		

THERMAL RESISTANCE RATINGS							
Parameter		Symbol	Typical	Maximum	Unit		
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 5 s	R <sub>thJA</sub>	80	100	°C/W		
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	40	60	0/11		

Notes:

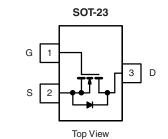
a. Package limited

b. Surface Mounted on 1" x 1" FR4 board.

c. t = 5 s.

d. Maximum under steady state conditions is 125 °C/W.

e. Based on T\_C = 25 °C.



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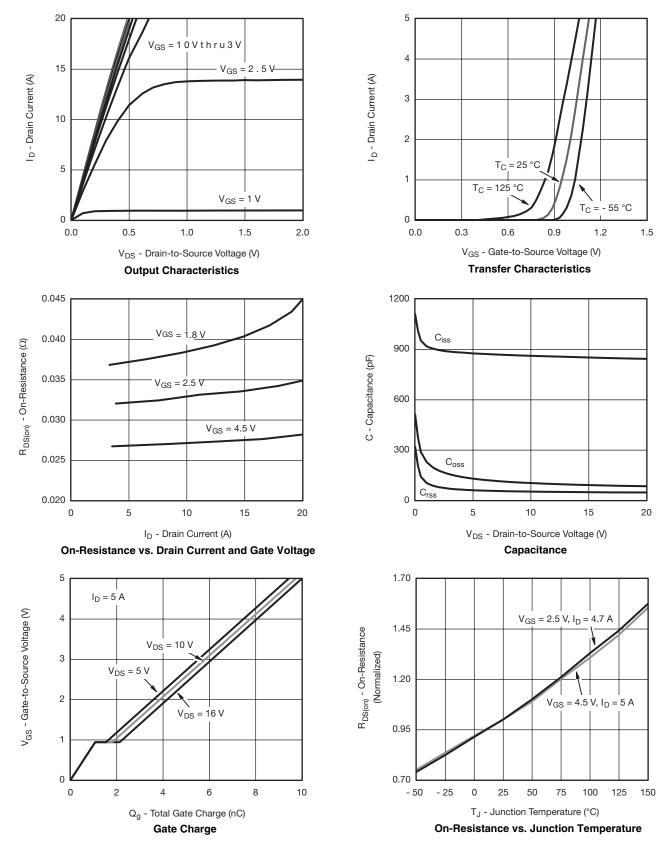
Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static				71	1		
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_{D} = 250 \mu\text{A}$	20			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	1 050 - 4		25		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = 250 μA		- 2.6			
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}$ , $I_D = 250 \ \mu A$	0.45		1.0	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 V, V_{GS} = \pm 8 V$			± 100	nA	
		$V_{DS} = 20 V, V_{GS} = 0 V$			1	μA	
Zero Gate Voltage Drain Current	IDSS	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, \text{ T}_{J} = 70 ^{\circ}\text{C}$			10		
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \le 5$ V, $V_{GS} = 4.5$ V	20			Α	
		$V_{GS} = 4.5 \text{ V}, \text{ I}_{D} = 5.0 \text{ A}$		0.028	28		
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	$V_{GS} = 2.5 \text{ V}, \text{ I}_{D} = 4.7 \text{ A}$		0.042		Ω	
		$V_{GS} = 1.8 \text{ V}, \text{ I}_{D} = 4.3 \text{ A}$		0.050			
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	$V_{DS} = 10 \text{ V}, \text{ I}_{D} = 5.0 \text{ A}$		24		S	
Dynamic <sup>b</sup>	- <b>I</b>					<u> </u>	
Input Capacitance	C <sub>iss</sub>			865		pF	
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, \text{ f} = 1 \text{ MHz}$		105			
Reverse Transfer Capacitance	C <sub>rss</sub>			55			
		$V_{DS} = 10 \text{ V}, V_{GS} = 5 \text{ V}, I_{D} = 5.0 \text{ A}$		12	18		
Total Gate Charge	Qg			8.8	14	nC	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_{D}$ = 5.0 A		1.1			
Gate-Drain Charge	Q <sub>gd</sub>			0.7			
Gate Resistance	Rg	f = 1 MHz	0.5	2.4	4.8	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			8	16		
Rise Time	t <sub>r</sub>	$V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$		17	26	- - _ ns	
Turn-Off Delay Time	t <sub>d(off)</sub>	$\text{I}_\text{D} \cong$ 4 A, $\text{V}_\text{GEN}$ = 4.5 V, $\text{R}_\text{g}$ = 1 $\Omega$		31	47		
Fall Time	t <sub>f</sub>			8	16		
Turn-On Delay Time	t <sub>d(on)</sub>			5	10	110	
Rise Time	t <sub>r</sub>	$V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$		13	20		
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 4 \text{ A}, V_{GEN} = 5 \text{ V}, \text{ R}_g = 1 \Omega$		21	32		
Fall Time	t <sub>f</sub>			6	12		
Drain-Source Body Diode Characteristic	s		<u></u>	•	<b></b>		
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			1.75	۸	
Pulse Diode Forward Current	I <sub>SM</sub>		T		20	A	
Body Diode Voltage	V <sub>SD</sub>	$I_{S} = 4 \text{ A}, V_{GS} = 0 \text{ V}$		0.75	1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>			12	20	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	I <sub>F</sub> = 4 A, dl/dt = 100 A/μs, T <sub>J</sub> = 25 °C		5	10	nC	
Reverse Recovery Fall Time	t <sub>a</sub>	$F = 4 \text{ A}, \text{ u/ul} = 100 \text{ A/}\mu\text{s}, T_{\text{J}} = 25 ^{\circ}\text{C}$		7			
Reverse Recovery Rise Time t <sub>b</sub>				5		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.





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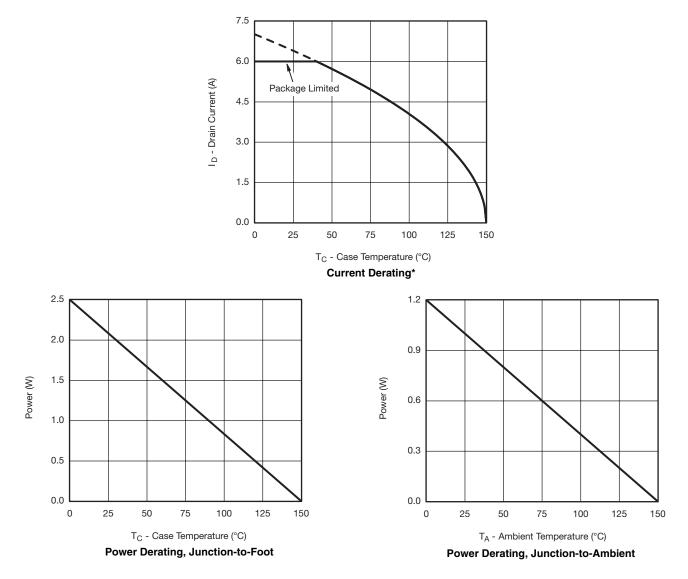


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#### $I_D = 5 A$ $R_{DS(on)}$ - On-Resistance ( $\Omega$ ) 0.05 Is - Source Current (A) T<sub>J</sub> = 150 °C 10 0.04 T<sub>J</sub> = 125 °C $T_J = 25 \degree C$ 1 0.03 $T_J = 25 \ ^{\circ}C$ 0.1 0.02 0.0 0.3 0.6 0.9 1.2 0 2 4 6 V<sub>SD</sub> - Source-to-Drain Voltage (V) V<sub>GS</sub> - Gate-to-Source Voltage (V) Source-Drain Diode Forward Voltage On-Resistance vs. Gate-to-Source Voltage 0.9 32 0.7 24 $I_D = 250 \ \mu A$ V<sub>GS(th)</sub> (V) Power (W) 0.5 16 0.3 8 0.1 0 - 25 - 50 0 25 50 75 100 125 150 0.001 0.01 0.1 1 10 100 Time (s) T<sub>J</sub> - Temperature (°C) Single Pulse Power (Junction-to-Ambient) **Threshold Voltage** 100 Limited by R<sub>DS(on</sub> 10 I<sub>D</sub> - Drain Current (A) 100 µs ms 1 10 ms T<sub>A</sub> = 25 °C 100 ms Single Pulse 0.1 10 **BVDSS** Limited 0.01 0.1 10 100 1 V<sub>DS</sub> - Drain-to-Source Voltage (V) \* $V_{GS}$ > minimum $V_{GS}$ at which $R_{DS(on)}$ is specified Safe Operating Area, Junction-to-Ambient

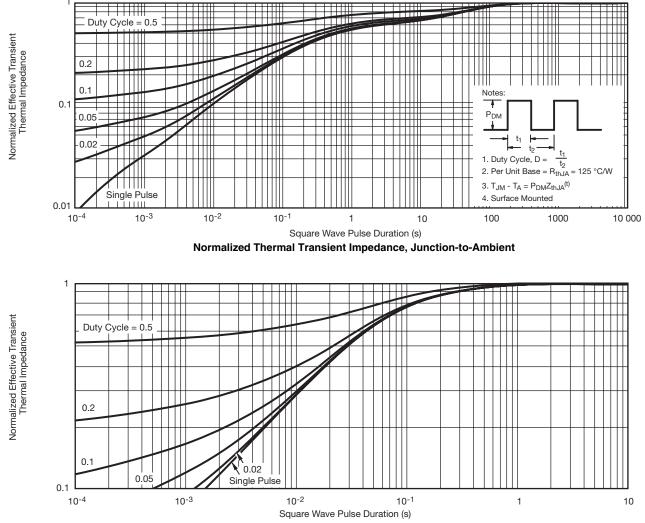
0.06





\* 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.

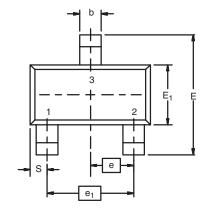




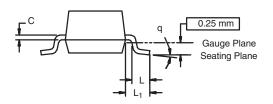
Normalized Thermal Transient Impedance, Junction-to-Foot



### SOT-23 (TO-236): 3-LEAD





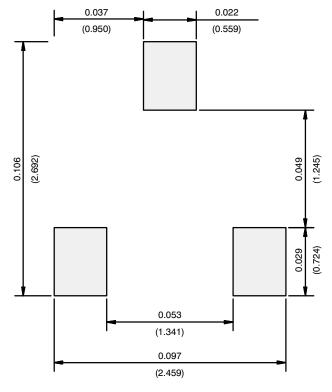


Dim	MILLIN	NETERS	INCHES			
	Min	Max	Min	Max		
Α	0.89	1.12	0.035	0.044		
A <sub>1</sub>	0.01	0.10	0.0004	0.004		
A <sub>2</sub>	0.88	1.02	0.0346	0.040		
b	0.35	0.50	0.014	0.020		
C	0.085	0.18	0.003	0.007		
D	2.80	3.04	0.110	0.120		
E	2.10	2.64	0.083	0.104		
E <sub>1</sub>	1.20	1.40	0.047	0.055		
е	0.95 BSC		0.0374 Ref			
e <sub>1</sub>	1.90	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024		
L <sub>1</sub>	0.64 Ref		0.025 Ref			
S	0.50 Ref		0.020 Ref			
q	3°	8°	3°	8°		
ECN: S-03946-Rev. K, 09- DWG: 5479	Jul-01	•				

## NTR4501NT1G-VB



#### **RECOMMENDED MINIMUM PADS FOR SOT-23**



Recommended Minimum Pads Dimensions in Inches/(mm)



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