

### NCE2301C-VB Datasheet

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

MOSFET PRODUCT SUMMARY						
V <sub>DS</sub> (V)	<b>R<sub>DS(on)</sub> (</b> Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)			
	0.060 at V <sub>GS</sub> = - 10 V	- 4.0				
- 20	0.065 at V <sub>GS</sub> = - 4.5 V	- 3.5	10 nC			
	0.080 at V <sub>GS</sub> = - 2.5 V	- 2.0				

G

s

#### **FEATURES**

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

#### **APPLICATIONS**

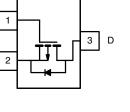
- Load Switch
- PA Switch
- DC/DC Converters

ABSOLUTE MAXIMUM RATINGS ( $T_A =$	25 °C, unless ot	herwise noted)		
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	- 20	V	
Gate-Source Voltage	V <sub>GS</sub>	± 12	Ť	
	T <sub>C</sub> = 25 °C		- 4 <sup>e</sup>	
Continuous Drain Current ( $T_1 = 150 \ ^{\circ}C$ )	T <sub>C</sub> = 70 °C	- I <sub>D</sub> -	-3.2	
	T <sub>A</sub> = 25 °C		- 3 .5 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		- 2 .5 <sup>b, c</sup>	A
Pulsed Drain Current	I <sub>DM</sub>	- 10		
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	l <sub>s</sub>	- 2.1	
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	'5	- 1.0 <sup>b, c</sup>	
	T <sub>C</sub> = 25 °C		2.5	
Maximum Power Dissipation	T <sub>C</sub> = 70 °C	PD	1.6	w
	T <sub>A</sub> = 25 °C	- D	1.25 <sup>b, c</sup>	
	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	

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	≤ 5 s	R <sub>thJA</sub>	75	100	°C/W	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	40	50	0/11	

Notes:

- a. Based on T<sub>C</sub> = 25 °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 166 °C/W.
- e. Package limited.



**TO-236** (SOT-23)

MOSFET SPECIFICATIONS Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>DS</sub> = 0 V, I <sub>D</sub> = - 250 μA	- 20			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$			- 13.4			
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = - 250 μA		2.9		mV/°C	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = -250 \ \mu A$	- 0.5		- 1.5	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 V, V_{GS} = \pm 12 V$			± 100	nA	
Zana Cata Maltana Duain Cumunat		V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V			- 1		
Zero Gate Voltage Drain Current	IDSS	$V_{DS}$ = - 20 V, $V_{GS}$ = 0 V, $T_{J}$ = 55 °C			- 10	μΑ	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \leq$ - 5 V, $V_{GS}$ = - 4.5 V	- 10			Α	
		V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 3 A		0.060			
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 2.5 A		0.065		Ω	
		$V_{GS} = -2.5 \text{ V}, \text{ I}_{D} = -2 \text{ A}$		0.080			
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = - 5 V, I <sub>D</sub> = - 3 A		15		S	
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>			835		pF	
Output Capacitance	C <sub>oss</sub>	V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz		180			
Reverse Transfer Capacitance	C <sub>rss</sub>			155			
T + 1 0 + 0		$V_{DS} = -10 \text{ V}, \text{ V}_{GS} = -4.5 \text{ V}, \text{ I}_{D} = -3.1 \text{ A}$		10			
Total Gate Charge	Qg			6.4			
Gate-Source Charge	Q <sub>gs</sub>	V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 3.1 A		1.7		nC	
Gate-Drain Charge	Q <sub>gd</sub>			3.4			
Gate Resistance	Rg	f = 1 MHz	0.9	4.4	8.8	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			22	33		
Rise Time	t <sub>r</sub>	$V_{DD}$ = - 10 V, $R_L$ = 2.4 $\Omega$		20	30	- ns	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D$ = - 3.1 A, $V_{GEN}$ = - 4.5 V, $R_g$ = 1 $\Omega$		28	42		
Fall Time	t <sub>f</sub>			9	18		
Drain-Source Body Diode Characteristi	cs				<u> </u>		
Continuous Source-Drain Diode Current	۱ <sub>S</sub>	T <sub>C</sub> = 25 °C			- 2.1	- A	
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 1 0		
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 3.1 A		- 0.8	- 1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>			23	35	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			12	20	nC	
Reverse Recovery Fall Time	ta	I <sub>F</sub> = - 3.1 A, dl/dt = 100 A/μs, T <sub>J</sub> = 25 °C		15		ns	
Reverse Recovery Rise Time	t <sub>b</sub>			8			

Notes:

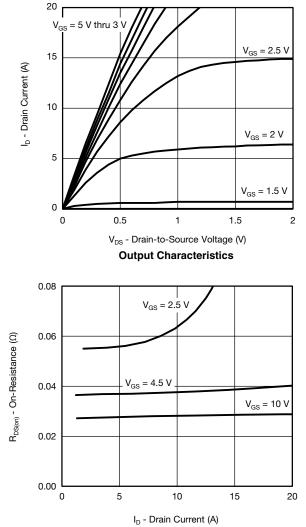
a. Pulse test; pulse width  $\leq$  300  $\mu s,$  duty cycle  $\leq$  2 %.

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

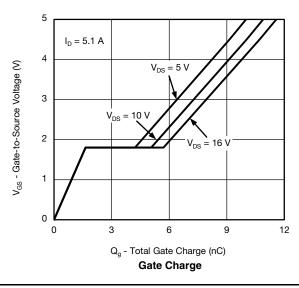
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

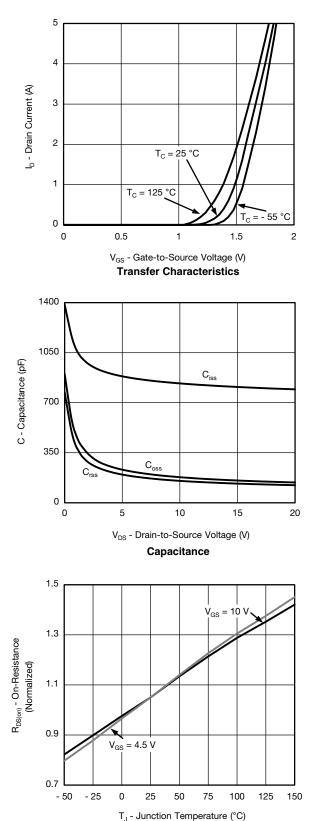
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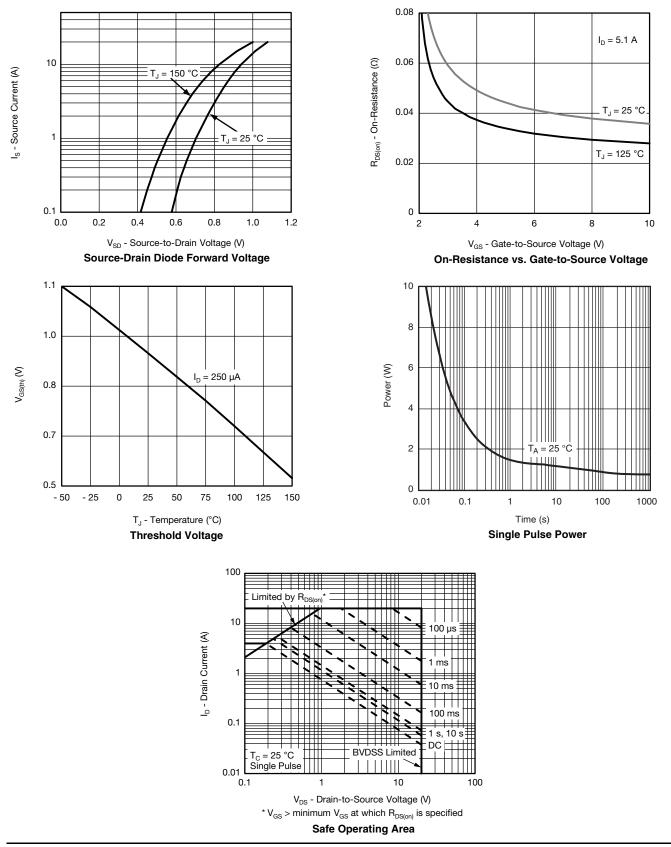




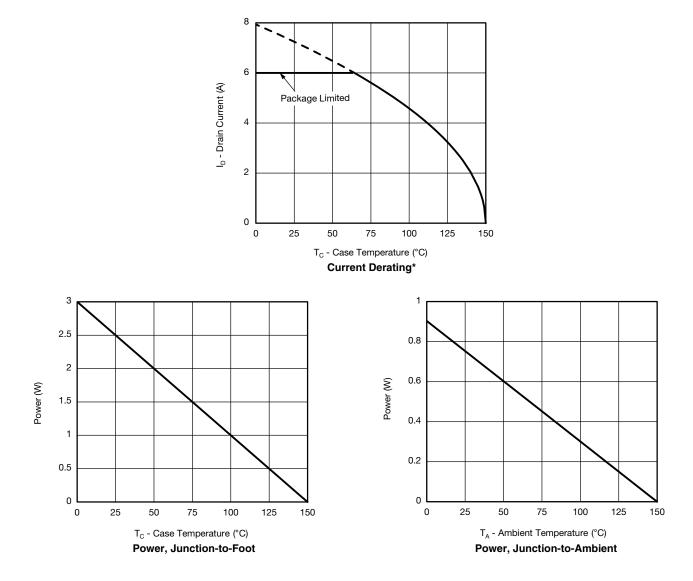


**On-Resistance vs. Junction Temperature** 



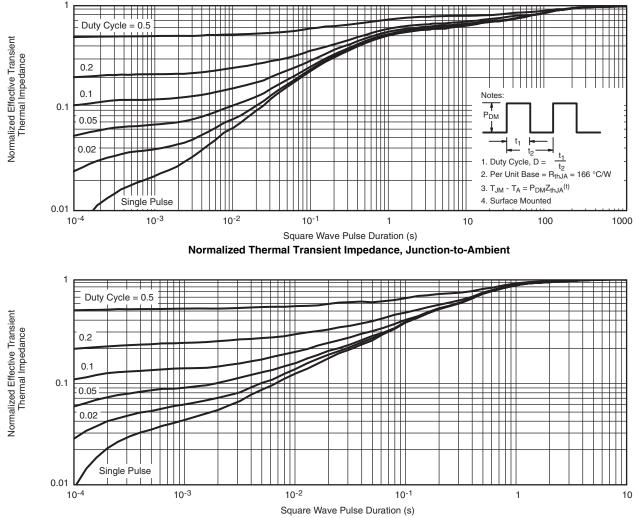






\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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

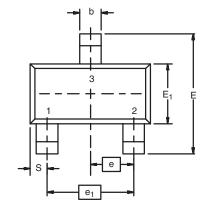


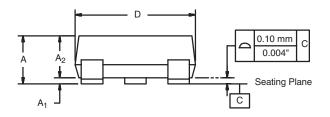


Normalized Thermal Transient Impedance, Junction-to-Foot



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







Dim	MILLIN	IETERS	INCHES			
	Min	Мах	Min	Мах		
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 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	0.020 Ref		
q	3°	8°	3°	8°		
ECN: S-03946-Rev. K, 09- DWG: 5479	Jul-01					



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



Recommended Minimum Pads Dimensions in Inches/(mm)

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