

**SuperMOS – SOT-23 20V  $BV_{DSS}$ , 23m $\Omega$   $R_{DS(on)}$ , N-channel MOSFET**

**1. Description**

The NDS331N-ES is N-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product NDS331N-ES is Pb-free.

**2. Features**

- 20V,  $R_{DS(ON)}$ =23.0m $\Omega$ (Typ),  $V_{GS}$ =4.5V  
 $R_{DS(ON)}$ =30.5m $\Omega$ (Typ),  $V_{GS}$ =2.5V
- Use trench MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

**3. Applications**

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

**4. Ordering Information**

Part Number	Package	Marking	Material	Packing	Quantity per reel	Flammability Rating	Reel Size
NDS331N-ES	SOT-23	2300	Halogen free	Tape & Reel	3,000 PCS	UL 94V-0	7 inches

Table-1 Ordering information

**5. Pin Configuration and Functions**

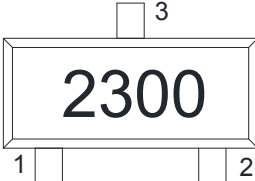
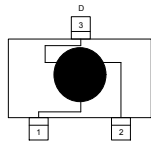
Pin	Function	Outline	Circuit Diagram
1	Gate		
2	Source		
3	Drain		

Table-2 Pin configuration

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$BV_{DSS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Continuous Drain Current	$I_D$	4.5	A
Maximum Power Dissipation	$P_D$	1	W
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	18	A
Operating Junction Temperature	$T_J$	150	°C
Lead Temperature	$T_L$	260	°C
Storage Temperature Range	$T_{stg}$	-55 to 150	°C

#### Thermal resistance ratings

Single Operation					
Parameter		Symbol	Typical	Maximum	Unit
Junction-to-Ambient Thermal Resistance	$t \leq 10$ s	$R_{\theta JA}$	100	125	°C/W

Note:

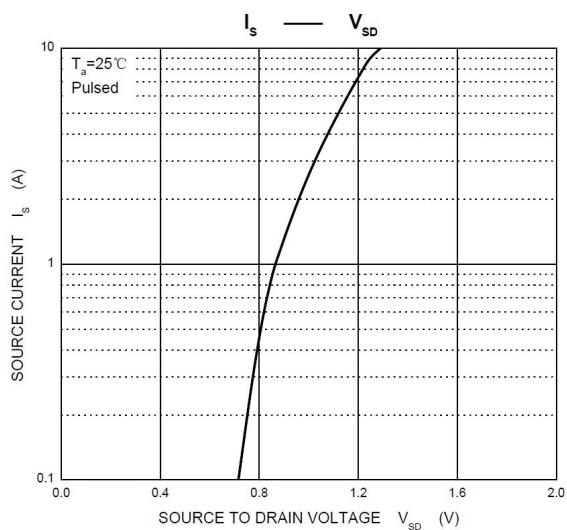
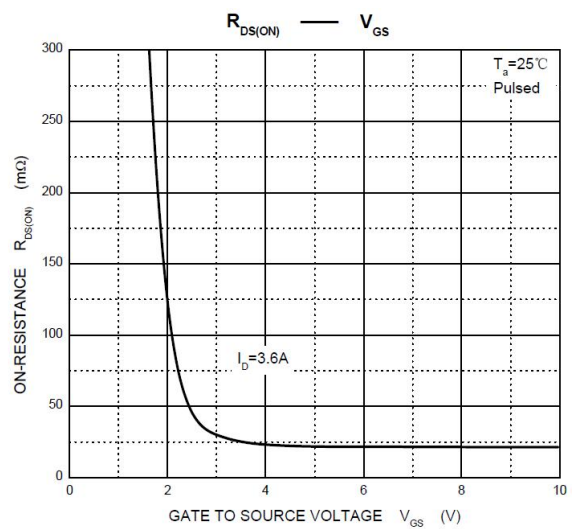
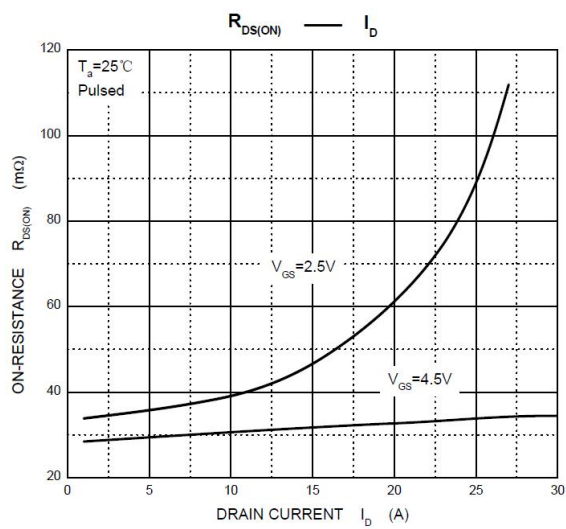
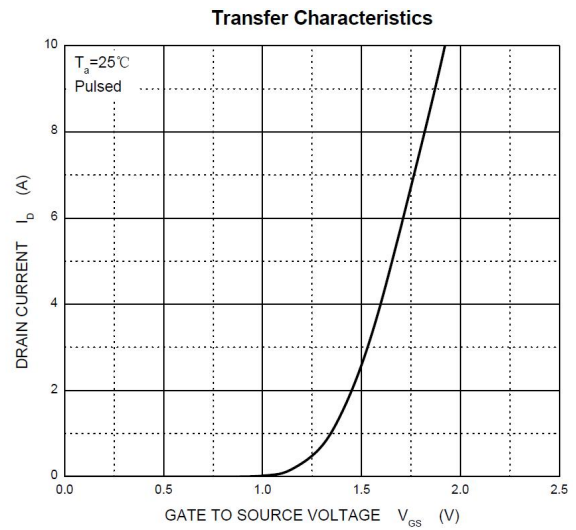
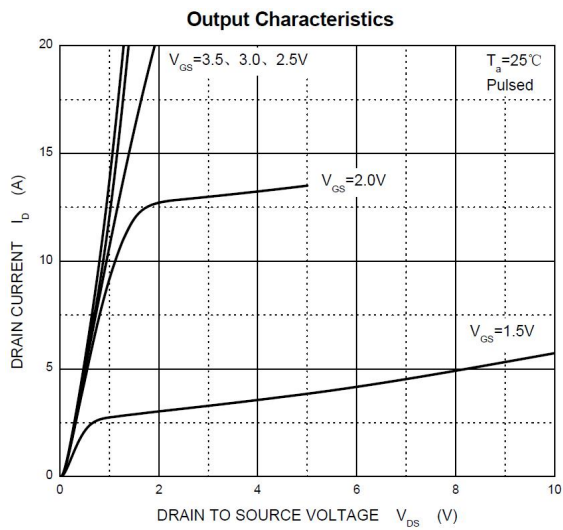
a: Repetitive rating, pulse width limited by junction temperature,  $t_p=10\mu s$ , Duty Cycle=1%

## Electrical Characteristics

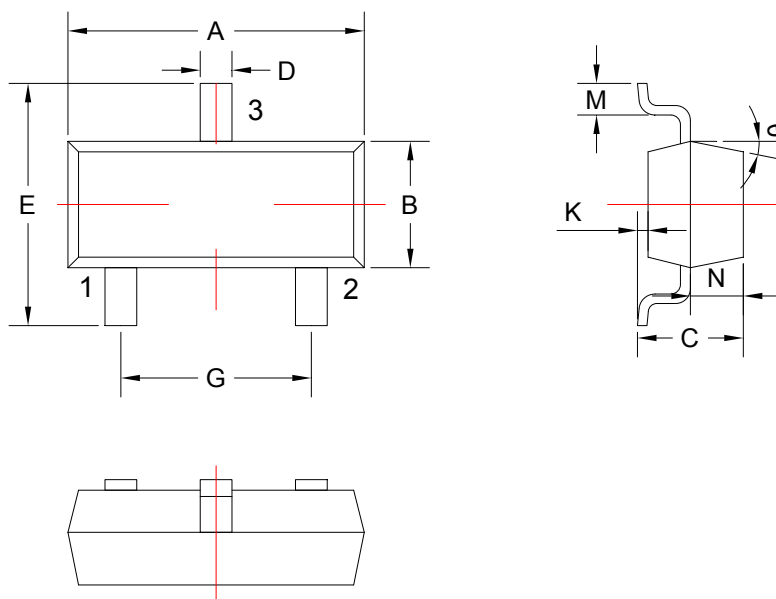
At TA = 25°C unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=20V, V_{GS}=0V$			1	$\mu A$
Gate-to-source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 10V$			$\pm 100$	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	0.45	0.7	1.1	V
Drain-to-source On-resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=3.6A$		23.0	33.0	m $\Omega$
		$V_{GS}=2.5V, I_D=3.0A$		30.5	45.0	
Forward Trans conductance	$g_{FS}$	$V_{DS}=5.0V, I_D=4.5A$			40	S
<b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V, f=1MHz,$ $V_{DS}=10V$		311		pF
Output Capacitance	$C_{OSS}$			125		
Reverse Transfer Capacitance	$C_{RSS}$			88		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=4.5V, V_{DS}=10V,$ $I_D=3.6A$		4.1	10.5	nC
Gate-to-Source Charge	$Q_{GS}$			0.68		
Gate-to-Drain Charge	$Q_{GD}$			1.55		
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS}=4.5V, V_{DS}=10V,$ $R_L=55\Omega, R_G=6\Omega$		7.2	15	ns
Rise Time	$t_r$			58.0	80	
Turn-Off Delay Time	$t_{d(OFF)}$			15.8	62	
Fall Time	$t_f$			10.6	25	
<b>BODY DIODE CHARACTERISTICS</b>						
Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=1.0A$		0.75	1.5	V

## 7. Typical Characteristic



8. Dimension (SOT-23)



COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER					
SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A	2.85	3.04	G	1.80	2.00
B	1.20	1.40	K	0	0.10
C	0.90	1.10	M	0.20	-
D	0.40	0.50	N	0.50	0.70
E	2.25	2.55	$\theta$	5°	9°

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