

SuperMOS – SOT-23 20V  $BV_{DSS}$ , 25m $\Omega$   $R_{DS(on)}$ , 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,  $R_{DS(ON)}=25m\Omega$ (Typ.),  $V_{GS}=4.5V$   
 $R_{DS(ON)}=29m\Omega$ (Typ.),  $V_{GS}=2.5V$
- 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

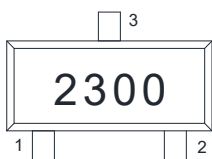
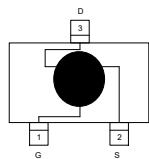
| Pin | Function | Outline                                                                             | Circuit Diagram                                                                       |
|-----|----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 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            |                           | $V_{GS}$   | $\pm 12$   | V                |
| Continuous Drain Current       | $T_A = 25^\circ\text{C}$  | $I_D$      | 4          | A                |
|                                | $T_A = 100^\circ\text{C}$ |            | 3          |                  |
| Maximum Power Dissipation      |                           | $P_D$      | 1.2        | W                |
| Pulsed Drain Current           |                           | $I_{DM}$   | 16         | A                |
| Operating Junction Temperature |                           | $T_J$      | 150        | $^\circ\text{C}$ |
| Lead Temperature               |                           | $T_L$      | 260        | $^\circ\text{C}$ |
| Storage Temperature Range      |                           | $T_{stg}$  | -55 to 150 | $^\circ\text{C}$ |

### Thermal resistance ratings

| Single Operation                       |                 |         |         |                    |
|----------------------------------------|-----------------|---------|---------|--------------------|
| Parameter                              | Symbol          | Typical | Maximum | Unit               |
| Junction-to-Ambient Thermal Resistance | $R_{\theta JA}$ |         | 106     | $^\circ\text{C/W}$ |

## NDS331N-ES

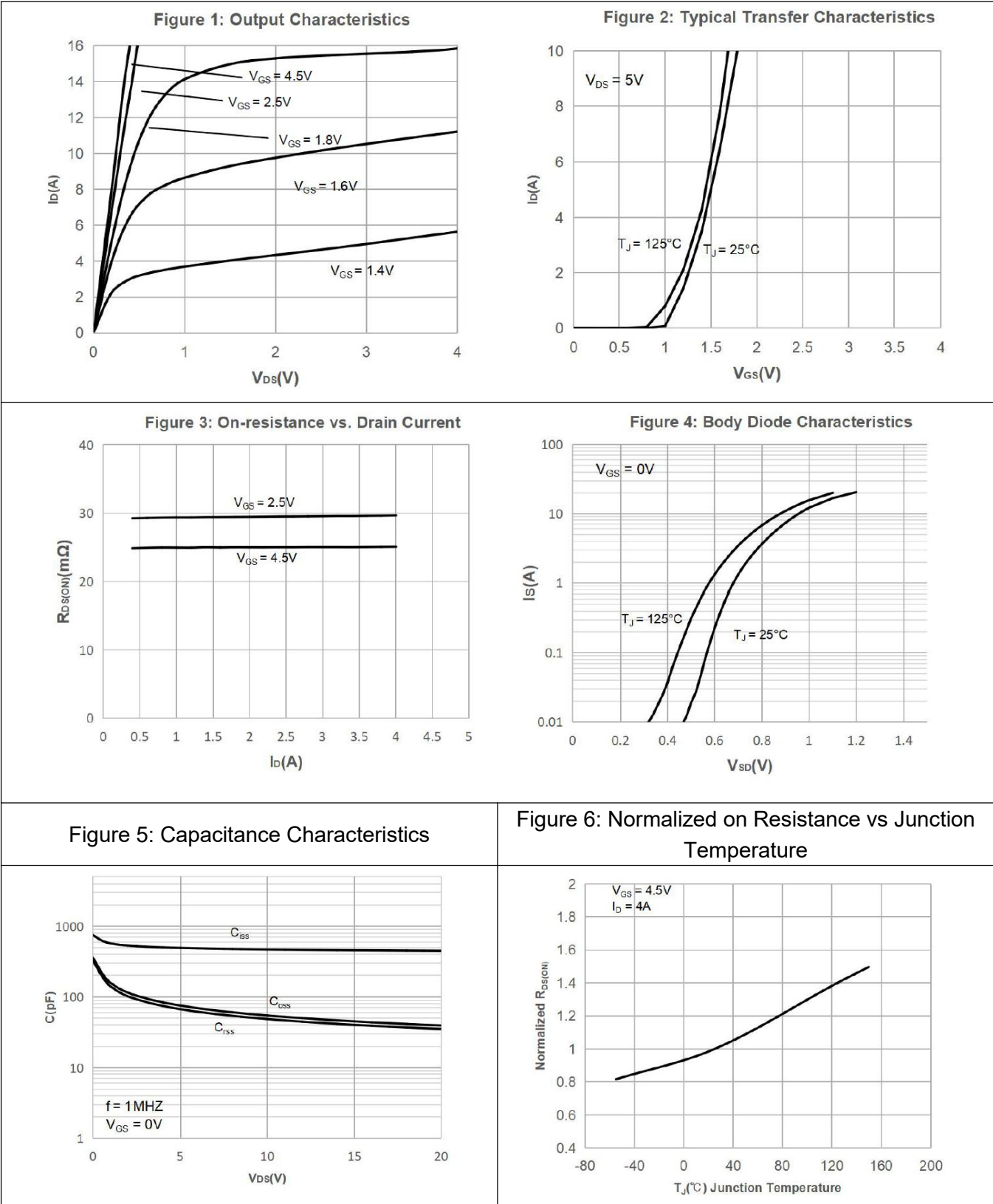
Rev-1.3

## Electrical Characteristics

At TA = 25°C unless otherwise specified

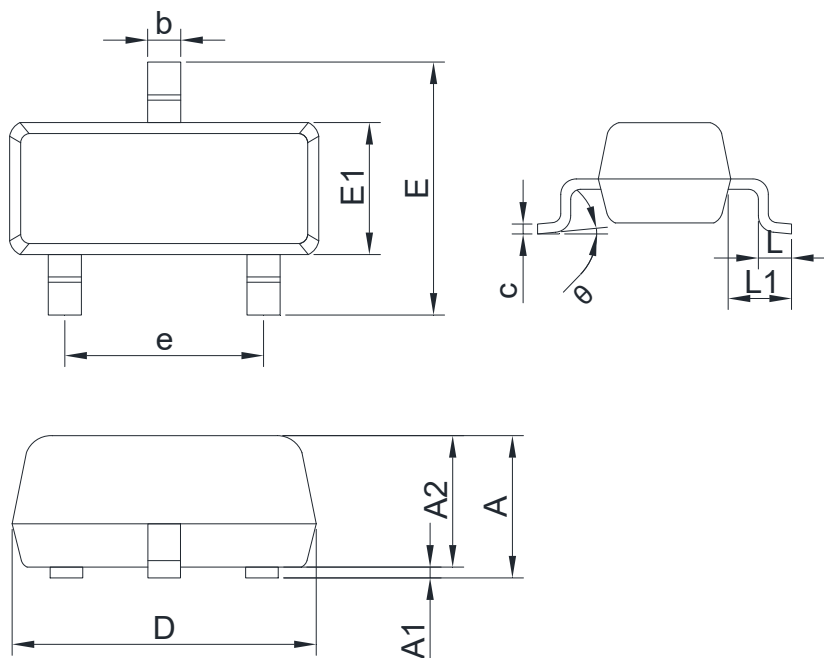
| Parameter                                 | Symbol              | Test Conditions                                                                        | Min. | Typ. | Max. | Unit |
|-------------------------------------------|---------------------|----------------------------------------------------------------------------------------|------|------|------|------|
| OFF CHARACTERISTICS                       |                     |                                                                                        |      |      |      |      |
| Drain-to-Source Breakdown Voltage         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                             | 20   |      |      | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V                                              |      |      | 1    | uA   |
| Gate-to-source Leakage Current            | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V                                             |      |      | ±100 | nA   |
| ON CHARACTERISTICS                        |                     |                                                                                        |      |      |      |      |
| Gate Threshold Voltage                    | V <sub>GS(TH)</sub> | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                               | 0.5  | 0.75 | 1.0  | V    |
| Drain-to-source On-resistance             | R <sub>DS(on)</sub> | V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A                                              |      | 25   | 32   | mΩ   |
|                                           |                     | V <sub>GS</sub> =2.5V, I <sub>D</sub> =3A                                              |      | 29   | 38   |      |
| CHARGES, CAPACITANCES AND GATE RESISTANCE |                     |                                                                                        |      |      |      |      |
| Input Capacitance                         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, f=1MHz,<br>V <sub>DS</sub> =10V                                   |      | 470  |      | pF   |
| Output Capacitance                        | C <sub>OSS</sub>    |                                                                                        |      | 55   |      |      |
| Reverse Transfer Capacitance              | C <sub>RSS</sub>    |                                                                                        |      | 50   |      |      |
| Total Gate Charge                         | Q <sub>G(TOT)</sub> | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V,<br>I <sub>D</sub> =2A                     |      | 6    |      | nC   |
| Gate-to-Source Charge                     | Q <sub>GS</sub>     |                                                                                        |      | 1    |      |      |
| Gate-to-Drain Charge                      | Q <sub>GD</sub>     |                                                                                        |      | 1.5  |      |      |
| SWITCHING CHARACTERISTICS                 |                     |                                                                                        |      |      |      |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V,<br>I <sub>D</sub> =2A, R <sub>G</sub> =3Ω |      | 4    |      | ns   |
| Rise Time                                 | t <sub>r</sub>      |                                                                                        |      | 13   |      |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |                                                                                        |      | 65   |      |      |
| Fall Time                                 | t <sub>f</sub>      |                                                                                        |      | 33   |      |      |
| BODY DIODE CHARACTERISTICS                |                     |                                                                                        |      |      |      |      |
| Forward Voltage                           | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =4A                                                |      |      | 1.5  | V    |

7. Typical Characteristic



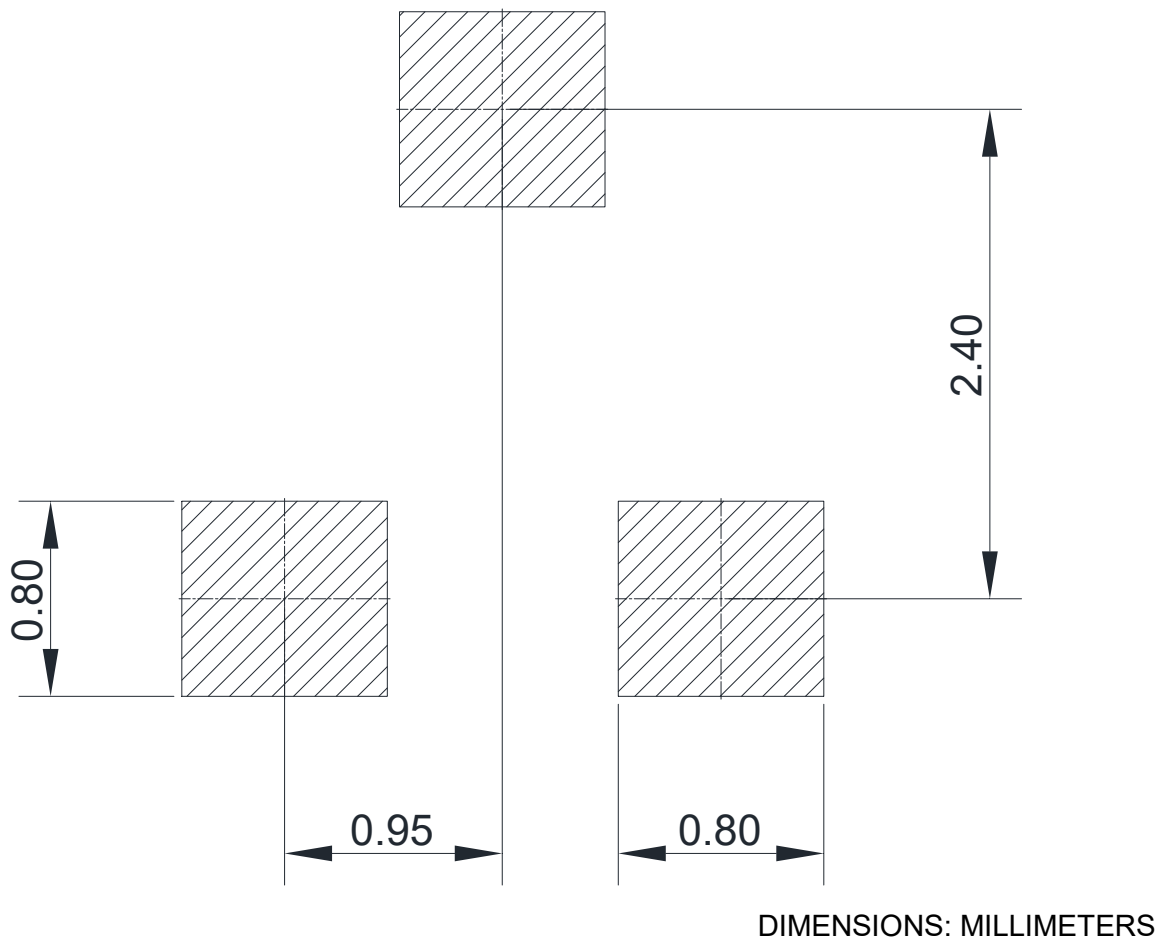
## 8. Dimension (SOT-23)

POD(Z)



| COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER |      |      |          |       |       |
|---------------------------------------------|------|------|----------|-------|-------|
| SYMBOL                                      | MIN  | MAX  | SYMBOL   | MIN   | MAX   |
| A                                           | 0.90 | 1.20 | E        | 2.25  | 2.55  |
| A1                                          | 0.00 | 0.10 | E1       | 1.20  | 1.40  |
| A2                                          | 0.90 | 1.10 | e        | 1.80  | 2.00  |
| b                                           | 0.30 | 0.50 | L        | 0.30  | 0.50  |
| c                                           | 0.07 | 0.18 | L1       | 0.475 | 0.625 |
| D                                           | 2.80 | 3.04 | $\theta$ | 0°    | 8°    |

## 9. Recommended Soldering Footprint



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