



## N-Channel Depletion-Mode Vertical DMOS FETs

### Features

- ▶ High input impedance
- ▶ Low input capacitance
- ▶ Fast switching speeds
- ▶ Low on-resistance
- ▶ Free from secondary breakdown
- ▶ Low input and output leakage

### Applications

- ▶ Normally-on switches
- ▶ Solid state relays
- ▶ Converters
- ▶ Linear amplifiers
- ▶ Constant current sources
- ▶ Power supply circuits
- ▶ Telecom

### General Description

The Supertex DN3135 is a low threshold depletion-mode (normally-on) transistor utilizing an advanced vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and with the high input impedance and positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, this device is free from thermal runaway and thermally-induced secondary breakdown.

Supertex's vertical DMOS FETs are ideally suited to a wide range of switching and amplifying applications where high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

### Ordering Information

| Device | Package Options   |                   | $BV_{DSX}/BV_{DGX}$<br>(V) | $R_{DS(ON)}$<br>(max)<br>( $\Omega$ ) | $I_{DSS}$<br>(min)<br>(mA) |
|--------|-------------------|-------------------|----------------------------|---------------------------------------|----------------------------|
|        | TO-236AB (SOT-23) | TO-243AA (SOT-89) |                            |                                       |                            |
| DN3135 | DN3135K1-G        | DN3135N8-G        | 350                        | 35                                    | 180                        |

-G indicates package is RoHS compliant ('Green')



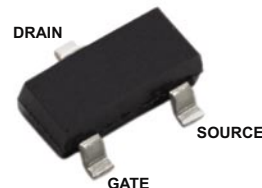
### Absolute Maximum Ratings

| Parameter                         | Value                             |
|-----------------------------------|-----------------------------------|
| Drain-to-source voltage           | $BV_{DSX}$                        |
| Drain-to-gate voltage             | $BV_{DGX}$                        |
| Gate-to-source voltage            | $\pm 20V$                         |
| Operating and storage temperature | $-55^{\circ}C$ to $+150^{\circ}C$ |
| Soldering temperature*            | $300^{\circ}C$                    |

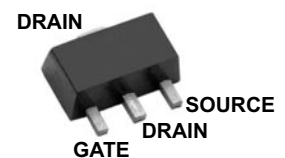
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

\* Distance of 1.6mm from case for 10 seconds.

### Pin Configurations



TO-236AB (SOT-23) (K1)



TO-243AA (SOT-89) (N8)

### Product Marking

**N1SW** W = Code for week sealed  
\_\_\_\_\_ = "Green" Packaging

Package may or may not include the following marks: Si or

**TO-236AB (SOT-23) (K1)**

**DN1SW** W = Code for week sealed  
\_\_\_\_\_ = "Green" Packaging

Package may or may not include the following marks: Si or

**TO-243AA (SOT-89) (N8)**

## Thermal Characteristics

| Package  | $I_D$<br>(continuous) <sup>†</sup><br>(mA) | $I_D$<br>(pulsed)<br>(mA) | Power Dissipation<br>@ $T_A = 25^\circ\text{C}$<br>(W) | $\theta_{jc}$<br>( $^\circ\text{C/W}$ ) | $\theta_{ja}$<br>( $^\circ\text{C/W}$ ) | $I_{DR}^{\dagger}$<br>(mA) | $I_{DRM}$<br>(mA) |
|----------|--------------------------------------------|---------------------------|--------------------------------------------------------|-----------------------------------------|-----------------------------------------|----------------------------|-------------------|
| TO-236AB | 72                                         | 300                       | 0.36                                                   | 200                                     | 350                                     | 72                         | 300               |
| TO-243AA | 135                                        | 300                       | 1.3 <sup>‡</sup>                                       | 34                                      | 97 <sup>‡</sup>                         | 135                        | 300               |

### Notes:

- <sup>†</sup>  $I_D$  (continuous) is limited by max rated  $T_J$ .  
<sup>‡</sup> Mounted on FR4 board, 25mm x 25mm 1.57mm.

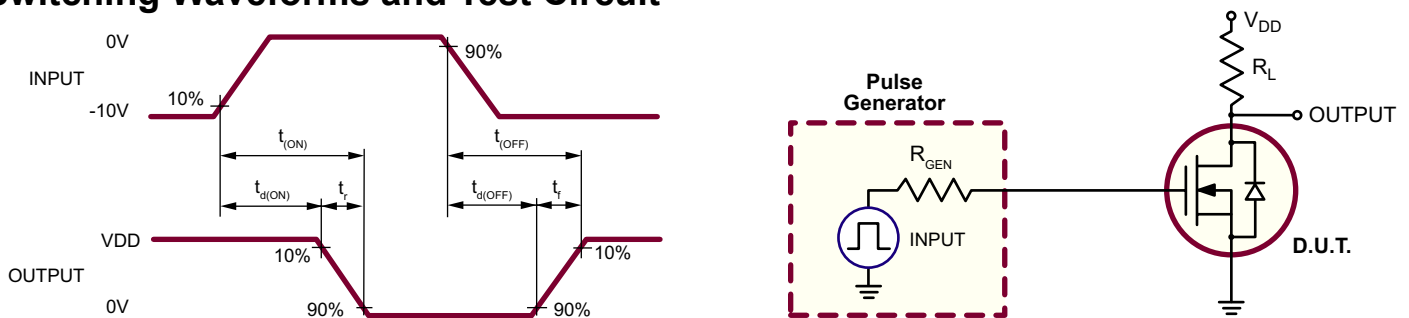
## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Sym                  | Parameter                                  | Min  | Typ | Max  | Units                | Conditions                                                                                                          |
|----------------------|--------------------------------------------|------|-----|------|----------------------|---------------------------------------------------------------------------------------------------------------------|
| $BV_{DSX}$           | Drain-to-source breakdown voltage          | 350  | -   | -    | V                    | $V_{GS} = -5.0\text{V}$ , $I_D = 100\mu\text{A}$                                                                    |
| $V_{GS(OFF)}$        | Gate-to-source off voltage                 | -1.5 | -   | -3.5 | V                    | $V_{DS} = 15\text{V}$ , $I_D = 10\mu\text{A}$                                                                       |
| $\Delta V_{GS(OFF)}$ | Change in $V_{GS(OFF)}$ with temperature   | -    | -   | -4.5 | mV/ $^\circ\text{C}$ | $V_{DS} = 15\text{V}$ , $I_D = 10\mu\text{A}$                                                                       |
| $I_{GSS}$            | Gate body leakage current                  | -    | -   | 100  | nA                   | $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$                                                                    |
| $I_{D(OFF)}$         | Drain-to-source leakage current            | -    | -   | 1.0  | $\mu\text{A}$        | $V_{DS} = \text{Max rating}$ , $V_{GS} = -5.0\text{V}$                                                              |
|                      |                                            | -    | -   | 1.0  | mA                   | $V_{DS} = 0.8 \text{ Max Rating}$ ,<br>$V_{GS} = -5.0\text{V}$ , $T_A = 125^\circ\text{C}$                          |
| $I_{DSS}$            | Saturated drain-to-source current          | 180  | -   | -    | mA                   | $V_{GS} = 0\text{V}$ , $V_{DS} = 15\text{V}$                                                                        |
| $R_{DS(ON)}$         | Static drain-to-source on-state resistance | -    | -   | 35   | $\Omega$             | $V_{GS} = 0\text{V}$ , $I_D = 150\text{mA}$                                                                         |
| $\Delta R_{DS(ON)}$  | Change in $R_{DS(ON)}$ with temperature    | -    | -   | 1.1  | %/ $^\circ\text{C}$  | $V_{GS} = 0\text{V}$ , $I_D = 150\text{mA}$                                                                         |
| $G_{FS}$             | Forward transconductance                   | 140  | -   | -    | mmho                 | $V_{DS} = 10\text{V}$ , $I_D = 100\text{mA}$                                                                        |
| $C_{ISS}$            | Input capacitance                          | -    | 60  | 120  | pF                   | $V_{GS} = -5.0\text{V}$ ,<br>$V_{DS} = 25\text{V}$ ,<br>$f = 1.0\text{MHz}$                                         |
| $C_{OSS}$            | Common source output capacitance           | -    | 6.0 | 15   |                      |                                                                                                                     |
| $C_{RSS}$            | Reverse transfer capacitance               | -    | 3.0 | 10   |                      |                                                                                                                     |
| $t_{d(ON)}$          | Turn-on delay time                         | -    | -   | 10   | ns                   | $V_{DD} = 25\text{V}$ ,<br>$I_D = 150\text{mA}$ ,<br>$R_{GEN} = 25\Omega$ ,<br>$V_{GS} = 0\text{V to } -10\text{V}$ |
| $t_r$                | Rise time                                  | -    | -   | 15   |                      |                                                                                                                     |
| $t_{d(OFF)}$         | Turn-off delay time                        | -    | -   | 15   |                      |                                                                                                                     |
| $t_f$                | Fall time                                  | -    | -   | 20   |                      |                                                                                                                     |
| $V_{SD}$             | Diode forward voltage drop                 | -    | -   | 1.8  | V                    | $V_{GS} = -5.0\text{V}$ , $I_{SD} = 150\text{mA}$                                                                   |
| $t_{rr}$             | Reverse recovery time                      | -    | 800 | -    | ns                   | $V_{GS} = -5.0\text{V}$ , $I_{SD} = 150\text{mA}$                                                                   |

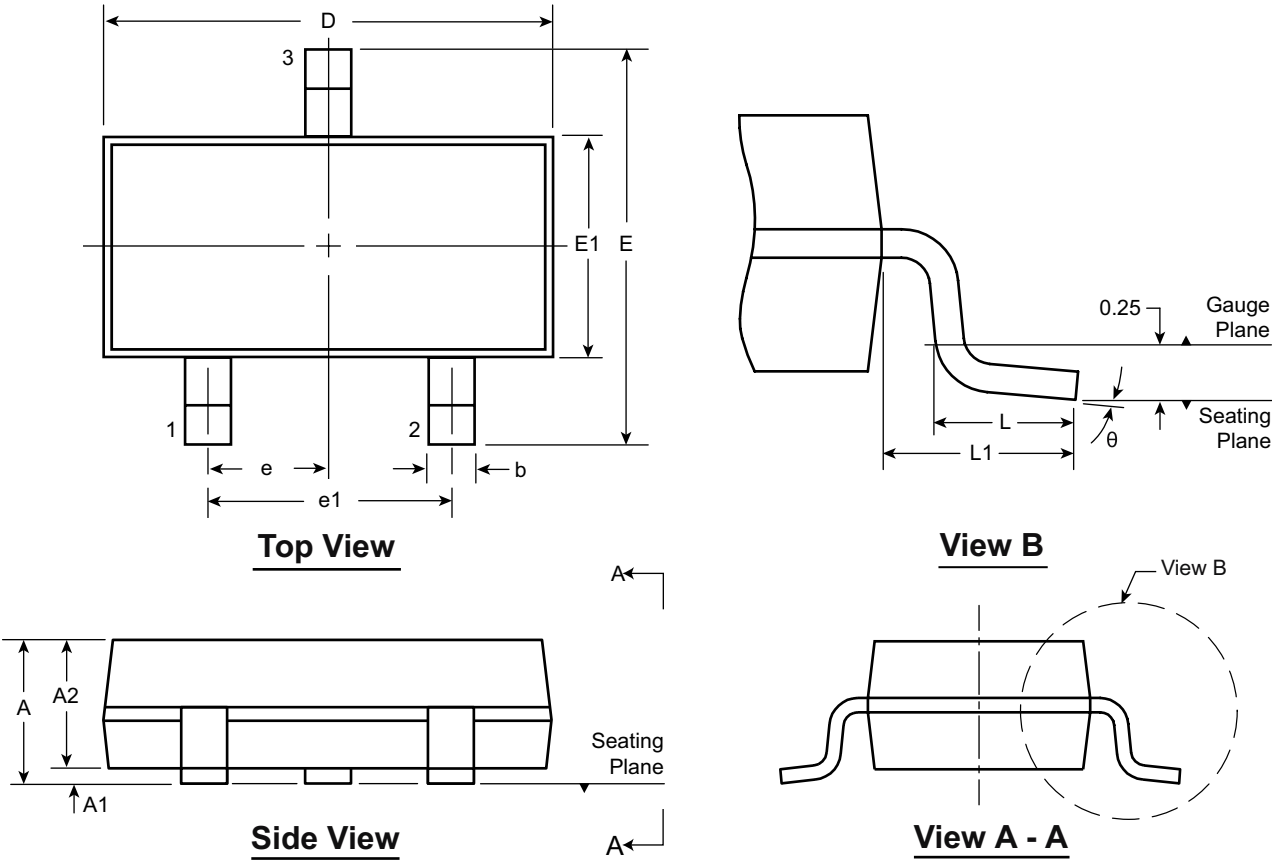
### Notes:

- All D.C. parameters 100% tested at  $25^\circ\text{C}$  unless otherwise stated. (Pulse test: 300 $\mu\text{s}$  pulse, 2% duty cycle.)
- All A.C. parameters sample tested.

## Switching Waveforms and Test Circuit



3-Lead TO-236AB (SOT-23) Package Outline (K1)  
2.90x1.30mm body, 1.12mm height (max), 1.90mm pitch



| Symbol         |     | A    | A1   | A2   | b    | D    | E    | E1   | e        | e1       | L                 | L1       | θ  |
|----------------|-----|------|------|------|------|------|------|------|----------|----------|-------------------|----------|----|
| Dimension (mm) | MIN | 0.89 | 0.01 | 0.88 | 0.30 | 2.80 | 2.10 | 1.20 | 0.95 BSC | 1.90 BSC | 0.20 <sup>†</sup> | 0.54 REF | 0° |
|                | NOM | -    | -    | 0.95 | -    | 2.90 | -    | 1.30 |          |          | 0.50              |          | -  |
|                | MAX | 1.12 | 0.10 | 1.02 | 0.50 | 3.04 | 2.64 | 1.40 |          |          | 0.60              |          | 8° |

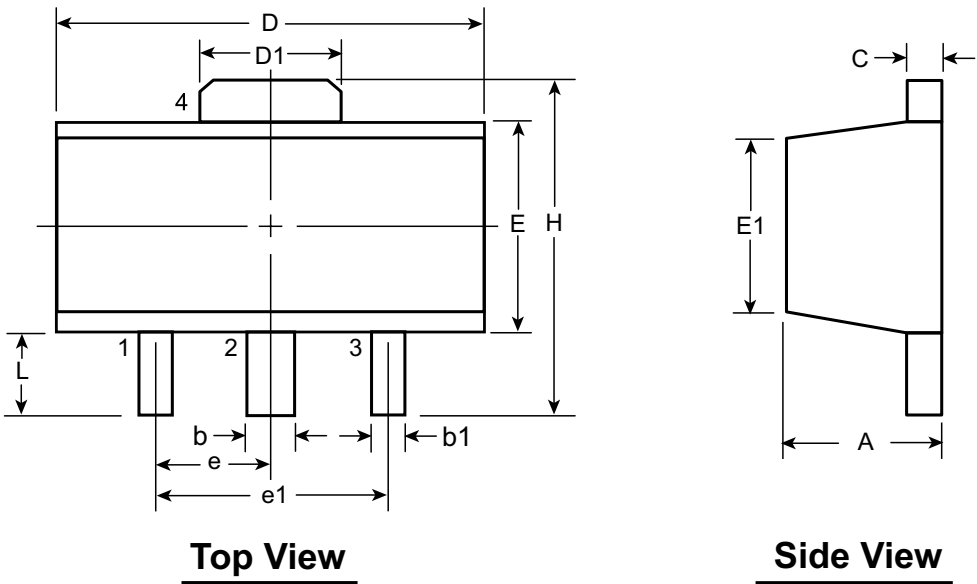
JEDEC Registration TO-236, Variation AB, Issue H, Jan. 1999.

<sup>†</sup> This dimension differs from the JEDEC drawing.

Drawings not to scale.

Supertex Doc.#: DSPD-3TO236ABK1, Version C041309.

3-Lead TO-243AA (SOT-89) Package Outline (N8)



| Symbol             |     | A    | b    | b1   | C    | D    | D1   | E    | E1    | e           | e1          | H    | L    |
|--------------------|-----|------|------|------|------|------|------|------|-------|-------------|-------------|------|------|
| Dimensions<br>(mm) | MIN | 1.40 | 0.44 | 0.36 | 0.35 | 4.40 | 1.62 | 2.29 | 2.00† | 1.50<br>BSC | 3.00<br>BSC | 3.94 | 0.89 |
|                    | NOM | -    | -    | -    | -    | -    | -    | -    | -     |             |             | -    | -    |
|                    | MAX | 1.60 | 0.56 | 0.48 | 0.44 | 4.60 | 1.83 | 2.60 | 2.29  |             |             | 4.25 | 1.20 |

JEDEC Registration TO-243, Variation AA, Issue C, July 1986.

† This dimension differs from the JEDEC drawing

Drawings not to scale.

Supertex Doc. #: DSPD-3TO243AAN8, Version E051509.

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to <http://www.supertex.com/packaging.html>.)

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