

## SuperMOS – TO-252 30V $BV_{DSS}$ , 4m $\Omega$ $R_{DS(on)}$ , N-channel MOSFET

### 1. Description

The ESA50N03BD 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 ESA50N03BD is Pb-free.

### 2. Features

- 30V,  $R_{DS(on)}=4m\Omega(Typ.) @V_{GS}=10V$   
 $R_{DS(on)}=6m\Omega(Typ.) @V_{GS}=4.5V$
- 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

100% UIS TESTED!

### 4. Ordering Information

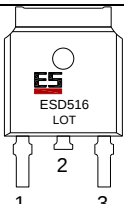
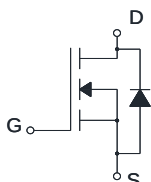
| Part Number | Package | Marking    | Material     | Packing     | Quantity per reel | Flammability Rating | Reel Size |
|-------------|---------|------------|--------------|-------------|-------------------|---------------------|-----------|
| ESA50N03BD  | TO-252  | ESD516/LOT | Halogen free | Tape & Reel | 2,500 PCS         | UL 94V-0            | 13 inches |

### 5. Pin Configuration and Functions

| Pin | Function | Outline | Circuit Diagram |
|-----|----------|---------|-----------------|
| 1   | Gate     |         |                 |
| 3   | Source   |         |                 |

## ESA50N03BD

Rev-1.4

|   |       |                                                                                   |                                                                                     |
|---|-------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 2 | Drain |  |  |
|---|-------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|

## 6. Specification

## Absolute Maximum Rating &amp; Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

| Parameter                                     |                          | Symbol     | Limit      | Unit               |
|-----------------------------------------------|--------------------------|------------|------------|--------------------|
| Drain-Source Voltage                          |                          | $BV_{DSS}$ | 30         | V                  |
| Gate-Source Voltage                           |                          | $V_{GS}$   | $\pm 20$   | V                  |
| Continuous Drain Current                      | $T_C=25^{\circ}\text{C}$ | $I_D$      | 65         | A                  |
|                                               | $T_C=75^{\circ}\text{C}$ |            | 50         |                    |
| Maximum Power Dissipation                     | $T_C=25^{\circ}\text{C}$ | $P_D$      | 42         | W                  |
|                                               | $T_C=75^{\circ}\text{C}$ |            | 25         |                    |
| Pulsed Drain Current <sup>a</sup>             |                          | $I_{DM}$   | 260        | A                  |
| Avalanche Current, Single Pulsed <sup>b</sup> |                          | $I_{AS}$   | 32         | A                  |
| Avalanche Energy, Single Pulsed <sup>b</sup>  |                          | $E_{AS}$   | 153        | mJ                 |
| 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 | Unit                 |
| Junction-to-Case Thermal Resistance | $t \leq 10 \text{ s}$ | $R_{\theta JC}$ | 3       | $^{\circ}\text{C/W}$ |

Note:

a: Repetitive rating, pulse width limited by junction temperature,  $t_p=10\mu\text{s}$ , Duty Cycle=1%b:  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=30\text{V}$ ,  $V_G=10\text{V}$ ,  $L=0.3\text{mH}$ ,  $R_g=25\Omega$

## 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                                              | 30   |      |      | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                               |      |      | 1.0  | uA   |
| Gate-to-source Leakage Current            | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                              |      |      | ±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                                | 1.0  | 1.75 | 2.5  | V    |
| Drain-to-source On-resistance             | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                               |      | 4.0  | 6.5  | mΩ   |
|                                           |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                              |      | 6.0  | 8.5  |      |
| Forward Trans conductance                 | g <sub>FS</sub>     | V <sub>DS</sub> =5.0V, I <sub>D</sub> =20A                                              |      |      | 60   | S    |
| CHARGES, CAPACITANCES AND GATE RESISTANCE |                     |                                                                                         |      |      |      |      |
| Input Capacitance                         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, f=1MHz, V <sub>DS</sub> =25V                                       |      | 1036 |      | pF   |
| Output Capacitance                        | C <sub>OSS</sub>    |                                                                                         |      | 444  |      |      |
| Reverse Transfer Capacitance              | C <sub>RSS</sub>    |                                                                                         |      | 62   |      |      |
| Total Gate Charge                         | Q <sub>G(TOT)</sub> | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =20A                         |      | 15.8 |      | nC   |
| Gate-to-Source Charge                     | Q <sub>GS</sub>     |                                                                                         |      | 3.3  |      |      |
| Gate-to-Drain Charge                      | Q <sub>GD</sub>     |                                                                                         |      | 3.6  |      |      |
| SWITCHING CHARACTERISTICS                 |                     |                                                                                         |      |      |      |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>G</sub> =0.75Ω, R <sub>G</sub> =1.8Ω |      | 5.5  |      | ns   |
| Rise Time                                 | t <sub>r</sub>      |                                                                                         |      | 3.3  |      |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |                                                                                         |      | 18   |      |      |
| Fall Time                                 | t <sub>f</sub>      |                                                                                         |      | 4.3  |      |      |
| BODY DIODE CHARACTERISTICS                |                     |                                                                                         |      |      |      |      |
| Forward Voltage                           | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =1.0A                                               |      | 0.75 | 1.5  | V    |

7. Typical Characteristic

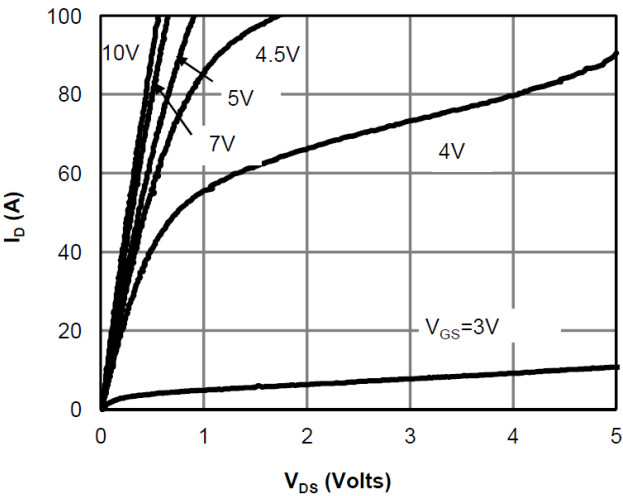


Fig 1: On-Region Characteristics

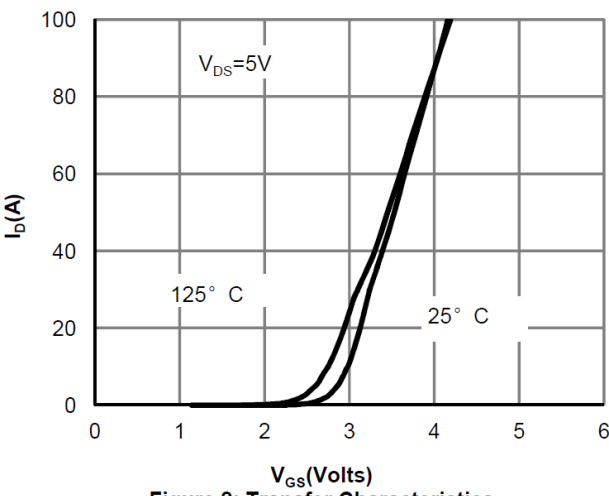


Figure 2: Transfer Characteristics

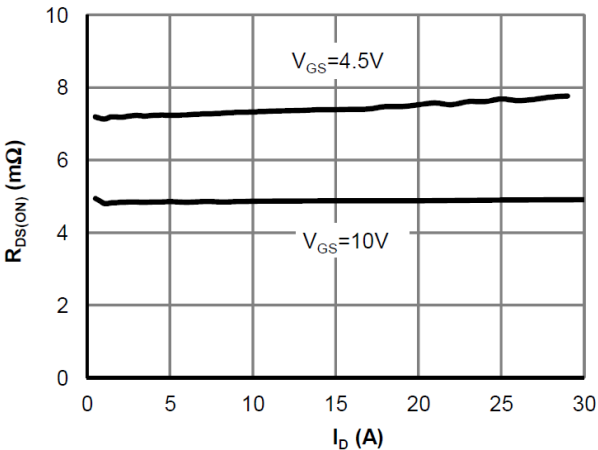


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

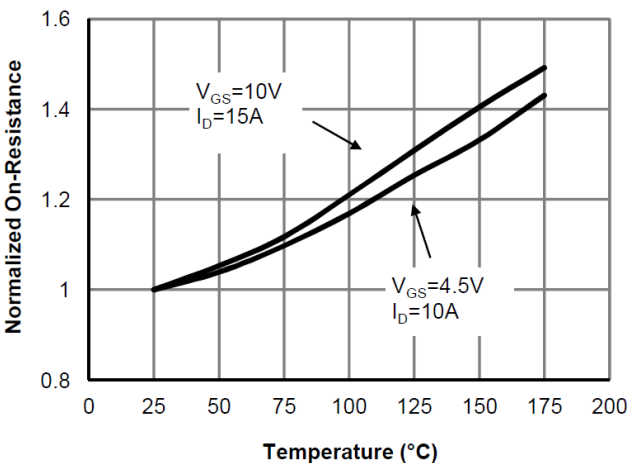


Figure 4: On-Resistance vs. Junction Temperature

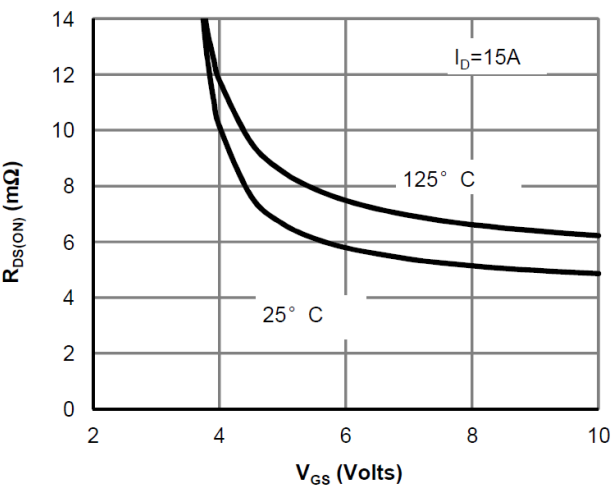


Figure 5: On-Resistance vs. Gate-Source Voltage

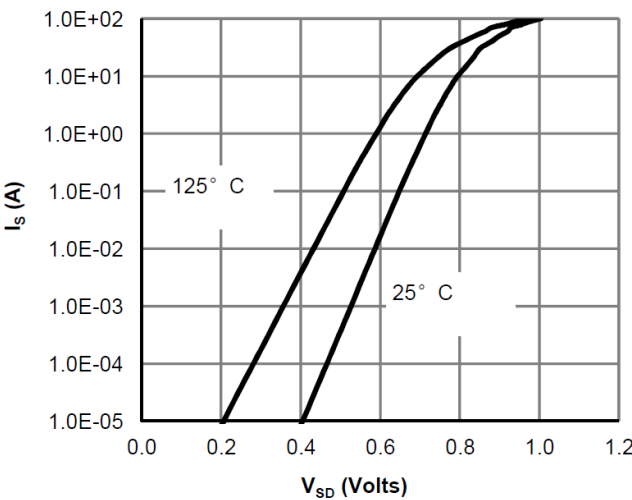


Figure 6: Body-Diode Characteristics

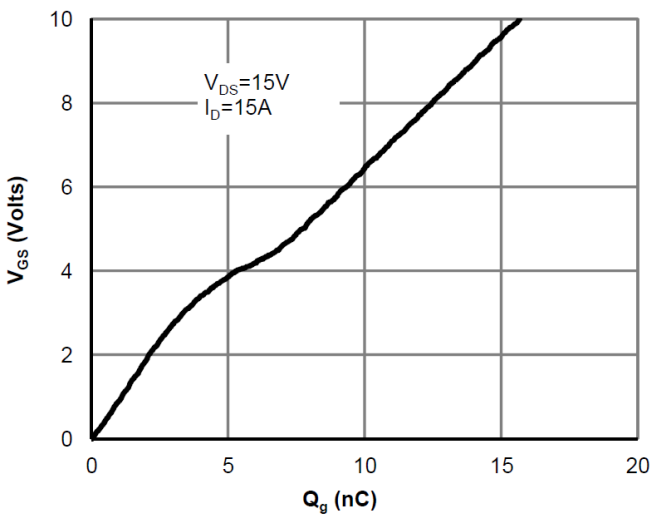


Figure 7: Gate-Charge Characteristics

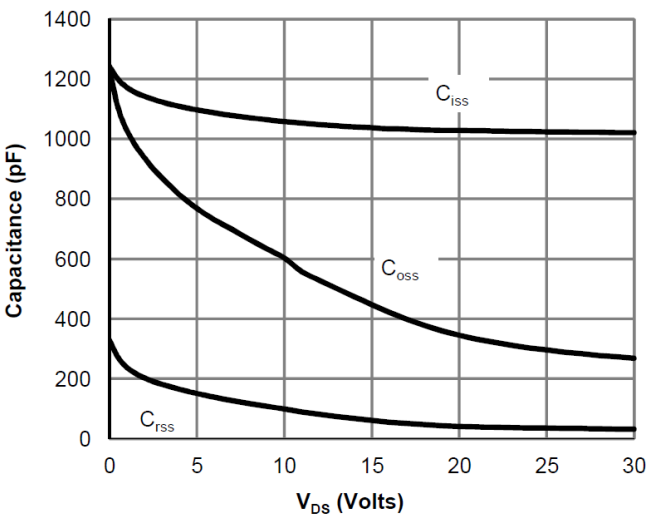


Figure 8: Capacitance Characteristics

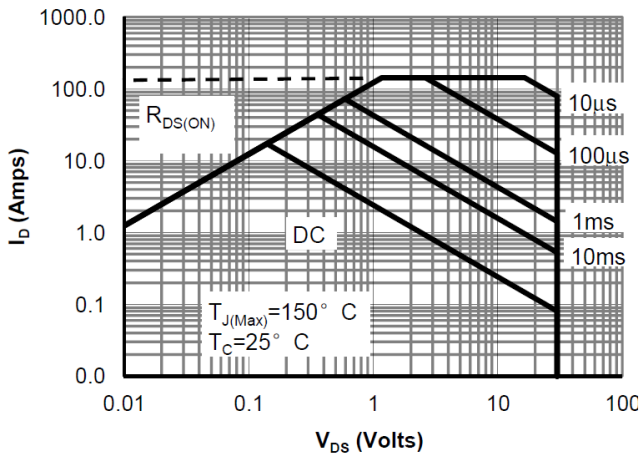


Figure 9: Maximum Forward Biased Safe Operating Area

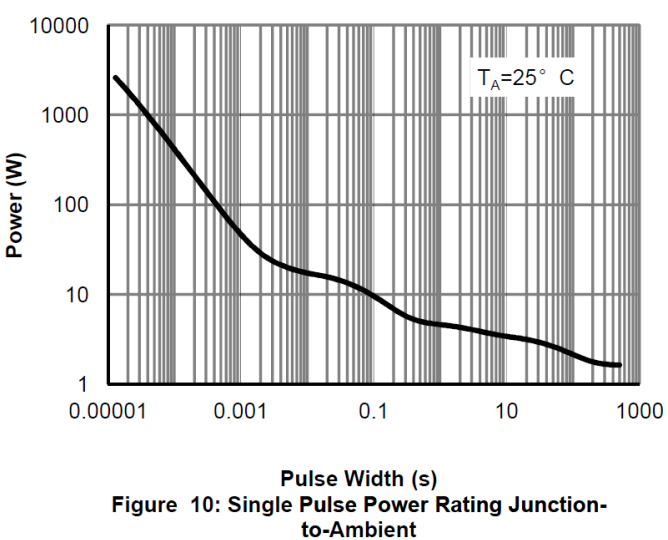


Figure 10: Single Pulse Power Rating Junction-to-Ambient

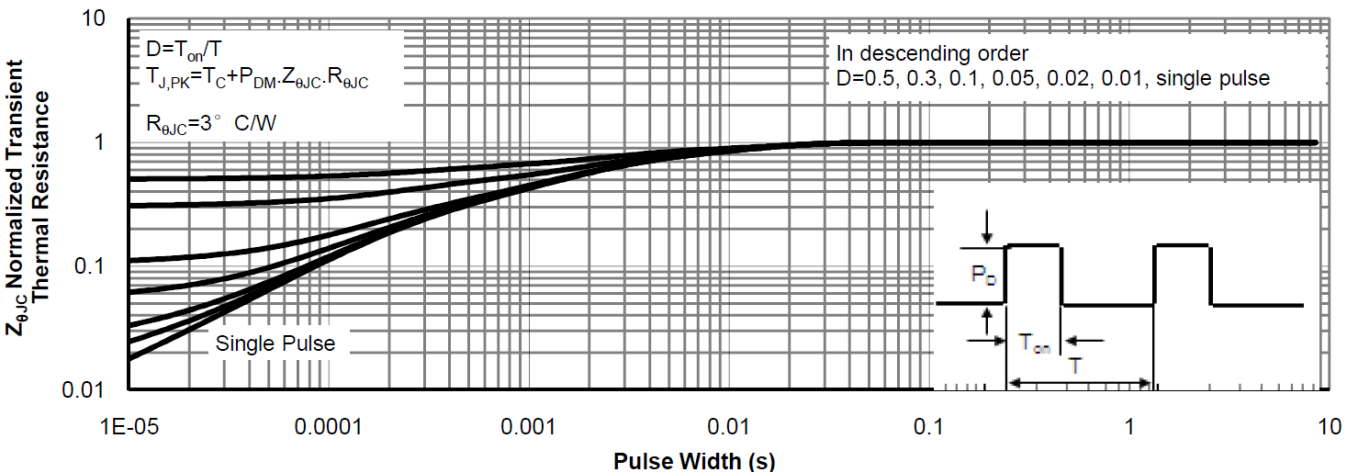
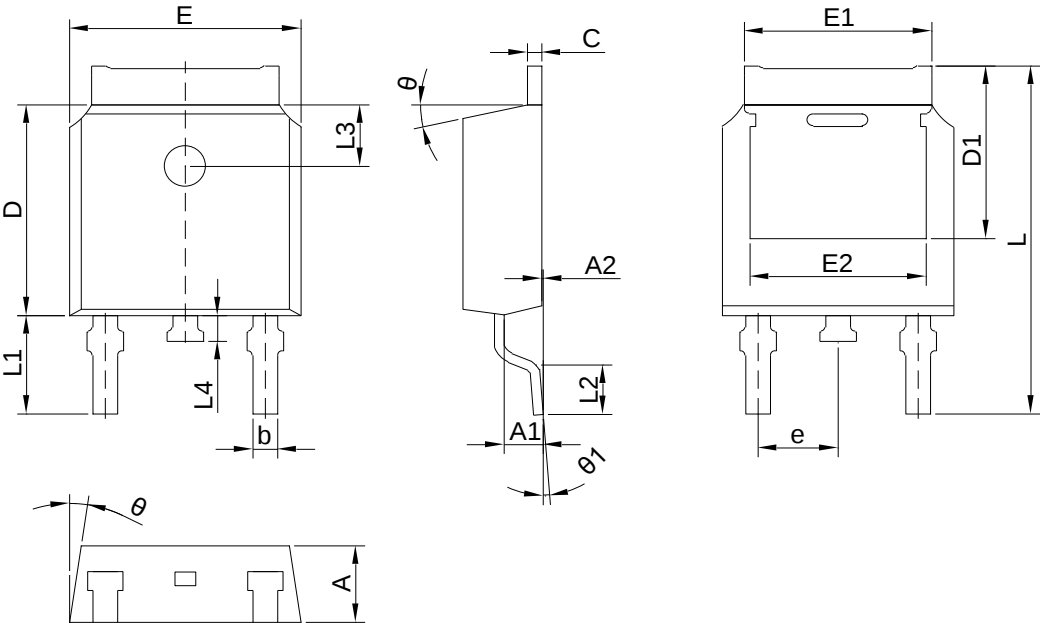


Figure 11: Normalized Maximum Transient Thermal Impedance

8. Dimension (TO-252)



| COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER |      |      |      |        |           |       |       |
|---------------------------------------------|------|------|------|--------|-----------|-------|-------|
| SYMBOL                                      | MIN  | TYP  | MAX  | SYMBOL | MIN       | TYP   | MAX   |
| A                                           | 2.10 | 2.30 | 2.50 | E2     | 4.63      | 4.83  | 5.03  |
| A1                                          | 0.97 | 1.07 | 1.17 | L      | 9.90      | 10.10 | 10.30 |
| A2                                          | 0.00 | -    | 0.12 | L1     | 2.74      | 2.94  | 3.14  |
| b                                           | 0.66 | 0.76 | 0.86 | L2     | 1.40      | 1.50  | 1.70  |
| C                                           | 0.45 | 0.51 | 0.60 | L3     | 1.65      | 1.80  | 1.95  |
| D                                           | 5.90 | 6.10 | 6.30 | L4     | 0.60      | 0.80  | 1.00  |
| D1                                          | 5.10 | 5.30 | 5.45 | e      | 2.286 BSC |       |       |
| E                                           | 6.40 | 6.60 | 6.80 | θ      | 5°        | 7°    | 10°   |
| E1                                          | 5.10 | 5.33 | 5.45 | θ1     | 0°        | -     | 3°    |

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