

SuperMOS – SOT-323 60V  $BV_{DSS}$ ,  $1.5\Omega$   $R_{DS(on)}$ , N-channel MOSFET

## 1. Description

The BSS138W-7-F-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 BSS138W-7-F-ES is Pb-free.

## 2. Features

- 60V,  $R_{DS(on)}=1.5\Omega$ (TYP.) @ $V_{GS}=10V$   
 $R_{DS(on)}=1.6\Omega$ (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

## 4. Ordering Information

| Part Number    | Package | Marking | Material     | Packing     | Quantity per reel | Flammability Rating | Reel Size |
|----------------|---------|---------|--------------|-------------|-------------------|---------------------|-----------|
| BSS138W-7-F-ES | SOT-323 | 38KQ    | Halogen free | Tape & Reel | 3,000 PCS         | UL 94V-0            | 7 inches  |

Table-1 Ordering information

## 5. Pin Configuration and Functions

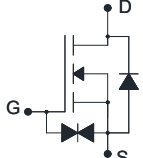
| Pin | Function | Outline                                                                             | Circuit Diagram                                                                       |
|-----|----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 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              | $BV_{DSS}$ | 60         | V    |
| Gate-Source Voltage               | $V_{GS}$   | $\pm 20$   | V    |
| Continuous Drain Current          | $I_D$      | 0.36       | A    |
| Maximum Power Dissipation         | $P_D$      | 236        | mW   |
| Pulsed Drain Current <sup>a</sup> | $I_{DM}$   | 1.44       | 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 | Unit |
| Junction-to-Ambient Thermal Resistance | $R_{\theta JA}$ | 530     | °C/W |

Note:

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

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## 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> =10mA                                               | 60   |      |      | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>J</sub> =25℃                          |      |      | 1.0  | uA   |
|                                           |                     | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>J</sub> =125℃                         |      |      | 100  |      |
| Gate-to-source Leakage Current            | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                              |      |      | ±10  | uA   |
| ON CHARACTERISTICS                        |                     |                                                                                         |      |      |      |      |
| Gate Threshold Voltage                    | V <sub>GS(TH)</sub> | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                                | 0.8  | 1.0  | 1.5  | V    |
| Drain-to-source On-resistance             | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =0.3A                                              |      | 1.5  | 1.9  | Ω    |
|                                           |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.2A                                             |      | 1.6  | 2.5  |      |
|                                           |                     | V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.1A                                             |      | 2.7  | 4.5  |      |
| CHARGES, CAPACITANCES AND GATE RESISTANCE |                     |                                                                                         |      |      |      |      |
| Input Capacitance                         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, f=1MHz, V <sub>DS</sub> =25V                                       |      | 25   | 50   | pF   |
| Output Capacitance                        | C <sub>OSS</sub>    |                                                                                         |      | 9.7  | 22   |      |
| Reverse Transfer Capacitance              | C <sub>RSS</sub>    |                                                                                         |      | 2.2  | 5    |      |
| Total Gate Charge                         | Q <sub>G(TOT)</sub> | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =25V, I <sub>D</sub> =0.3A                       |      | 0.65 | 1    | nC   |
| Gate-to-Source Charge                     | Q <sub>GS</sub>     |                                                                                         |      | 0.2  |      |      |
| Gate-to-Drain Charge                      | Q <sub>GD</sub>     |                                                                                         |      | 0.23 |      |      |
| SWITCHING CHARACTERISTICS                 |                     |                                                                                         |      |      |      |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =25V, I <sub>D</sub> =0.3A,<br>R <sub>G</sub> =6Ω |      | 2.3  | 5    | ns   |
| Rise Time                                 | t <sub>r</sub>      |                                                                                         |      | 19.2 | 40   |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |                                                                                         |      | 6.3  | 12   |      |
| Fall Time                                 | t <sub>f</sub>      |                                                                                         |      | 23   | 50   |      |
| BODY DIODE CHARACTERISTICS                |                     |                                                                                         |      |      |      |      |
| Forward Voltage                           | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =0.5A                                               |      | 0.86 | 1.5  | V    |

## 7. Typical Characteristic

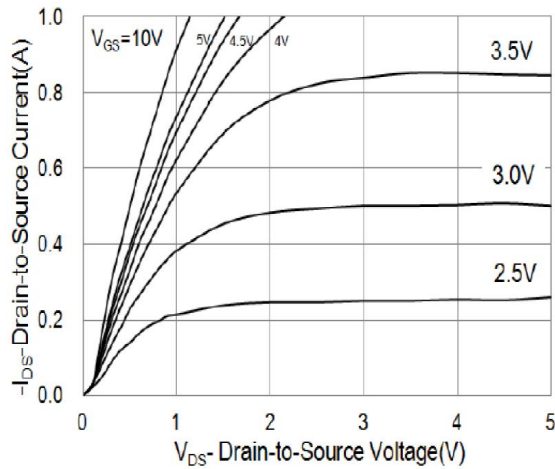


Fig.1 On-Region Characteristics

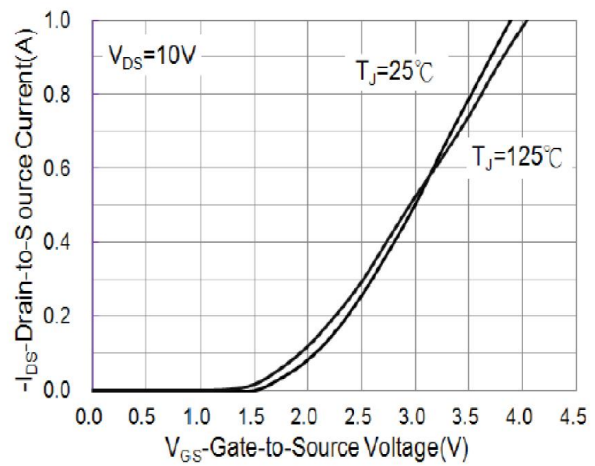


Fig.2 Transfer Characteristics

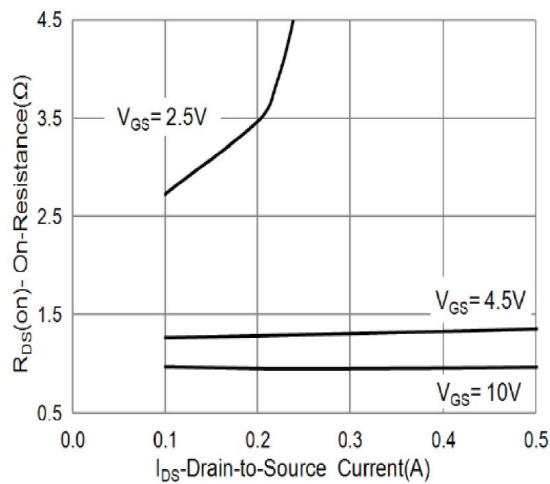


Fig.3 On-Resistance vs. Drain Current

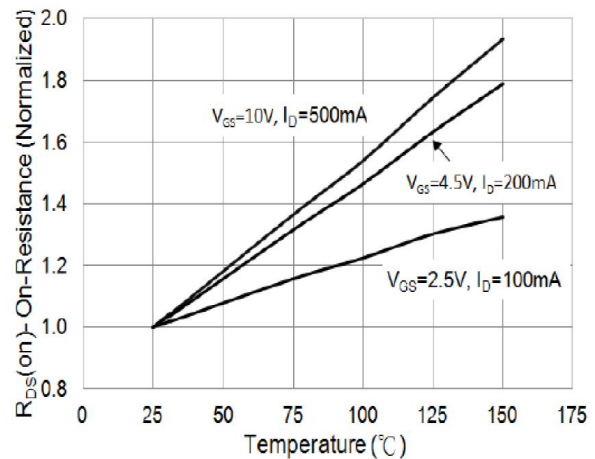


Fig.4 On-Resistance vs. Junction temperature

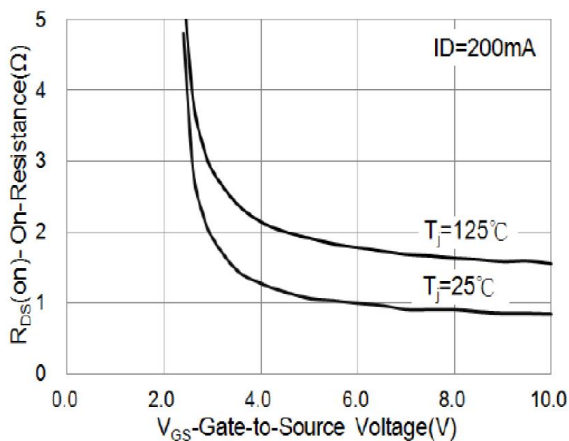


Fig.5 On-Resistance Variation with V\_GS

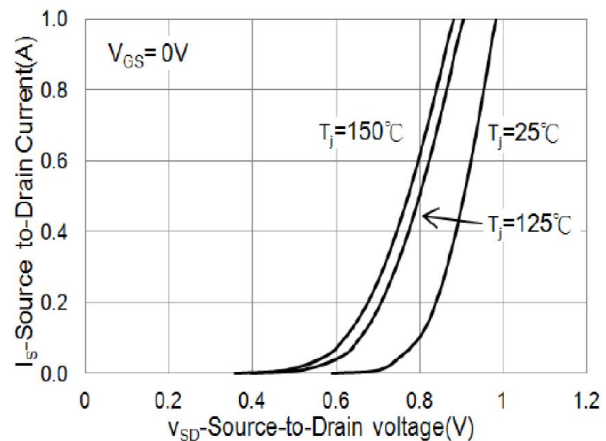


Fig.6 Body Diode Characteristics

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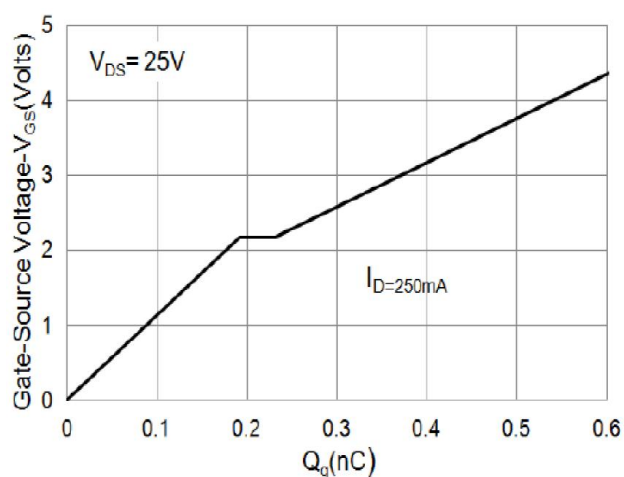


Fig.7 Gate-Charge Characteristics

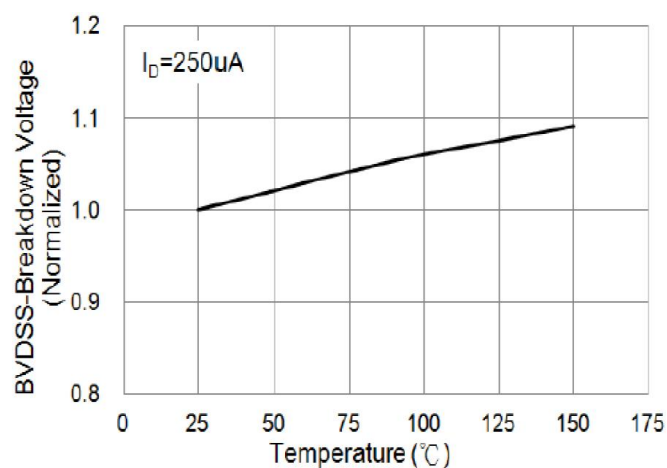


Fig.8 Breakdown Voltage Variation vs. Temperature

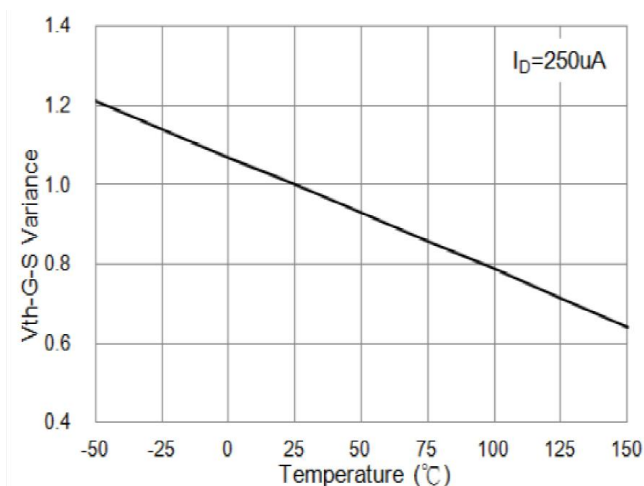


Fig.9 Threshold Voltage Variation with Temperature

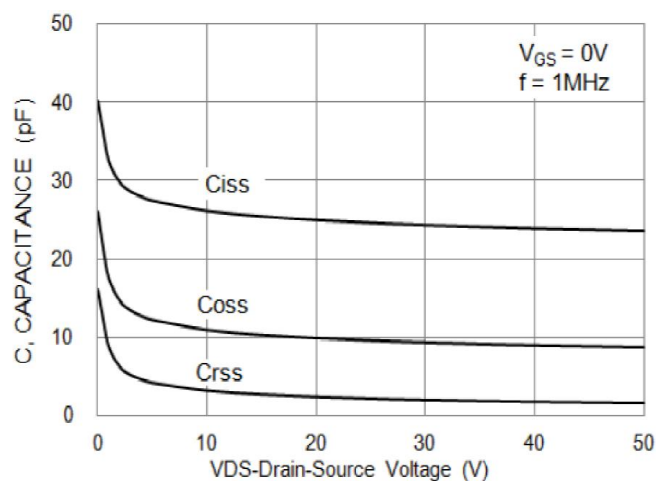
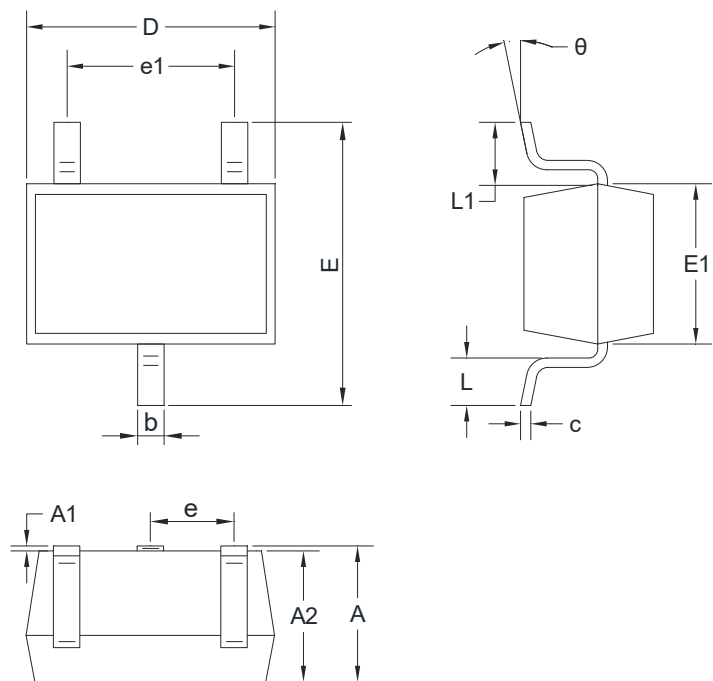


Fig.10 Capacitance vs. Drain-Source Voltage.

8. Dimension and Patterns (SOT-323)



| Symbol | Millimeters |      | Symbol | Millimeters |      |
|--------|-------------|------|--------|-------------|------|
|        | Min         | Max  |        | Min         | Max  |
| A      | 0.90        | 1.10 | E1     | 1.15        | 1.35 |
| A1     | 0.00        | 0.10 | e      | 0.65 TYP    |      |
| A2     | 0.90        | 1.00 | e1     | 1.20        | 1.40 |
| b      | 0.20        | 0.40 | L      | 0.26        | 0.46 |
| c      | 0.08        | 0.15 | L1     | 0.525 REF   |      |
| D      | 2.00        | 2.20 | θ      | 0°          | 8°   |
| E      | 2.15        | 2.45 |        |             |      |

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