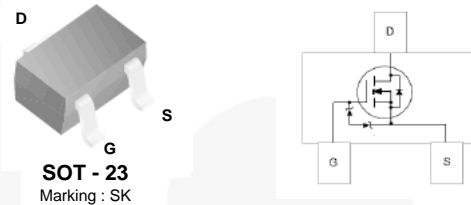


# BSS138K

## N-Channel Logic Level Enhancement Mode Field Effect Transistor

### Features

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- Pb Free / RoHS Compliant
- Green Compound
- ESD HBM = 2000 V as per JEDEC A114A; ESD CDM = 2000 V as per JEDEC C101C



### Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol    | Parameter                            | Value       | Units            |
|-----------|--------------------------------------|-------------|------------------|
| $V_{DSS}$ | Drain-Source Voltage                 | 50          | V                |
| $V_{GSS}$ | Gate-Source Voltage                  | $\pm 12$    | V                |
| $I_D$     | Drain Current                        | Continuous  | 0.22             |
|           |                                      | Pulsed      | 0.88             |
| $T_J$     | Operating Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range            | -55 to +150 | $^\circ\text{C}$ |

#### Note:

1. These ratings are limiting values above which the serviceability of any semiconductor device maybe impaired.

### Thermal Characteristics

| Symbol          | Parameter  | Value | Units                     |
|-----------------|--|-------|---------------------------|
| $P_D$           | Total Device Dissipation                               | 350   | mW                        |
|                 | Derating above $T_A = 25^\circ\text{C}$                | 2.8   | mW/ $^\circ\text{C}$      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient <sup>(2)</sup> | 350   | $^\circ\text{C}/\text{W}$ |

#### Note:

2. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch. Minimum land pad size.

### Package Marking and Ordering Information

| Device Marking | Device  | Reel Size | Tape Width | Quantity   |
|----------------|---------|-----------|------------|------------|
| SK             | BSS138K | 7"        | 8 mm       | 3000 units |

## Electrical Characteristics

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol  | Parameter                                      | Test Condition   | Min. | Typ. | Max.       | Units                      |
|---|--|--|------|------|------------|----------------------------|
| <b>Off Characteristics</b>                                    |  |  |      |      |            |                            |
| $BV_{DSS}$  | Drain-Source Breakdown Voltage                 | $V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$   | 50   |      |            | V                          |
| $\frac{BV_{DSS}}{T_J}$  | Breakdown Voltage Temperature Coefficient      | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                                  |      | 0.11 |            | $\text{V}/^\circ\text{C}$  |
| $I_{DSS}$   | Zero Gate Voltage Drain Current                | $V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$  |      |      | 0.1        | $\mu\text{A}$              |
| $I_{GSS}$   | Gate-Body Leakage                              | $V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V}$  |      |      | $\pm 1$    | $\mu\text{A}$              |
|   |  | $V_{GS} = \pm 10\text{ V}, V_{DS} = 0\text{ V}$  |      |      | $\pm 0.5$  |                            |
|   |  | $V_{GS} = \pm 5\text{ V}, V_{DS} = 0\text{ V}$   |      |      | $\pm 0.05$ |                            |
| <b>On Characteristics</b>                                     |  |  |      |      |            |                            |
| $V_{GS(th)}$  | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 0.6  |      | 1.2        | V                          |
| $\frac{V_{GS(th)}}{T_J}$                                      | Gate Threshold Voltage Temperature Coefficient | $I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$                                       |      | -1.4 |            | $\text{mV}/^\circ\text{C}$ |
| $R_{DS(ON)}$  | Static Drain-Source On-Resistance              | $V_{GS} = 1.8\text{ V}, I_D = 50\text{ mA}$ ,  |      |      | 2.5        | $\Omega$                   |
|   |  | $V_{GS} = 2.5\text{ V}, I_D = 50\text{ mA}$  |      |      | 2.0        |                            |
|   |  | $V_{GS} = 5\text{ V}, I_D = 50\text{ mA}$  |      |      | 1.6        |                            |
| $I_{D(ON)}$   | On-State Drain Current                         | $V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$  | 0.2  |      |            | A                          |
| $g_{FS}$  | Forward Transconductance                       | $V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$  | 200  |      |            | mS                         |
| <b>Dynamic Characteristics</b>                                |  |  |      |      |            |                            |
| $C_{iss}$   | Input Capacitance                              | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                        |      | 58   |            | $\text{pF}$                |
| $C_{oss}$   | Output Capacitance                             |  |      | 9.75 |            |                            |
| $C_{rss}$   | Reverse Transfer Capacitance                   |  |      | 5.2  |            |                            |
| $R_G$   | Gate Resistance                                | $V_{DS} = 5\text{ V}, V_{GS} = 10\text{ mV}$   |      | 281  |            | $\Omega$                   |
| <b>Switching Characteristics</b>                              |  |  |      |      |            |                            |
| $t_{D(ON)}$   | Turn-On Delay Time                             | $V_{DD} = 30\text{ V}, I_D = 0.29\text{ A}$ ,<br>$V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$ |      |      | 5          | ns                         |
| $t_r$   | Turn-On Rise Time                              |  |      |      | 5          |                            |
| $t_{D(OFF)}$  | Turn-Off Delay Time                            |  |      |      | 60         |                            |
| $t_f$   | Turn-Off Fall Time                             |  |      |      | 35         |                            |
| $Q_g$   | Total Gate Charge                              | $V_{DS} = 25\text{ V}, I_D = 0.2\text{ A}$ ,<br>$V_{GS} = 10\text{ V}, I_G = 0.1\text{ mA}$  |      |      | 2.4        | nC                         |
| $Q_{gs}$  | Gate-Source Charge                             |  |      |      | 0.5        |                            |
| $Q_{gd}$  | Gate-Drain Charge                              |  |      |      | 0.5        |                            |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |  |  |      |      |            |                            |
| $V_{sd}$  | Drain-Source Diode Forward Voltage             | $V_{GS} = 0\text{ V}, I_S = 115\text{ mA}$   |      |      | 1.2        | V                          |

Typical Performance Characteristics

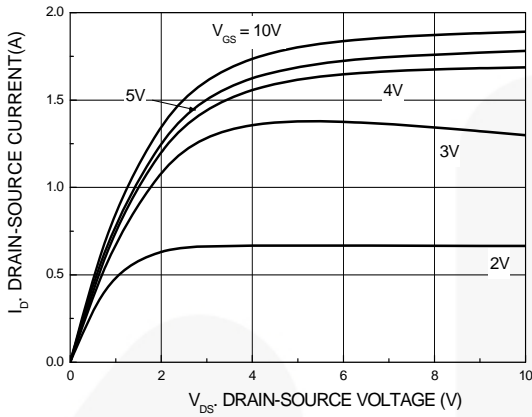


Figure 1. On-Region Characteristics

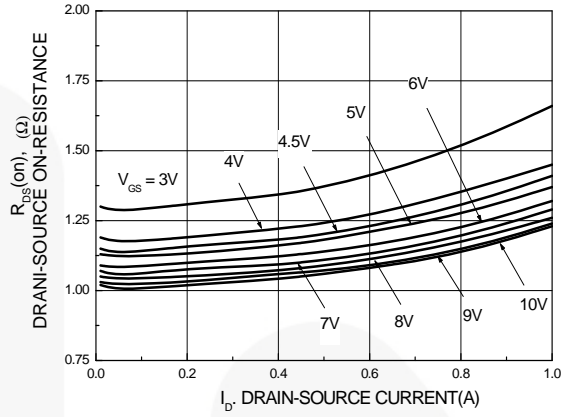


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

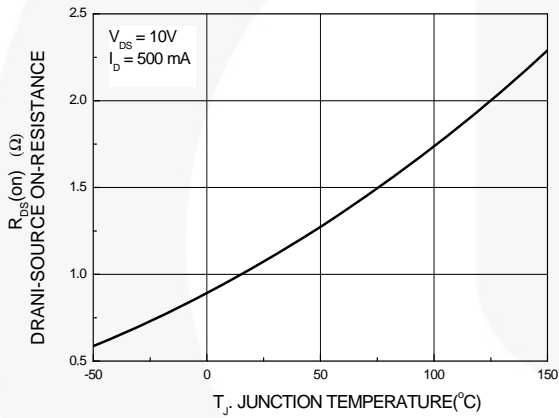


Figure 3. On-Resistance Variation with Temperature

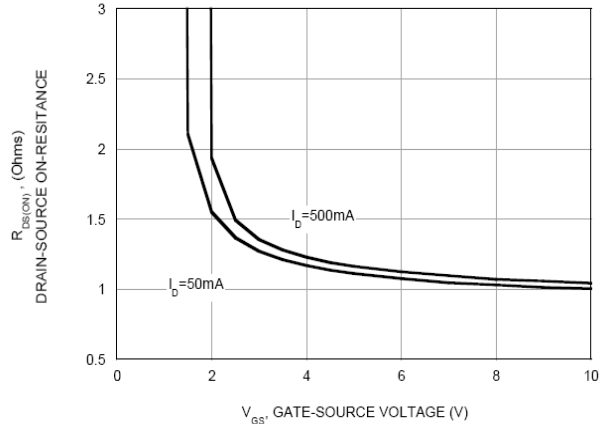


Figure 4. On-Resistance Variation with Gate-Source Voltage

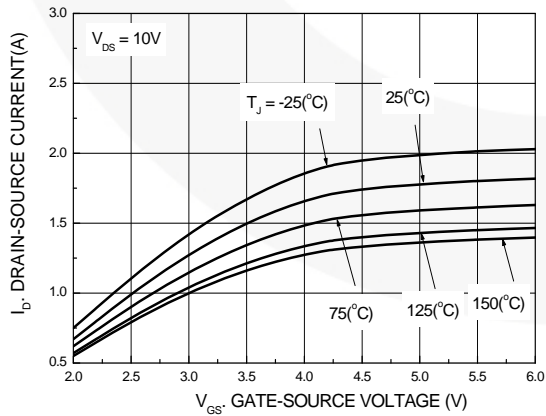


Figure 5. Transfer Characteristics

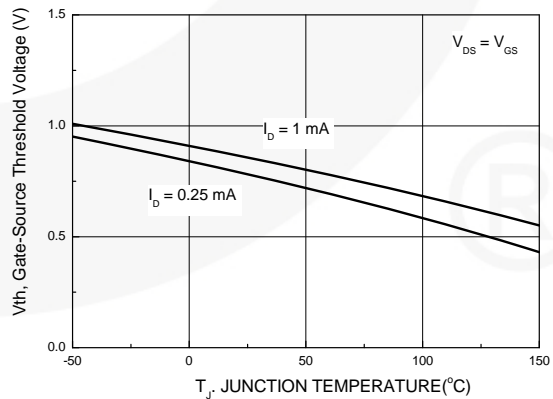


Figure 6. Gate Threshold Variation with Temperature

Typical Performance Characteristics (Continue)

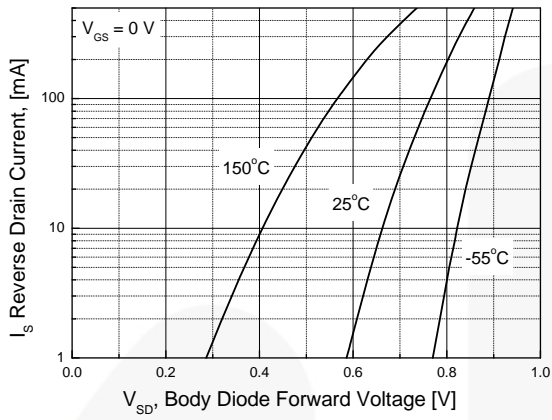
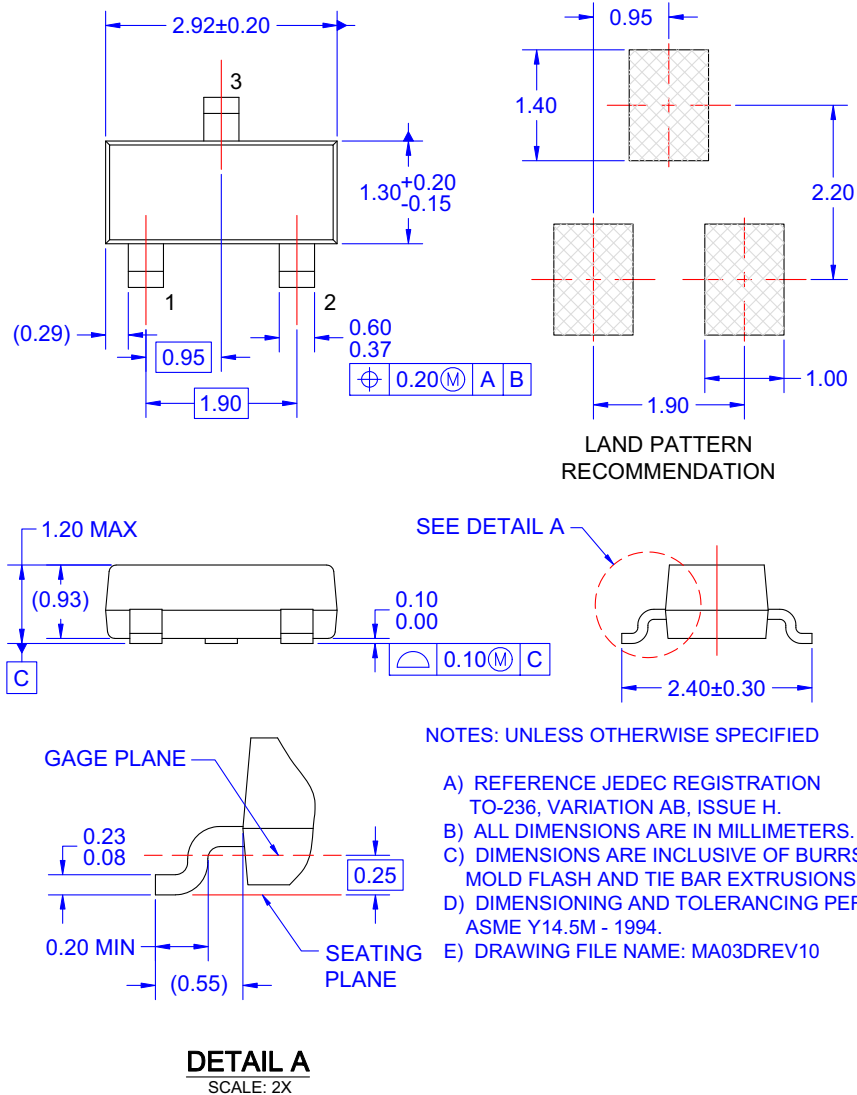


Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature



## Physical Dimensions

### SOT-23



**Figure 8. 3LEAD, SOT23, JEDEC TO-236, LOW PROFILE (ACTIVE)**

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