

N-Channel Logic Level Enhancement Mode Field Effect Transistor

BSS138K

Features

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

ABSOLUTE MAXIMUM RATINGS

 $(T_A = 25^{\circ}C \text{ unless otherwise noted})$ (Note 1)

| Symbol | Parameter | Value | Unit |
|------------------|--------------------------------------|-------------|-------|
| V_{DSS} | Drain-Source Voltage | 50 | V |
| V _{GSS} | Gate-Source Voltage | ±12 | V |
| I _D | Drain Current – Continuous | 0.22 | Α |
| | Drain Current – Pulsed | 0.88 | |
| P_{D} | Total Device Dissipation | 350 | mV |
| | Derating above T _A = 25°C | 2.8 | mW/°C |
| T_J | Operating Junction Temperature Range | -55 to +150 | °C |
| T _{STG} | Storage Temperature Range | -55 to +150 | °C |

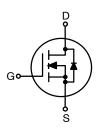
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Unit |
|-----------------|---|-------|------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 2) | 350 | ٧ |

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





SOT-23-3 CASE 318-08

MARKING DIAGRAM



SK = Specific Device Code

M = Assembly Operation Month

= Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------|-----------------------|-----------------------|
| BSS138K | SOT-23-3 (Pb-Free) | 3000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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ELECTRICAL CHARACTERISTICS ($T_A = 25^{\circ}C$ unless otherwise noted)

| Drain—Source Breakdown Voltage Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current Gate—Body Leakage | $V_{GS} = 0 \text{ V, } I_D = 10 \mu\text{A}$ $I_D = 250 \mu\text{A, Referenced to } 25^{\circ}\text{C}$ $V_{DS} = 50 \text{ V, } V_{GS} = 0 \text{ V}$ | 50 | 0.11 | - | V |
|--|---|--|---|---|--|
| Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current | I_D = 250 μ A, Referenced to 25°C V_{DS} = 50 V, V_{GS} = 0 V | | 0.11 | - | · |
| Coefficient Zero Gate Voltage Drain Current | V _{DS} = 50 V, V _{GS} = 0 V | - | 0.11 | _ | 1 |
| | | | | | V/°C |
| Gate–Body Leakage | | - | _ | 0.1 | μΑ |
| | $V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$ | - | - | ±1 | μΑ |
| | $V_{GS} = \pm 10 \text{ V}, V_{DS} = 0 \text{ V}$ | _ | - | ±0.5 | |
| | $V_{GS} = \pm 5 \text{ V}, V_{DS} = 0 \text{ V}$ | - | - | ±0.05 | |
| TERISTICS | • | | | | |
| Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250 \mu A$ | 0.6 | - | 1.2 | V |
| Gate Threshold Voltage Temperature Coefficient | I _D = 1 mA, Referenced to 25°C | - | -1.4 | _ | mV/°C |
| Static Drain-Source On-Resistance | $V_{GS} = 1.8 \text{ V}, I_D = 50 \text{ mA}$ | - | - | 2.5 | Ω |
| | $V_{GS} = 2.5 \text{ V}, I_D = 50 \text{ mA}$ | - | - | 2.0 | |
| | $V_{GS} = 5 \text{ V}, I_D = 50 \text{ mA},$ | - | - | 1.6 | 1 |
| On-State Drain Current | V _{GS} = 10 V, V _{DS} = 5 V | 0.2 | - | - | Α |
| Forward Transconductance | V _{DS} = 10 V, I _D = 200 mA | 200 | _ | - | mS |
| ARACTERISTICS | • | | | | |
| Input Capacitance | V _{DS} = 25 V, V _{GS} = 0 V, | - | 58 | - | pF |
| Output Capacitance | f = 1.0 MHz | - | 9.75 | - | 1 |
| Reverse Transfer Capacitance | 1 | - | 5.2 | - | 1 |
| Gate Resistance | V _{DS} = 5 V, V _{GS} = 10 mV | _ | 281 | - | Ω |
| CHARACTERISTICS | • | | | | |
| Turn-On Delay Time | $V_{DD} = 30 \text{ V}, I_D = 0.29 \text{ A},$ | - | _ | 5 | ns |
| Turn-On Rise Time | V_{GS} = 10 V, R_{GEN} = 6 Ω | - | - | 5 | 1 |
| Turn-Off Delay Time | | - | - | 60 | 1 |
| Turn-Off Fall Time | | - | - | 35 | |
| Total Gate Charge | V _{DS} = 25 V, I _D = 0.2 A, V _{GS} = 10 V, I _G = 0.1 mA | - | - | 2.4 | nC |
| Gate-Source Charge | | _ | - | 0.5 | 1 |
| Gate-Drain Charge | | _ | - | 0.5 | 1 |
| RCE DIODE CHARACTERISTICS AND MA | AXIMUM RATINGS | | | | |
| Drain-Source Diode Forward Voltage | $V_{GS} = 0 \text{ V, } I_{S} = 115 \text{ mA}$ | _ | _ | 1.2 | V |
| | Gate Threshold Voltage Gate Threshold Voltage Temperature Coefficient Static Drain—Source On—Resistance On—State Drain Current Forward Transconductance ARACTERISTICS Input Capacitance Output Capacitance Reverse Transfer Capacitance Gate Resistance CHARACTERISTICS Turn—On Delay Time Turn—On Rise Time Turn—Off Delay Time Turn—Off Fall Time Total Gate Charge Gate—Source Charge Gate—Drain Charge GCE DIODE CHARACTERISTICS AND MARKET | TERISTICS Gate Threshold Voltage $V_{DS} = V_{GS}$, $I_D = 250 \mu A$ Gate Threshold Voltage Temperature Coefficient $I_D = 1 \text{ mA}$, Referenced to 25°C Static Drain—Source On—Resistance $V_{GS} = 1.8 \text{ V}$, $I_D = 50 \text{ mA}$ $V_{GS} = 2.5 \text{ V}$, $I_D = 50 \text{ mA}$ $V_{GS} = 10 \text{ V}$, $V_{DS} = 5 \text{ V}$ Forward Transconductance $V_{DS} = 10 \text{ V}$, $I_D = 200 \text{ mA}$ ARACTERISTICS Input Capacitance $V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$, $I_{CS} = 10 \text{ MHz}$ Output Capacitance $V_{DS} = 25 \text{ V}$, $V_{GS} = 10 \text{ mV}$ CHARACTERISTICS Turn—On Delay Time $V_{DS} = 30 \text{ V}$, $V_{DS} = 0.29 \text{ A}$, $V_{GS} = 10 \text{ V}$, $V_{GS} = 10$ | Gate Threshold Voltage $V_{DS} = V_{GS}$, $I_D = 250 \mu A$ 0.6 Gate Threshold Voltage Temperature Coefficient $I_D = 1 \text{mA}$, Referenced to 25°C — Static Drain—Source On—Resistance $V_{GS} = 1.8 \text{V}$, $I_D = 50 \text{mA}$ — $V_{GS} = 2.5 \text{V}$, $I_D = 50 \text{mA}$ — V _{GS} = 5 V, $I_D = 50 \text{mA}$ — V _{GS} = 10 V, V _{DS} = 5 V 0.2 Forward Transconductance $V_{DS} = 10 \text{V}$, $I_D = 200 \text{mA}$ 200 ARACTERISTICS Input Capacitance $V_{DS} = 25 \text{V}$, $V_{GS} = 0 \text{V}$, $I_D = 200 \text{mA}$ — Output Capacitance $V_{DS} = 25 \text{V}$, $V_{GS} = 10 \text{mV}$ — CHARACTERISTICS Turn—On Delay Time $V_{DS} = 5 \text{V}$, $V_{GS} = 10 \text{mV}$ — CHARACTERISTICS Turn—On Rise Time $V_{CS} = 10 \text{V}$, $V_{CS} = 10 \text{mV}$ — Turn—Off Delay Time $V_{CS} = 10 \text{V}$, $V_{CS} = 10 \text{V}$ — Turn—Off Fall Time — — Total Gate Charge $V_{CS} = 10 \text{V}$, $V_{CS} = 10 $ | Gate Threshold Voltage $V_{DS} = V_{GS}$, $I_D = 250 \mu A$ 0.6 - Gate Threshold Voltage Temperature Coefficient $I_D = 1 \text{mA}$, Referenced to 25°C - -1.4 Static Drain—Source On–Resistance $V_{GS} = 1.8 \text{V}$, $I_D = 50 \text{mA}$ - - $V_{GS} = 2.5 \text{V}$, $I_D = 50 \text{mA}$ - - - $V_{GS} = 5 \text{V}$, $I_D = 50 \text{mA}$ - - On–State Drain Current $V_{GS} = 10 \text{V}$, $V_{DS} = 5 \text{V}$ 0.2 - Forward Transconductance $V_{DS} = 10 \text{V}$, $I_D = 200 \text{mA}$ 200 - ARACTERISTICS Input Capacitance $V_{DS} = 25 \text{V}$, $V_{GS} = 0 \text{V}$, $I_D = 200 \text{mA}$ 200 - Beverse Transfer Capacitance $V_{DS} = 25 \text{V}$, $V_{GS} = 10 \text{mV}$ - 58 Gate Resistance $V_{DS} = 5 \text{V}$, $V_{GS} = 10 \text{mV}$ - 281 CHARACTERISTICS Turn—On Delay Time $V_{DS} = 30 \text{V}$, $V_{DS} = 6 \Omega$ - - - Turn—On Rise Time $V_{CS} = 10 \text{V}$, $V_{CS} = 10 \text{V}$ - - - Turn—Off Fall Time $V_{CS} = 10 \text{V}$, $V_{CS} = 10 \text{V}$ - < | ERISTICS Gate Threshold Voltage VDS = VGS, ID = 250 μA 0.6 - 1.2 Gate Threshold Voltage Temperature Coefficient ID = 1 mA, Referenced to 25°C - -1.4 - Static Drain-Source On-Resistance VGS = 1.8 V, ID = 50 mA - - 2.5 VGS = 2.5 V, ID = 50 mA - - 2.0 VGS = 5 V, ID = 50 mA - - 1.6 On-State Drain Current VGS = 10 V, VDS = 5 V 0.2 - - Forward Transconductance VDS = 10 V, ID = 200 mA 200 - - Forward Transconductance VDS = 25 V, VGS = 0 V, ID = 200 mA 200 - - Input Capacitance VDS = 25 V, VGS = 10 mV - 58 - Output Capacitance VDS = 5 V, VGS = 10 mV - 281 - CHARACTERISTICS VDS = 5 V, VGS = 10 mV - 281 - CHARACTERISTICS VDS = 30 V, ID = 0.29 A, VGS = 10 mV - - 5 Turn-On Blay Time VDS = 25 V, ID = 0.2 A, VGS = 10 mA - - -< |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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TYPICAL CHARACTERISTICS

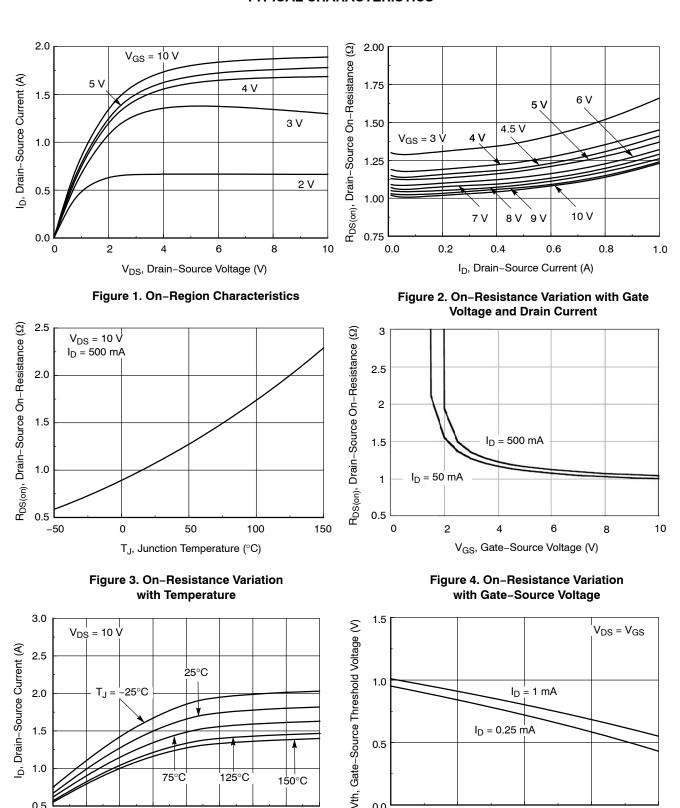


Figure 5. Transfer Characteristics

4.0

V_{GS}, Gate-Source Voltage (V)

75°C

3.5

125°C

5.0

4.5

150°C

5.5

6.0

1.0

0.5

2.0

2.5

3.0

Figure 6. Gate Threshold Variation with Temperature

50

T_J, Junction Temperature (°C)

100

150

0

0.0

-50

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TYPICAL CHARACTERISTICS (continued)

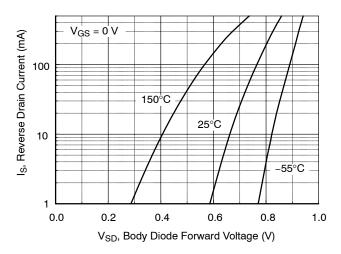


Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature

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