

# BSS138

Power MOSFET

## N-CHANNEL LOGIC LEVEL ENHANCEMENT MODE

### DESCRIPTION

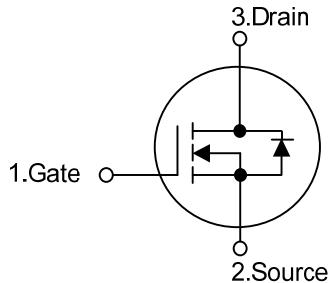
This device employs advanced MOSFET technology and features low gate charge while maintaining low on-resistance.

Optimized for switching applications, this device improves the overall efficiency of DC/DC converters and allows operation to higher switching frequencies.

### FEATURES

- \*  $R_{DS(ON)} \leq 3.5\Omega$  @  $V_{GS}=10V$ ,  $I_D=0.22A$
- $R_{DS(ON)} \leq 6.0\Omega$  @  $V_{GS}=4.5V$ ,  $I_D=0.22A$
- $R_{DS(ON)} \leq 8.0\Omega$  @  $V_{GS}=2.5V$ ,  $I_D=0.20A$
- \* Low Capacitance
- \* Low Gate Charge
- \* Fast Switching Capability
- \* Avalanche Energy Specified

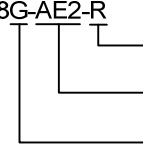
### SYMBOL

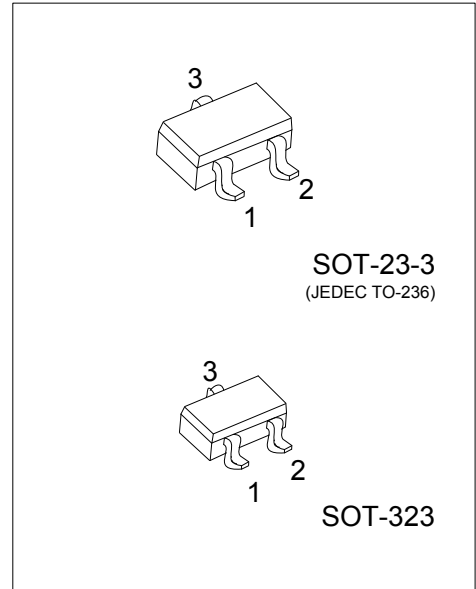


### ORDERING INFORMATION

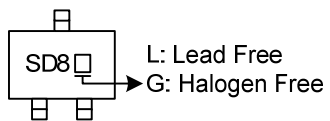
| Ordering Number |               | Package  | Pin Assignment |   |   | Packing   |
|-----------------|---------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free  |          | 1              | 2 | 3 |           |
| BSS138L-AE2-R   | BSS138G-AE2-R | SOT-23-3 | G              | S | D | Tape Reel |
| BSS138L-AL3-R   | BSS138G-AL3-R | SOT-323  | G              | S | D | Tape Reel |

Note: Pin Assignment: G: Gate S: Source D: Drain

|                                                                                                                                                                                |  |                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------|
| <p>BSS138G-AE2-R</p>  <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p> |  | <p>(1) R: Tape Reel</p> <p>(2) AE2: SOT-23-3. AL3: SOT-323</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------|



## ■ MARKING



# ■ **ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

| PARAMETER                |          | SYMBOL    | RATINGS    | UNIT             |
|--------------------------|----------|-----------|------------|------------------|
| Drain-Source Voltage     |          | $V_{DS}$  | 50         | V                |
| Gate-Source Voltage      |          | $V_{GS}$  | $\pm 20$   | V                |
| Continuous Drain Current | DC       | $I_D$     | 0.22       | A                |
|                          | Pulse    |           | 0.88       |                  |
| Power Dissipation        | SOT-23-3 | $P_D$     | 0.36       | W                |
|                          | SOT-323  |           | 0.15       |                  |
| Junction Temperature     |          | $T_J$     | +150       | $^\circ\text{C}$ |
| Storage Temperature      |          | $T_{STG}$ | -55 ~ +150 | $^\circ\text{C}$ |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

# ■ **THERMAL CHARACTERISTICS**

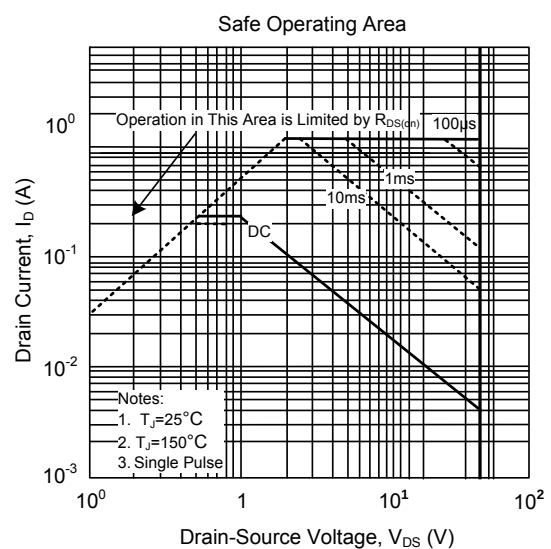
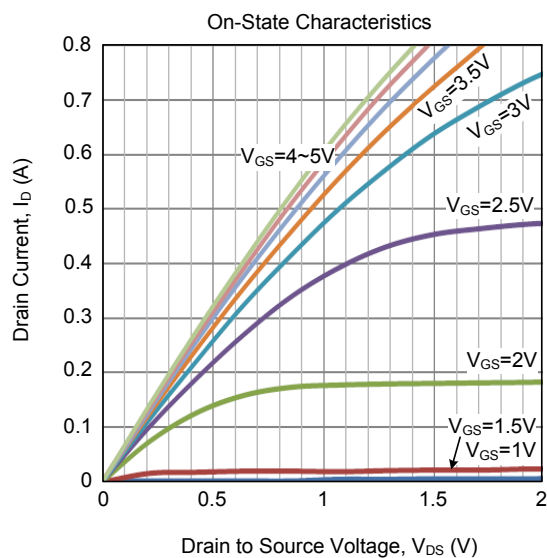
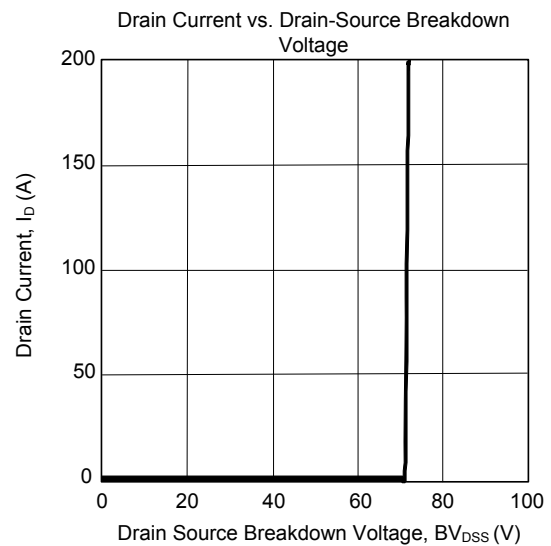
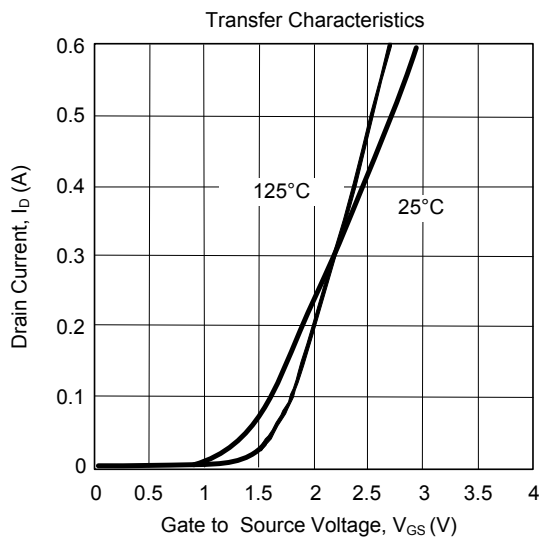
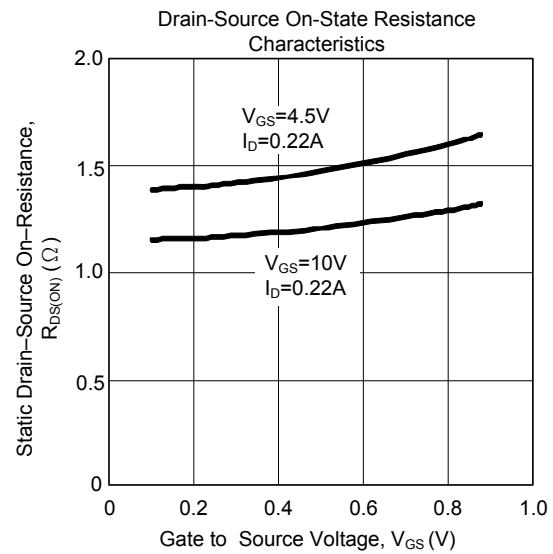
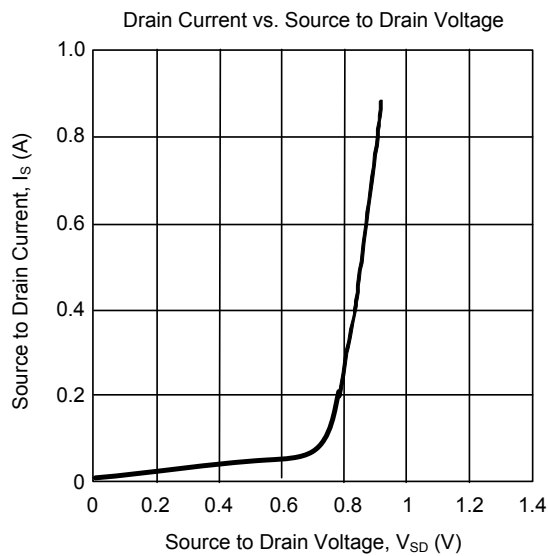
| PARAMETER           |          | SYMBOL        | RATINGS | UNIT               |
|---------------------|----------|---------------|---------|--------------------|
| Junction to Ambient | SOT-23-3 | $\theta_{JA}$ | 350     | $^\circ\text{C/W}$ |
|                     | SOT-323  |               | 833     |                    |

# ■ **ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

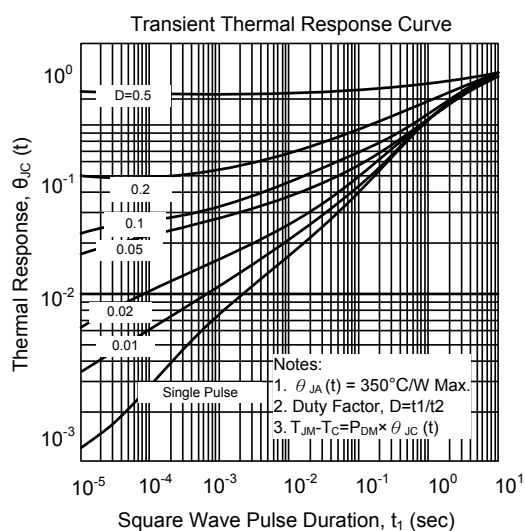
| PARAMETER                                       | SYMBOL                                | TEST CONDITIONS                                                                        | MIN  | TYP | MAX  | UNIT  |
|-------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------|------|-----|------|-------|
| OFF CHARACTERISTICS                             |                                       |                                                                                        |      |     |      |       |
| Drain-Source Breakdown Voltage                  | BV <sub>DSS</sub>                     | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                             | 50   |     |      | V     |
| Breakdown Voltage Temperature Coefficient       | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>   | I <sub>D</sub> =250μA, Referenced to 25°C                                              |      | 72  |      | mV/°C |
| Zero Gate Voltage Drain Current                 | I <sub>DSS</sub>                      | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V                                              |      |     | 0.5  | μA    |
|                                                 |                                       | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                              |      |     | 0.1  |       |
| Gate–Body Leakage, Forward                      | I <sub>GSS</sub>                      | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                             |      |     | ±100 | nA    |
| ON CHARACTERISTICS (Note)                       |                                       |                                                                                        |      |     |      |       |
| Gate-Threshold Voltage                          | V <sub>GS(TH)</sub>                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =1m A                                | 0.8  | 1.3 | 1.5  | V     |
| Gate Threshold Voltage Temperature Coefficient  | ΔV <sub>GS(TH)</sub> /ΔT <sub>J</sub> | I <sub>D</sub> =1mA, Referenced to 25°C                                                |      | -2  |      | mV/°C |
| Static Drain–Source On–Resistance               | R <sub>DS(ON)</sub>                   | V <sub>GS</sub> =10 V, I <sub>D</sub> =0.22A                                           |      | 0.7 | 3.5  | Ω     |
|                                                 |                                       | V <sub>GS</sub> =4.5 V, I <sub>D</sub> =0.22A                                          |      | 1.0 | 6.0  | Ω     |
|                                                 |                                       | V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.20A                                           |      |     | 8.0  | Ω     |
| On-State Drain Current                          | I <sub>D(ON)</sub>                    | V <sub>GS</sub> =10 V, V <sub>DS</sub> =5V                                             | 0.2  |     |      | A     |
| Forward Transconductance                        | g <sub>FS</sub>                       | V <sub>DS</sub> =10V, I <sub>D</sub> =0.22A                                            | 0.12 | 0.5 |      | S     |
| DYNAMIC PARAMETERS                              |                                       |                                                                                        |      |     |      |       |
| Input Capacitance                               | C <sub>ISS</sub>                      | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz                                      |      | 27  |      | pF    |
| Output Capacitance                              | C <sub>OSS</sub>                      |                                                                                        |      | 13  |      | pF    |
| Reverse Transfer Capacitance                    | C <sub>RSS</sub>                      |                                                                                        |      | 6   |      | pF    |
| SWITCHING PARAMETERS (Note)                     |                                       |                                                                                        |      |     |      |       |
| Total Gate Charge                               | Q <sub>G</sub>                        | V <sub>DS</sub> =25V, V <sub>GS</sub> =10V, I <sub>D</sub> =0.22A                      |      | 1.7 | 2.4  | nC    |
| Gate Source Charge                              | Q <sub>GS</sub>                       |                                                                                        |      | 0.1 |      | nC    |
| Gate Drain Charge                               | Q <sub>GD</sub>                       |                                                                                        |      | 0.4 |      | nC    |
| Turn-ON Delay Time                              | t <sub>D(ON)</sub>                    | V <sub>DD</sub> =30V, I <sub>D</sub> =0.29A, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω, |      | 2.5 | 5    | ns    |
| Turn-ON Rise Time                               | t <sub>R</sub>                        |                                                                                        |      | 9   | 18   | ns    |
| Turn-OFF Delay Time                             | t <sub>D(OFF)</sub>                   |                                                                                        |      | 20  | 36   | ns    |
| Turn-OFF Fall-Time                              | t <sub>F</sub>                        |                                                                                        |      | 7   | 14   | ns    |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS |                                       |                                                                                        |      |     |      |       |
| Max. Diode Forward Current                      | I <sub>S</sub>                        |                                                                                        |      |     | 0.22 | A     |
| Drain-Source Diode Forward Voltage              | V <sub>SD</sub>                       | V <sub>GS</sub> = 0V, I <sub>S</sub> =0.44A (Note)                                     |      | 0.8 | 1.4  | V     |

Note: Pulse test, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

## TYPICAL CHARACTERISTICS



# TYPICAL CHARACTERISTICS (Cont.)



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