

### Features

- Low on-resistance
- Low input capacitance
- Fast switching speed
- HBM: JESD22-A114-B: 2

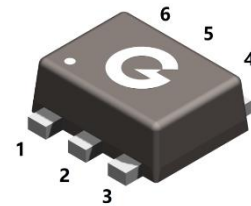
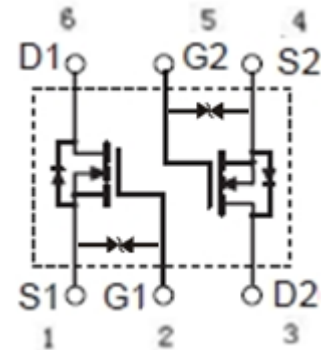
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### Typical Applications

- DC-DC converters
- Power management functions
- Battery operated systems and solid-state relays
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.

### Mechanical Data

- Case: SOT-563
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin-Plated Leads, Solderability-per MIL-STD-202, Method 208



SOT-563

### Ordering Information

| Part Number | Package | Shipping Quantity      | Marking Code |
|-------------|---------|------------------------|--------------|
| BSS138ESV   | SOT-563 | 3000 pcs / Tape & Reel | MM5          |

### Maximum Ratings (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                                                                 | Symbol    | Value           | Unit             |
|---------------------------------------------------------------------------|-----------|-----------------|------------------|
| Drain-to-Source Voltage                                                   | $V_{DS}$  | 50              | V                |
| Gate-to-Source Voltage                                                    | $V_{GS}$  | $\pm 20$        | V                |
| Continuous Drain Current ( $T_A = 25^\circ\text{C}$ ) <sup>*1</sup>       | $I_D$     | 360             | mA               |
| Continuous Drain Current ( $T_A = 70^\circ\text{C}$ ) <sup>*1</sup>       |           | 290             | mA               |
| Pulsed Drain Current ( $t_p = 10\mu\text{s}$ , $T_A = 25^\circ\text{C}$ ) | $I_{DM}$  | 1500            | mA               |
| Single Pulse Avalanche Energy <sup>*3</sup>                               | $E_{AS}$  | 0.2             | mJ               |
| Power Dissipation ( $T_A = 25^\circ\text{C}$ ) <sup>*1</sup>              | $P_D$     | 250             | mW               |
| Operating Junction Temperature Range                                      | $T_J$     | $-55 \sim +150$ | $^\circ\text{C}$ |
| Storage Temperature Range                                                 | $T_{STG}$ | $-55 \sim +150$ | $^\circ\text{C}$ |

### Thermal Characteristics

| Parameter                                        | Symbol          | Min. | Typ. | Max. | Unit               |
|--------------------------------------------------|-----------------|------|------|------|--------------------|
| Thermal Resistance Junction-to-Air <sup>*1</sup> | $R_{\theta JA}$ | -    | -    | 500  | $^\circ\text{C/W}$ |

### Electrical Characteristics (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Symbol                             | Parameter                         | Test Condition                                                                              | Min. | Typ. | Max. | Unit |
|------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics             |                                   |                                                                                             |      |      |      |      |
| V <sub>DSS</sub>                   | Drain-Source Breakdown Voltage    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                | 50   | -    | -    | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current   | V <sub>DS</sub> = 50V, V <sub>GS</sub> = 0V                                                 | -    | -    | 1    | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current         | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                                | -    | -    | ±10  | μA   |
| On Characteristics                 |                                   |                                                                                             |      |      |      |      |
| R <sub>DS(ON)</sub>                | Drain-Source On-resistance *2     | V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A                                                | -    | 1    | 1.6  | Ω    |
|                                    |                                   | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 0.2A                                               | -    | 1.2  | 2.5  |      |
|                                    |                                   | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 0.1A                                               | -    | 1.7  | 4.5  |      |
| V <sub>GS(TH)</sub>                | Static Drain-Source On-resistance | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                  | 0.8  | 1    | 1.5  | V    |
| R <sub>G</sub>                     | Gate Resistance                   | V <sub>GS</sub> = 0V, f = 1MHz                                                              | -    | 48   | -    | Ω    |
| Dynamic Characteristics            |                                   |                                                                                             |      |      |      |      |
| C <sub>ISS</sub>                   | Input Capacitance                 | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 25V<br>f = 1.0MHz                                 | -    | 32   | -    | pF   |
| C <sub>OSS</sub>                   | Output Capacitance                |                                                                                             | -    | 6    | -    |      |
| C <sub>RSS</sub>                   | Reverse Transfer Capacitance      |                                                                                             | -    | 3    | -    |      |
| Switching Characteristics          |                                   |                                                                                             |      |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time *4             | V <sub>DD</sub> = 25V, I <sub>D</sub> = 0.36A<br>V <sub>GS</sub> = 10V, R <sub>G</sub> = 6Ω | -    | 2.2  | -    | ns   |
| t <sub>r</sub>                     | Turn-on Rise Time *4              |                                                                                             | -    | 19.2 | -    |      |
| t <sub>d(off)</sub>                | Turn-Off Delay Time *4            |                                                                                             | -    | 6.2  | -    |      |
| t <sub>f</sub>                     | Turn-Off Fall Time *4             |                                                                                             | -    | 23   | -    |      |
| Q <sub>G</sub>                     | Total Gate-Charge                 | V <sub>DS</sub> = 25V                                                                       | -    | 4    | -    | nC   |
| Q <sub>GS</sub>                    | Gate to Source Charge             | V <sub>GS</sub> = 10V                                                                       | -    | 0.5  | -    |      |
| Q <sub>GD</sub>                    | Gate to Drain (Miller) Charge     | I <sub>D</sub> = 0.2A                                                                       | -    | 0.4  | -    |      |
| Source-Drain Diode Characteristics |                                   |                                                                                             |      |      |      |      |
| V <sub>SD</sub>                    | Diode Forward Voltage *2          | I <sub>S</sub> = 0.5A, V <sub>GS</sub> = 0V                                                 | -    | 0.89 | 1.4  | V    |
| t <sub>rr</sub>                    | Reverse Recovery Time             | I <sub>F</sub> = 1A, V <sub>GS</sub> = 0V                                                   | -    | 15   | -    | ns   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge           | di <sub>F</sub> /dt = 100A/μs                                                               | -    | 8    | -    | nC   |

Notes:

- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper
- The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- The  $E_{AS}$  data shows Max. rating. The test condition is  $V_{DD} = 30V, V_{GS} = 10V, L = 0.5mH$
- Guaranteed by design, not subject to production

Ratings and Characteristic Curves (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)

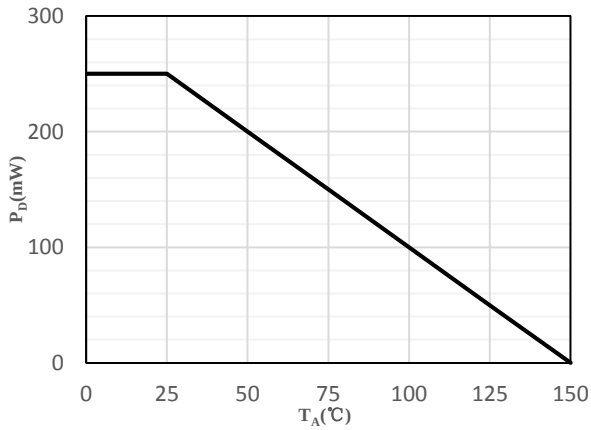


Fig 1 Power Dissipation

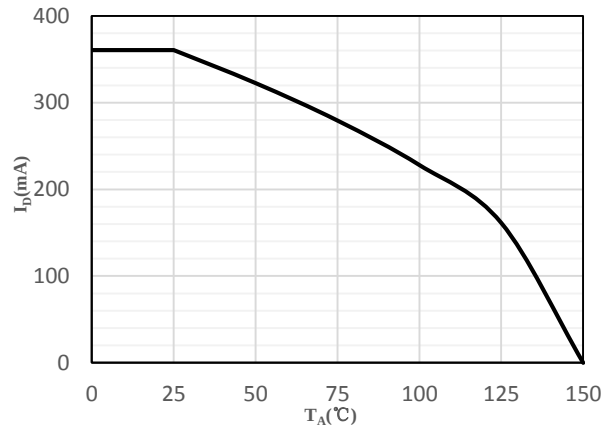


Fig 2 Drain Current

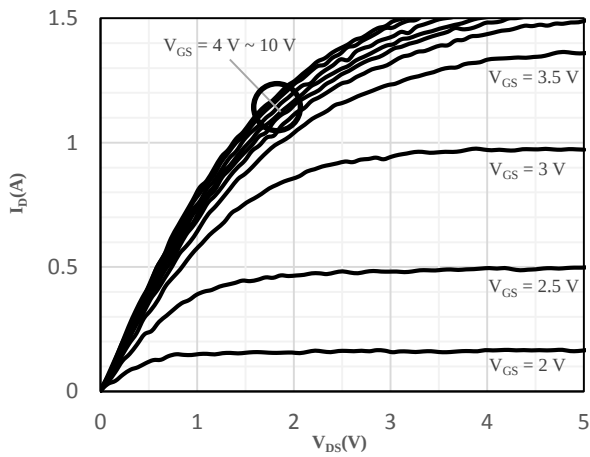


Fig 3 Typical Output Characteristics

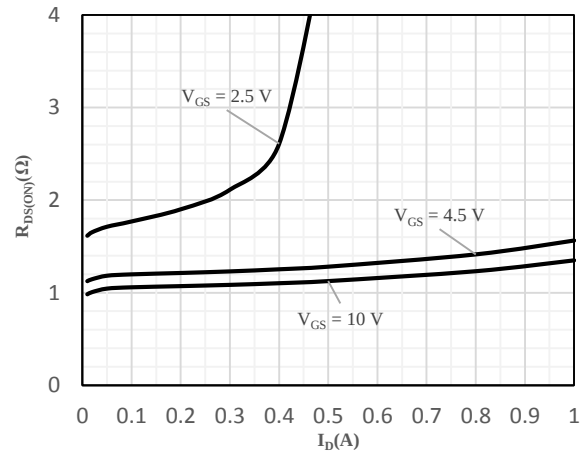


Fig 4 On-Resistance vs. Drain Current  
and Gate Voltage

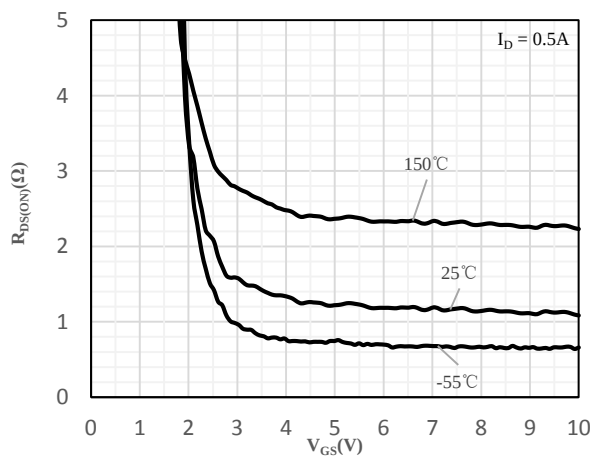


Fig 5 On-Resistance vs. Gate-Source Voltage

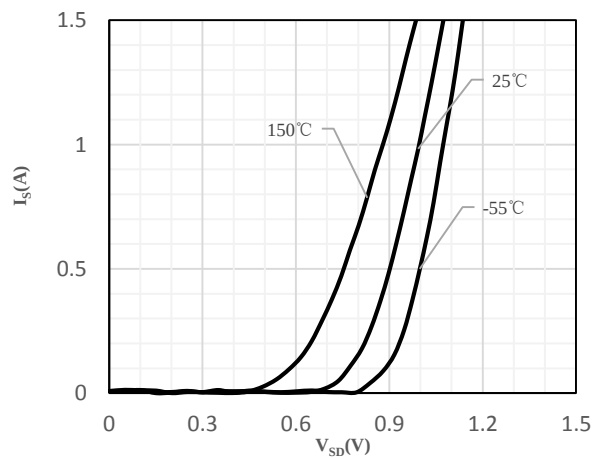


Fig 6 Body-Diode Characteristics

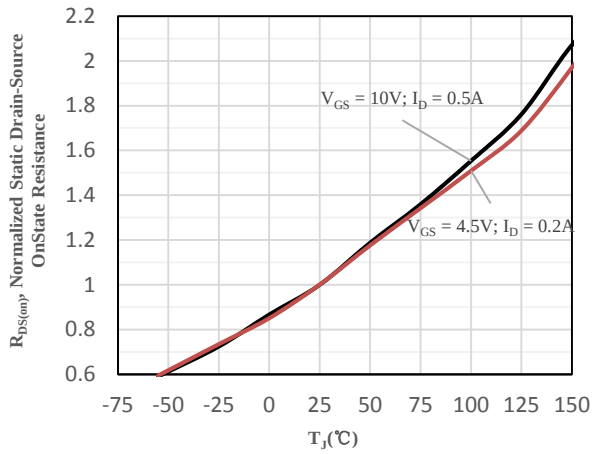


Fig 7 Normalized On-Resistance vs. Junction Temperature

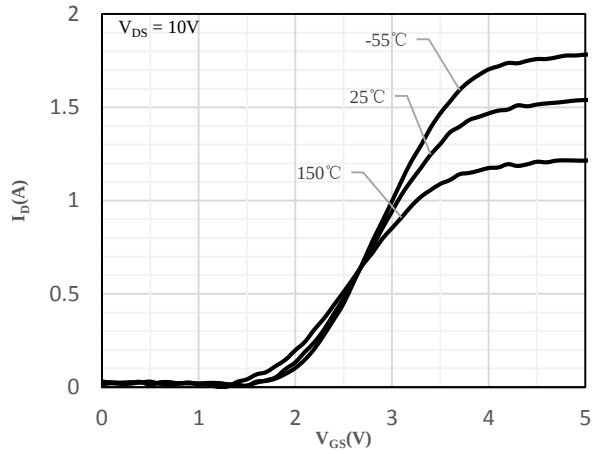


Fig 8 Transfer Characteristics

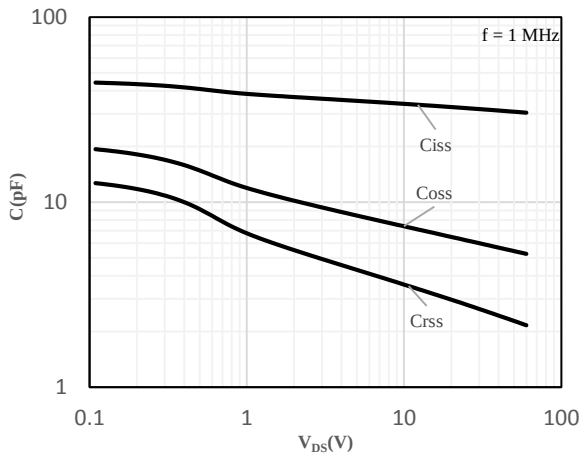


Fig 9 Capacitance Characteristics

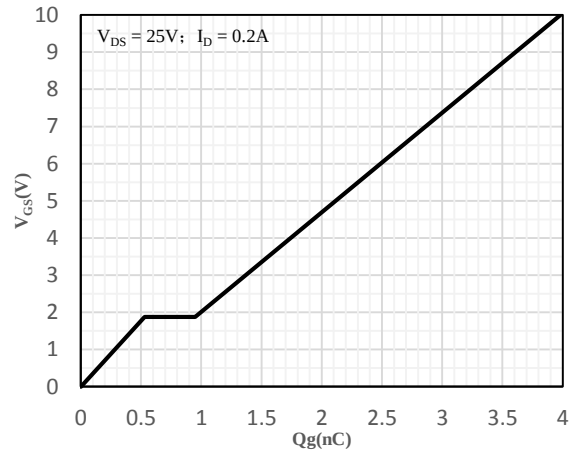


Fig 10 Gate-Charge Characteristics

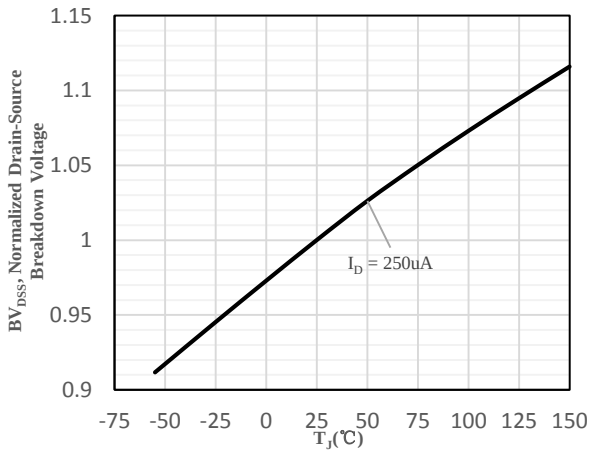


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

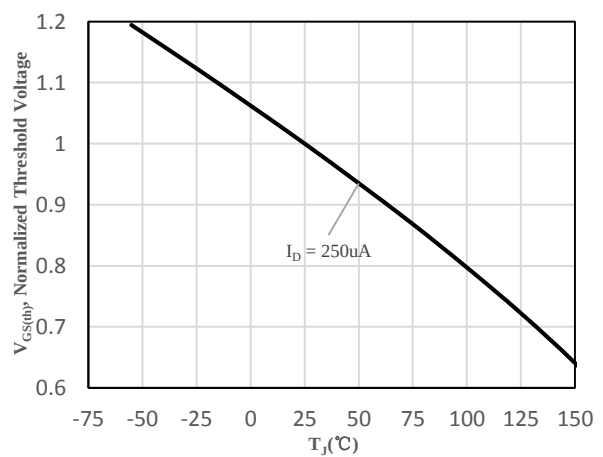
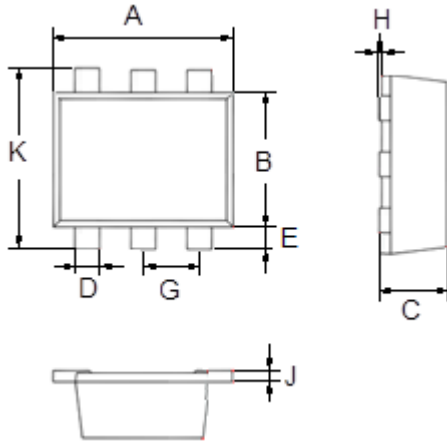


Fig 12 Normalized  $V_{GS(th)}$  vs. Junction Temperature

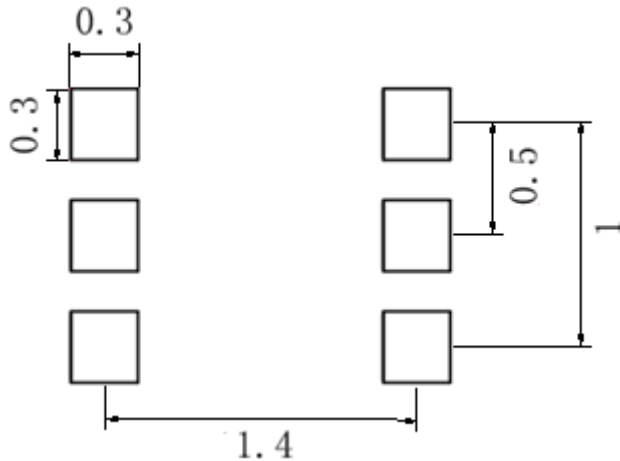
## Package Outline Dimensions (Unit: mm)



| SOT-563   |       |       |
|-----------|-------|-------|
| Dimension | Min.  | Max.  |
| A         | 1.500 | 1.700 |
| B         | 1.100 | 1.300 |
| C         | 0.525 | 0.600 |
| D         | 0.170 | 0.270 |
| E         | 0.100 | 0.300 |
| G         | 0.450 | 0.550 |
| H         | 0.000 | 0.050 |
| J         | 0.090 | 0.160 |
| K         | 1.500 | 1.700 |

## Mounting Pad Layout (Unit: mm)

### SOT-563



## IMPORTANT NOTICE

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