

### • General Description

Through advanced trench and field cutoff technology to provide very low  $V_{CE(sat)}$ , low gate charge, and excellent switching performance.

### • Features

- Very low  $V_{CE(sat)}$
- Low switching power loss
- Low switching surge and noise
- Low thermal resistance
- High short circuit capability (10us)

### • Application

- Energy Generation
- Industrial power supplies
- Welding

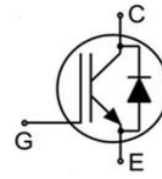
### • Ordering Information:

|                           |                 |
|---------------------------|-----------------|
| Part NO.                  | ZMBG15N120SD1AC |
| Marking                   | BG15N120SD1A    |
| Packing information       | TUBE BULK       |
| Basic ordering unit (pcs) | 600             |

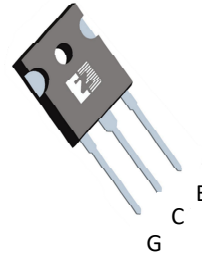
### • Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

| Parameter                      | Symbol        | Conditions                                                      | Value       | Unit             |
|--------------------------------|---------------|-----------------------------------------------------------------|-------------|------------------|
| Collector-emitter voltage      | $V_{CE}$      |                                                                 | 1200        | V                |
| Gate-emitter voltage           | $V_{GE}$      |                                                                 | $\pm 30$    | V                |
| Collector current              | $I_C$         | $T_C=25^\circ\text{C}$                                          | 30          | A                |
|                                | $I_C$         | $T_C=100^\circ\text{C}$                                         | 15          | A                |
| Pulsed collector current       | $I_{CM}$      | $T_C=25^\circ\text{C}$                                          | 45          | A                |
| Diode forward current          | $I_F$         | $T_C=25^\circ\text{C}$                                          | 30          | A                |
|                                | $I_F$         | $T_C=100^\circ\text{C}$                                         | 15          | A                |
|                                | $I_{F,pulse}$ | $T_C=25^\circ\text{C}$                                          | 45          | A                |
| Total power Dissipation        | $P_D$         | $T_C=25^\circ\text{C}$                                          | 203         | W                |
| Total Power Dissipation        | $P_D$         | $T_A=25^\circ\text{C}$                                          | 3.8         | W                |
| Short Circuit Withstand Time   | $T_{sc}$      | $V_{GE}=15\text{ V}, V_{CE}=600\text{ V}, T_J=25^\circ\text{C}$ | 10          | us               |
| Operating Junction Temperature | $T_J$         |                                                                 | -55 to +175 | $^\circ\text{C}$ |
| Storage Temperature            | $T_{STG}$     |                                                                 | -55 to +175 | $^\circ\text{C}$ |

### • Product Summary



$V_{CE} = 1200\text{V}$   
 $V_{CE(sat)} = 1.85\text{V}$   
 $I_C = 15\text{A}$



TO-247



**•Thermal resistance**

| Parameter                                 | Symbol             | Min. | Typ. | Max. | Unit |
|-------------------------------------------|--------------------|------|------|------|------|
| Thermal resistance, junction - case IGBT  | $R_{thJC}$         | -    | -    | 0.74 | °C/W |
| Thermal resistance, junction - case diode | $R_{thJC}$         | -    | -    | 2.4  | °C/W |
| Thermal resistance, junction-ambient      | $R_{thJA}^{\circ}$ | -    | -    | 40   | °C/W |
| Soldering temperature (total time<10s)    | Tsold              | -    | -    | 260  | °C   |

**•Electronic Characteristics**

| Parameter                            | Symbol        | Condition                                   | Min. | Typ. | Max. | Unit    |
|--------------------------------------|---------------|---------------------------------------------|------|------|------|---------|
| Collector-emitter breakdown voltage  | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=250\mu A$                   | 1200 | -    | -    | V       |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=15A$                       | -    | 1.85 | 2.30 | V       |
|                                      |               | $V_{GE}=15V, I_C=15A, T_J=175^{\circ}C$     | -    | 2.3  | -    |         |
| Gate-emitter threshold voltage       | $V_{GE(th)}$  | $V_{CE}=V_{GE}, I_C=1.5mA$                  | 5.0  | 6.0  | 7.0  | V       |
| Forward on-voltage                   | $V_F$         | $I_F=15A, T_J=25^{\circ}C$                  |      | 1.9  | 2.3  | V       |
|                                      |               | $I_F=15A, T_J=125^{\circ}C$                 |      | 1.6  | 2.2  |         |
|                                      |               | $I_F=15A, T_J=175^{\circ}C$                 |      | 1.45 | 2.0  |         |
| Zero gate voltage collector current  | $I_{CES}$     | $V_{GE}=0V, V_{CE}=1200V, T_J=25^{\circ}C$  | -    | -    | 10.0 | $\mu A$ |
| Zero gate voltage collector current  | $I_{CES}$     | $V_{GE}=0V, V_{CE}=1200V, T_J=175^{\circ}C$ | -    | -    | 10.0 | mA      |
| Gate-emitter leakage current         | $I_{GES}$     | $V_{GE}=\pm 30V, V_{CE}=0V$                 | -    | -    | 100  | nA      |

**•Dynamic characteristics , at  $T_J=25^{\circ}C$** 

| Parameter                    | Symbol    | Condition                            | Min. | Typ. | Max. | Unit |
|------------------------------|-----------|--------------------------------------|------|------|------|------|
| Input capacitance            | $C_{ies}$ | $f=1MHz, V_{CE}=600V$                | -    | 1325 | -    | pF   |
| Output capacitance           | $C_{oes}$ |                                      | -    | 21   | -    |      |
| Reverse transfer capacitance | $C_{res}$ |                                      | -    | 4    | -    |      |
| Total gate charge            | $Q_g$     | $V_{CC}=600V, I_C=15.0A, V_{GE}=15V$ | -    | 68   | -    | nC   |
| Gate-emitter charge          | $Q_{ge}$  |                                      | -    | 12   | -    | nC   |
| Gate-collector charge        | $Q_{gc}$  |                                      | -    | 40   | -    | nC   |

**SwitchingCharacteristic, at  $T_J=25^{\circ}C$** 

|                        |              |                                                                                   |   |       |   |    |
|------------------------|--------------|-----------------------------------------------------------------------------------|---|-------|---|----|
| Turn-on delay time     | $t_{D(on)}$  | $T_J=25^{\circ}C, V_{CC}=600V, I_C=15A, V_{GE}=-8/15V, R_g=6.2\Omega, L=200\mu H$ | - | 27.9  | - | ns |
| Turn-on rise time      | $t_r$        |                                                                                   | - | 58.5  | - | ns |
| Turn-off delay time    | $t_{D(off)}$ |                                                                                   | - | 76.2  | - | ns |
| Turn-off fall time     | $t_f$        |                                                                                   | - | 29.4  | - | ns |
| Turn-on energy         | $E_{on}$     |                                                                                   | - | 0.772 | - | mJ |
| Turn-off energy        | $E_{off}$    |                                                                                   | - | 0.499 | - | mJ |
| Total switching energy | $E_{ts}$     |                                                                                   | - | 1.271 | - | mJ |

Switching Characteristic, at  $T_J=150^\circ\text{C}$

|                        |              |                                                                                                                                        |   |       |   |    |
|------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------|---|-------|---|----|
| Turn-on delay time     | $t_{D(on)}$  | $T_J=150^\circ\text{C},$<br>$V_{CC}=600\text{V}, I_C=15\text{A},$<br>$V_{GE}=-8/15\text{V},$<br>$R_g=6.2\Omega,$<br>$L=200\mu\text{H}$ | - | 29.6  | - | ns |
| Turn-on rise time      | $t_r$        |                                                                                                                                        | - | 58    | - | ns |
| Turn-off delay time    | $t_{D(off)}$ |                                                                                                                                        | - | 99.5  | - | ns |
| Turn-off fall time     | $t_f$        |                                                                                                                                        | - | 130.5 | - | ns |
| Turn-on energy         | $E_{on}$     |                                                                                                                                        | - | 1.006 | - | mJ |
| Turn-off energy        | $E_{off}$    |                                                                                                                                        | - | 0.571 | - | mJ |
| Total switching energy | $E_{ts}$     |                                                                                                                                        | - | 1.577 | - | mJ |

Diode switching characteristics (inductive load)

|                          |           |                                                                                                  |   |      |   |    |
|--------------------------|-----------|--------------------------------------------------------------------------------------------------|---|------|---|----|
| Reverse recovery time    | $t_{rr}$  | $I_F=15\text{A}, V_R=600\text{V},$<br>$di/dt=-200\text{A}/\mu\text{s}$<br>$T_J=25^\circ\text{C}$ | - | 68   | - | ns |
| Reverse recovery charge  | $Q_{rr}$  |                                                                                                  | - | 787  | - | nC |
| Reverse recovery current | $I_{rrm}$ |                                                                                                  | - | 20.6 | - | A  |

Fig.1 Gate-Charge characteristics

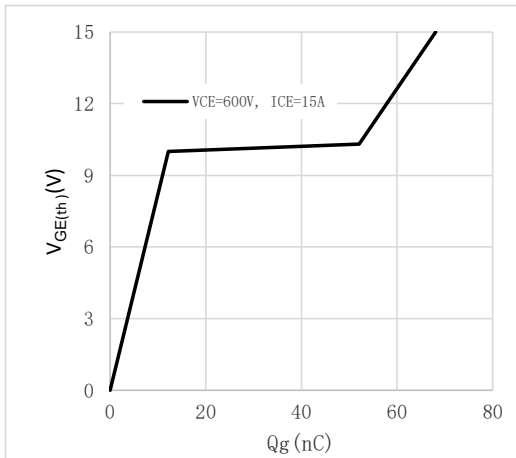


Fig.2 Capacitance characteristics

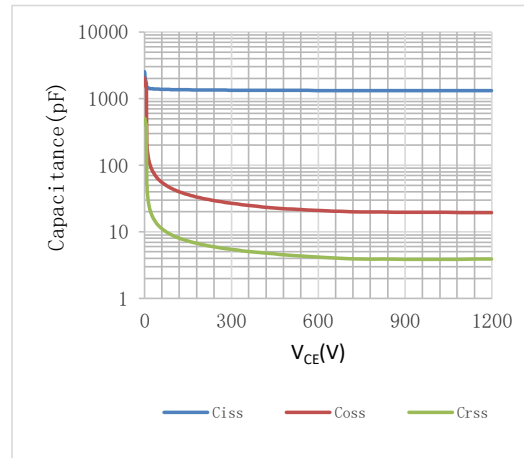


Fig.3 Power dissipation

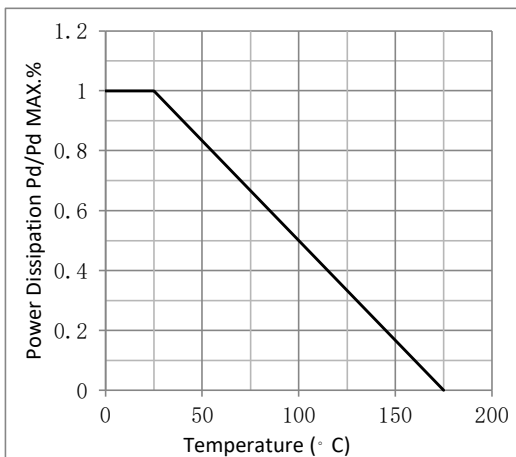


Fig.4 Typical output characteristics

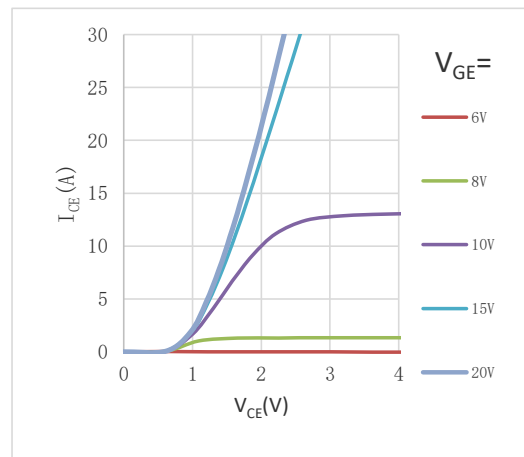


Fig.5 Threshold voltage V.S junction temperature

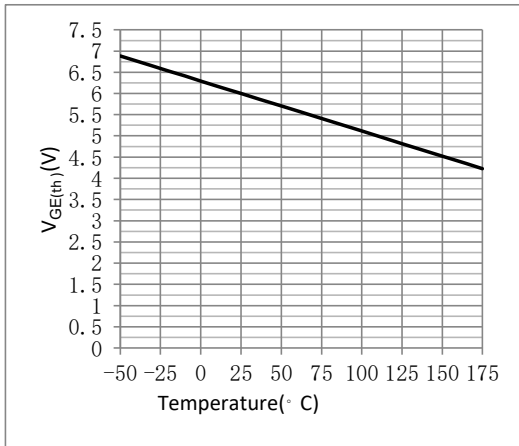


Fig.6 IC vs. Junction Temperature<sup>③</sup>

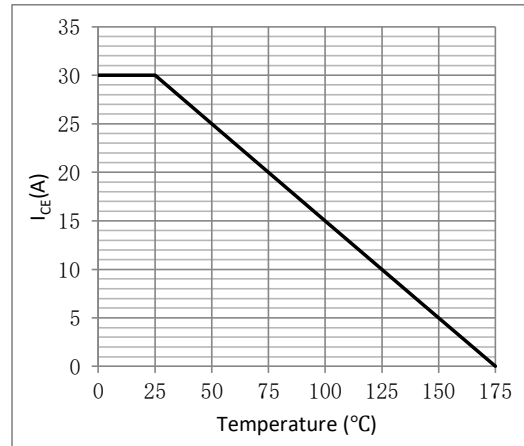


Fig.7 Collector-Emitter VS gate source voltage

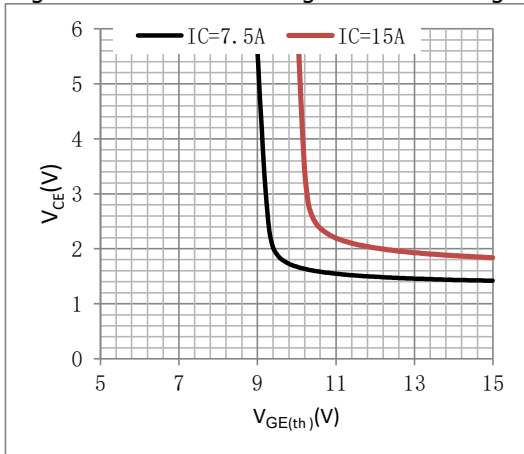


Figure 8. Transfer characteristics

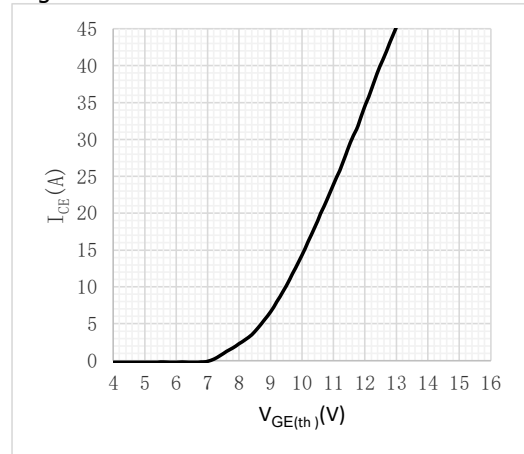


Fig.9 Safe operating area

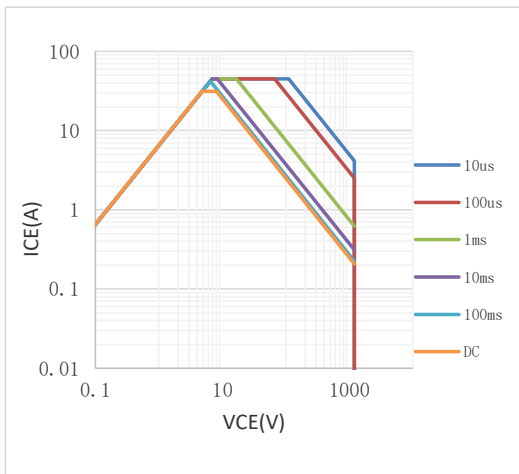


Fig.10 Max transient thermal impedance for IGBT

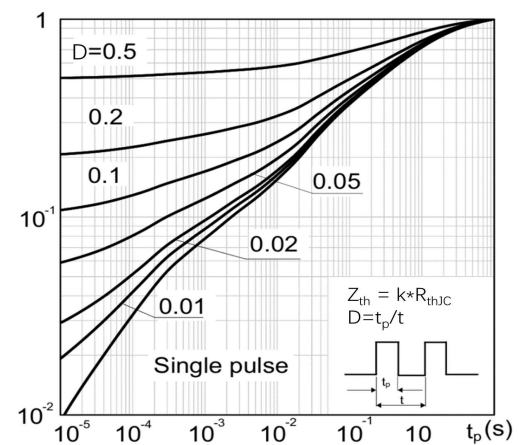


Fig.11 Max transient thermal impedance for Diode

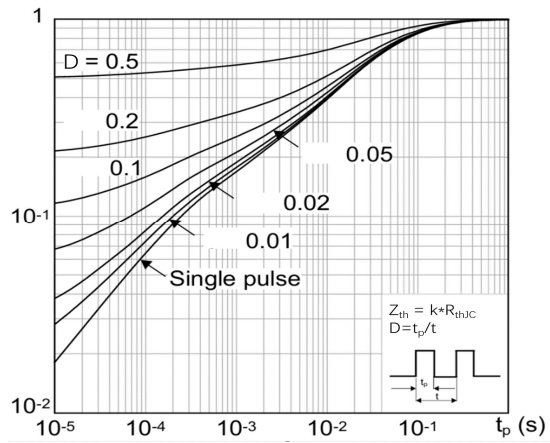
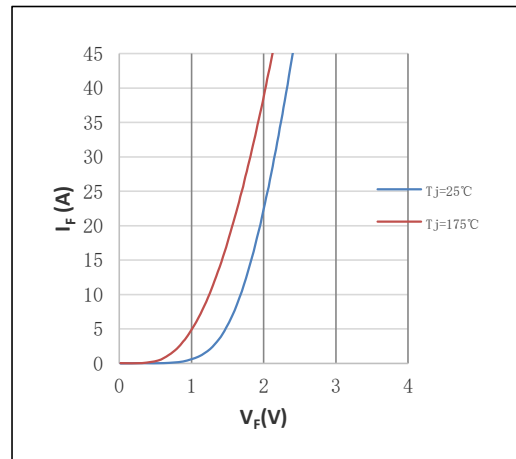
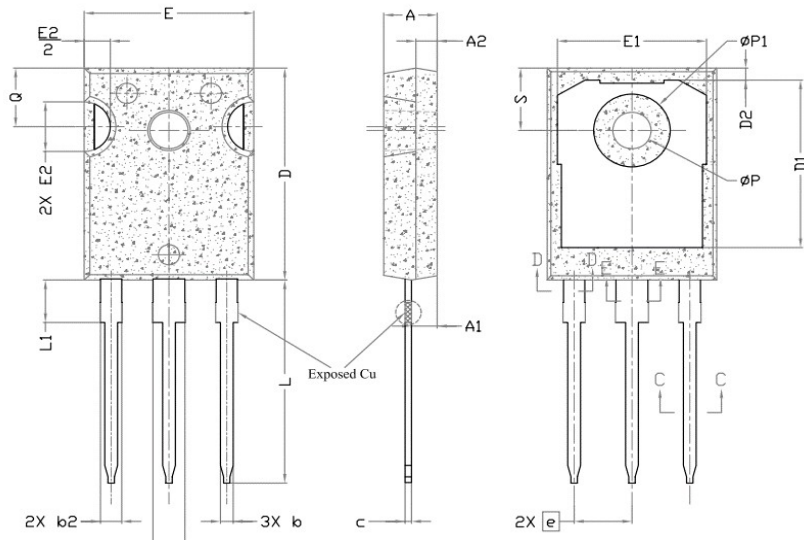


Fig.12 Typical diode forward current as a function of forward voltage



•TO-247 Package Outline



| SYMBOL | DIMENSIONS |       |       | NOTES |
|--------|------------|-------|-------|-------|
|        | MIN.       | NOM.  | MAX.  |       |
| A      | 4.83       | 5.02  | 5.21  |       |
| A1     | 2.29       | 2.41  | 2.55  |       |
| A2     | 1.50       | 2.00  | 2.49  |       |
| b      | 1.12       | 1.20  | 1.33  |       |
| b1     | 1.12       | 1.20  | 1.28  |       |
| b2     | 1.91       | 2.00  | 2.39  | 6     |
| b3     | 1.91       | 2.00  | 2.34  |       |
| b4     | 2.87       | 3.00  | 3.22  | 6, 8  |
| b5     | 2.87       | 3.00  | 3.18  |       |
| c      | 0.55       | 0.60  | 0.69  | 6     |
| c1     | 0.55       | 0.60  | 0.65  |       |
| D      | 20.80      | 20.95 | 21.10 | 4     |
| D1     | 16.25      | 16.55 | 17.65 | 5     |
| D2     | 0.51       | 1.19  | 1.35  |       |
| E      | 15.75      | 15.94 | 16.13 | 4     |
| E1     | 13.46      | 14.02 | 14.16 | 5     |
| E2     | 4.32       | 4.91  | 5.49  | 3     |
| e      | 5.44BSC    |       |       |       |
| L      | 19.81      | 20.07 | 20.32 |       |
| L1     | 4.10       | 4.19  | 4.40  | 6     |
| ØP     | 3.56       | 3.61  | 3.65  | 7     |
| ØP1    | 7.19REF.   |       |       |       |
| Q      | 5.39       | 5.79  | 6.20  |       |
| S      | 6.04       | 6.17  | 6.30  |       |

**Note:**

① Practically the current will be limited by PCB, thermal design and operating temperature.  
VGE=15V.

**Disclaimer**

- Reproducing and modifying information of the document is prohibited without permission from ZMJ SEMICONDDUCTORS CO.,LTD.
- ZMJ SEMICONDDUCTORS CO.,LTD. reserves the rights to make changes of the content herein the document anytime without notification. Please refer to our website for the latest document.
- ZMJ SEMICONDDUCTORS CO.,LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- ZMJ SEMICONDDUCTORS CO.,LTD. does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications. ZMJ SEMICONDDUCTORS CO.,LTD. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify ZMJ SEMICONDDUCTORS CO.,LTD. for any damages resulting from such improper use or sale.
- Since ZMJ uses lot number as the tracking base, please provide the lot number for tracking when complaining.

## Revision History

| Version | Date      | Change |
|---------|-----------|--------|
| A       | 2025/4/15 | New    |
|         |           |        |
|         |           |        |
|         |           |        |
|         |           |        |
|         |           |        |
|         |           |        |
|         |           |        |
|         |           |        |