## ●General Description

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

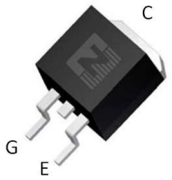
## ●Features

- ■Very low $V_{CE(sat)}$
- ■Low switching power loss
- ■Low switching surge and noise
- ■Low thermal resistance
- ■AEC-Q101 qualified

## ●Application

- ■Motor drives

## ●Product Summary

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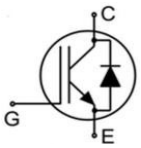



$V_{CE}$=650V

$V_{CE(sat)}$ =1.47V

$I_C$=30A

RoHS REACH COMPLIANT HF

## ●Ordering Information

| Part NO. | ZMBGA30N065TD1AB |
|---|---|
| Marking | BG30N065TD1A |
| Packing information | REEL TAPE |
| Basic ordering unit (pcs) | 800 |

## ●Absolute Maximum Ratings（$T_A$=25℃,unless otherwise specified）

| Parameter | Symbol | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | | - | 650 | V |
| Gate-emitter voltage① | $V_{GE}$ | | -20 | 20 | V |
| Continuous collector current | $I_C$ | $V_{GE}$=15V, $T_C$=25℃ | - | 60 | A |
| | $I_C$ | $V_{GE}$=15V, $T_C$=100℃ | - | 30 | A |
| Pulsed collector current ① | $I_{CM}$ | Pulsed; $t_p$ ≤ 10 μs; $T_C$ = 25 °C | - | 120 | A |
| Diode forward current | $I_F$ | $V_{GE}$=0V, $T_C$=25℃ | - | 60 | A |
| | | $V_{GE}$=0V, $T_C$=100℃ | - | 30 | A |
| Pulsed diode forward current | $I_{F,pulse}$ | Pulsed; $t_p$ ≤ 10 μs; $T_C$ = 25 °C | - | 120 | A |
| Total power dissipation | $P_D$ | $T_C$=25℃ | - | 417 | W |
| Total power dissipation | $P_D$ | $T_A$=25℃ | - | 3.8 | W |
| Operating junction temperature | $T_J$ | | -55 | 175 | ℃ |
| Storage temperature | $T_{STG}$ | | -55 | 175 | ℃ |

## ●Thermal resistance

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Thermal resistance, junction - case IGBT | $R_{thJC}$ | - | - | 0.36 | °C/W |
| Thermal resistance, junction - case diode | $R_{thJC}$ | - | - | 0.88 | °C/W |
| Thermal resistance, junction - ambient | $R_{thJA}$② | - | - | 40 | °C/W |
| Soldering temperature（total time<10s) | $T_{sold}$ | - | - | 260 | °C |

## ●Electronic Characteristics ($T_j$=25°C, unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector-emitter breakdown voltage | $BV_{CES}$ | $V_{GE}$ =0V, $I_C$ =250uA | 650 | - | - | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $V_{GE}$=$V_{CE}$, $I_C$=1mA | 4 | 5.3 | 6 | V |
| Zero gate voltage collector current | $I_{CES}$ | $V_{GE}$=0V, $V_{CE}$=650V, $T_j$=25℃ | - | - | 10 | uA |
| | | $V_{GE}$=0V, $V_{CE}$=650V, $T_j$=175℃ | - | - | 10 | mA |
| Gate- emitter leakage current | $I_{GES}$ | $V_{GE}$=±20V, $V_{CE}$ =0V | - | - | 100 | nA |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$=15V, $I_C$=30A, $T_j$=25℃ | - | 1.47 | 1.75 | V |
| | | $V_{GE}$=15V, $I_D$=30A, $T_j$=175℃ | - | 1.87 | - | V |
| Forward transconductance | gFS | $V_{CE}$ =20V, $I_C$ = 30A | - | 22 | - | S |
| Diode forward voltage | $V_F$ | $I_F$=30A, $T_C$=25℃ | - | 1.4 | 1.8 | V |
| | | $I_F$=30A, $T_C$=175℃ | - | 1.1 | 1.5 | V |

## ●Dynamic characteristics ($T_j$=25°C, unless otherwise specified)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{ies}$ | f = 100KHz, $V_{CE}$=400V, $V_{GE}$=0V | - | 2521 | - | pF |
| Output capacitance | $C_{oes}$ | | - | 44 | - | pF |
| Reverse transfer capacitance | $C_{res}$ | | - | 6.5 | - | pF |
| Gate resistance | $R_g$ | f = 1MHz | - | 1.6 | - | Ω |
| Total gate charge | $Q_g$ | $V_{CC}$ =400V, $I_C$ = 30A, $V_{GE}$ = 15V | - | 78.4 | - | nC |
| Gate-emitter charge | $Q_{ge}$ | | - | 20.5 | - | nC |
| Gate-collector charge | $Q_{gc}$ | | - | 29.3 | - | nC |

## ●Switching characteristics ($T_j$=25°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d(on)}$ | $T_j$=25℃<br>$V_{GE}$=15/-15V,<br>$V_{CE}$=400V,<br>$R_G$ =10Ω,<br>$I_C$ =30A,<br>L=105uH | - | 20 | - | ns |
| Turn-on rise time | $t_r$ | | - | 20 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 70 | - | ns |
| Turn-off fall time | $t_f$ | | - | 65 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.95 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.48 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 1.43 | - | mJ |

## ●Switching characteristics ($T_j$=150°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d(on)}$ | $T_j$=150℃<br>$V_{GE}$=15/-15V,<br>$V_{CE}$=400V,<br>$R_G$ =10Ω,<br>$I_C$ =30A,<br>L=105uH | - | 19 | - | ns |
| Turn-on rise time | $t_r$ | | - | 18 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 81 | - | ns |
| Turn-off fall time | $t_f$ | | - | 90 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 1.03 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.63 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 1.66 | - | mJ |

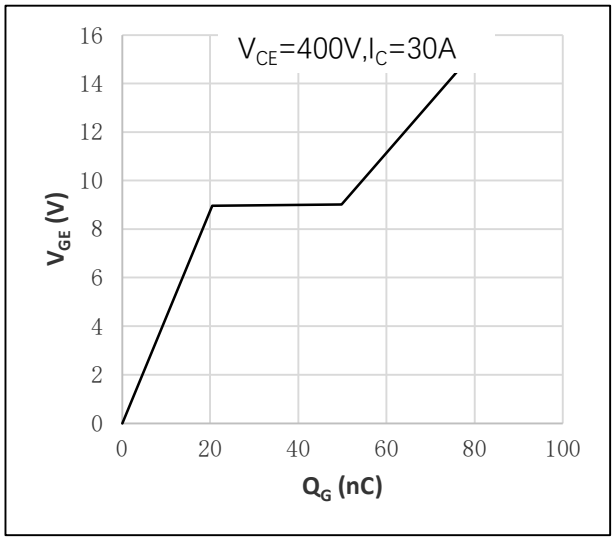
## ●Diode switching characteristics ($T_j$=25°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Reverse recovery time | $t_{rr}$ | $T_j$=25℃<br>$V_R$=400V,$I_F$ =30A,<br>$di_F/dt$=1000A/us, | - | 28 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 189 | - | nC |
| Reverse recovery | $I_{rrm}$ | | - | 11.8 | - | A |
| Reverse recovery energy | $E_{rr}$ | | - | 78 | - | uJ |

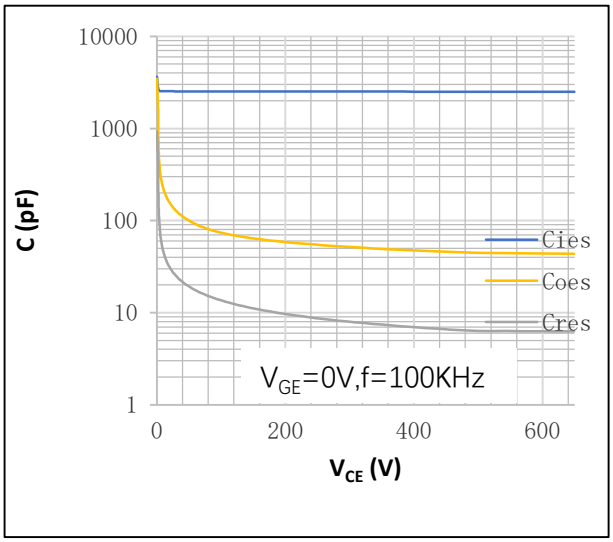
## ●Switching characteristics ($T_j$=150°C)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Reverse recovery time | $t_{rr}$ | $T_j$=150℃<br>$V_R$=400V,$I_F$ =30A,<br>$di_F/dt$=1000A/us, | - | 139 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 1160 | - | nC |
| Reverse recovery | $I_{rrm}$ | | - | 16.8 | - | A |
| Reverse recovery energy | $E_{rr}$ | | - | 167 | - | uJ |

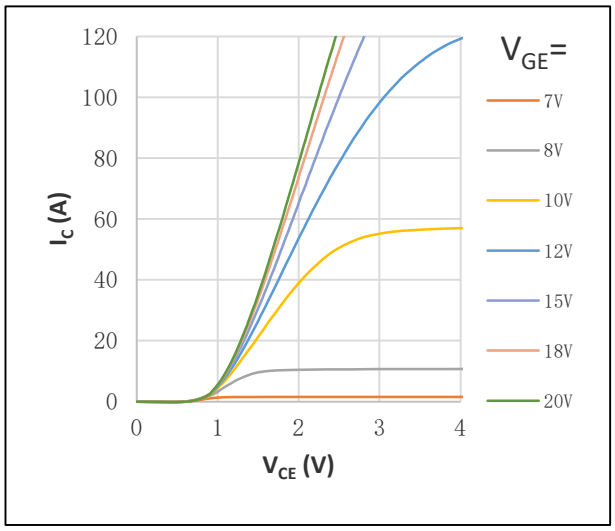
●Fig.1 Gate-emitter voltage as a function of gate charge; Typical values; $T_j$=25℃



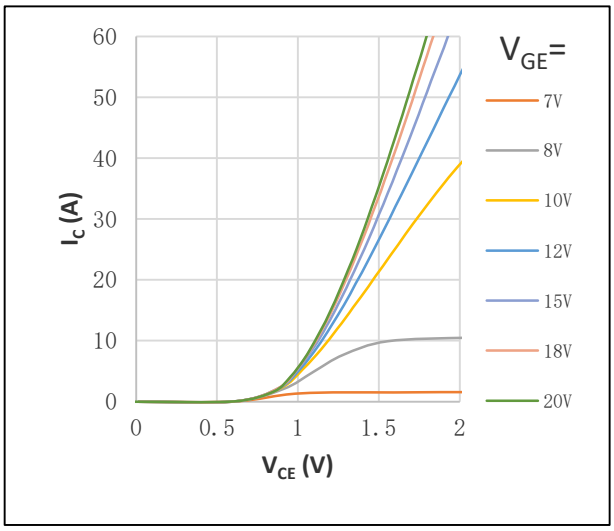

●Fig.2 Input, output and reverse transfer capacitances as a function of collector-emitter voltage; Typical values; $T_j$=25℃



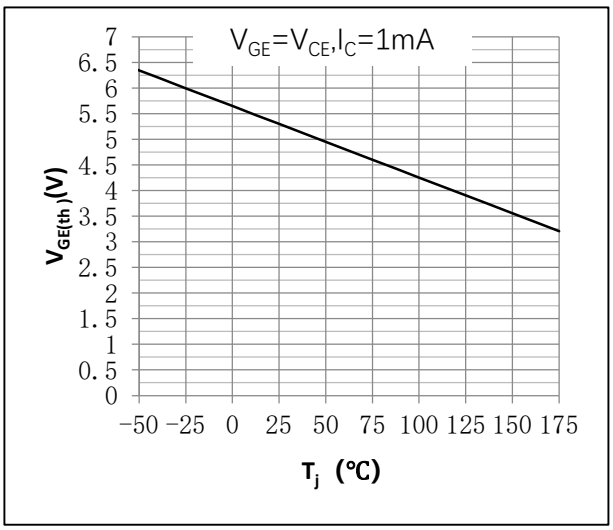

●Fig.3 Output characteristics: collector current as a function of collector-emitter voltage; Typical values; $T_j$=25℃



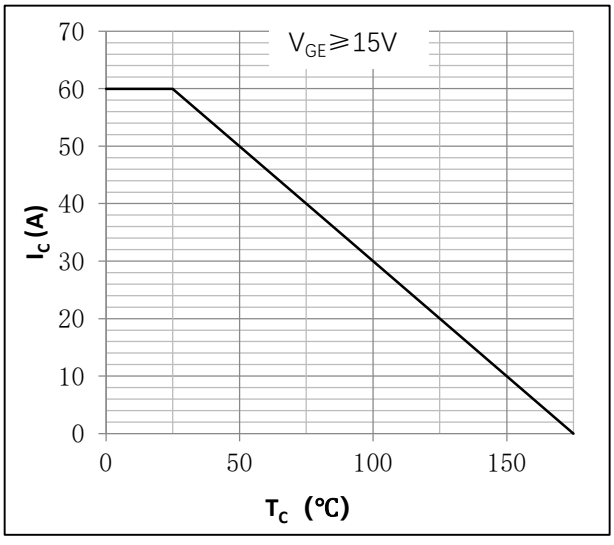

●Fig.4 Output characteristics: collector current as a function of collector-emitter voltage; Typical values: Expanded curve; $T_j$=25℃



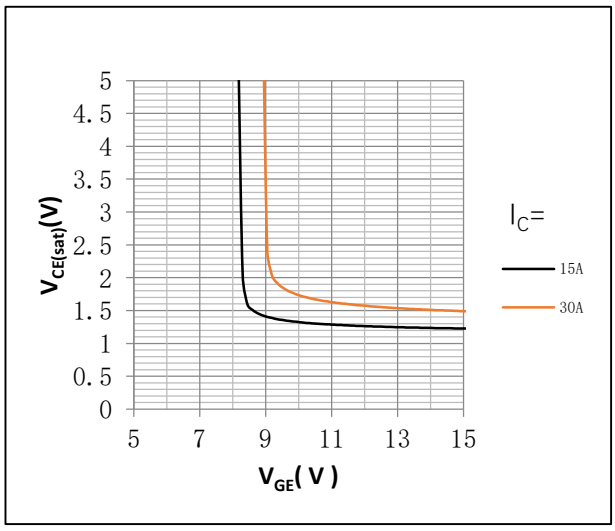

●Fig.5 Gate-emitter threshold voltage as a function of junction temperature; Typical values



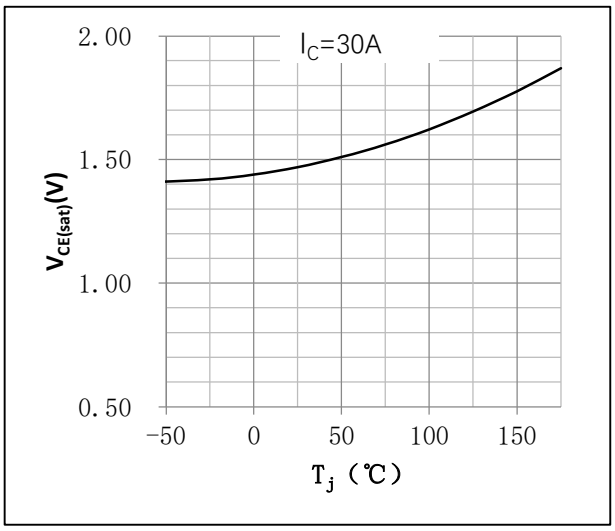

●Fig.6 Continuous collector current as a function of case temperature[3];Calculative values



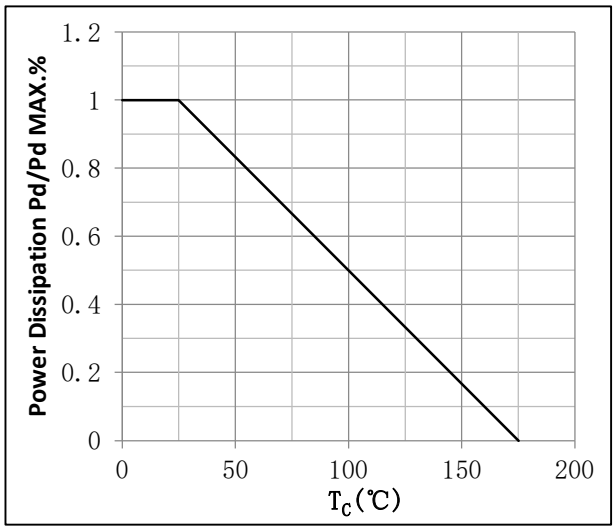
●Fig.7 Collector-emitter saturation voltage as a function of gate-emitter voltage; Typical values



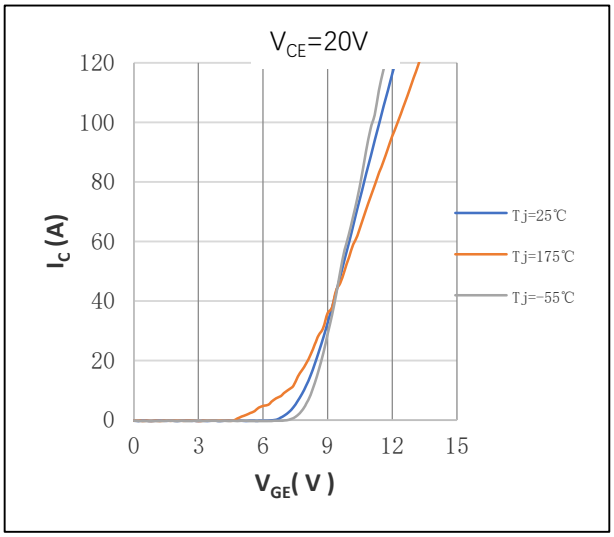

●Fig.8 Fig.6 Collector-emitter saturation voltage as a function of junction temperature; Typical values; Tj=25℃



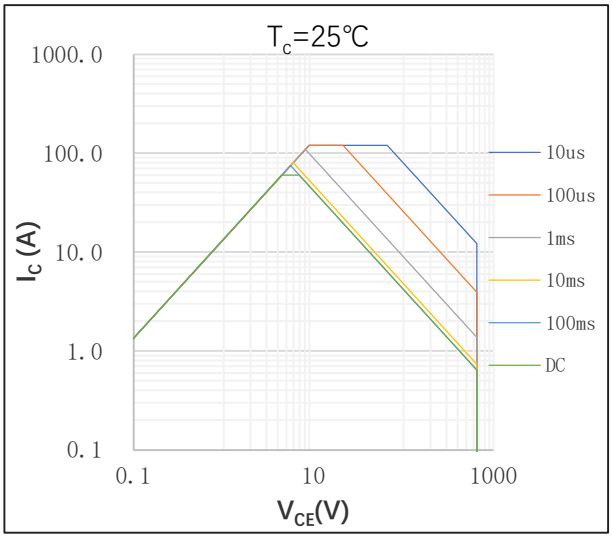

●Figure 9. Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =$P_d/P_d$(25℃)



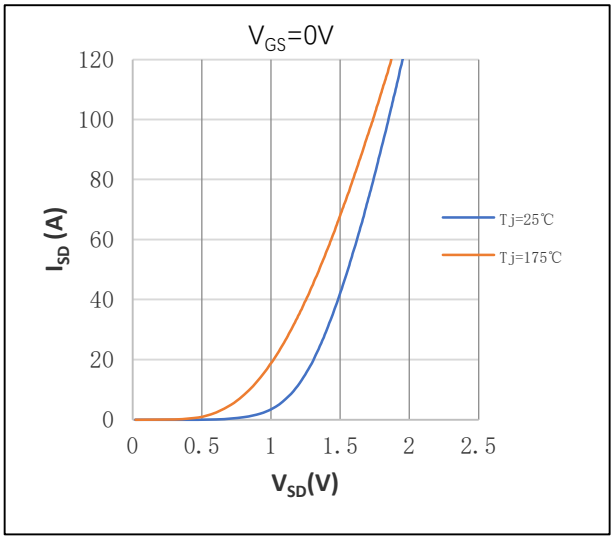

●Figure 10. Transfer characteristics: Collector current as a function of gate-emitter voltage; Typical values



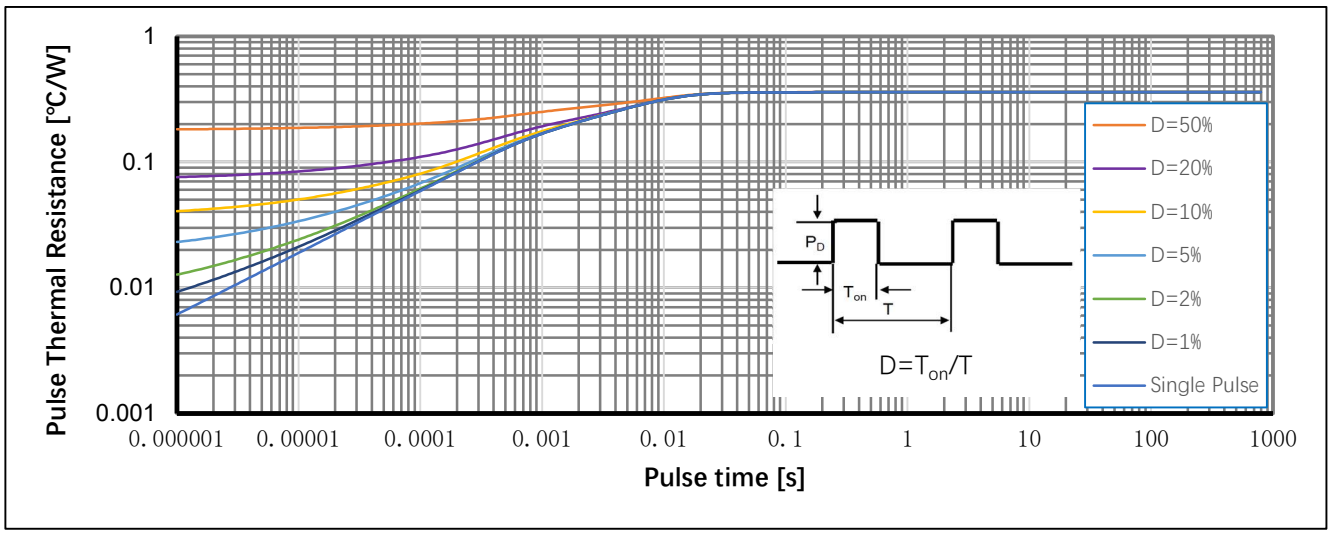

●Fig.11 Safe operating area: continuous and peak collector currents as a function of collector-emitter voltage; Calculative values



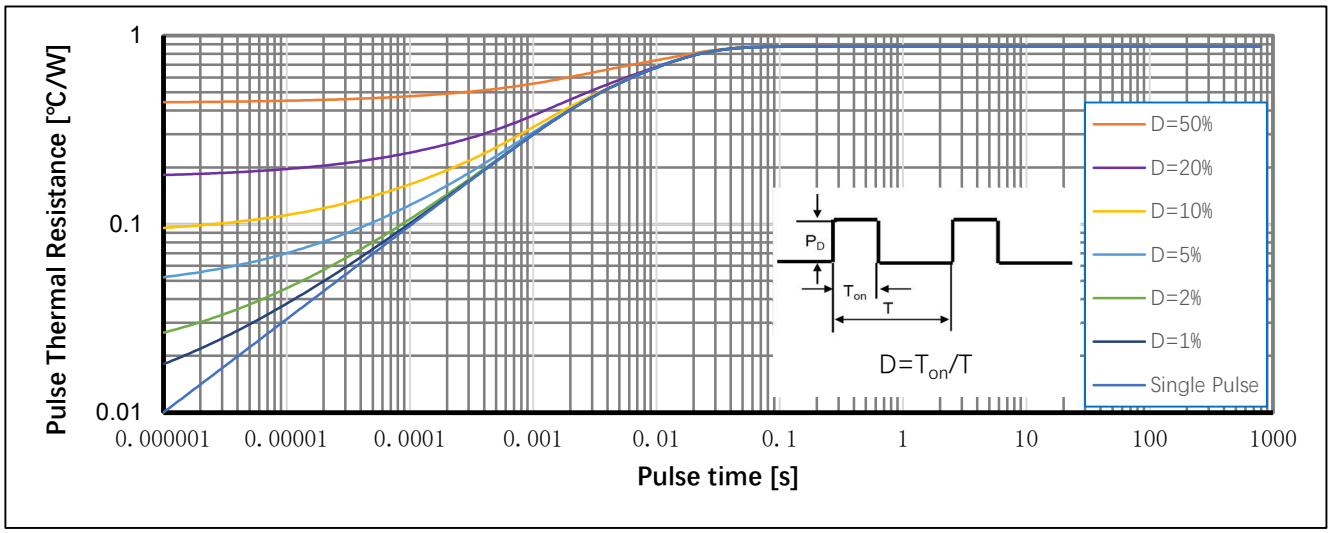

●Fig.12 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



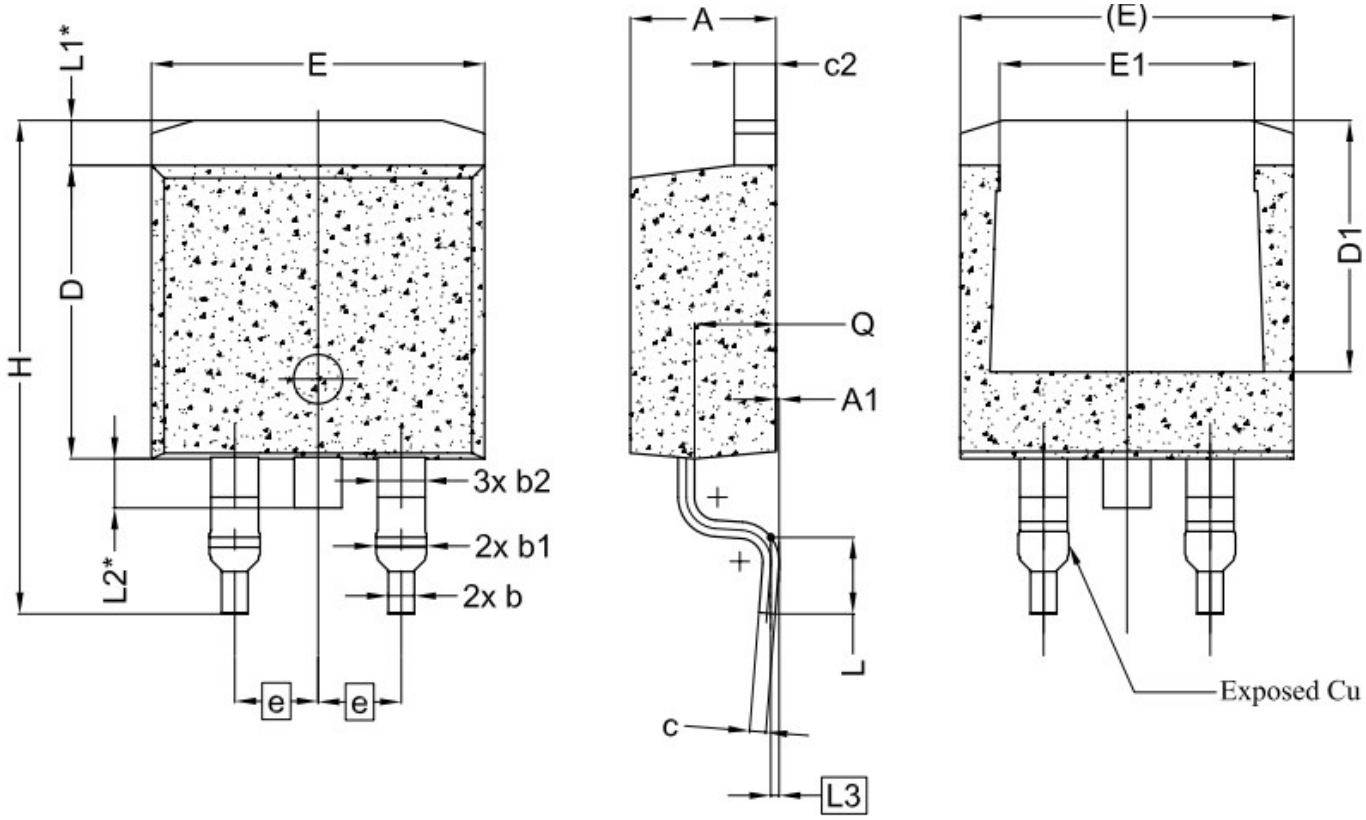
●Fig.13 Transient thermal impedance from junction to case -IGBT as a function of pulse duration; max values

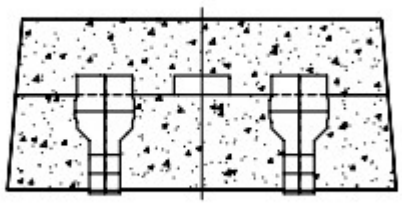



●Fig.14 Transient thermal impedance from junction to case -diode as a function of pulse duration; max values



## ●Package Outline



| SYMBOL | DIMENSIONS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.24 | 4.44 | 4.64 |
| A1 | 0.00 | 0.10 | 0.25 |
| b | 0.70 | 0.80 | 0.90 |
| b1 | 1.20 | 1.55 | 1.75 |
| b2 | 1.20 | 1.45 | 1.70 |
| c | 0.40 | 0.50 | 0.60 |
| c2 | 1.15 | 1.27 | 1.40 |
| D | 8.82 | 8.92 | 9.02 |
| D1 | 6.86 | 7.65 | -- |
| E | 9.96 | 10.16 | 10.36 |
| E1 | 6.89 | 7.77 | 7.89 |
| e | 2.54 BSC | | |
| H | 14.61 | 15.00 | 15.88 |
| L | 1.78 | 2.32 | 2.79 |
| L1 | 1.36 REF. | | |
| L2 | 1.50 REF. | | |
| L3 | 0.25 BSC | | |
| Q | 2.30 | 2.48 | 2.70 |

## Note

① Pulse : $V_{GE}$=+20V/-20V, Duty cycle=50%,$T_j$=175℃, t=1000 hours; For DC ， the following test conditions can be passed: $V_{GE}$=+20V/-10V, $T_j$=175℃, t=1000 hours;

② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;

③ Practically the current will be limited by PCB, thermal design and operating temperature. $V_{GE}$=15V.

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## ●Revision History

| Version | Date | Change |
|---|---|---|
| A | 2025/6/30 | New |
| | | |
| | | |
| | | |
| | | |