

## ● General Description

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

## ● Features

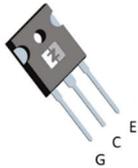
- Very low  $V_{CE(sat)}$
- Low switching power loss
- Low switching surge and noise
- Low thermal resistance
- High short circuit capability (10us)
- AEC-Q101 qualified

## ● Application

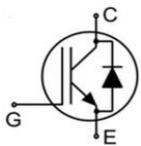
- Inverter
- Industrial motor drives
- Industrial power supplies



## ● Product Summary



TO-247



$V_{CE}=650V$

$V_{CE(sat)}=1.65V$

$I_C=80A$



## ● Ordering Information

Part NO.	ZMBGA80N065SD1AC
Marking	BG80N065SD1A
Packing information	TUBE BULK
Basic ordering unit (pcs)	600

## ● Absolute Maximum Ratings ( $T_A=25^{\circ}C$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Collector-emitter voltage	$V_{CE}$		-	650	V
Gate-emitter voltage <sup>①</sup>	$V_{GE}$		-20	20	V
Continuous collector current	$I_C$	$V_{GE}=15V, T_C=25^{\circ}C$	-	160	A
	$I_C$	$V_{GE}=15V, T_C=100^{\circ}C$	-	80	A
Pulsed collector current	$I_{CM}$	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$	-	320	A
Diode forward current	$I_F$	$V_{GE}=0V, T_C=25^{\circ}C$	-	160	A
		$V_{GE}=0V, T_C=100^{\circ}C$	-	80	A
Pulsed diode forward current	$I_{F,pulse}$	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$	-	320	A
Total power dissipation	$P_D$	$T_C=25^{\circ}C$	-	714	W
Total power dissipation	$P_D$	$T_A=25^{\circ}C$	-	3.8	W
Short circuit withstand time	$T_{sc}$	$V_{GE}=15V, V_{CE}=400V, T_j=150^{\circ}C$	-	10	us

Operating junction temperature	$T_J$		-55	175	°C
Storage temperature	$T_{STG}$		-55	175	°C

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case IGBT	$R_{thJC}$	-	-	0.21	°C/W
Thermal resistance, junction - case diode	$R_{thJC}$	-	-	0.42	°C/W
Thermal resistance, junction - ambient	$R_{thJA}^{\text{②}}$	-	-	40	°C/W
Soldering temperature (total time<10s)	$T_{sold}$	-	-	260	°C

● Electronic Characteristics ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Collector-emitter breakdown voltage	$BV_{CES}$	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.5mA$	4.7	5.7	6.7	V
Zero gate voltage collector current	$I_{CES}$	$V_{GE}=0V, V_{CE}=650V, T_J=25^{\circ}\text{C}$	-	-	10	$\mu A$
		$V_{GE}=0V, V_{CE}=650V, T_J=175^{\circ}\text{C}$	-	-	10	mA
Gate-emitter leakage current	$I_{GES}$	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	100	nA
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=80A, T_J=25^{\circ}\text{C}$	-	1.65	2.1	V
		$V_{GE}=15V, I_D=80A, T_J=175^{\circ}\text{C}$	-	2.1	-	V
Forward transconductance	$g_{FS}$	$V_{CE}=20V, I_C=80A$	-	35	-	S
Diode forward voltage	$V_F$	$I_F=80A, T_C=25^{\circ}\text{C}$	-	1.55	1.9	V
		$I_F=80A, T_C=175^{\circ}\text{C}$	-	1.35	1.75	V

● Dynamic characteristics ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	$C_{ies}$	$f=100\text{KHz}, V_{CE}=400V, V_{GE}=0V$	-	6954	-	pF
Output capacitance	$C_{oes}$		-	102	-	pF
Reverse transfer capacitance	$C_{res}$		-	24	-	pF
Gate resistance	$R_g$	$f=1\text{MHz}$	-	2	-	$\Omega$
Total gate charge	$Q_g$	$V_{CC}=400V, I_C=80A, V_{GE}=15V$	-	204	-	nC
Gate-emitter charge	$Q_{ge}$		-	60	-	nC
Gate-collector charge	$Q_{gc}$		-	83	-	nC

● Switching characteristics ( $T_j=25^\circ\text{C}$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ\text{C}$ $V_{GE}=15/0\text{V}$ , $V_{CE}=400\text{V}$ , $R_G=10\Omega$ , $I_C=80\text{A}$ , $L=50\mu\text{H}$	-	64	-	ns
Turn-on rise time	$t_r$		-	143	-	ns
Turn-off delay time	$t_{d(off)}$		-	130	-	ns
Turn-off fall time	$t_f$		-	47	-	ns
Turn-on energy	$E_{on}$		-	3.94	-	mJ
Turn-off energy	$E_{off}$		-	1.54	-	mJ
Total switching energy	$E_{ts}$		-	5.48	-	mJ

 ● Switching characteristics ( $T_j=150^\circ\text{C}$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	$T_j=150^\circ\text{C}$ $V_{GE}=15/0\text{V}$ , $V_{CE}=400\text{V}$ , $R_G=10\Omega$ , $I_C=80\text{A}$ , $L=50\mu\text{H}$	-	64	-	ns
Turn-on rise time	$t_r$		-	122	-	ns
Turn-off delay time	$t_{d(off)}$		-	141	-	ns
Turn-off fall time	$t_f$		-	46	-	ns
Turn-on energy	$E_{on}$		-	4	-	mJ
Turn-off energy	$E_{off}$		-	1.68	-	mJ
Total switching energy	$E_{ts}$		-	5.68	-	mJ

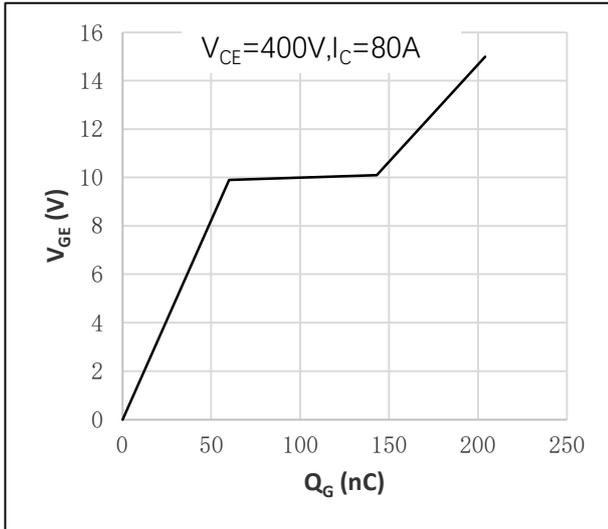
 ● Diode switching characteristics ( $T_j=25^\circ\text{C}$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse recovery time	$t_{rr}$	$T_j=25^\circ\text{C}$ $V_R=400\text{V}$ , $I_F=80\text{A}$ , $di_F/dt=700\text{A}/\mu\text{s}$ ,	-	77	-	ns
Reverse recovery charge	$Q_{rr}$		-	1220	-	nC
Reverse recovery	$I_{rrm}$		-	18	-	A

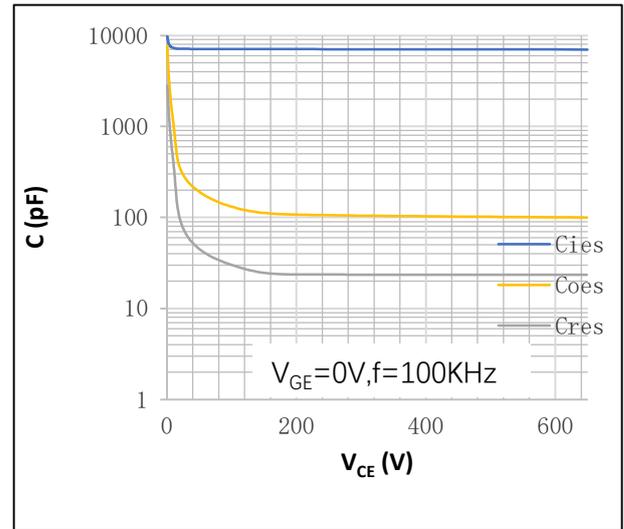
 ● Diode switching characteristics ( $T_j=150^\circ\text{C}$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse recovery time	$t_{rr}$	$T_j=150^\circ\text{C}$ $V_R=400\text{V}$ , $I_F=80\text{A}$ , $di_F/dt=700\text{A}/\mu\text{s}$ ,	-	130	-	ns
Reverse recovery charge	$Q_{rr}$		-	3186	-	nC
Reverse recovery	$I_{rrm}$		-	30.6	-	A

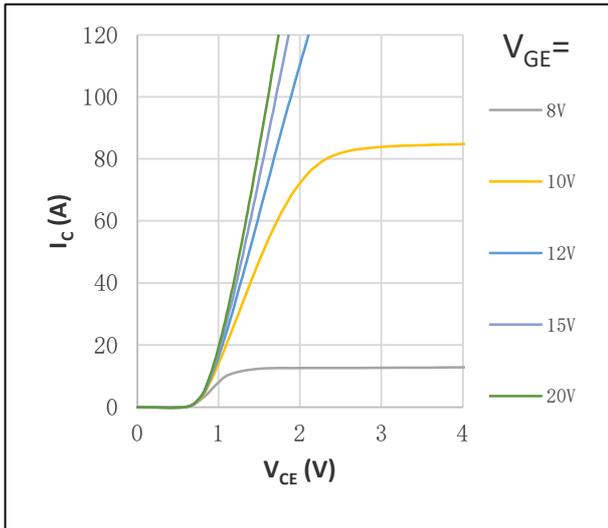
● Fig.1 Gate-emitter voltage as a function of gate charge; Typical values;  $T_j=25^\circ\text{C}$



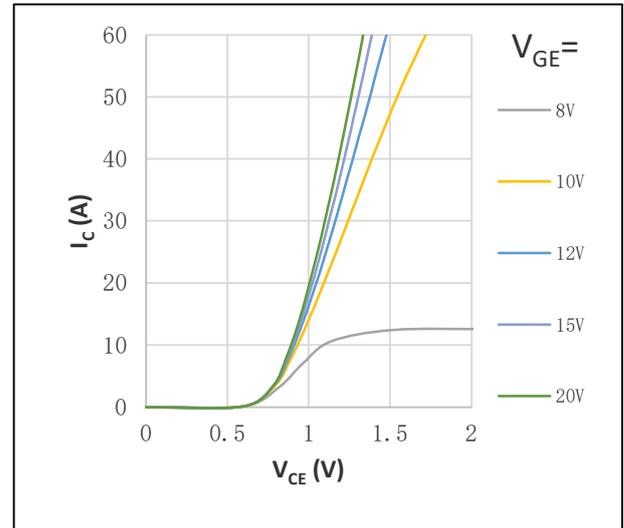
● Fig.2 Input, output and reverse transfer capacitances as a function of collector-emitter voltage; Typical values;  $T_j=25^\circ\text{C}$



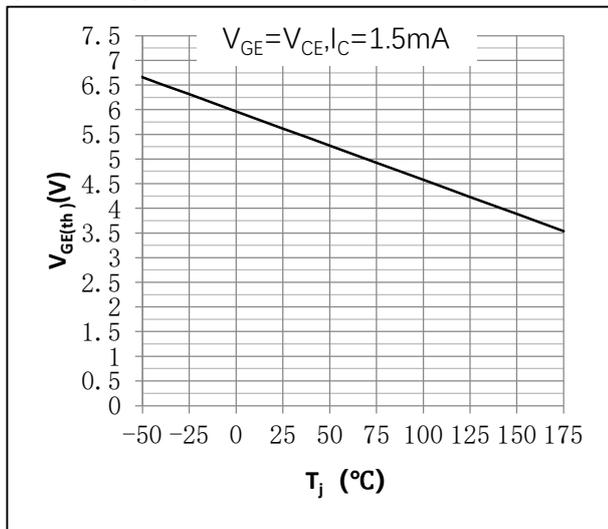
● Fig.3 Output characteristics: collector current as a function of collector-emitter voltage; Typical values;  $T_j=25^\circ\text{C}$



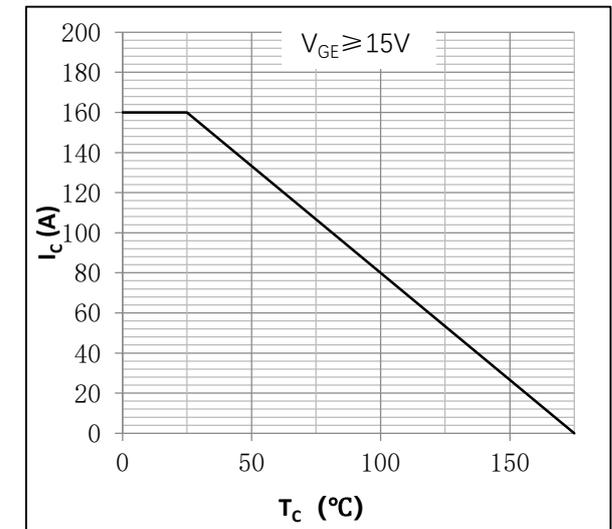
● Fig.4 Output characteristics: collector current as a function of collector-emitter voltage; Typical values: Expanded curve;  $T_j=25^\circ\text{C}$



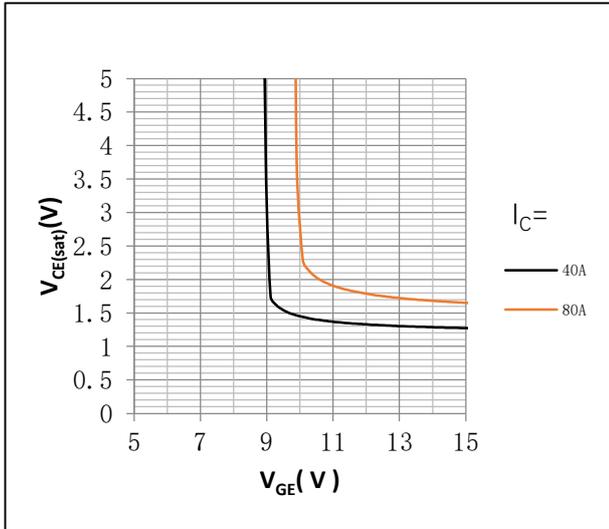
● Fig.5 Gate-emitter threshold voltage as a function of junction temperature; Typical values



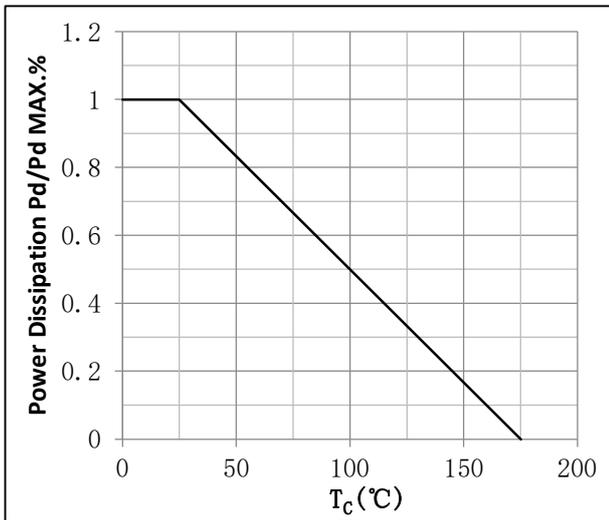
● Fig.6 Continuous collector current as a function of case temperature<sup>3</sup>; Calculative values



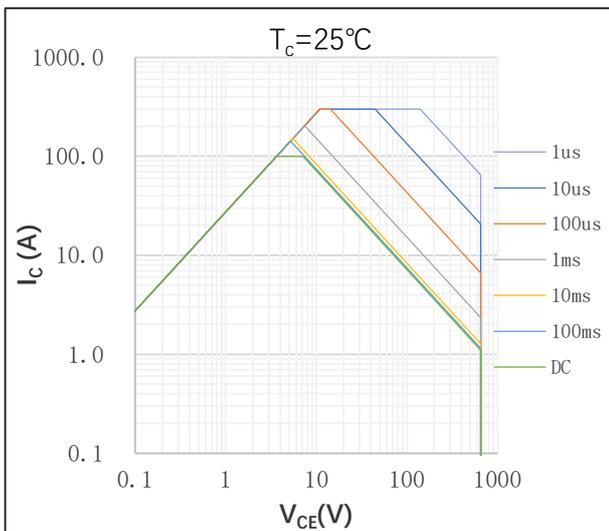
● Fig.7 Collector-emitter saturation voltage as a function of gate-emitter voltage; Typical values



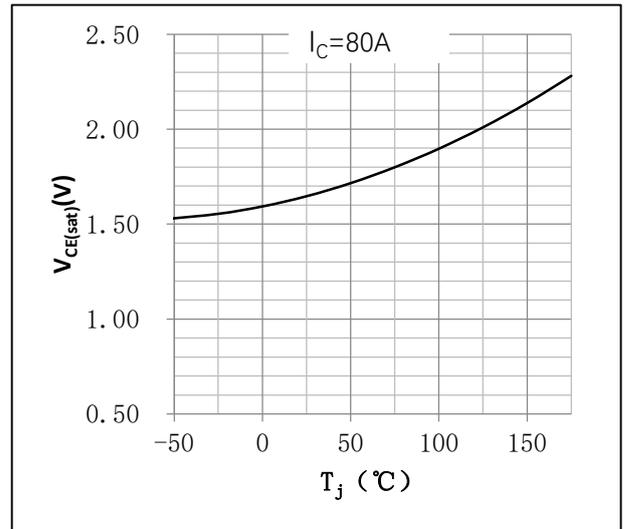
● Figure 9. Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =  $P_d/P_d(25^\circ C)$



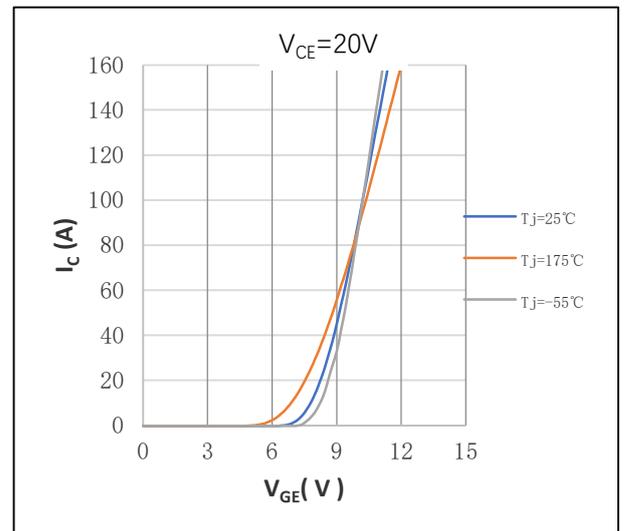
● Fig.11 Safe operating area: continuous and peak collector currents as a function of collector-emitter voltage; Calculative values



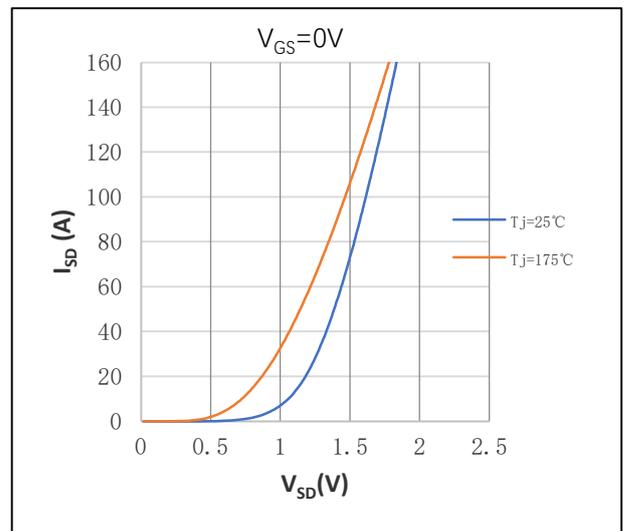
● Fig.8 Fig.6 Collector-emitter saturation voltage as a function of junction temperature; Typical values;  $T_j = 25^\circ C$



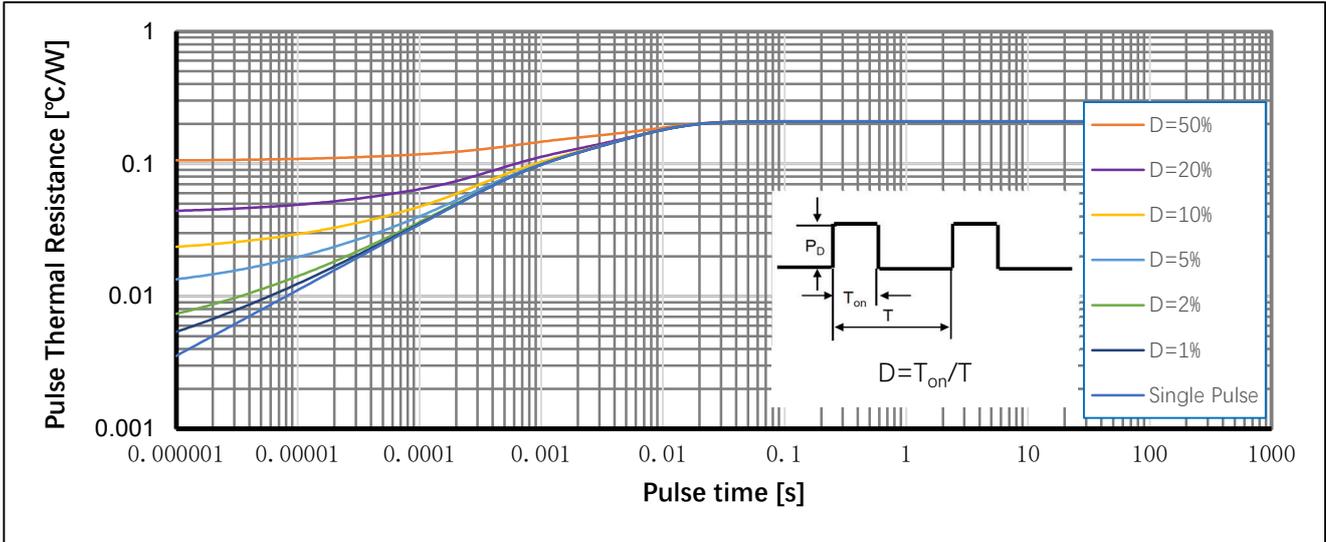
● Figure 10. Transfer characteristics: Collector current as a function of gate-emitter voltage; Typical values



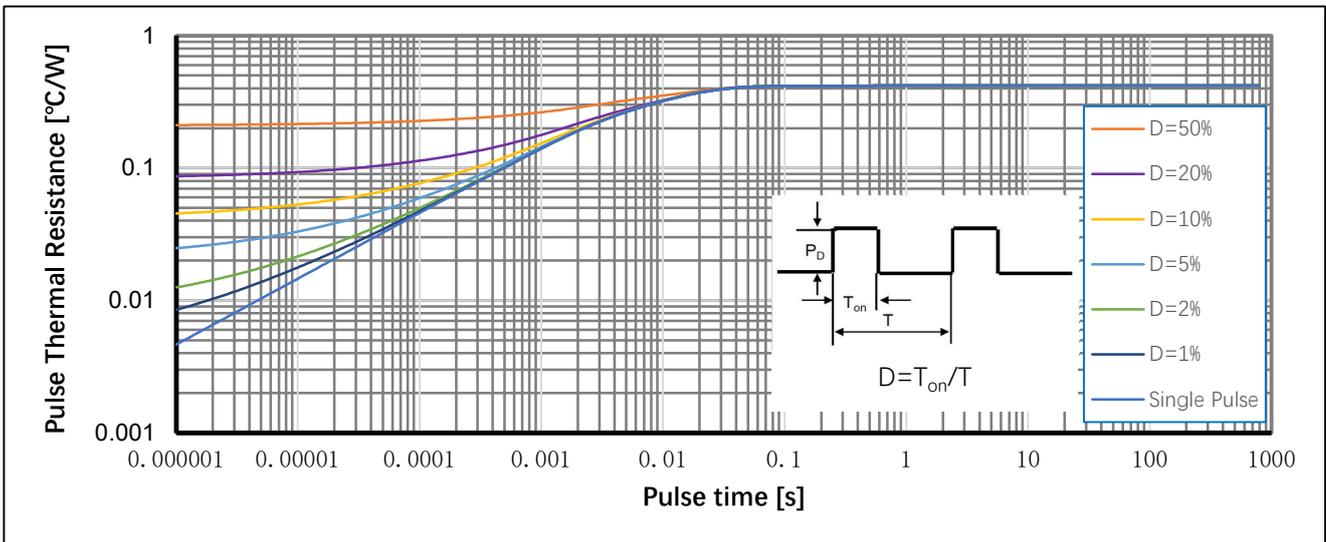
● Fig.12 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



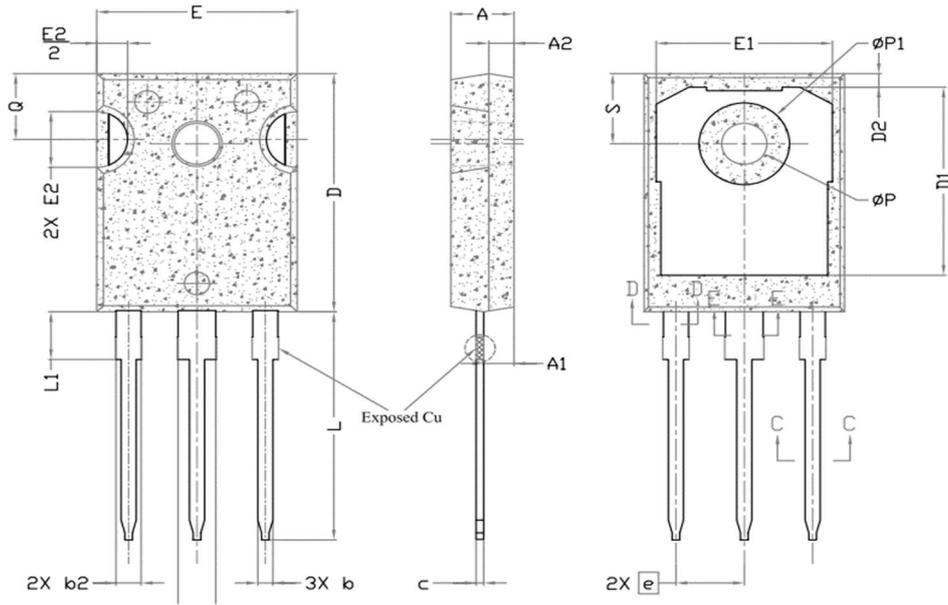
● Fig.13 Transient thermal impedance from junction to case -IGBT as a function of pulse duration; max values



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



## ● Package Outline



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

② 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	2025/4/2	New