

● General Description

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

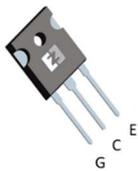
● Features

- Very low $V_{CE(sat)}$
- Low switching power loss
- Low switching surge and noise
- Low thermal resistance
- High speed switch frequency(15-40KHz)

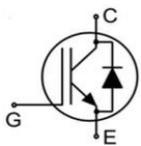
● Application

- Industrial UPS
- String inverter
- Welding

● Product Summary



TO-247



$V_{CE}=1200V$
 $V_{CE(sat)}=1.7V$
 $I_C=40A$



● Ordering Information

Part NO.	ZMBG40N120HD7AC
Marking	BG40N120HD7A
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}		-	1200	V
Gate-emitter voltage	V_{GE}		-30	30	V
Continuous collector current	I_C	$V_{GE}=15V, T_C=25^{\circ}C$	-	80	A
	I_C	$V_{GE}=15V, T_C=100^{\circ}C$	-	40	A
Pulsed collector current	I_{CM}	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$	-	160	A
Diode forward current	I_F	$V_{GE}=0V, T_C=25^{\circ}C$	-	80	A
		$V_{GE}=0V, T_C=100^{\circ}C$	-	40	A
Pulsed diode forward current	$I_{F,pulse}$	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$	-	160	A
Total power dissipation	P_D	$T_C=25^{\circ}C$	-	455	W
Total power dissipation	P_D	$T_A=25^{\circ}C$	-	3.8	W
Operating junction temperature	T_J		-55	175	$^{\circ}C$
Storage temperature	T_{STG}		-55	175	$^{\circ}C$

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case IGBT	R_{thJC}	-	-	0.33	°C/W
Thermal resistance, junction - case diode	R_{thJC}	-	-	0.31	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	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}	$V_{GE}=0V, I_c=250\mu A$	1200	-	-	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}	$V_{GE}=0V, V_{CE}=1200V, T_j=25^{\circ}\text{C}$	-	-	10	μA
		$V_{GE}=0V, V_{CE}=1200V, T_j=175^{\circ}\text{C}$	-	-	10	mA
Gate-emitter leakage current	I_{GES}	$V_{GE}=\pm 30V, V_{CE}=0V$	-	-	100	nA
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_c=40A, T_j=25^{\circ}\text{C}$	-	1.7	2.2	V
		$V_{GE}=15V, I_D=40A, T_j=175^{\circ}\text{C}$	-	2.2	-	V
Forward transconductance	g_{FS}	$V_{CE}=20V, I_c=40A,$	-	56	-	S
Diode forward voltage	V_F	$I_F=40A, T_C=25^{\circ}\text{C}$	-	1.55	1.85	V
		$I_F=40A, T_C=175^{\circ}\text{C}$	-	1.6	-	V

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{ies}	$f=100\text{KHz}, V_{CE}=600V, V_{GE}=0V$	-	8112	-	pF
Output capacitance	C_{oes}		-	55	-	pF
Reverse transfer capacitance	C_{res}		-	12	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	1.2	-	Ω
Total gate charge	Q_g	$V_{CC}=600V, I_c=40A, V_{GE}=15V$	-	259	-	nC
Gate-emitter charge	Q_{ge}		-	58.5	-	nC
Gate-collector charge	Q_{gc}		-	92.6	-	nC

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ\text{C}$ $V_{GE}=15/0\text{V}$, $V_{CE}=600\text{V}$, $R_G=6.2\Omega$, $I_C=40\text{A}$, $L=100\mu\text{H}$	-	61	-	ns
Turn-on rise time	t_r		-	88	-	ns
Turn-off delay time	$t_{d(off)}$		-	162	-	ns
Turn-off fall time	t_f		-	73	-	ns
Turn-on energy	E_{on}		-	2	-	mJ
Turn-off energy	E_{off}		-	1.1	-	mJ
Total switching energy	E_{ts}		-	3.1	-	mJ

● Switching characteristics ($T_j=175^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	$T_j=175^\circ\text{C}$ $V_{GE}=15/0\text{V}$, $V_{CE}=600\text{V}$, $R_G=6.2\Omega$, $I_C=40\text{A}$, $L=100\mu\text{H}$	-	60	-	ns
Turn-on rise time	t_r		-	80	-	ns
Turn-off delay time	$t_{d(off)}$		-	185	-	ns
Turn-off fall time	t_f		-	122	-	ns
Turn-on energy	E_{on}		-	2.2	-	mJ
Turn-off energy	E_{off}		-	1.6	-	mJ
Total switching energy	E_{ts}		-	3.8	-	mJ

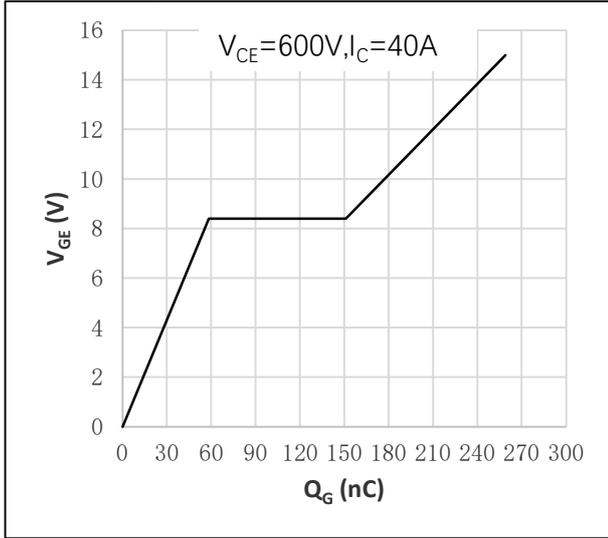
● Diode switching characteristics ($T_j=25^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse recovery time	t_{rr}	$T_j=25^\circ\text{C}$ $V_R=600\text{V}$, $I_F=40\text{A}$, $di_F/dt=500\text{A}/\mu\text{s}$,	-	238	-	ns
Reverse recovery charge	Q_{rr}		-	3.07	-	μC
Reverse recovery	I_{rrm}		-	30.2	-	A
Reverse recovery energy	E_{rr}		-	775	-	μJ

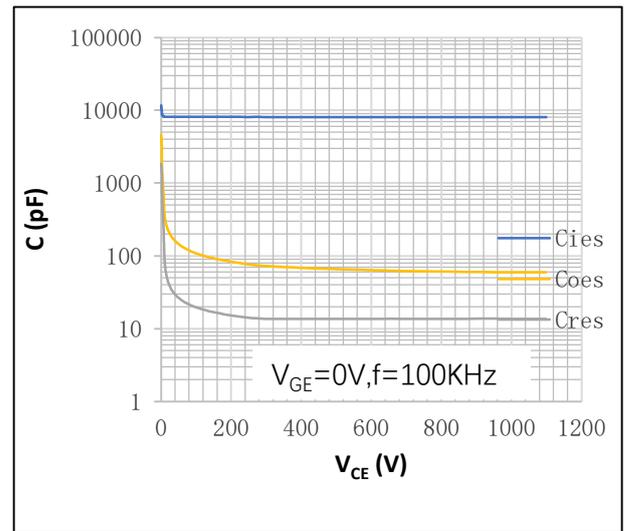
● Switching characteristics ($T_j=175^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse recovery time	t_{rr}	$T_j=175^\circ\text{C}$ $V_R=600\text{V}$, $I_F=40\text{A}$, $di_F/dt=500\text{A}/\mu\text{s}$,	-	474	-	ns
Reverse recovery charge	Q_{rr}		-	6.83	-	μC
Reverse recovery	I_{rrm}		-	38	-	A
Reverse recovery energy	E_{rr}		-	1317	-	μJ

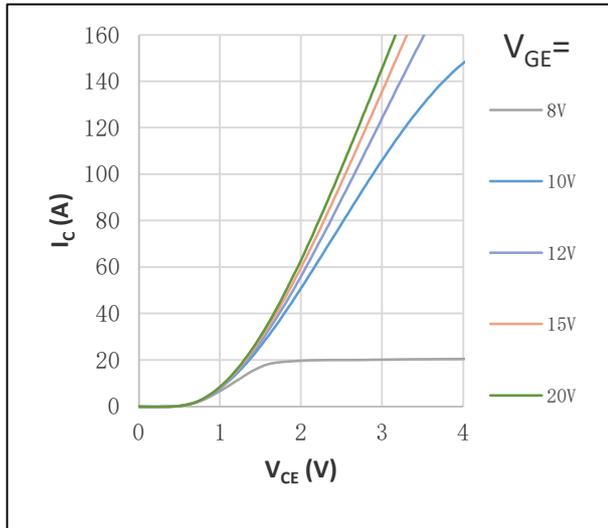
● Fig.1 Gate-emitter voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$



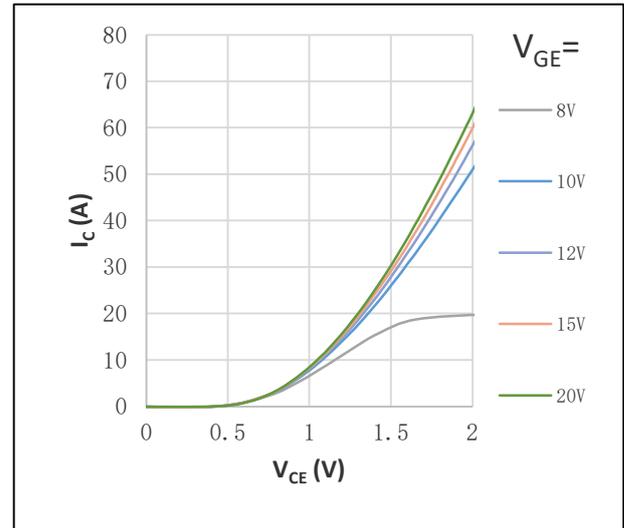
● Fig.2 Input, output and reverse transfer capacitances as a function of collector-emitter voltage; Typical values; $T_j=25^\circ\text{C}$



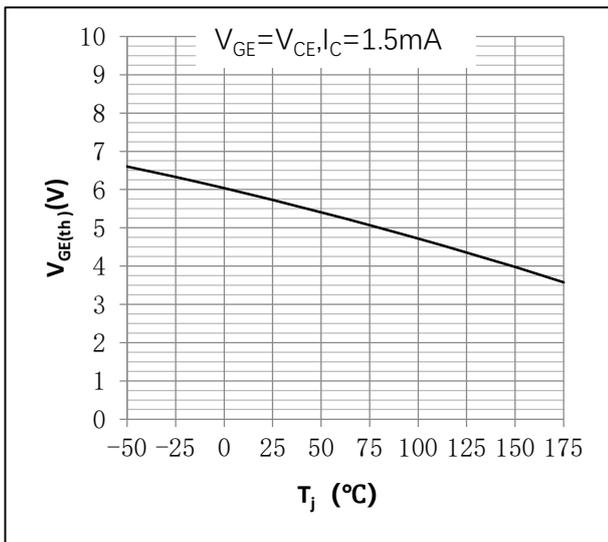
● Fig.3 Output characteristics: collector current as a function of collector-emitter voltage; Typical values; $T_j=25^\circ\text{C}$



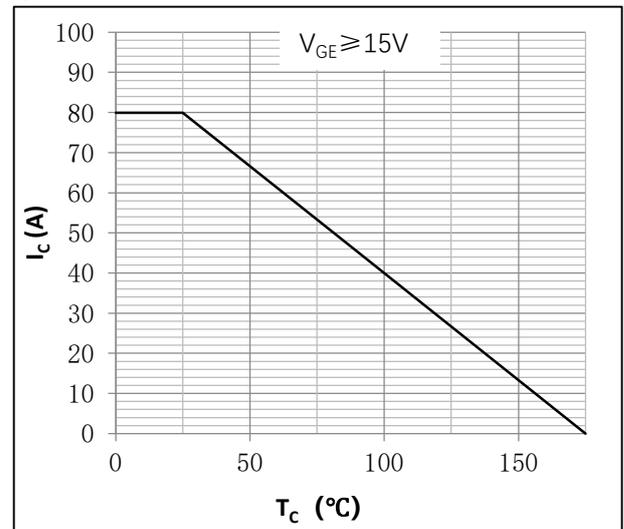
● Fig.4 Output characteristics: collector current as a function of collector-emitter voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$



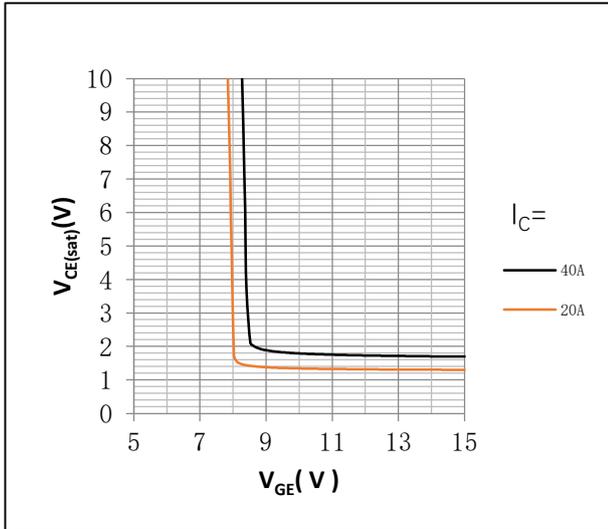
● Fig.5 Gate-emitter threshold voltage as a function of junction temperature; Typical values



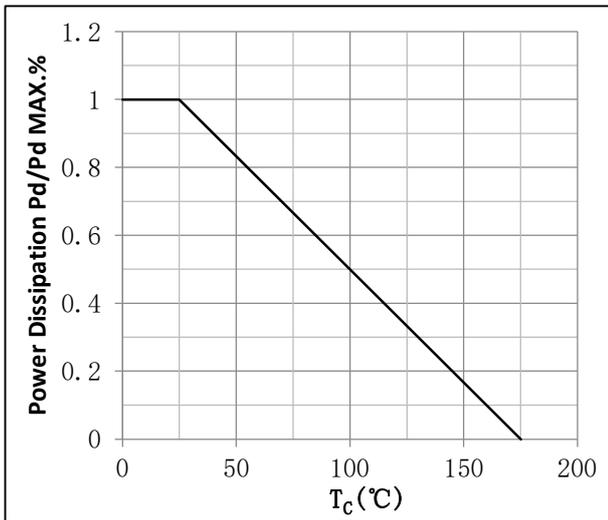
● Fig.6 Continuous collector current as a function of case temperature²; Calculative values



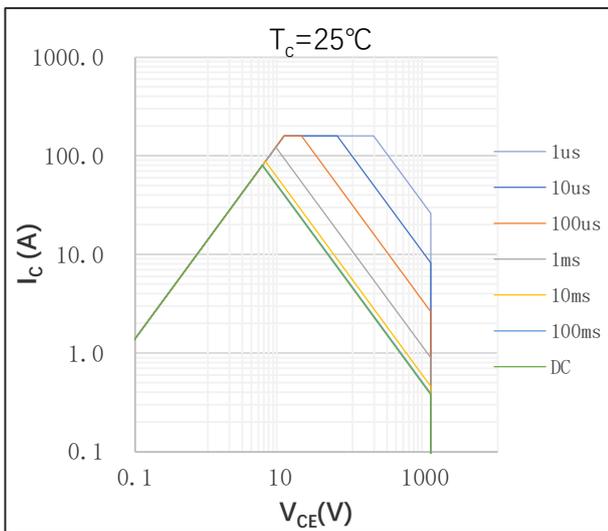
● Fig.7 Collector-emitter saturation voltage as a function of gate-emitter voltage; Typical values



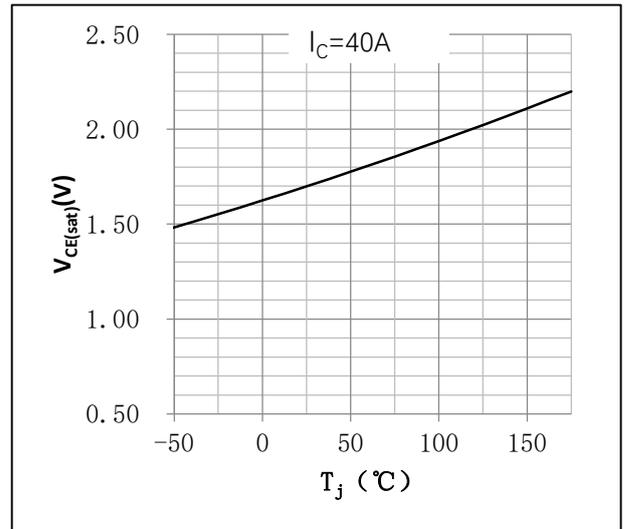
● Figure 9. Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation = $P_d/P_d(25^\circ C)$



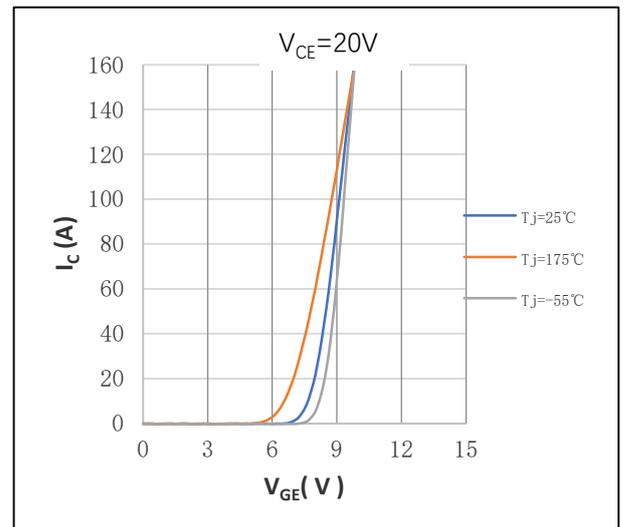
● Fig.11 Safe operating area: continuous and peak collector currents as a function of collector-emitter voltage; Calculative values



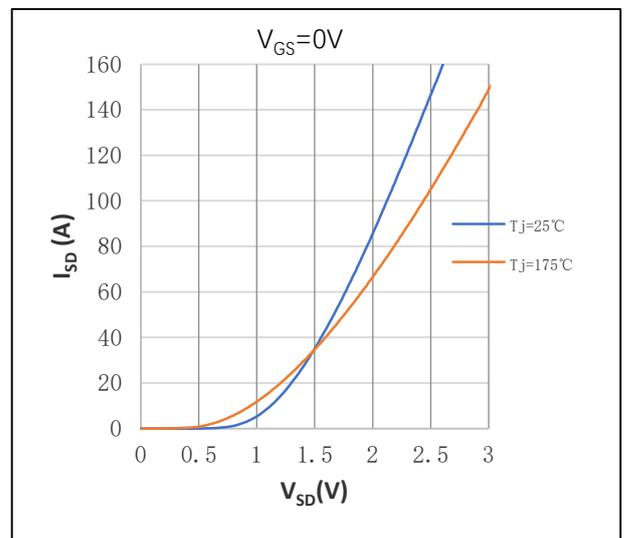
● Fig.8 Fig.6 Collector-emitter saturation voltage as a function of junction temperature; Typical values; $T_j = 25^\circ C$



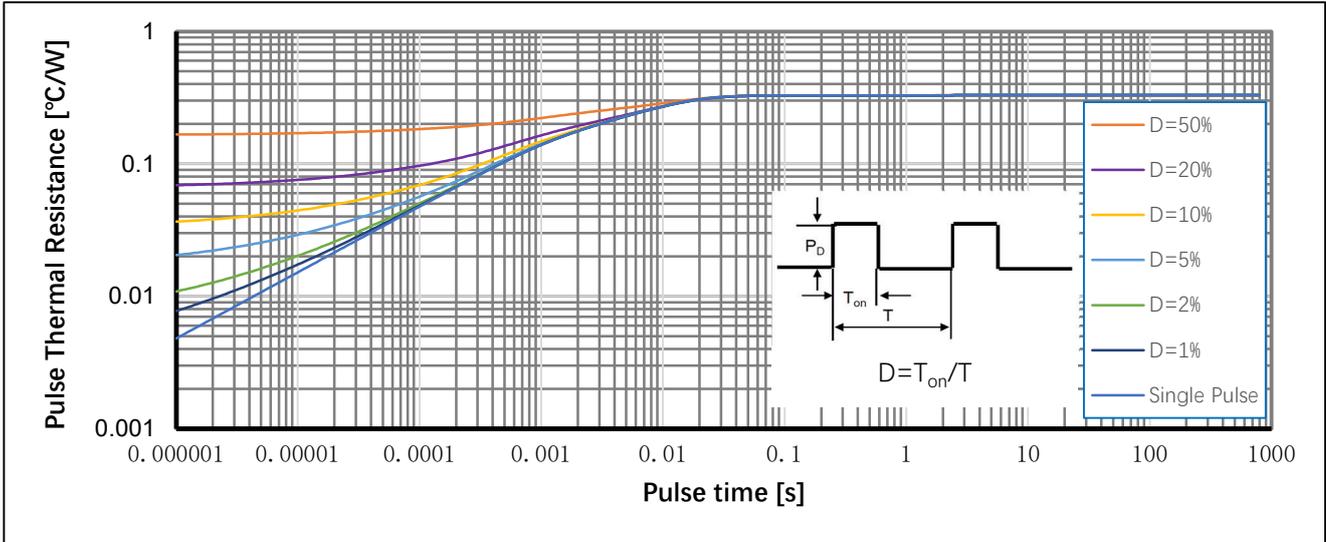
● Figure 10. Transfer characteristics: Collector current as a function of gate-emitter voltage; Typical values



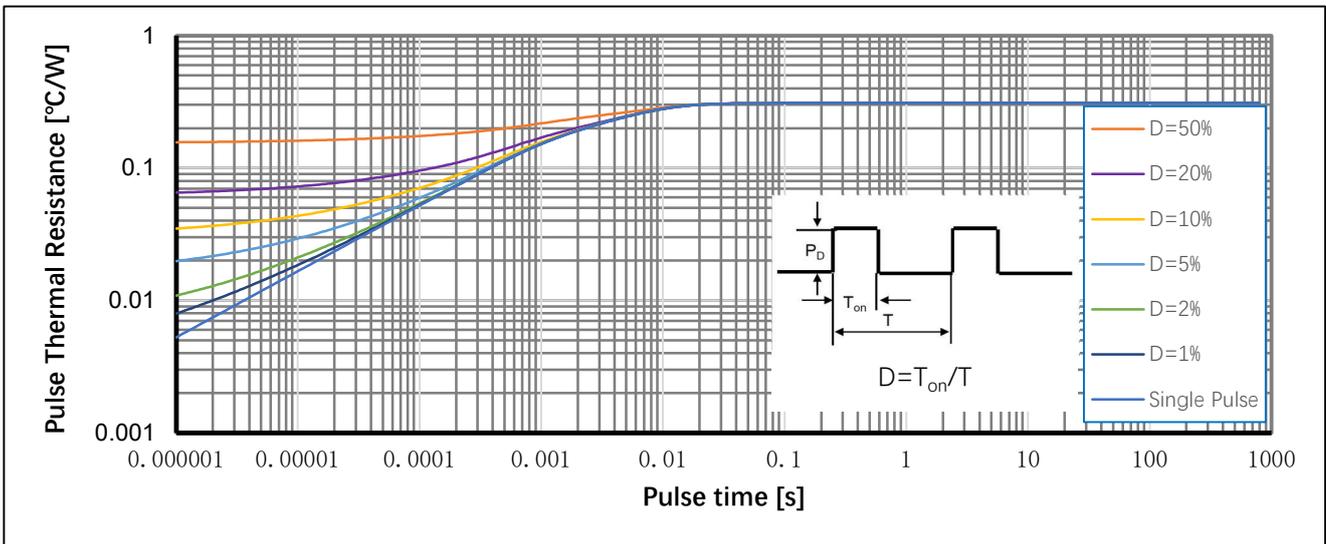
● Fig.12 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



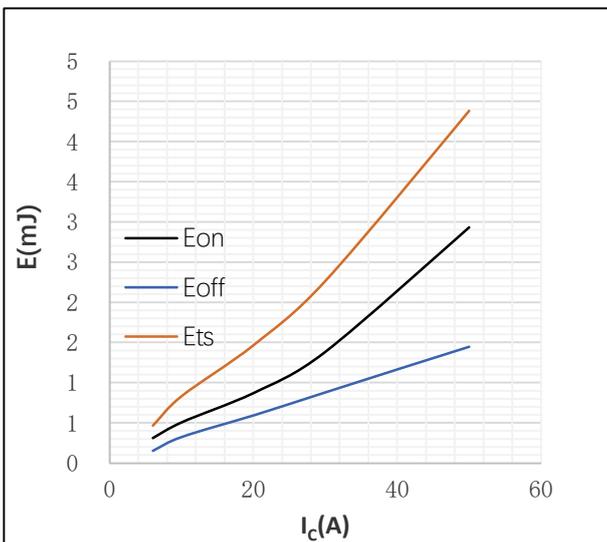
● Fig.13 Transient thermal impedance from junction to case -IGBT as a function of pulse duration; max values



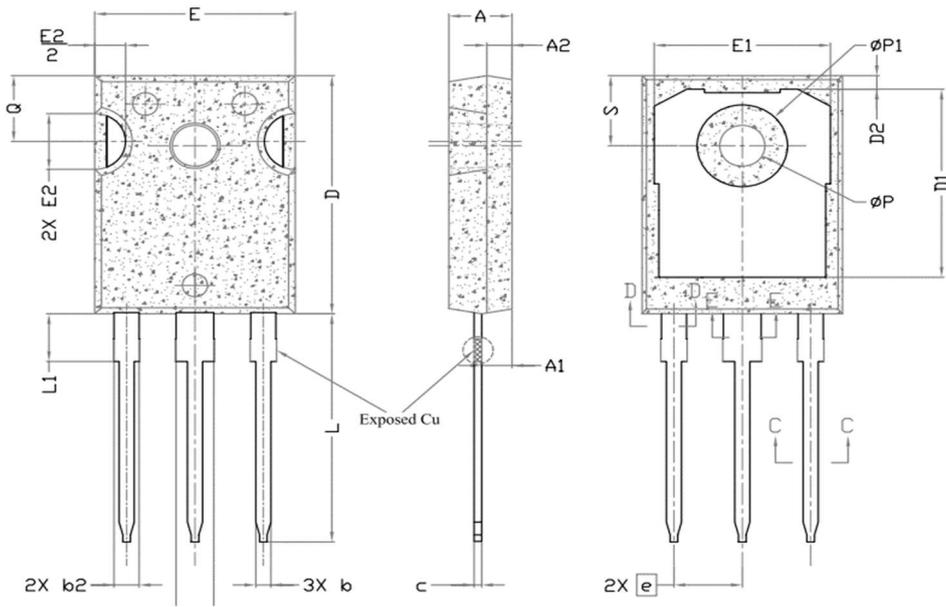
● Fig.14 Transient thermal impedance from junction to case -diode as a function of pulse duration; max values



● Fig.15 Switching energy losses as a function of collector current; typical 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 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	2025/8/1	New