

• General Description

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

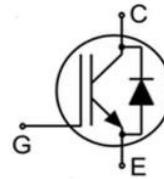
• Features

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

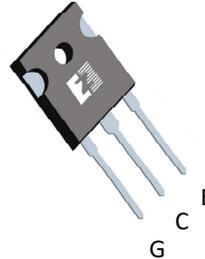
• Application

- Inverter
- HV Heater

• Product Summary



$V_{CE} = 1200V$
 $V_{CE(sat)} = 1.6V$
 $I_C = 40A$



TO-247



• Ordering Information:

Part NO.	ZMBGA40N120SD1AC
Marking	BG40N120SD1A
Packing information	TUBE BULK
Basic ordering unit (pcs)	600

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

Parameter	Symbol	Conditions	Value	Unit
Collector-emitter voltage	V_{CE}		1200	V
Gate-emitter voltage	V_{GE}		± 30	V
Collector current	I_C	$T_C=25^{\circ}C$	80	A
	I_C	$T_C=100^{\circ}C$	40	A
Pulsed collector current	I_{CM}	$T_C=25^{\circ}C$	120	A
Diode forward current	I_F	$T_C=25^{\circ}C$	80	A
	I_F	$T_C=100^{\circ}C$	40	A
	$I_{F,pulse}$	$T_C=25^{\circ}C$	120	A
Total power Dissipation	P_D	$T_C=25^{\circ}C$	556	W
Total Power Dissipation	P_D	$T_A=25^{\circ}C$	3.8	W
Short Circuit Withstand Time	T_{SC}	$V_{GE}=15V, V_{CE}=600V, T_J=25^{\circ}C$	10	us
Operating Junction Temperature	T_J		-55 to +175	$^{\circ}C$
Storage Temperature	T_{STG}		-55 to +175	$^{\circ}C$

•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case IGBT	R_{thJC}	-	-	0.27	°C/W
Thermal resistance, junction - case diode	R_{thJC}	-	-	0.5	°C/W
Thermal resistance, junction-ambient	$R_{thJA}^{②}$	-	-	40	°C/W
Soldering temperature (total time<10s)	T_{sold}	-	-	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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A$	-	1.60	2.10	V
		$V_{GE}=15V, I_C=40A, T_J=175^\circ C$	-	2	-	
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	$I_F=40A, T_J=25^\circ C$		2	2.4	V
		$I_F=40A, T_J=125^\circ C$		1.7	2.2	
		$I_F=40A, T_J=175^\circ C$		1.55	2.0	
Zero gate voltage collector current	I_{CES}	$V_{GE}=0V, V_{CE}=1200V, T_J=25^\circ C$	-	-	10.0	uA
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}	$f=1MHz, V_{CE}=600V$	-	7093	-	pF
Output capacitance	C_{oes}		-	30	-	
Reverse transfer capacitance	C_{res}		-	12	-	
Total gate charge	Q_g	$V_{CC}=600V, I_C=40.0A, V_{GE}=15V$	-	210	-	nC
Gate-emitter charge	Q_{ge}		-	56	-	nC
Gate-collector charge	Q_{gc}		-	78	-	nC

SwitchingCharacteristic, at $T_J=25^\circ C$

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{D(on)}$	$T_J=25^\circ C, V_{CC}=600V, I_C=40.0A, V_{GE}=-15.0/15.0V, R_g=6.0\Omega, L=200\mu H$	-	64	-	ns
Turn-on rise time	t_r		-	100	-	ns
Turn-off delay time	$t_{D(off)}$		-	160	-	ns
Turn-off fall time	t_f		-	312	-	ns
Turn-on energy	E_{on}		-	2.8	-	mJ
Turn-off energy	E_{off}		-	2.5	-	mJ
Total switching energy	E_{ts}		-	5.3	-	mJ

Diode switching characteristics (inductive load)

Reverse recovery time	t_{rr}	$I_F=1A, V_R=30V,$ $di/dt=-200 A/\mu s$ $T_J=25\text{ }^\circ C$	-	60	-	ns
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Fig.1 Gate-Charge characteristics

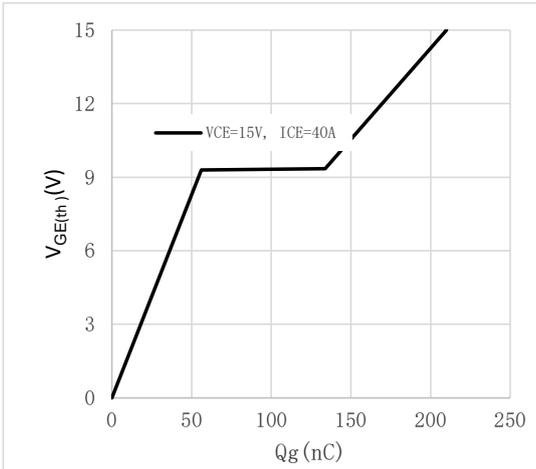


Fig.2 Capacitance characteristics

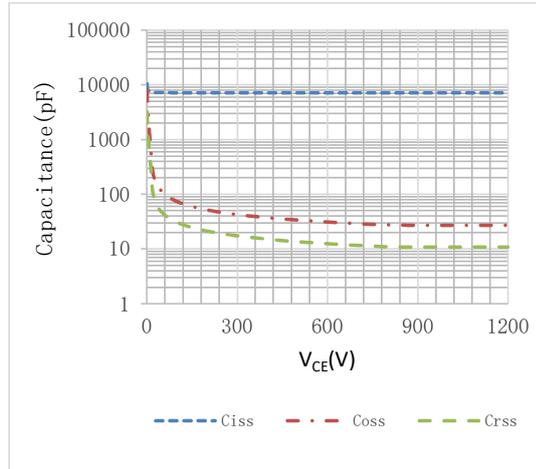


Fig.3 Power dissipation

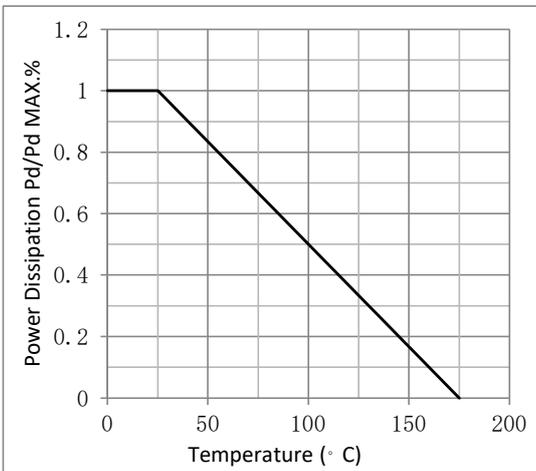


Fig.4 Typical output characteristics

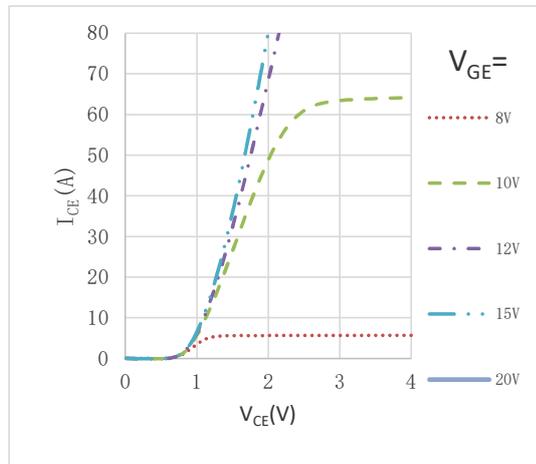


Fig.5 Threshold voltage V.S junction temperature

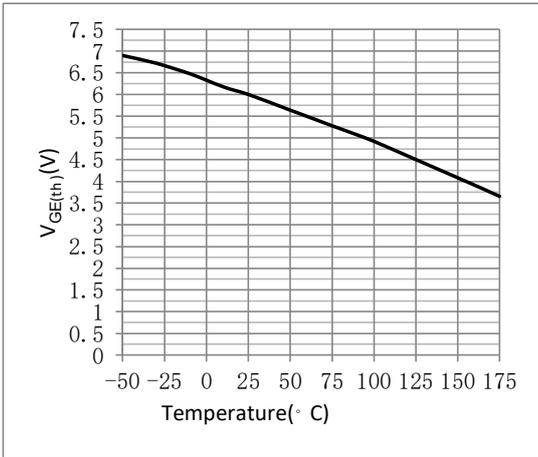


Fig.6 IC vs. Junction Temperature^③

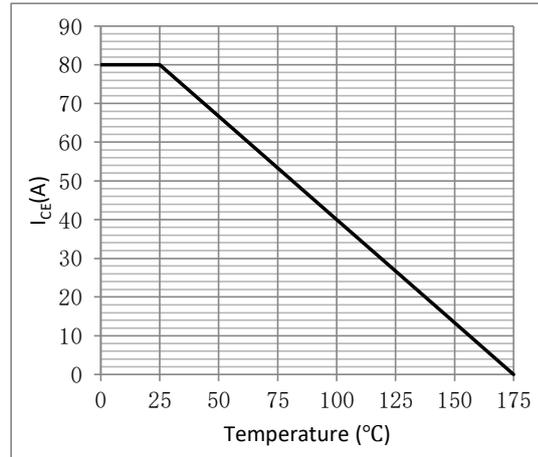


Fig.7 Collector-Emitter VS gate source voltage

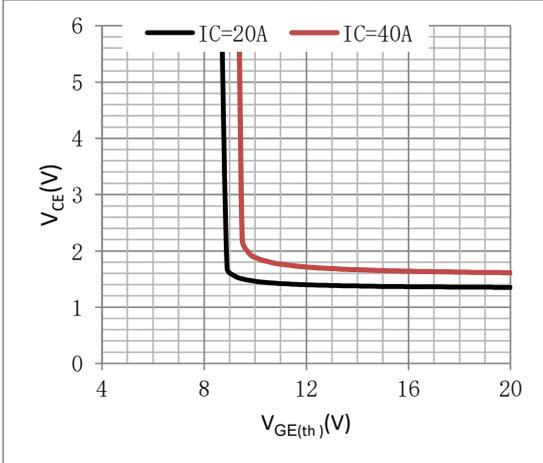


Figure 8. Transfer characteristics

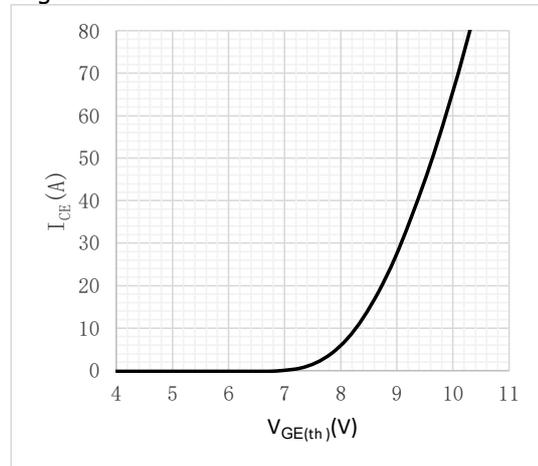


Fig.9 Safe operating area

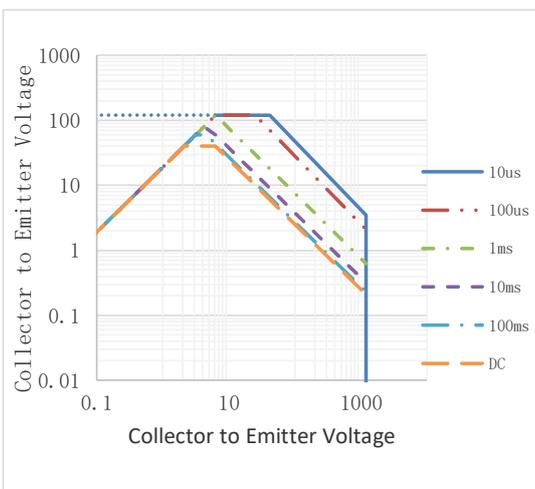


Fig.10 Max transient thermal impedance for IGBT

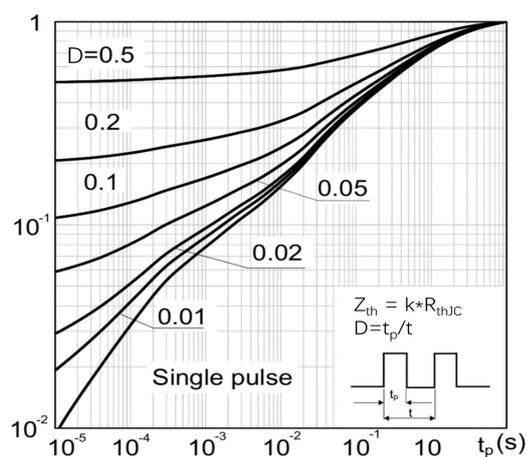
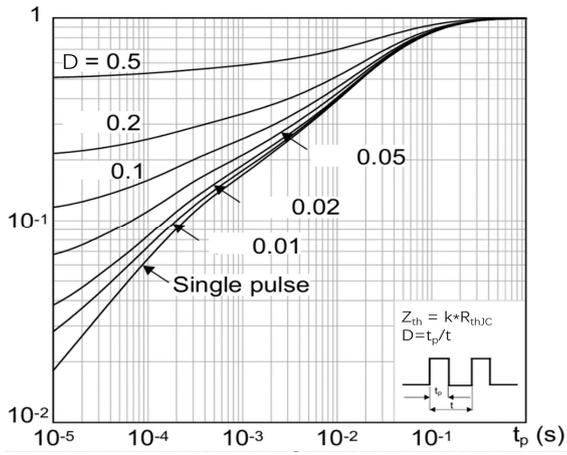
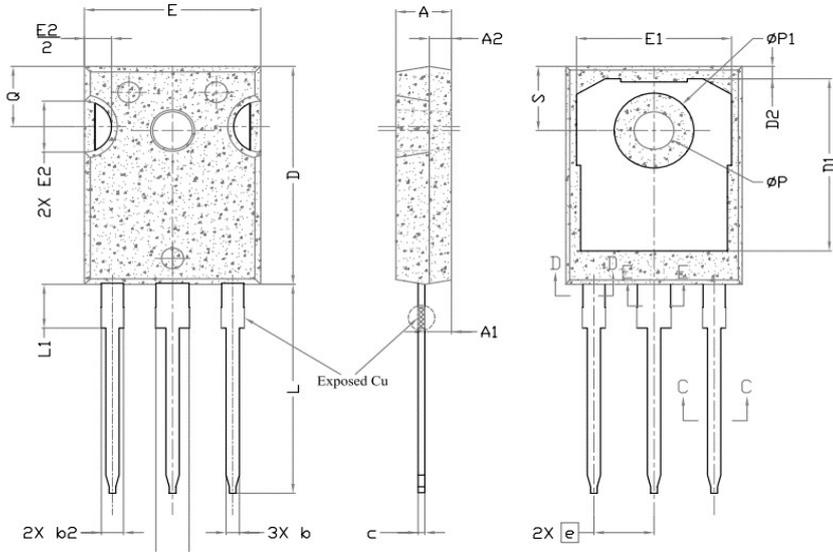


Fig.11 Max transient thermal impedance for Diode



•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
phi P	3.56	3.61	3.65	7
phi P1	7.19REF.			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	

Note:

① Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$, Accumulation time ≤ 50 hours; For DC , the following test conditions can be passed: $V_{GE}=20V/-10V$, $T_j=175^\circ\text{C}$, $t=1000$ 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	2024/10/31	New