General Description

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

Features

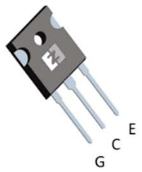
- ■Very low $V_{CE(sat)}$
- ■Low switching power loss
- ■Low switching surge and noise
- ■Low thermal resistance
- ■High short circuit capability (10us)
- ■AEC-Q101 qualified

Application

- ■PTC Heater

ZMJSEMI Automotive

Product Summary



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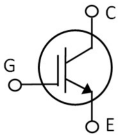


V_{CE}=1200V

$V_{CE(sat)}$ =1.55V

I_C=40A

RoHS REACH COMPLIANT HF

Ordering Information

Part NO.	ZMBGA40N120S1AC
Marking	BG40N120S1A
Packing information	BULK TUBE
Basic ordering unit (pcs)	600

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

Parameter	Symbol	Conditions	Min.	Max.	Unit
Collector-emitter voltage	V_{CE}		-	1200	V
Gate-emitter voltage①	V_{GE}		-30	30	V
Continuous collector current	I_C	V_{GE}=15V, T_C=25℃	-	80	A
	I_C	V_{GE}=15V, T_C=100℃	-	40	A
Pulsed collector current ①	I_{CM}	Pulsed; $t_p \leq 10$ μs; T_C = 25 °C;	-	160	A
Total power dissipation	P_D	T_C=25℃	-	556	W
Total power dissipation	P_D	T_A=25℃	-	3.8	W
Short circuit withstand time	T_{sc}	V_{GE}=15 V, V_{CE}=600 V, T_j=150℃	-	10	us
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	R_{thJC}	-	-	0.27	°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°C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Collector-emitter breakdown voltage	BV_{CES}	V_{GE} =0V, I_C =250uA	1200	-	-	V
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE}, I_C=1.5mA	4.6	5.6	6.6	V
Zero gate voltage collector current	I_{CES}	V_{GE}=0V, V_{CE}=1200V, T_j=25℃	-	-	10	uA
		V_{GE}=0V, V_{CE}=1200V, T_j=175℃	-	-	10	mA
Gate- emitter leakage current	I_{GES}	V_{GE}=±30V, V_{CE} =0V	-	-	100	nA
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A, T_j=25℃	-	1.55	2	V
		V_{GE}=15V, I_D=40A, T_j=175℃	-	2	-	V
Forward transconductance	gFS	V_{CE} =20V, I_C = 40A	-	26	-	S

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{ies}	f = 100KHz, V_{CE}=600V，V_{GE}=0V	-	7093	-	pF
Output capacitance	C_{oes}		-	30	-	pF
Reverse transfer capacitance	C_{res}		-	12	-	pF
Gate resistance	R_g	f = 1MHz	-	1.6	-	Ω
Total gate charge	Q_g	V_{CC} =600V, I_C = 40A, V_{GE} = 15V	-	210	-	nC
Gate-emitter charge	Q_{ge}		-	56	-	nC
Gate-collector charge	Q_{gc}		-	78	-	nC

Switching characteristics (T_j=25°C)

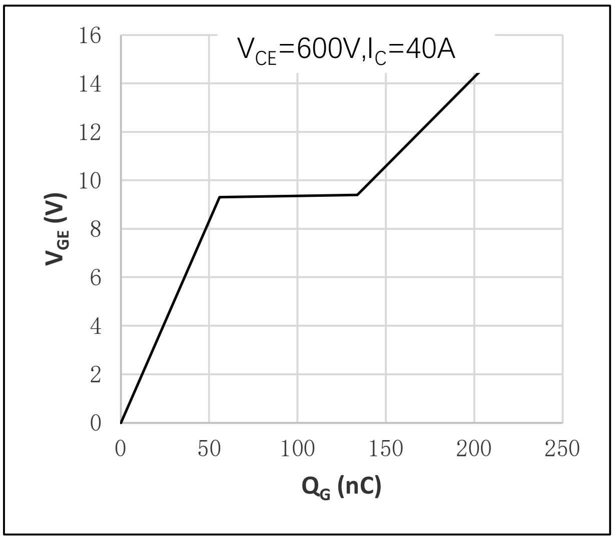
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	T_j=25℃ V_{GE}=15/0V, V_{CE}=600V,	-	63	-	ns
Turn-on rise time	t_r		-	87	-	ns
Turn-off delay time	$t_{d(off)}$		-	162	-	ns

Turn-off fall time	t_f	R_G =10Ω, I_C =40A, L=100uH	-	295	-	ns
Turn-on energy	E_{on}		-	2.18	-	mJ
Turn-off energy	E_{off}		-	2.88	-	mJ
Total switching energy	E_{ts}		-	5.06	-	mJ
Reverse Bias Safe Operating Area	RBSOA	T_j=25℃,V_{CC}=1200V, I_C=160A, V_{GE}=15V/0V,R_g=10Ω	Full Square			-

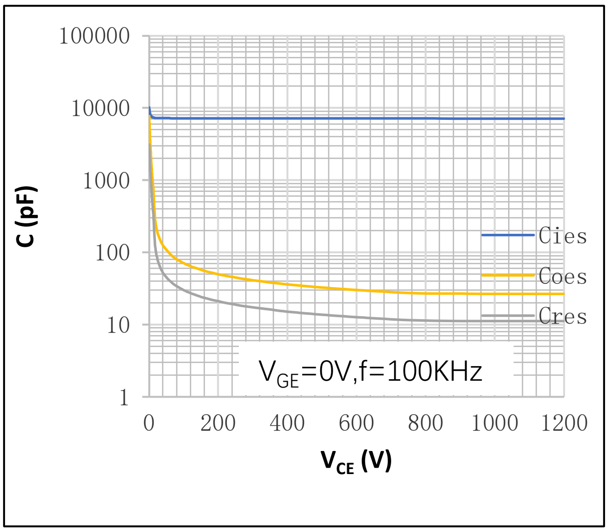
● Switching characteristics (T_j=175°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	T_j=175℃ V_{GE}=15/0V, V_{CE}=600V, R_G =10Ω, I_C =40A, L=100uH	-	61	-	ns
Turn-on rise time	t_r		-	93	-	ns
Turn-off delay time	$t_{d(off)}$		-	186	-	ns
Turn-off fall time	t_f		-	468	-	ns
Turn-on energy	E_{on}		-	2.39	-	mJ
Turn-off energy	E_{off}		-	4.06	-	mJ
Total switching energy	E_{ts}		-	6.45	-	mJ

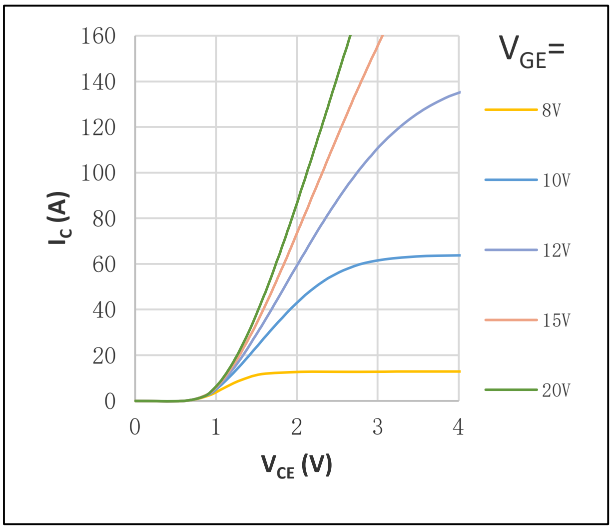
●Fig.1 Gate-emitter voltage as a function of gate charge; Typical values; T_j=25℃



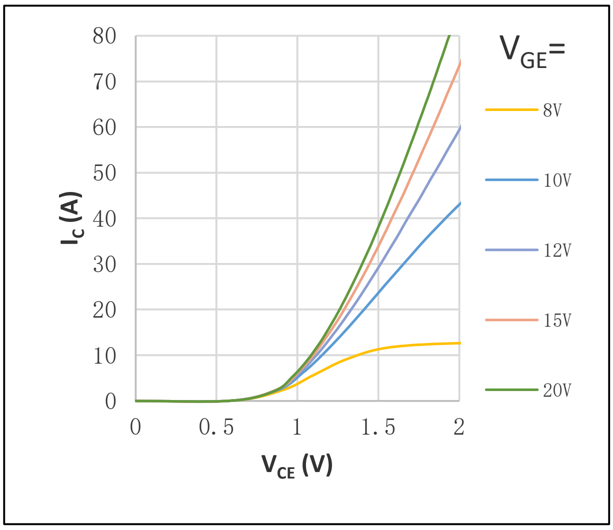
●Fig.2 Input, output and reverse transfer capacitances as a function of collector-emitter voltage; Typical values; T_j=25℃



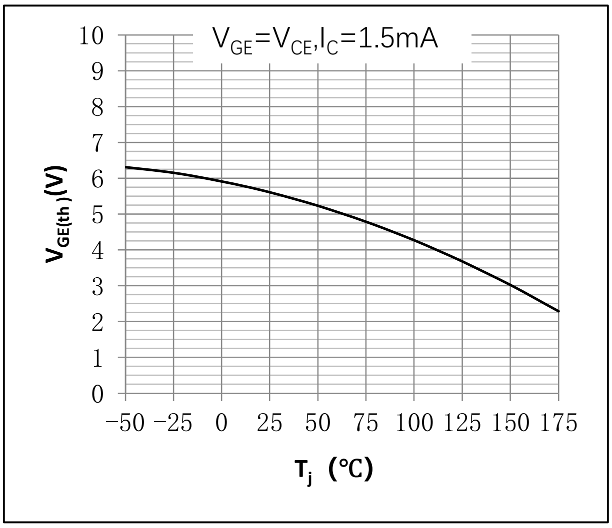
●Fig.3 Output characteristics: collector current as a function of collector-emitter voltage; Typical values; T_j=25℃



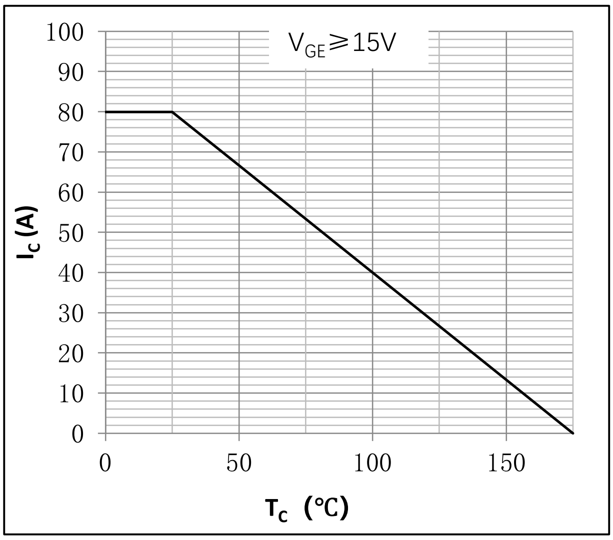
●Fig.4 Output characteristics: collector current as a function of collector-emitter voltage; Typical values: Expanded curve; T_j=25℃



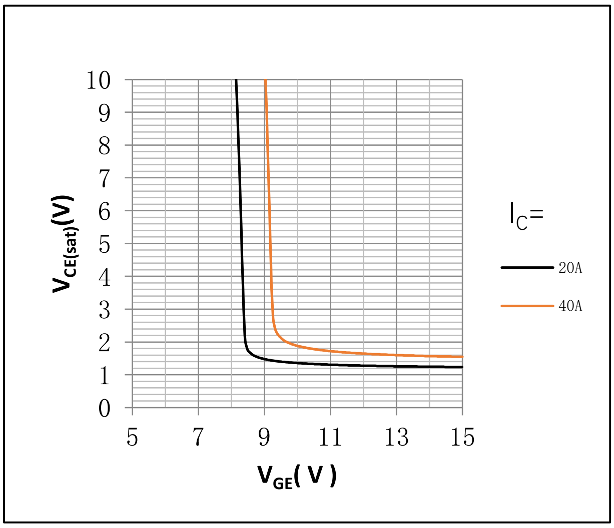
●Fig.5 Gate-emitter threshold voltage as a function of junction temperature; Typical values



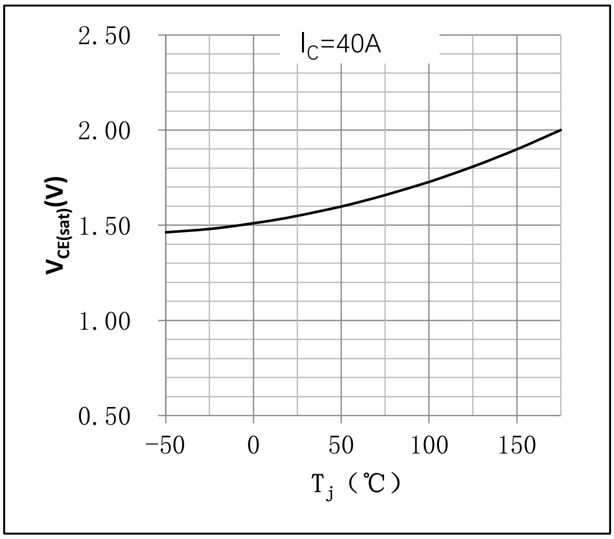
●Fig.6 Continuous collector current as a function of case temperature②;Calculative values



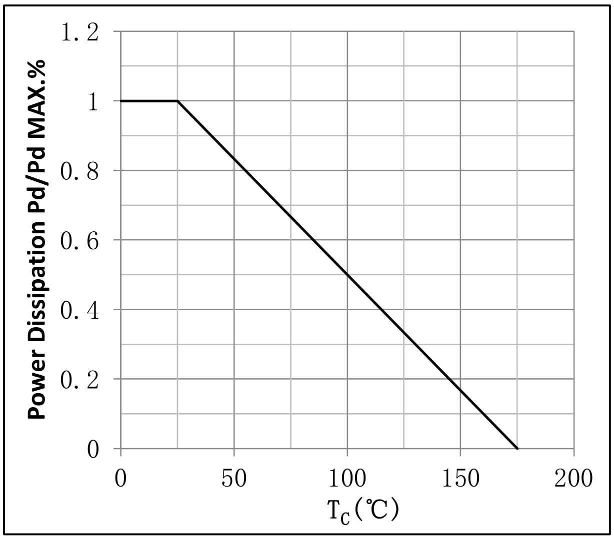
●Fig.7 Collector-emitter saturation voltage as a function of gate-emitter voltage; Typical values



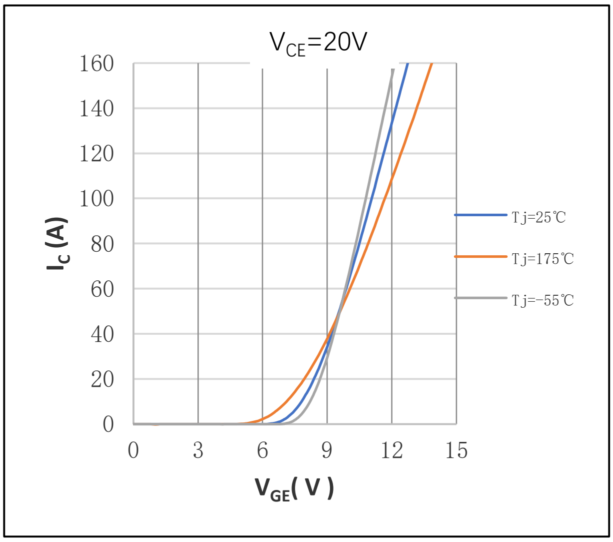
●Fig.8 Fig.6 Collector-emitter saturation voltage as a function of junction temperature; Typical values; Tj=25℃



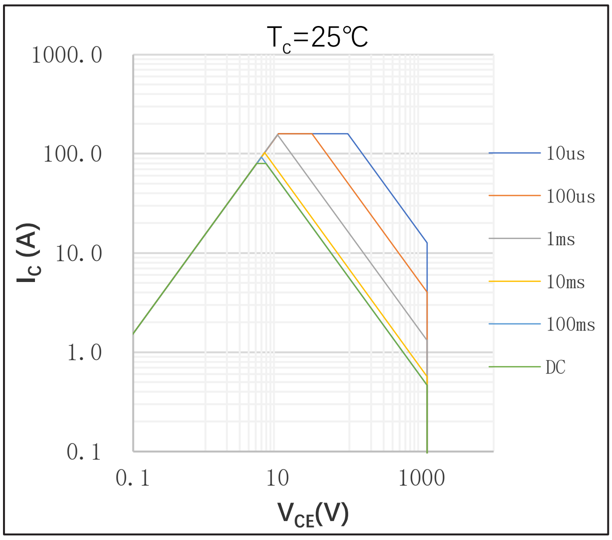
●Figure 9. Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =$P_d/P_d(25℃)$



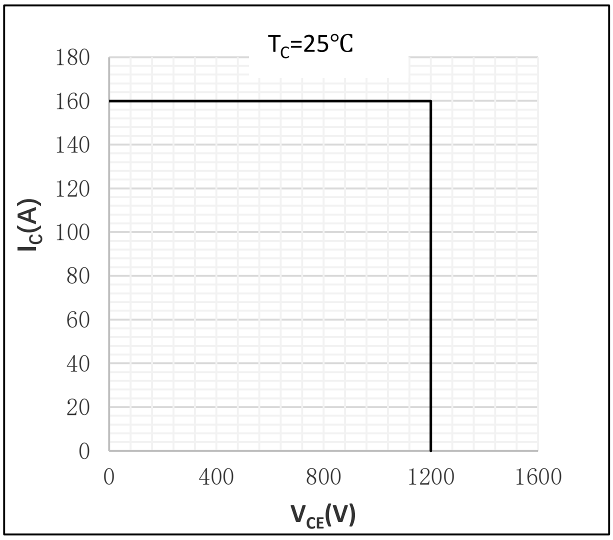
●Figure 10. Transfer characteristics: Collector current as a function of gate-emitter voltage; Typical values



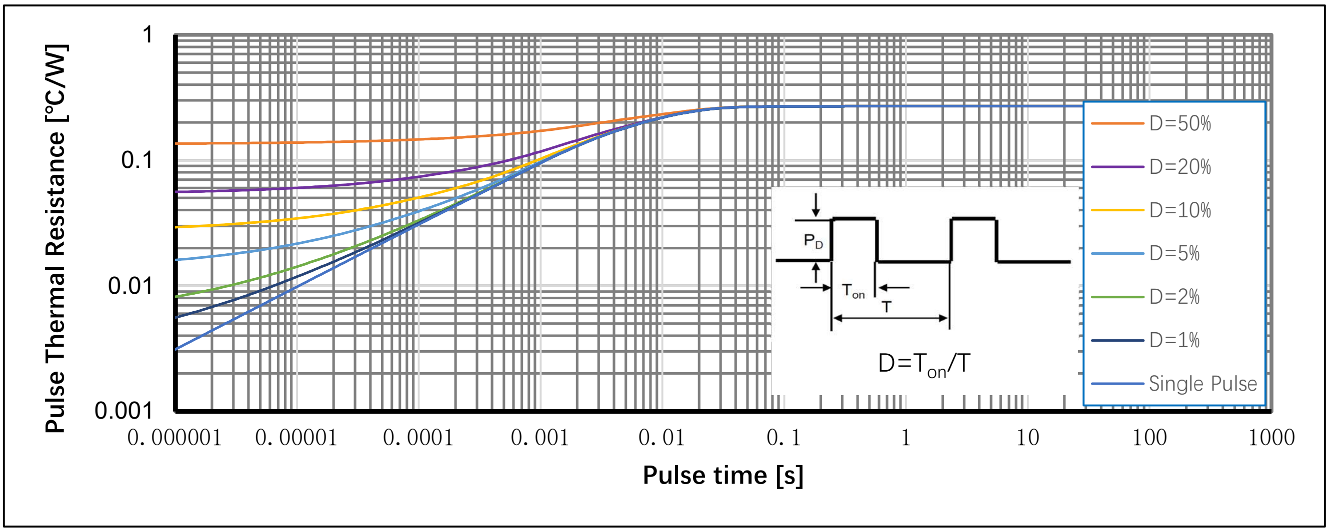
●Fig.11 Safe operating area: continuous and peak collector currents as a function of collector-emitter voltage; Calculative values



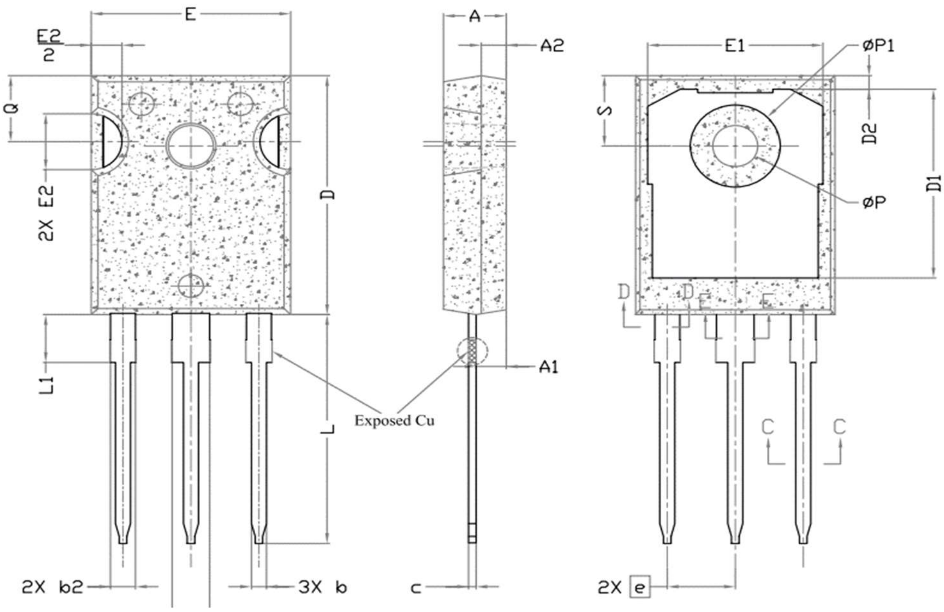
●Fig.12 Reverse bias safe operating area: peak collector currents as a function of collector-emitter voltage; Calculative values



●Fig.13 Transient thermal impedance from junction to case 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℃, t=1000 hours; For DC ， the following test conditions can be passed: V_{GE}=+20V/-10V, T_j=175℃, t=1000 hours；

②Practically 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	2023/10/23	New
B	2025/6/25	Apply new datasheet format
C	2025/9/5	Update short-circuit test temperature.