●General Description

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

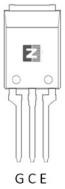
●Features

- ■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

●Product Summary



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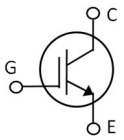


V_{CE}=1200V

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

I_C=40A

●Ordering Information

Part NO.	ZMBGA40N120S1AJ
Marking	BG40N120S1A
Packing information	BULK TUBE
Basic ordering unit (pcs)	1000

●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 ≤ 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=25℃	-	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	5	6	7	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	-	35	-	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	-	7031	-	pF
Output capacitance	C_{oes}		-	29	-	pF
Reverse transfer capacitance	C_{res}		-	12	-	pF
Gate resistance	R_g	f = 1MHz	-	1.8	-	Ω
Total gate charge	Q_g	V_{CC} =600V, I_C = 40A, V_{GE} = 15V	-	208	-	nC
Gate-emitter charge	Q_{ge}		-	57	-	nC
Gate-collector charge	Q_{gc}		-	79	-	nC

●Switching characteristics (T_j=25°C)

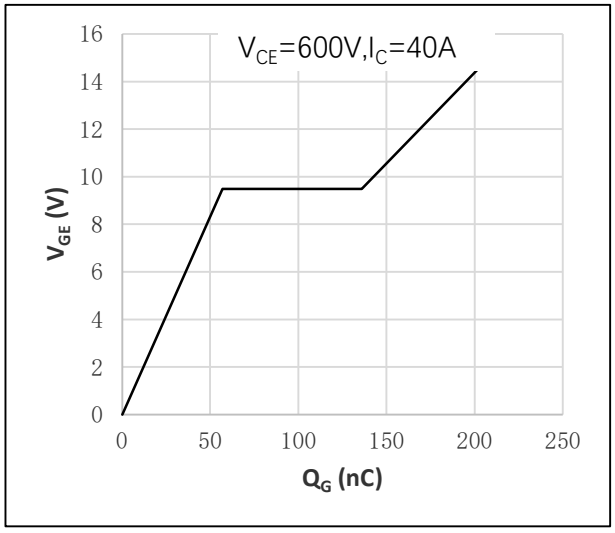
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	T_j=25℃ V_{GE}=15/-8V, V_{CE}=600V,	-	59	-	ns
Turn-on rise time	t_r		-	47	-	ns
Turn-off delay time	$t_{d(off)}$		-	167	-	ns

Turn-off fall time	t_f	R_G =6Ω, I_C =40A, L=100uH	-	44	-	ns
Turn-on energy	E_{on}		-	2.62	-	mJ
Turn-off energy	E_{off}		-	2.31	-	mJ
Total switching energy	E_{ts}		-	4.93	-	mJ
Reverse Bias Safe Operating Area	RBSOA	T_j=25℃,V_{CC}=1200V, I_C=160A, V_{GE}=15V/-8V,R_g=10Ω	Full Square			-

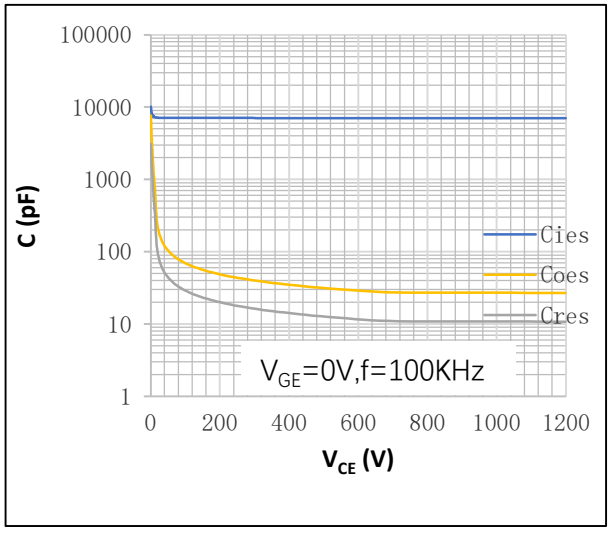
●Switching characteristics (T_j=150°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	T_j=150℃ V_{GE}=15/-8V, V_{CE}=600V, R_G =6Ω, I_C =40A, L=100uH	-	59	-	ns
Turn-on rise time	t_r		-	60	-	ns
Turn-off delay time	$t_{d(off)}$		-	186	-	ns
Turn-off fall time	t_f		-	53	-	ns
Turn-on energy	E_{on}		-	2.95	-	mJ
Turn-off energy	E_{off}		-	2.97	-	mJ
Total switching energy	E_{ts}		-	5.92	-	mJ

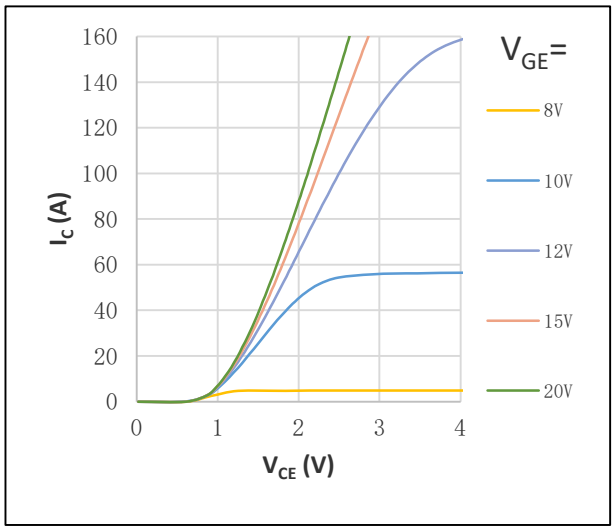
●Fig.1 Gate-emitter voltage as a function of gate charge; Typical values; T_j=25℃



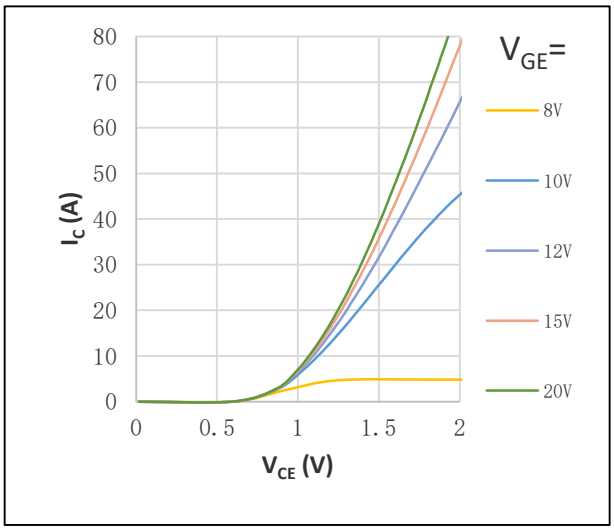
●Fig.2 Input, output and reverse transfer capacitances as a function of collector-emitter voltage; Typical values; T_j=25℃



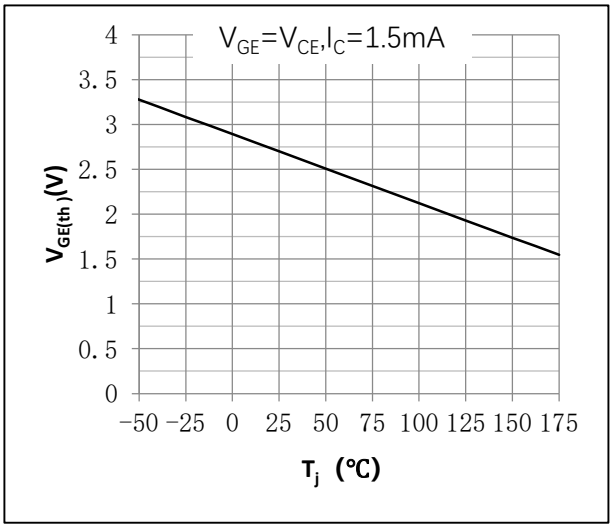
●Fig.3 Output characteristics: collector current as a function of collector-emitter voltage; Typical values; T_j=25℃



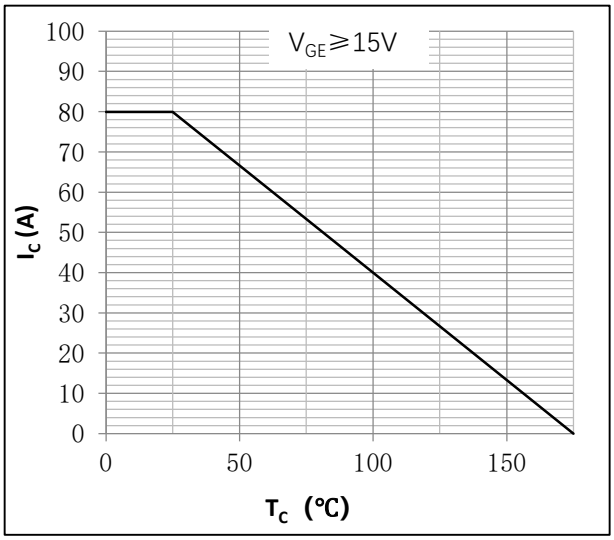
●Fig.4 Output characteristics: collector current as a function of collector-emitter voltage; Typical values: Expanded curve; T_j=25℃



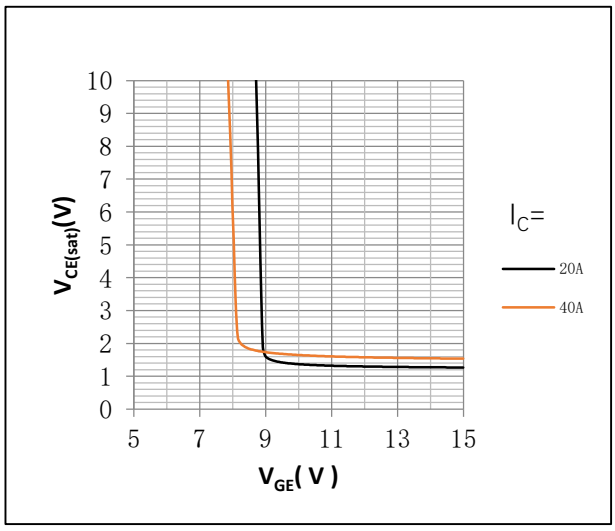
●Fig.5 Gate-emitter threshold voltage as a function of junction temperature; Typical values



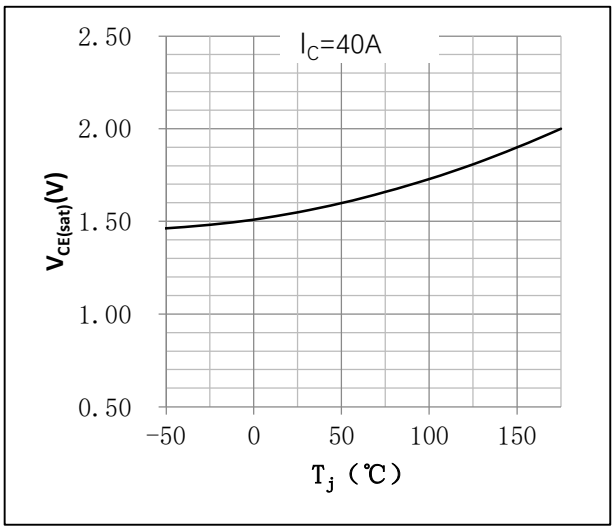
●Fig.6 Continuous collector current as a function of case temperature[2];Calculative values



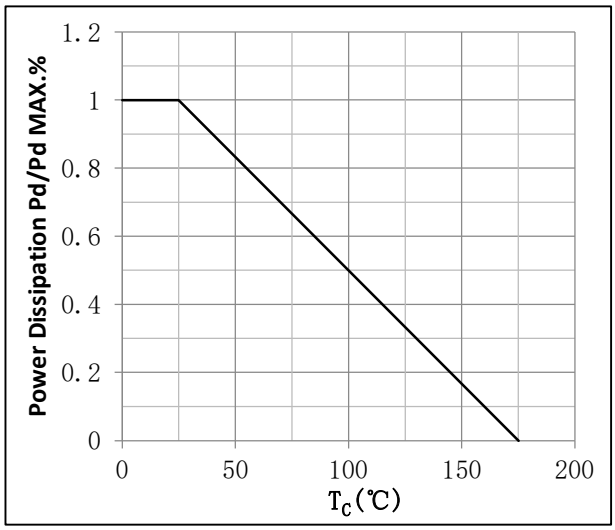
●Fig.7 Collector-emitter saturation voltage as a function of gate-emitter voltage; Typical values



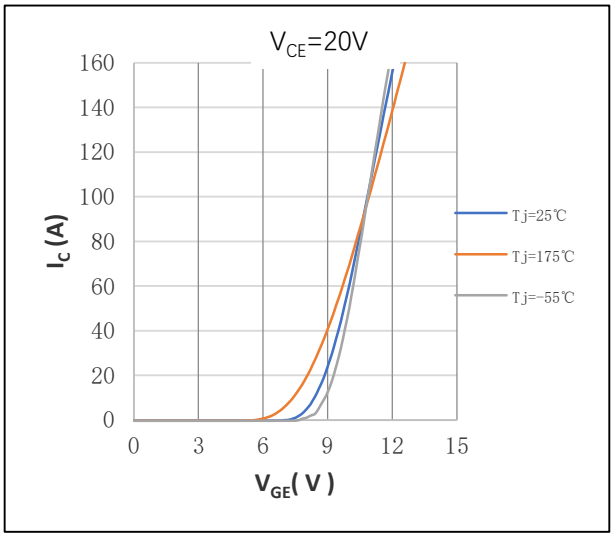
●Fig.8 Fig.6 Collector-emitter saturation voltage as a function of junction temperature; Typical values; Tj=25℃



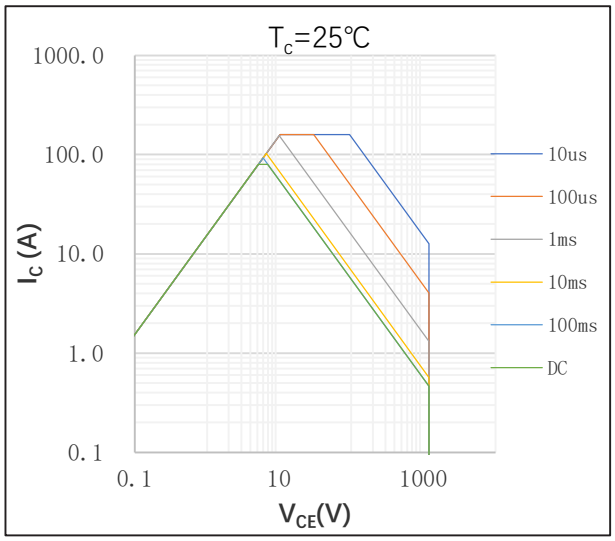
●Figure 9. Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =P_d/P_d(25℃)



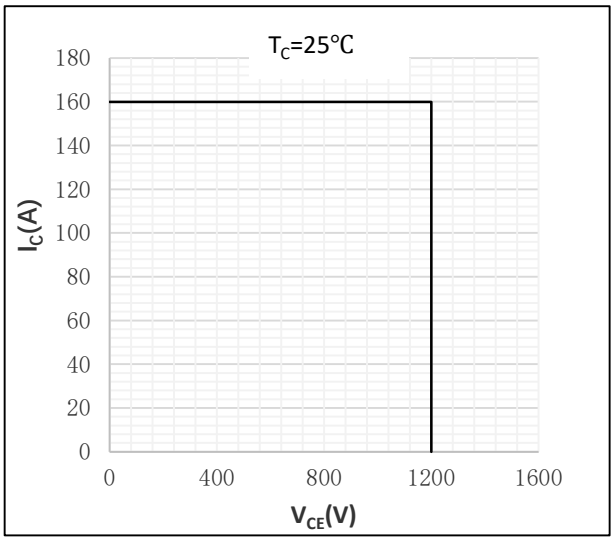
●Figure 10. Transfer characteristics: Collector current as a function of gate-emitter voltage; Typical values



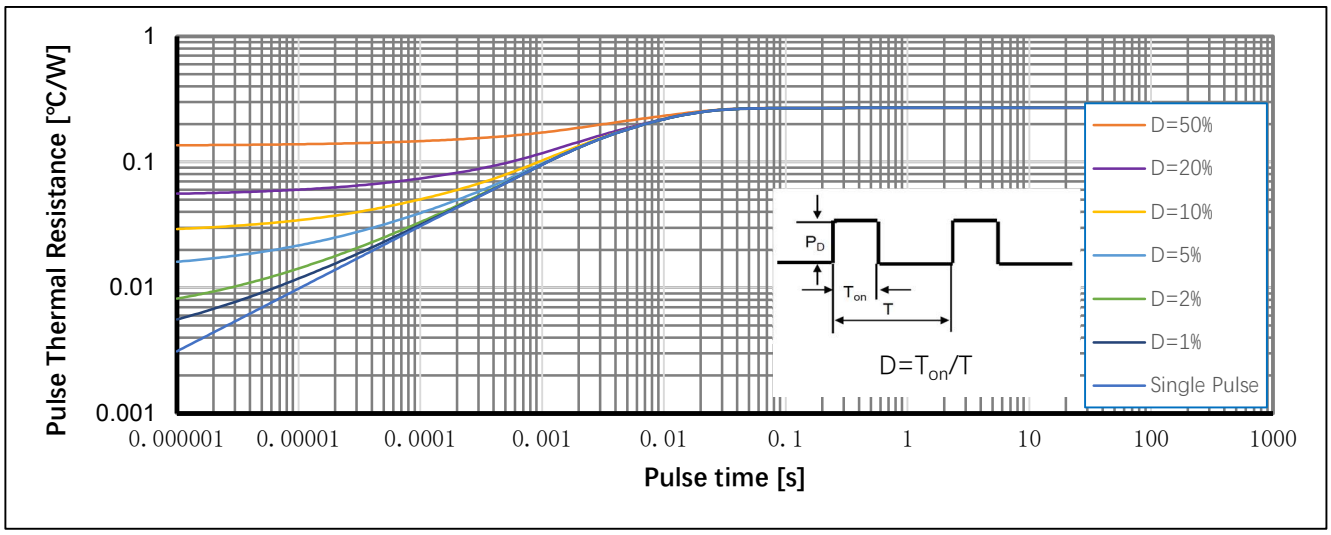
●Fig.11 Safe operating area: continuous and peak collector currents as a function of collector-emitter voltage; Calculative values



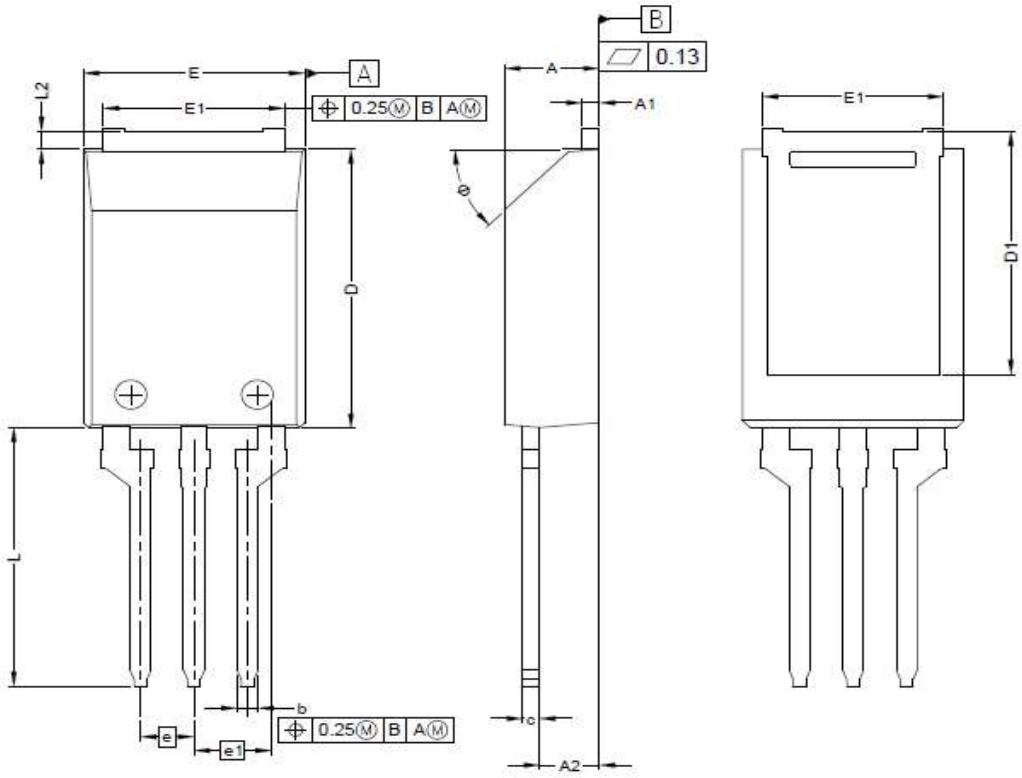
●Fig.12 Reverse bias safe operating area: peak collector currents as a function of collector-emitter voltage; Calculative values

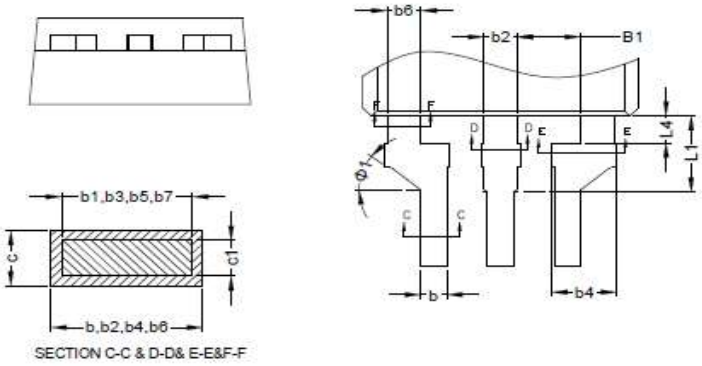


● Fig.13 Transient thermal impedance from junction to case as a function of pulse duration; max values



●Package Outline





SECTION C-C & D-D& E-E&F-F

Symbol	MIN	MAX	Symbol	MIN	MAX
A	4.34	4.74	c1	0.60	0.90
A1	0.50	1.00	D	14.00	15.00
A2	2.50	3.00	D1	12.50	13.50
B1	(2.20)	-	E	10.00	11.00
b	0.90	1.30	E1	8.00	9.00
b1	0.80	1.10	e	2.55 BSC	
b2	1.25	1.65	e1	3.66 BSC	
b3	1.10	1.55	L	13.00	14.50
b4	2.35	2.55	L1	3.00	3.50
b5	2.30	2.50	L2	0.50	1.50
b6	1.25	1.65	L4	-	1.50
b7	1.10	1.55	φ	42.50	47.50
c	0.70	1.00	φ1	-	42.50

●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