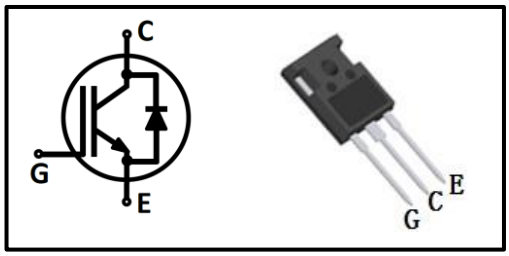
Features

- Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Low V_{CEsat}, fast switching
- High ruggedness, good thermal stability
- Very tight parameter distribution

Applications

- UPS
- PFC
- PTC Heater
- Climate Compressor

Type	Marking	Package Code
MPBW50N65ES	MP50N65ES	TO-247-3



Maximum Rated Values [1]

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	650	V
DC collector current[2]			A
T_C=25℃	I_C	80	
T_C=100℃		50	
Pulsed collector current[3]	I_{Cpuls}	200	
Diode forward current[2]			
T_C=25℃	I_F	80	
T_C=100℃		50	
Diode pulsed current[3]	I_{Fpuls}	200	
Short circuit withstanding time V_{GE}=15V, V_{CC}≤400V, T_J≤150℃	t_{SC}	5	us
Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage（t_p≤10us)		±30	
Power dissipation			W
T_C=25℃	P_{tot}	300	
T_C=100℃		150	
Operating junction temperature	T_j	-55~175	℃
Storage temperature	T_{stg}	-55~150	

1:Reference standard: JESD-022 2: limited by Tjmax 3: Tp limited by Tjmax ;

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
IGBT thermal resistance, junction-case	R_{thJC}	-	-	0.5	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.65	
Thermal Resistance, junction-ambient	R_{thJA}	-	-	40	

Electrical Characteristics（at Tj=25℃, unless otherwise specified）

Static Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.25mA	650	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=50A T_j=25℃	-	1.54	1.85	
		T_j=125℃	-	1.77	-	
		T_j=150℃	-	1.85	-	
Diode forward voltage	V_F	V_{GE}=0V， I_F=50A T_j=25℃	-	1.56	1.95	
		T_j=125℃	-	1.43	-	
		T_j=150℃	-	1.37	-	
G-E threshold voltage	$V_{GE(th)}$	I_C=250μA, V_{CE}=V_{GE}	4.0	5.0	6.0	
C-E leakage current	I_{CES}	V_{CE}=650V, V_{GE}=0V T_j=25℃	-	-	0.01	mA
		T_j=150℃	-	-	1.0	
G-E leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	250	nA
Transconductance	g_{FS}	V_{CE}=20V, I_C=50A	-	27	-	S

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{iss}	V_{CE}=30V, V_{GE}=0V, f=1MHz	-	3050	-	pF
Output capacitance	C_{oss}		-	172	-	
Reverse transfer capacitance	C_{rss}		-	38	-	
Gate charge	Q_G	V_{CC}=300V, I_C=50A, V_{GE}=15V	-	130	-	nC

IGBT Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	T_j=25℃, V_{CC}=400V, I_C=50A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	104	-	ns
Rise time	t_r		-	72	-	
Turn-off delay time	$t_{d(off)}$		-	218	-	
Fall time	t_f		-	44	-	
Turn-on energy	E_{on}		-	1.17	-	mJ
Turn-off energy	E_{off}		-	1.74	-	
Total switching energy	E_{ts}		-	2.91	-	
Turn-on delay time	$t_{d(on)}$	T_j=150℃, V_{CC}=400V, I_C=50A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	102	-	ns
Rise time	t_r		-	74	-	
Turn-off delay time	$t_{d(off)}$		-	236	-	
Fall time	t_f		-	60	-	
Turn-on energy	E_{on}		-	2.15	-	mJ
Turn-off energy	E_{off}		-	2.04	-	
Total switching energy	E_{ts}		-	4.19	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode reverse recovery time	t_{rr}	T_j=25℃, V_R=400V, I_F=50A, di_F/dt=600A/μs	-	100	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.99	-	μC
Diode peak reverse recovery current	I_{rrm}		-	17	-	A
Diode reverse recovery time	t_{rr}	T_j=150℃, V_R=400V, I_F=50A, di_F/dt=600A/μs		155		ns
Diode reverse recovery charge	Q_{rr}			2.7		uC
Diode peak reverse recovery current	I_{rrm}			26		A

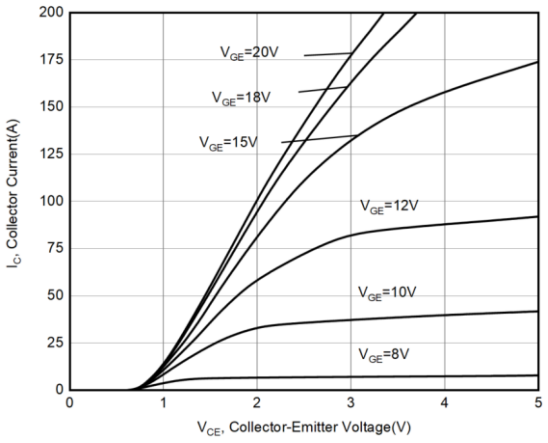


Figure 1. Typical output characteristic (T_j =25℃)

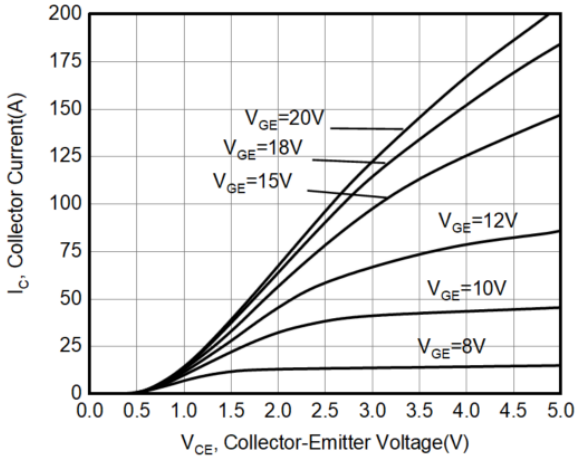


Figure 2. Typical output characteristic (T_j =150℃)

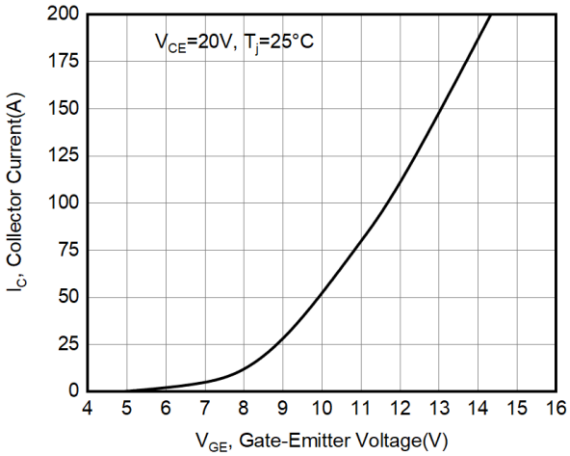


Figure 3. Typical transfer characteristic (T_j =25℃)

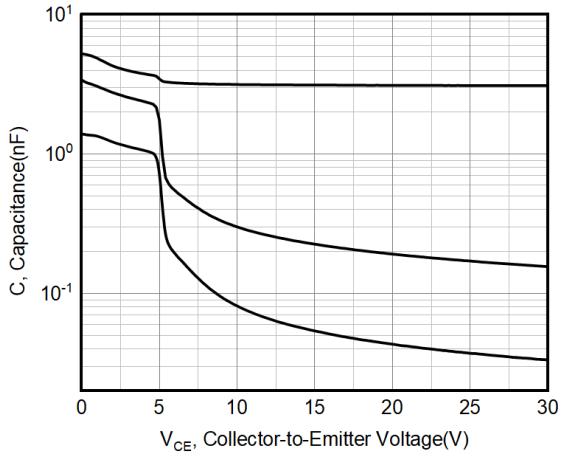


Figure 4. Capacitance characteristic (V_{GE}=0V, f=1MHz)

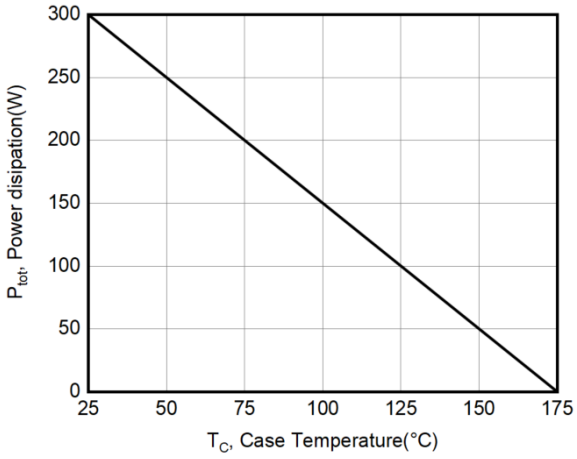


Figure 5. Power dissipation as a function of case temperature (T_j≤175℃)

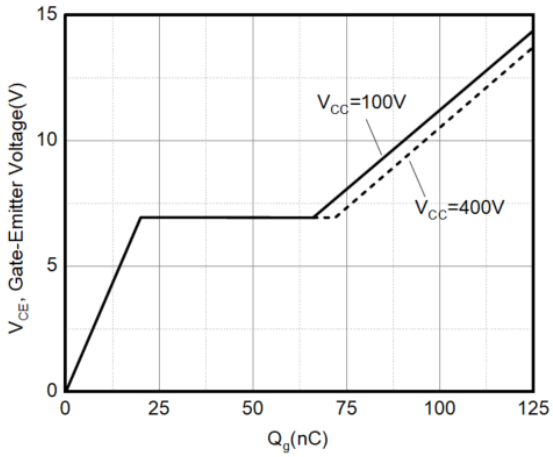


Figure 6. Typical gate charge (I_C=50A)

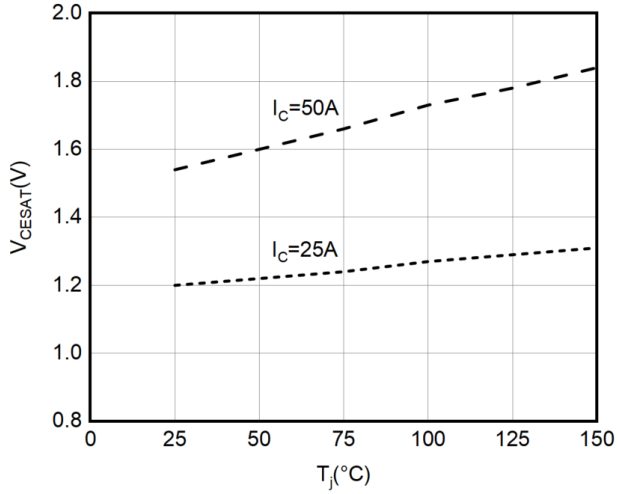
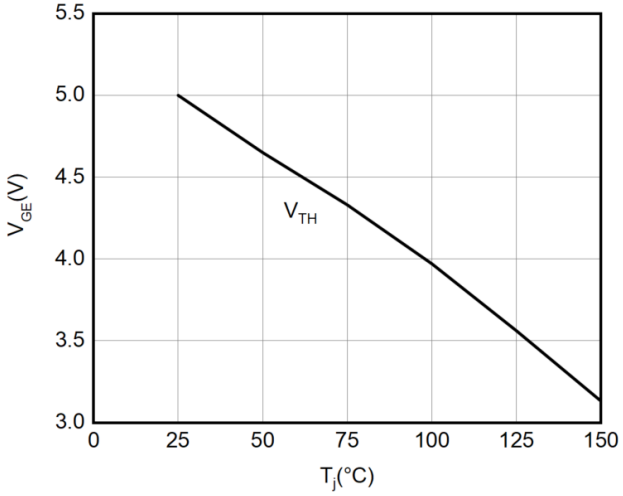


Figure 7. V_{CESAT} as a function of junction temperature (V_{GE}=15V)



igure 8. V_{TH} as a function of junction temperature (I_{CE}=250μA)

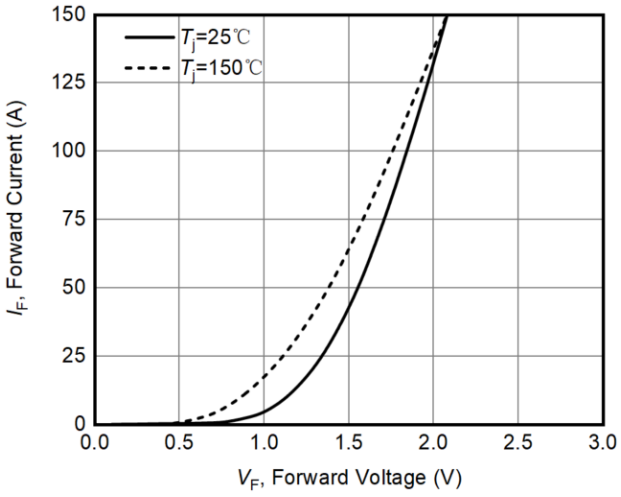


Figure 9. Typical diode forward current as a function of forward voltage

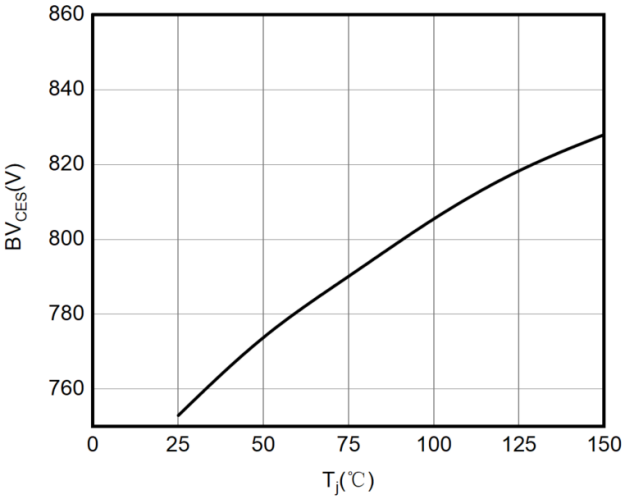


Figure 10. BV as a function of junction temperature (I_{CE}=250μA)

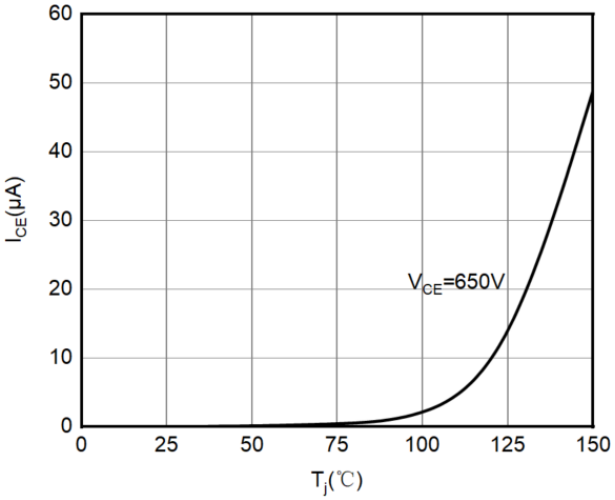


Figure 11. I_{CES} leakage current as a function of junction temperature

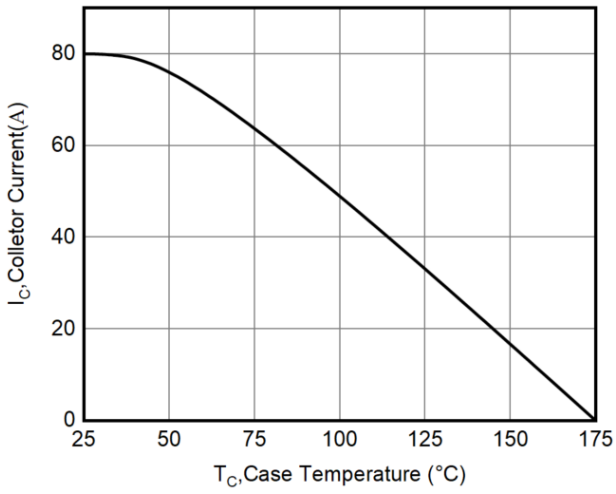


Figure 12. Collector current as a function of case temperature(V_{GE}≥15V, T_j≤175℃)

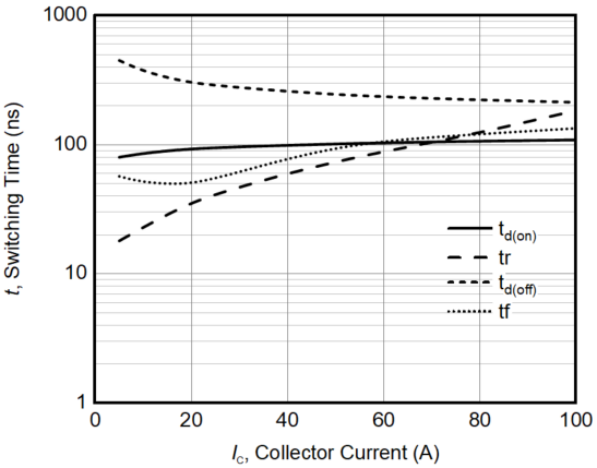


Figure 13. Typical switching times as a function of collector current
(T_j=150℃, V_{CE}=400V, $R_{G(on)}$=$R_{G(off)}$=10Ω)

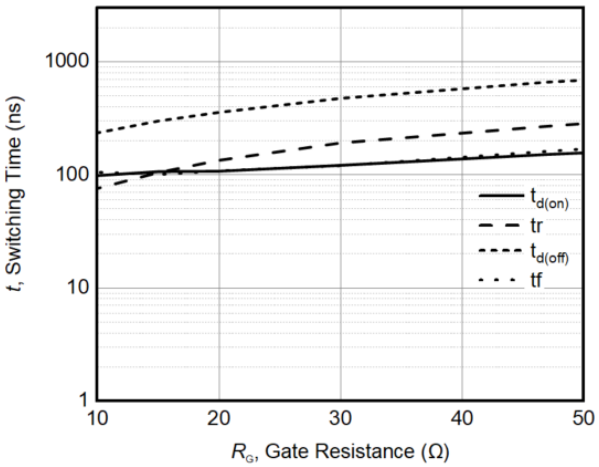


Figure 14. Typical switching times as a function of gate resistance
(T_j=150℃, V_{CE}=400V, I_C=50A)

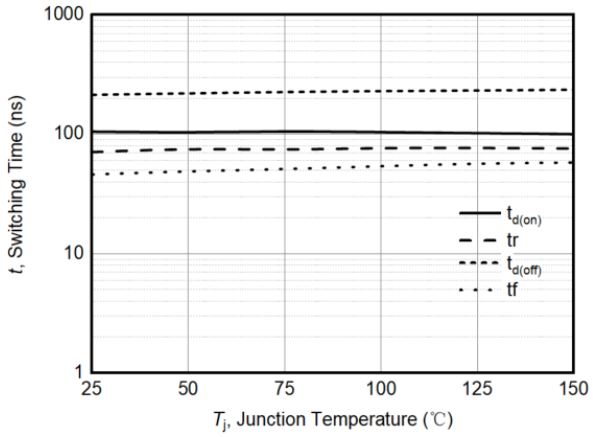


Figure 15. Typical switching times as a function of junction temperature
(V_{CE}=400V, I_C=50A, $R_{G(on)}$=$R_{G(off)}$=10Ω)

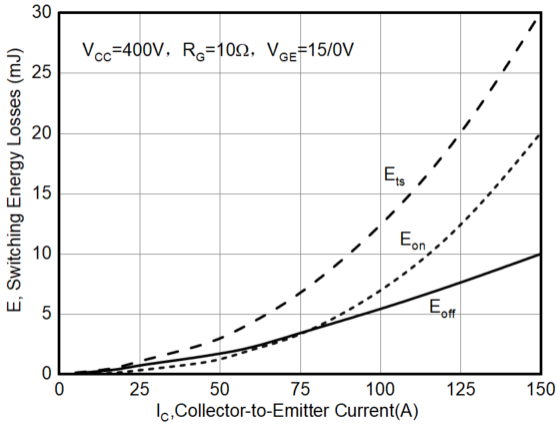


Figure 16. E_{on}, E_{off} as a function of I_C
(T_j=25℃)

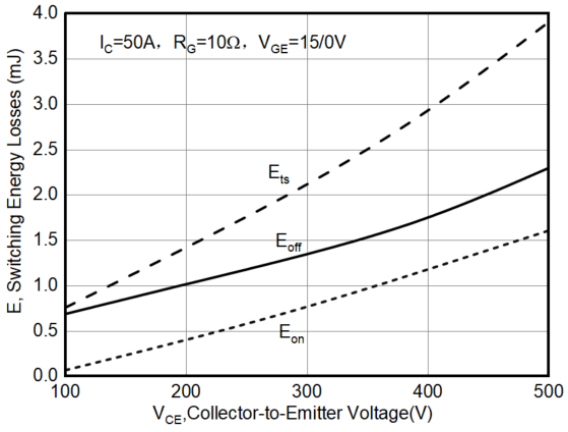


Figure 17. E_{on}, E_{off} as a function of V_{CE}
(T_j=25℃)

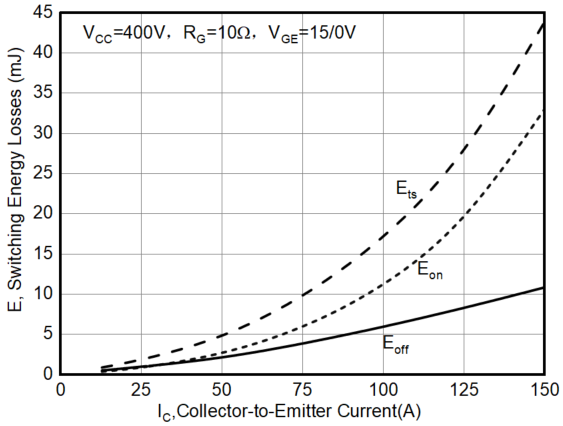


Figure 18. E_{on}, E_{off} as a function of I_C
(T_j=150℃)

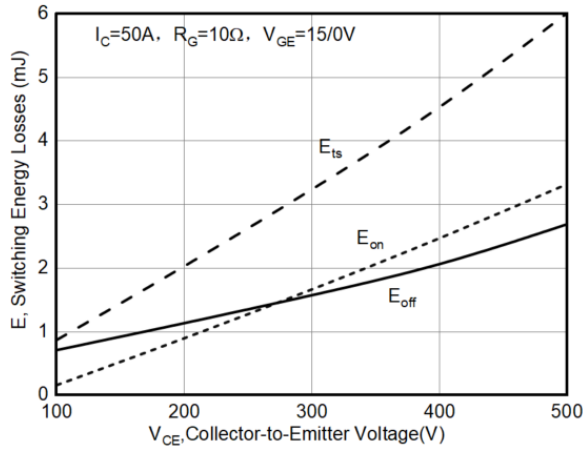


Figure 19. E_{on}, E_{off} as a function of V_{CE} (T_j=150℃)

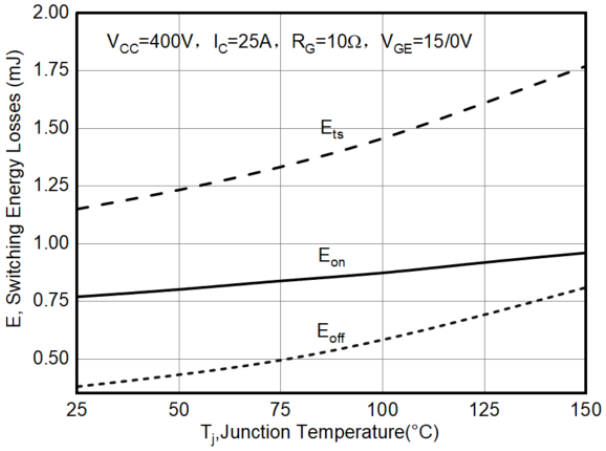


Figure 20. E_{on}, E_{off} as a function of junction temperature

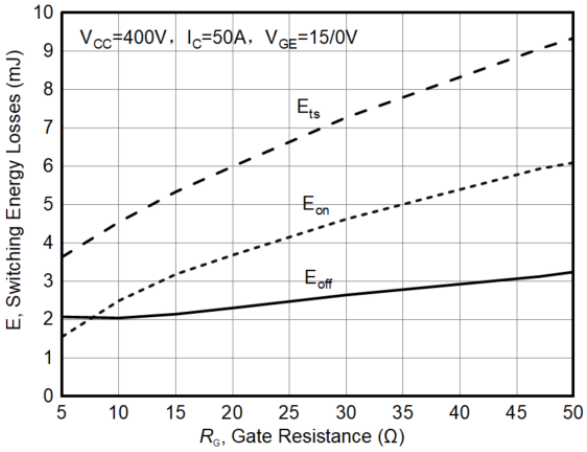


Figure 21. E_{on}, E_{off} as a function of gate resistance (T_j=150℃)

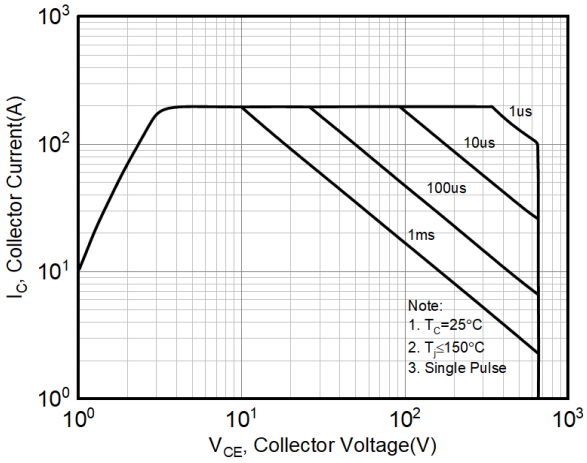


Figure 22. FBSOA

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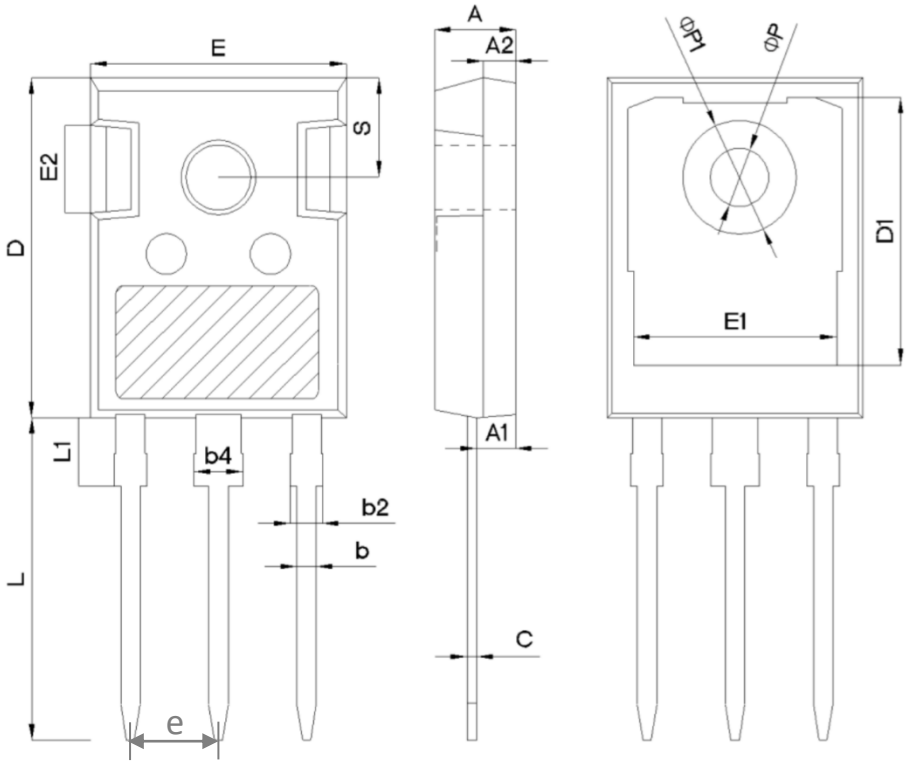

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

Revision History：

Revision	Date	Subjects (major changes since last revision)
1.0	2023-04-20	Initial Version
1.1	2023-05-09	Update the figure

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