

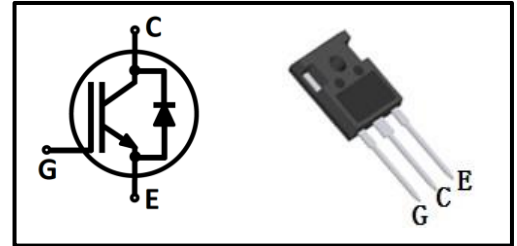
Features

- 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

Type	Marking	Package Code
MPBW50N65E	MP50N65E	TO-247-3

Applications

- UPS
- PFC
- PTC Heater
- Climate Compressor



Maximum Rated Values ¹

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	650	V
DC collector current ²			A
$T_C=25^\circ\text{C}$	I_C	80	
$T_C=100^\circ\text{C}$		50	
Pulsed collector current ³	I_{Cpuls}	200	
Diode forward current ²			
$T_C=25^\circ\text{C}$	I_F	80	
$T_C=100^\circ\text{C}$		50	
Diode pulsed current ³	I_{Fpuls}	200	
Gate-emitter voltage	V_{GE}	± 20	
Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$)		± 30	
Power dissipation			W
$T_C=25^\circ\text{C}$	P_{tot}	300	
$T_C=100^\circ\text{C}$		150	
Operating junction temperature	T_j	-55~175	$^\circ\text{C}$
Storage temperature	T_{stg}	-55~150	

1:Reference standard: JESD-022 2: limited by T_{jmax} 3: T_p limited by T_{jmax} ;



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 $T_j=25^\circ\text{C}$, 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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=50A, T_j=25^\circ\text{C}$	-	1.60	1.90	
		$T_j=125^\circ\text{C}$	-	1.90	-	
		$T_j=150^\circ\text{C}$	-	1.98	-	
Diode forward voltage	V_F	$V_{GE}=0V, I_F=50A, T_j=25^\circ\text{C}$	-	1.70	2.10	
		$T_j=125^\circ\text{C}$	-	1.60	-	
		$T_j=150^\circ\text{C}$	-	1.56	-	
G-E threshold voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	4.5	5.5	6.5	
C-E leakage current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_j=25^\circ\text{C}$	-	-	0.01	
		$T_j=150^\circ\text{C}$	-	-	1.0	
G-E leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	250	nA
Transconductance	g_{FS}	$V_{CE}=20V, I_C=50A$	-	21	-	S

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{iss}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	-	5573	-	pF
Output capacitance	C_{oss}		-	175	-	
Reverse transfer capacitance	C_{riss}		-	80	-	
Gate charge	Q_G	$V_{CC}=300V, I_C=50A, V_{GE}=15V$	-	230	-	nC



IGBT Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Turn-on delay time	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load	-	89	-	ns	
Rise time	t_r		-	62	-		
Turn-off delay time	$t_{d(off)}$		-	265	-		
Fall time	t_f		-	47	-		
Turn-on energy	E_{on}		$T_j=150^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load	-	1.22	-	mJ
Turn-off energy	E_{off}			-	1.20	-	
Total switching energy	E_{ts}			-	2.42	-	
Turn-on delay time	$t_{d(on)}$	$T_j=150^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load	-	91	-	ns	
Rise time	t_r		-	63	-		
Turn-off delay time	$t_{d(off)}$		-	302	-		
Fall time	t_f		-	55	-		
Turn-on energy	E_{on}		$T_j=150^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load	-	2.24	-	mJ
Turn-off energy	E_{off}			-	1.50	-	
Total switching energy	E_{ts}			-	3.74	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode reverse recovery time	t_{rr}	$T_j=25^{\circ}\text{C}$, $V_R=400\text{V}$, $I_F=50\text{A}$, $di_F/dt=600\text{A}/\mu\text{s}$	-	105	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.96	-	μC
Diode peak reverse recovery current	I_{rrm}		-	14.8	-	A
Diode reverse recovery time	t_{rr}	$T_j=150^{\circ}\text{C}$, $V_R=400\text{V}$, $I_F=50\text{A}$, $di_F/dt=600\text{A}/\mu\text{s}$		150		ns
Diode reverse recovery charge	Q_{rr}			3.05		μC
Diode peak reverse recovery current	I_{rrm}			33		A

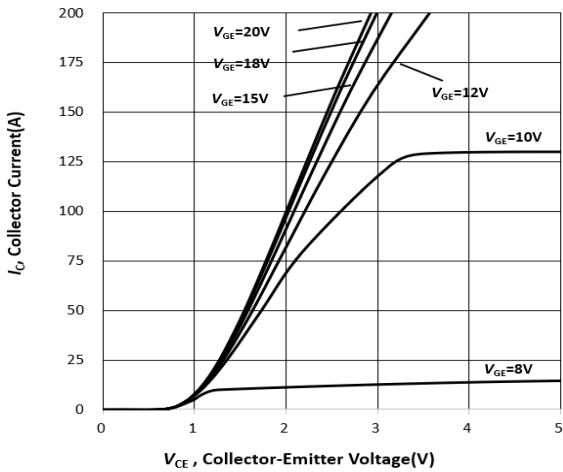


Figure 1. Typical output characteristic ($T_j = 25\text{ }^\circ\text{C}$)

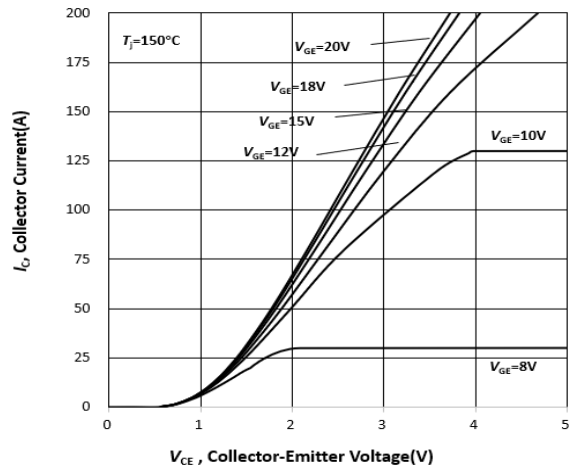


Figure 2. Typical output characteristic ($T_j = 150\text{ }^\circ\text{C}$)

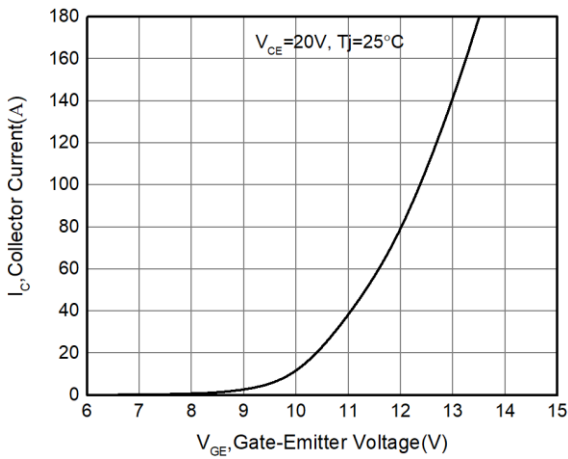


Figure 3. Typical transfer characteristic ($T_j = 25\text{ }^\circ\text{C}$)

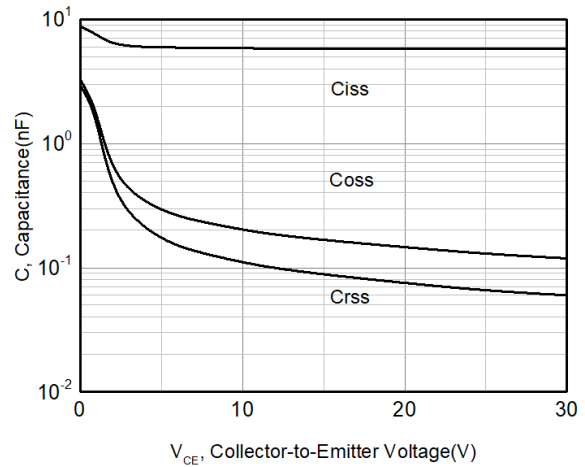


Figure 4. Capacitance characteristic ($V_{GE} = 0\text{V}$, $f = 1\text{MHz}$)

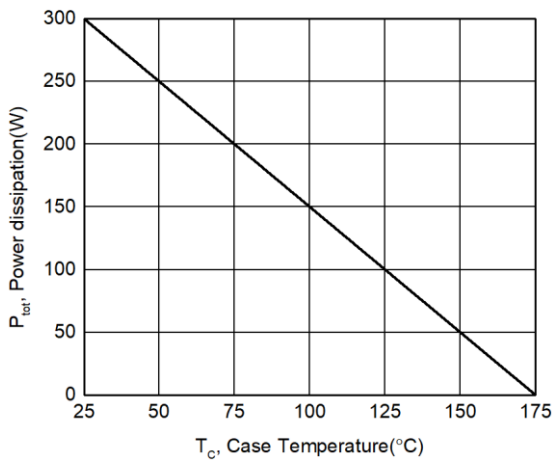


Figure 5. Power dissipation as a function of case temperature ($T_j \leq 175\text{ }^\circ\text{C}$)

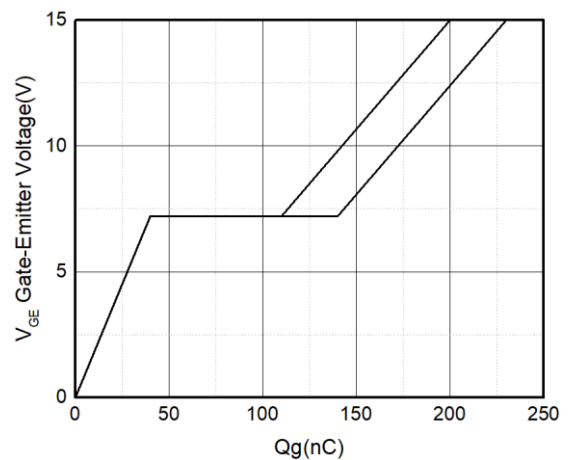


Figure 6. Typical gate charge ($I_C = 50\text{A}$)

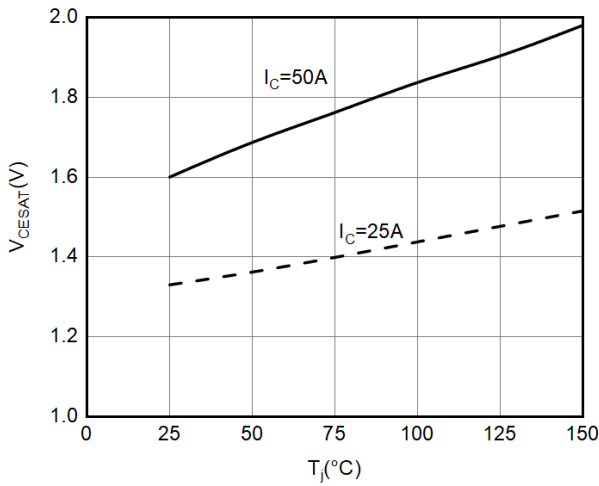


Figure 7. V_{CESAT} as a function of junction temperature ($V_{GE}=15V$)

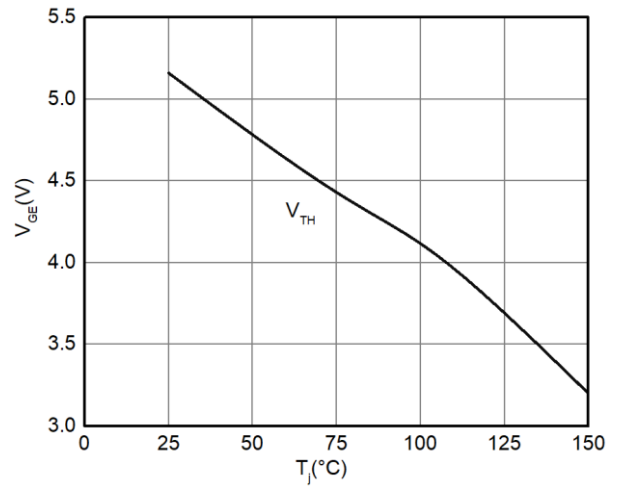


Figure 8. V_{TH} as a function of junction temperature ($I_{CE}=250\mu A$)

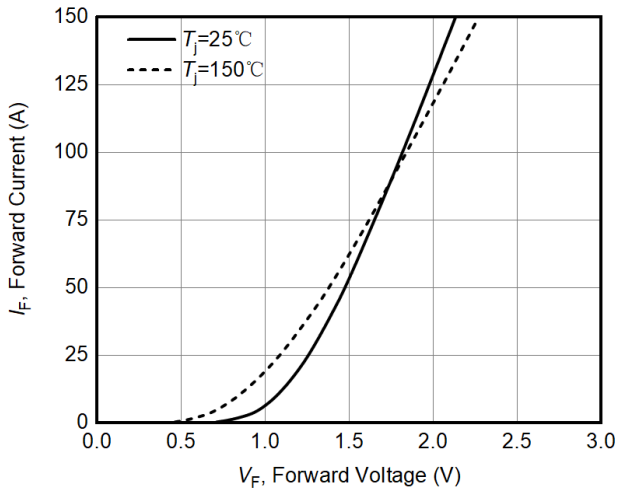


Figure 9. Typical diode forward current as a function of forward voltage

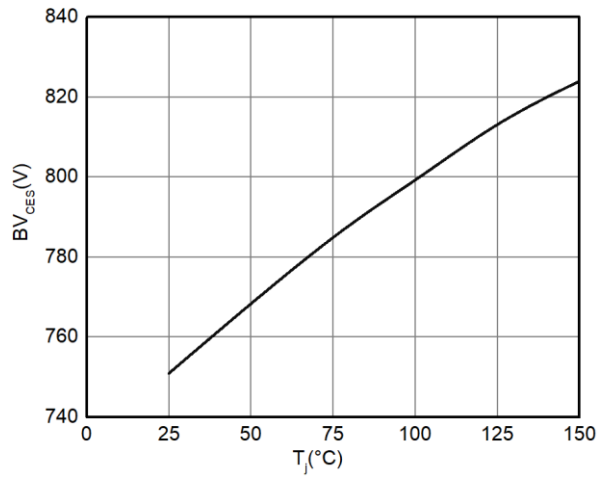


Figure 10. BV as a function of junction temperature ($I_{CE}=250\mu A$)

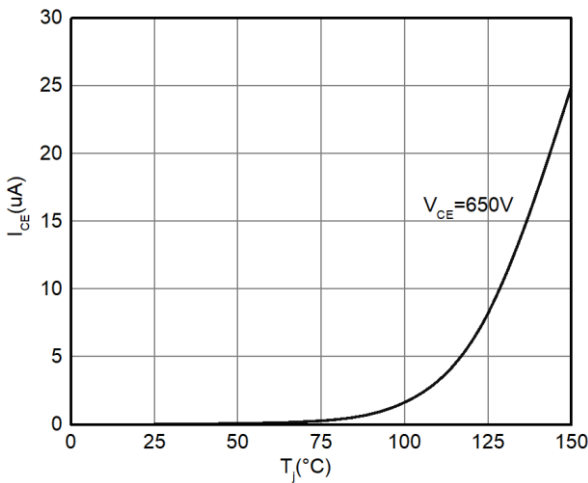


Figure 11. I_{CES} leakage current as a function of junction temperature

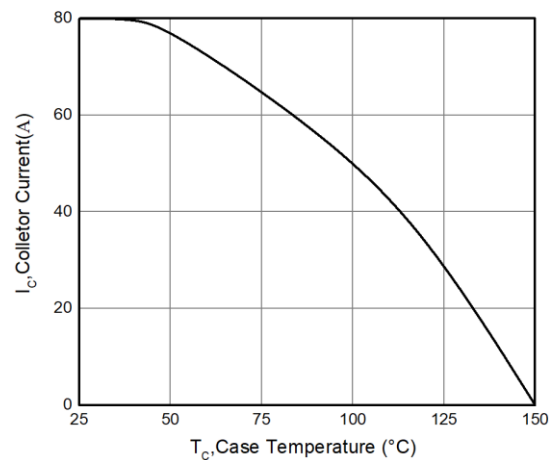


Figure 12. Collector current as a function of case temperature ($V_{GE}\geq 15V$, $T_J\leq 150^\circ C$)

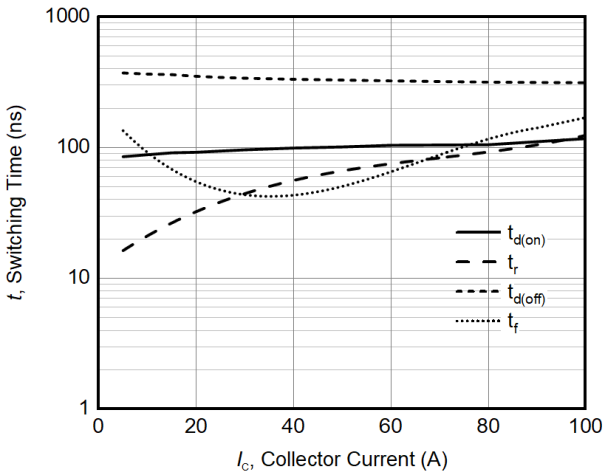


Figure 13. Typical switching times as a function of collector current
 ($T_j=150\text{ }^\circ\text{C}$, $V_{CE}=400\text{V}$, $R_{G(on)}=R_{G(off)}=10\Omega$)

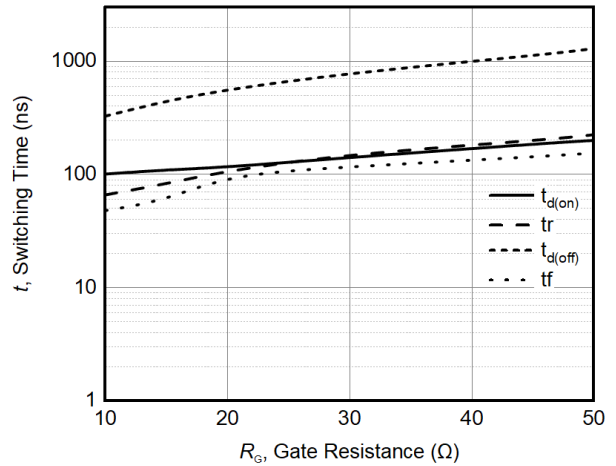


Figure 14. Typical switching times as a function of gate resistance
 ($T_j=150\text{ }^\circ\text{C}$, $V_{CE}=400\text{V}$, $I_C=50\text{A}$)

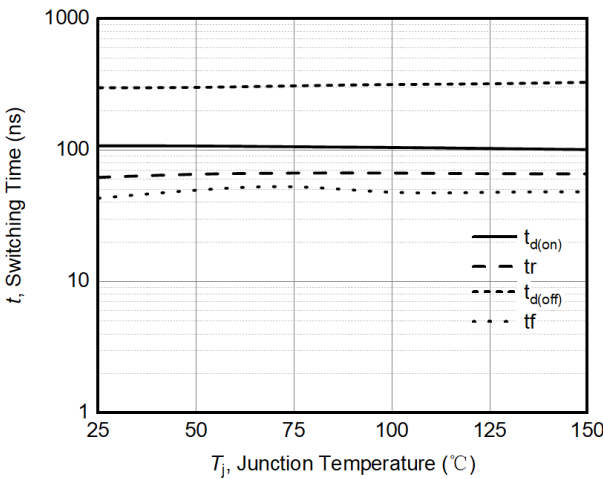


Figure 15. Typical switching times as a function of junction temperature
 ($V_{CE}=400\text{V}$, $I_C=50\text{A}$, $R_{G(on)}=R_{G(off)}=10\Omega$)

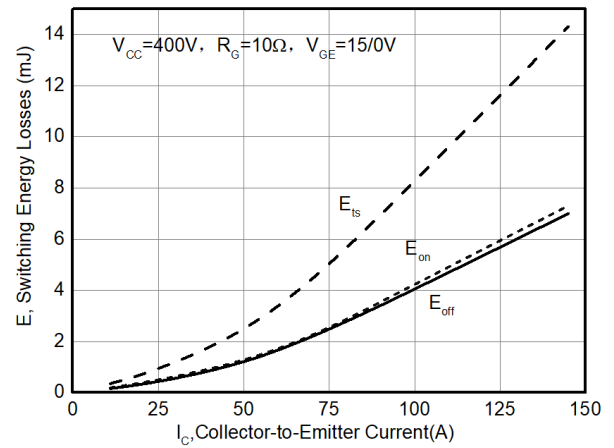


Figure 16. E_{on} , E_{off} as a function of I_C
 ($T_j=25\text{ }^\circ\text{C}$)

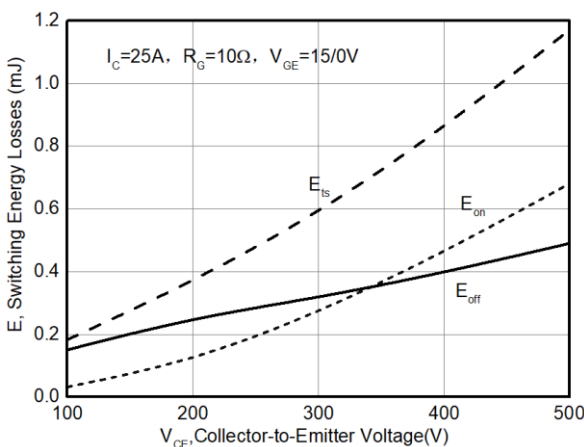


Figure 17. E_{on} , E_{off} as a function of V_{CE}
 ($T_j=25\text{ }^\circ\text{C}$)

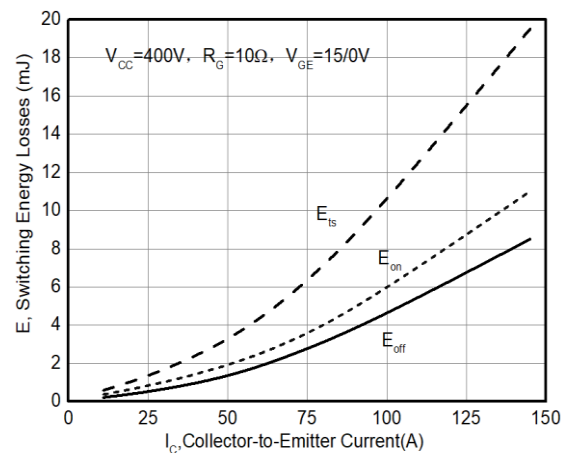


Figure 18. E_{on} , E_{off} as a function of I_C
 ($T_j=150\text{ }^\circ\text{C}$)

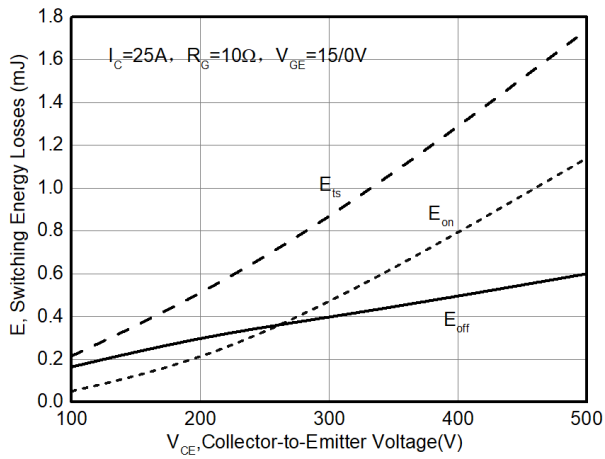


Figure 19. E_{on} , E_{off} as a function of V_{CE} ($T_j=150^\circ C$)

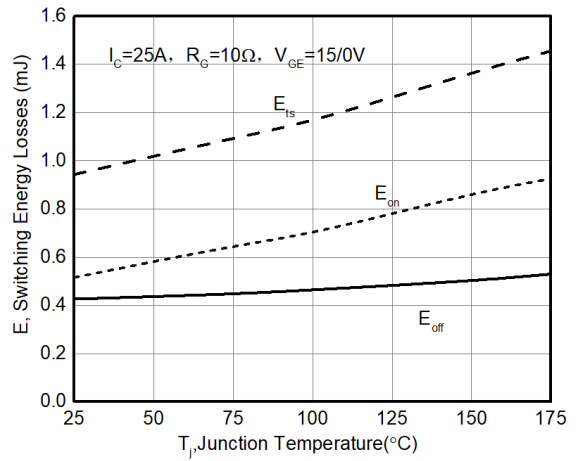


Figure 20. E_{on} , E_{off} as a function of junction temperature

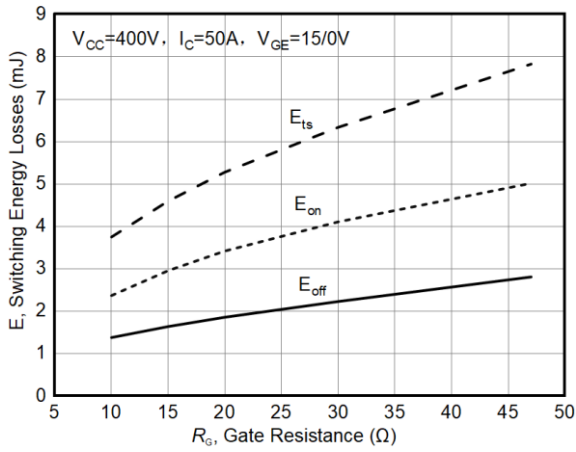


Figure 21. E_{on} , E_{off} as a function of gate resistance ($T_j=150^\circ C$)

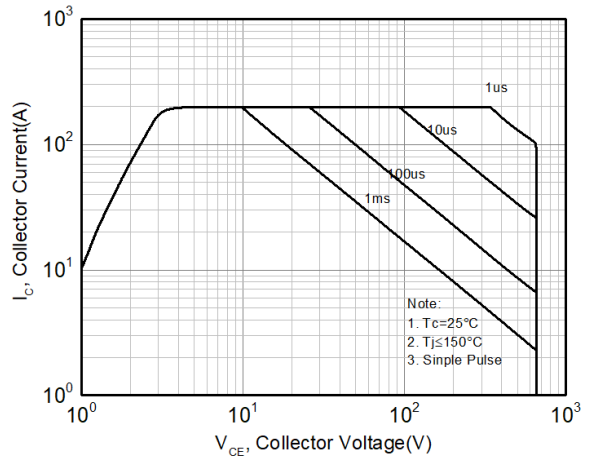
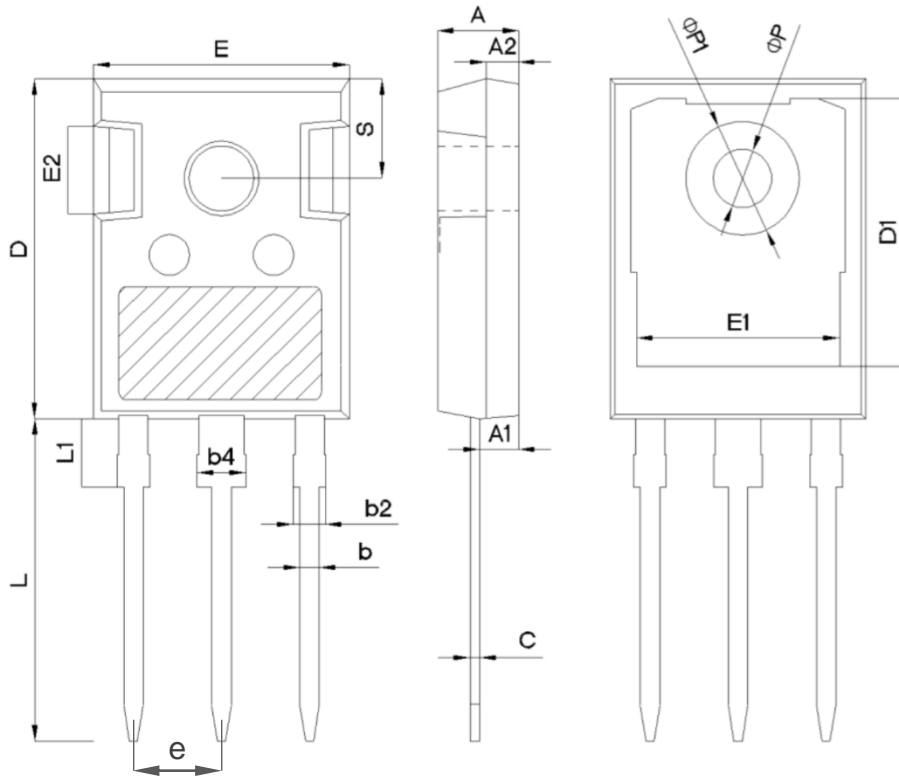


Figure 22. FBSOA

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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	2020-12-27	Initial Version
1.1	2021-12-13	Update Electrical Characteristics and charts @ $T_j=25^\circ\text{C}$ and @ $T_j=150^\circ\text{C}$
1.2	2022-01-07	Update Capacitance curve
1.3	2022-04-02	Update output characteristic @ $T_j=150^\circ\text{C}$
1.4	2022-11-21	Update I_F & V_F and dynamic graphs
1.5	2022-12-22	Update V_F , Capacitance, E_{on} and E_{off}



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