

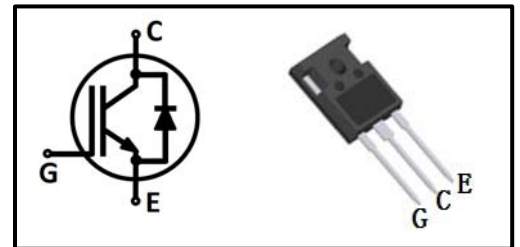
Features

- 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

- Solar Inverter
- Welding Machine
- UPS
- PFC
- PTC heater
- Climate compressor

Type	Marking	Package Code
MPBW40N120E	MP40N120E	TO-247-3



Maximum Rated Values

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} $T_C=25^\circ\text{C}$ $T_C=130^\circ\text{C}$	I_C	80 40	A
Pulsed collector current, t_p limited by T_{vjmax} ¹⁾	I_{Cpuls}	160	
Diode forward current, limited by T_{vjmax} $T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$	I_F	80 40	
Diode pulsed current, t_p limited by T_{vjmax} ¹⁾	I_{Fpuls}	160	
Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}, D < 0.01$)		± 30	
Power dissipation $T_C=25^\circ\text{C}$	P_{tot}	428	W
Power dissipation $T_C=100^\circ\text{C}$		214	
Operating junction temperature	T_{vj}	-40~175	°C
Storage temperature	T_{stg}	-55~150	
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

¹⁾ Defined by design. Not subject to production test.



Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
IGBT thermal resistance, junction-case	R_{thJC}	-	0.28	0.35	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.80	
Thermal Resistance, junction-ambient	R_{thJA}	-	-	40	

Electrical Characteristics (at $T_{vj}=25^{\circ}C$, unless otherwise specified)
Static Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.25mA$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A$ $T_{vj}=25^{\circ}C$	-	1.6	2.0	
		$T_{vj}=150^{\circ}C$	-	1.9	-	
		$T_{vj}=175^{\circ}C$	-	2.0	-	
G-E threshold voltage	$V_{GE(th)}$	$I_C=1.5mA, V_{CE}=V_{GE}$	5.0	5.8	6.5	
C-E leakage current	I_{CES}	$V_{CE}=1200V,$ $V_{GE}=0V$ $T_{vj}=25^{\circ}C$	-	-	0.1	mA
		$T_{vj}=175^{\circ}C$	-	-	4.0	
G-E leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	250	nA

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{iss}	$V_{CE}=30V,$ $V_{GE}=0V,$ $f=1MHz$	-	8153	-	pF
Output capacitance	C_{oss}		-	98	-	
Reverse transfer capacitance	C_{rss}		-	118	-	
Gate charge	Q_G	$V_{CC}=600V, I_C=40A,$ $V_{GE}=15V$	-	467	-	nC



IGBT Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Turn-on delay time	$t_{d(on)}$	$T_{vj}=25^{\circ}C,$ $V_{CC}=600V,$ $I_C=40A,$ $V_{GE}=0/15V,$ $R_G=10\Omega,$ Inductive load	-	113	-	ns	
Rise time	t_r		-	76	-		
Turn-off delay time	$t_{d(off)}$		-	738	-		
Fall time	t_f			-	80	-	mJ
Turn-on energy	E_{on}			-	2.56	-	
Turn-off energy	E_{off}			-	2.13	-	
Total switching energy	E_{ts}			-	4.69	-	
Turn-on delay time	$t_{d(on)}$	$T_{vj}=175^{\circ}C,$ $V_{CC}=600V,$ $I_C=40A,$ $V_{GE}=0/15V,$ $R_G=10\Omega,$ Inductive load	-	118	-	ns	
Rise time	t_r		-	54	-		
Turn-off delay time	$t_{d(off)}$		-	738	-		
Fall time	t_f			-	162	-	mJ
Turn-on energy	E_{on}			-	3.62	-	
Turn-off energy	E_{off}			-	3.54	-	
Total switching energy	E_{ts}			-	7.16	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode forward voltage	V_F	$V_{GE}=0V, I_F=40A$ $T_{vj}=25^{\circ}C$	-	2.4	2.8	V
		$T_{vj}=150^{\circ}C$	-	2.1	-	
		$T_{vj}=175^{\circ}C$	-	2.0	-	
Diode reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}C,$ $V_R=600V,$ $I_F=40A,$ $di_F/dt=550A/\mu s$	-	164	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.49	-	μC
Diode peak reverse recovery current	I_{rrm}		-	20.0	-	A
Diode reverse recovery time	t_{rr}	$T_{vj}=175^{\circ}C,$ $V_R=600V,$ $I_F=40A,$ $di_F/dt=550A/\mu s$	-	286	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.52	-	μC
Diode peak reverse recovery current	I_{rrm}		-	28.8	-	A

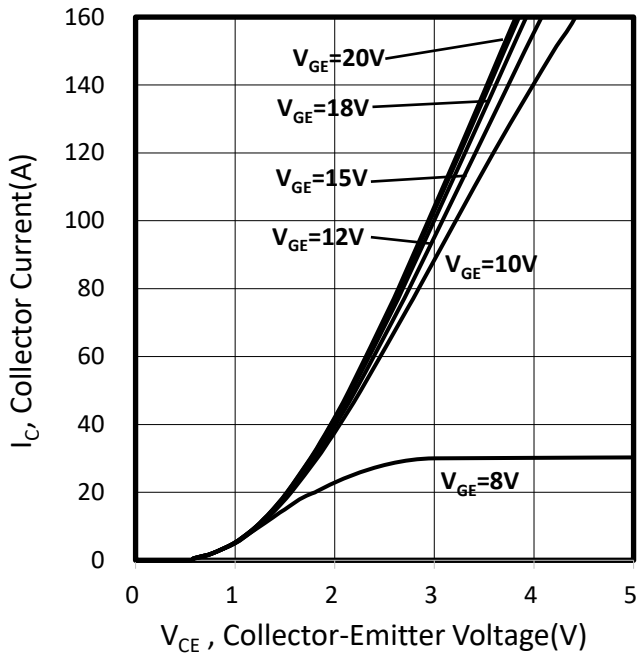


Figure 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

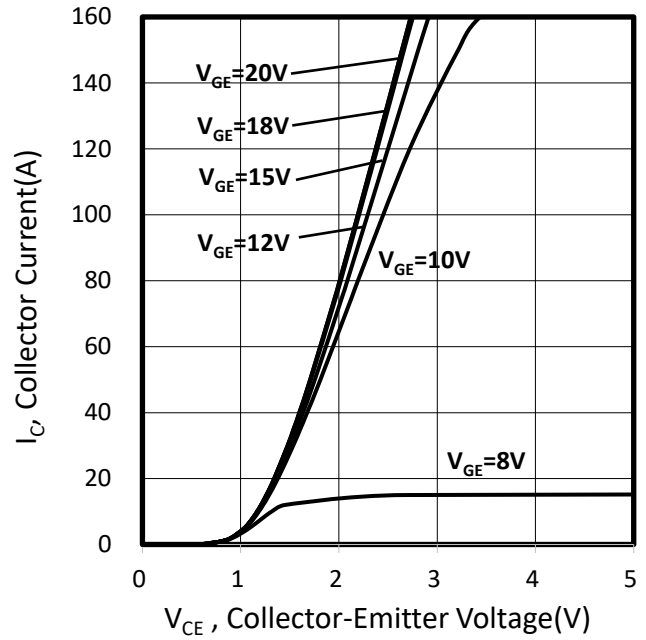


Figure 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

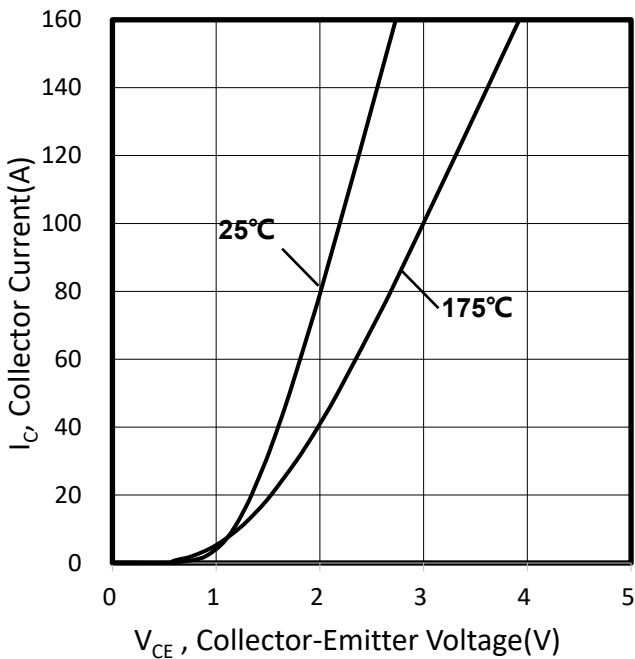


Figure 3. Typical $V_{CE(sat)}-T_j$ characteristic ($V_{GE}=15\text{V}$)

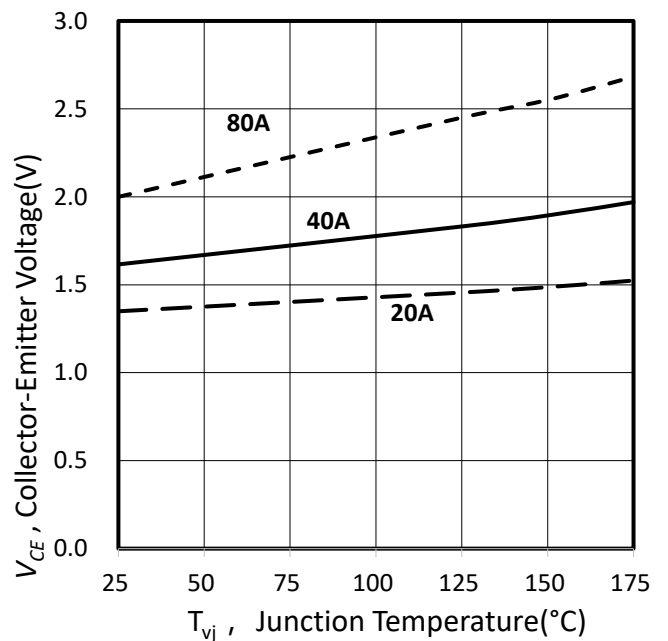


Figure 4. Typical $V_{CE(sat)}-T_j$ characteristic ($V_{GE}=15\text{V}$)

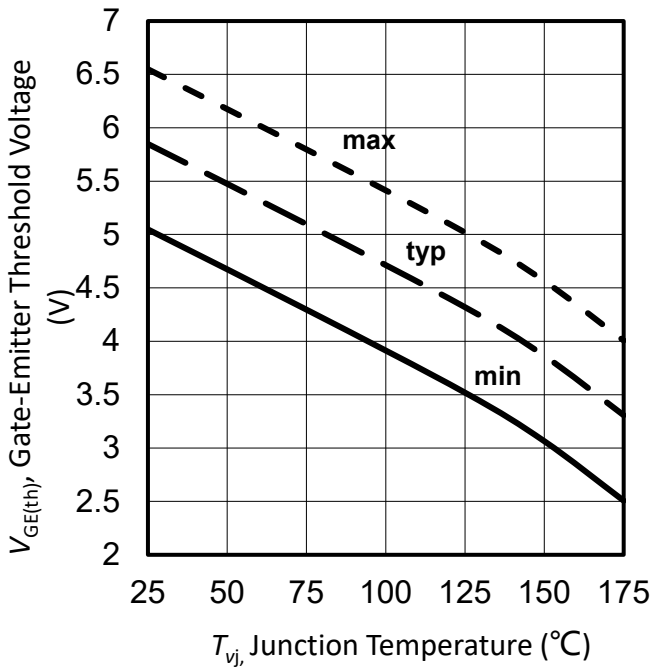


Figure 5. $V_{GE(th)}-T_j$ characteristic ($I_c=1.5mA$)

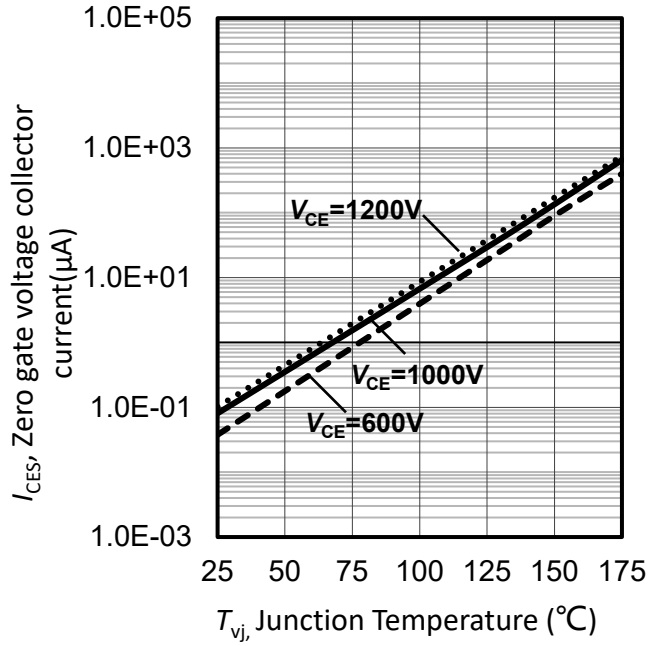


Figure 6. Typical $I_{CES}-T_j$ characteristic ($V_{GE}=0V$)

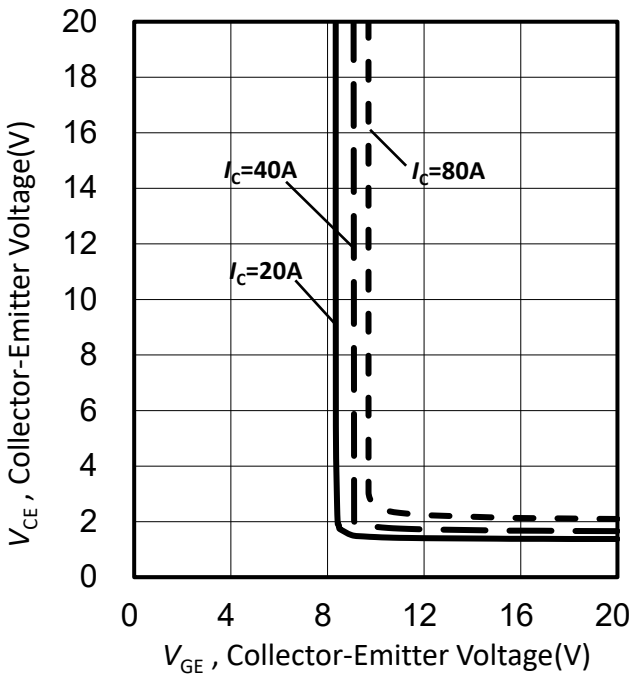


Figure 7. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=25^{\circ}C$)

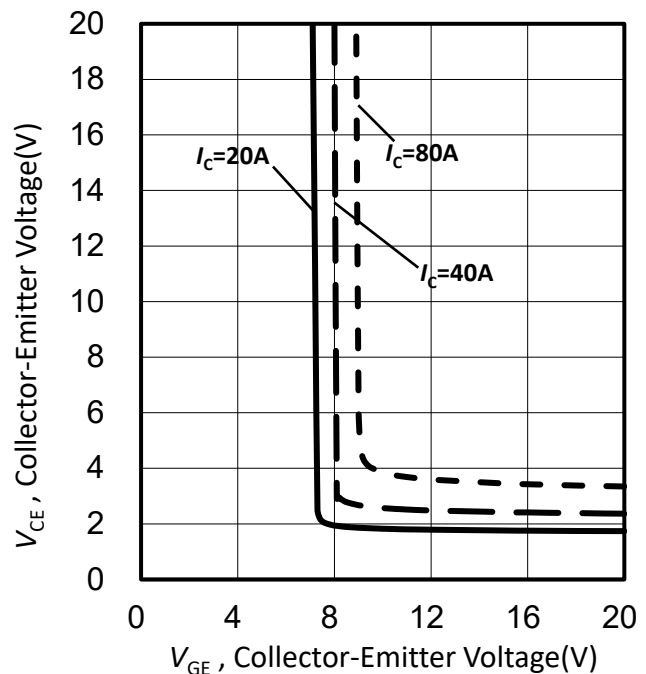


Figure 8. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=175^{\circ}C$)

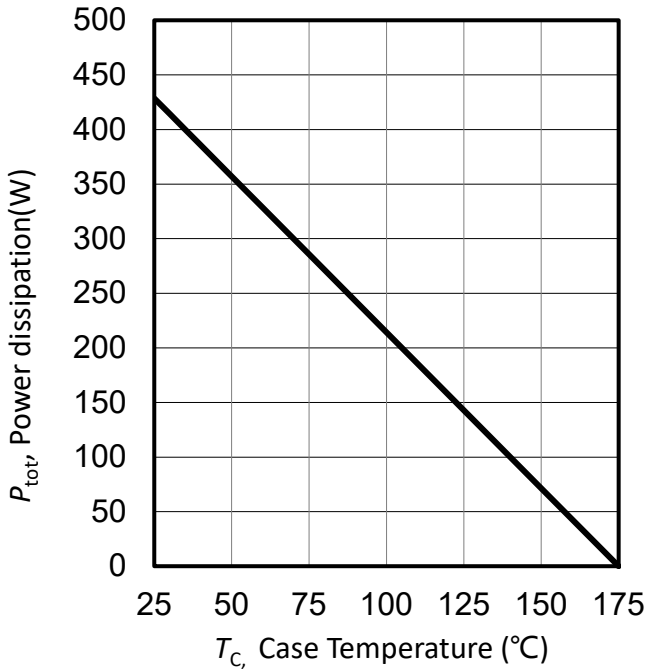


Figure 9. Power dissipation as a function of case temperature ($T_{vj} \leq 175^\circ\text{C}$)

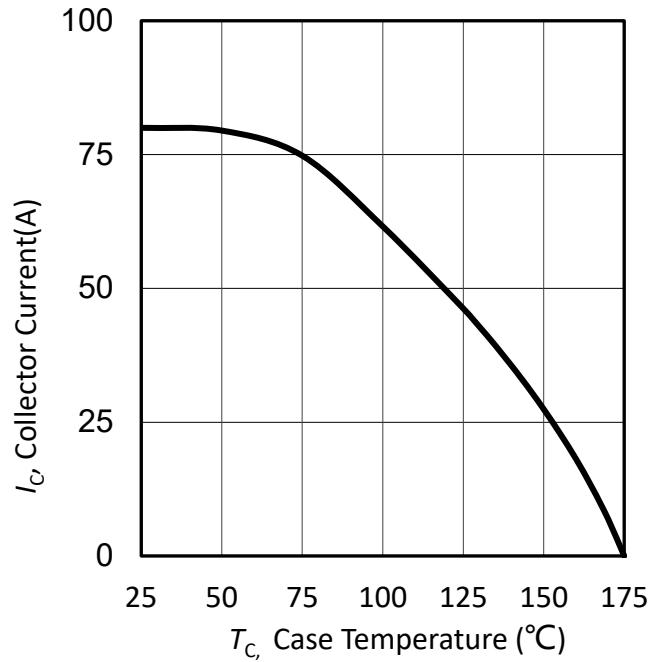


Figure 10. Collector current as a function of case temperature ($T_{vj} \leq 175^\circ\text{C}, V_{GE} \geq 15\text{V}$)

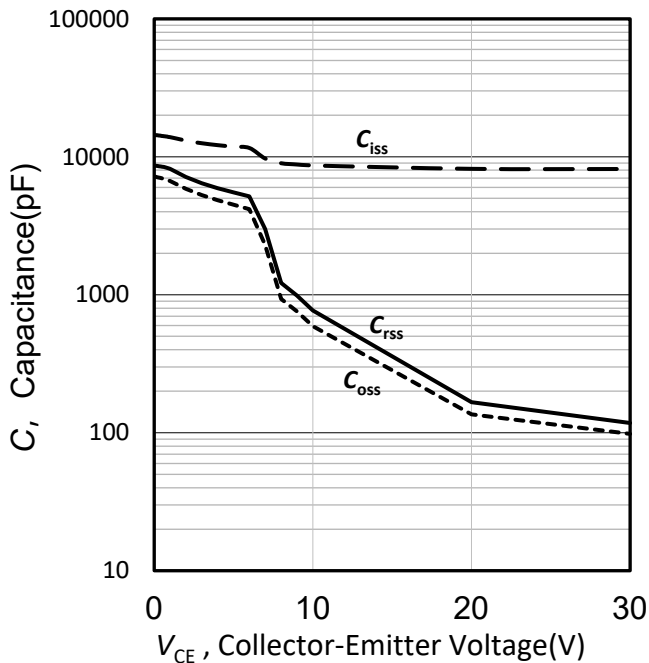


Figure 11. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0\text{V}, f=1\text{MHz}$)

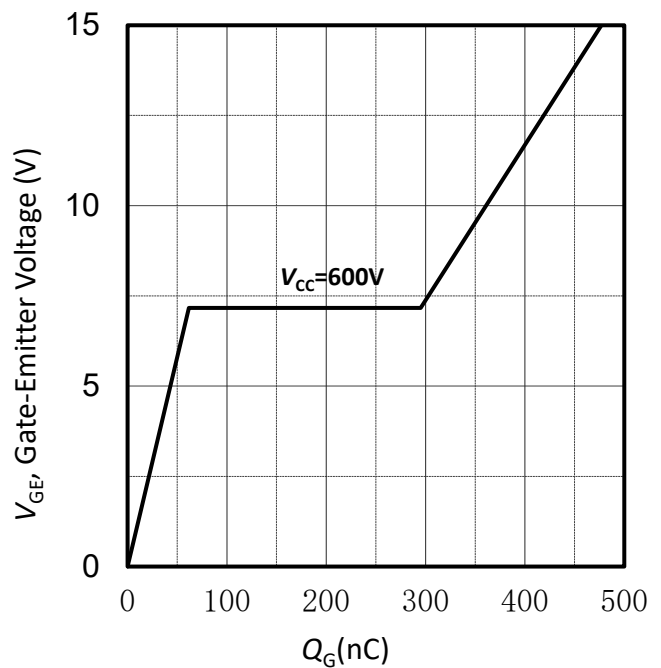


Figure 12. Typical gate charge

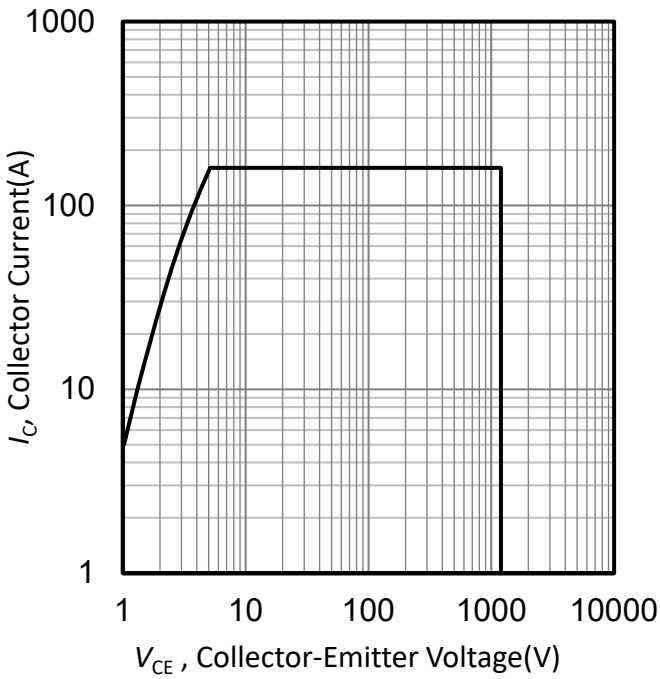


Figure 13. IGBT reverse bias safe operating area ($T_{vj} \leq 175^\circ\text{C}, V_{GE} = 15\text{V}$)

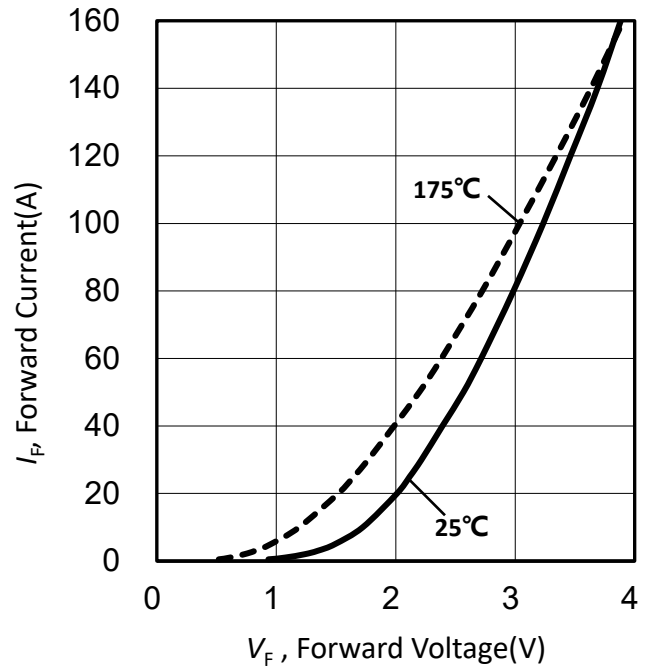


Figure 14. Typical diode forward current as a function of forward voltage

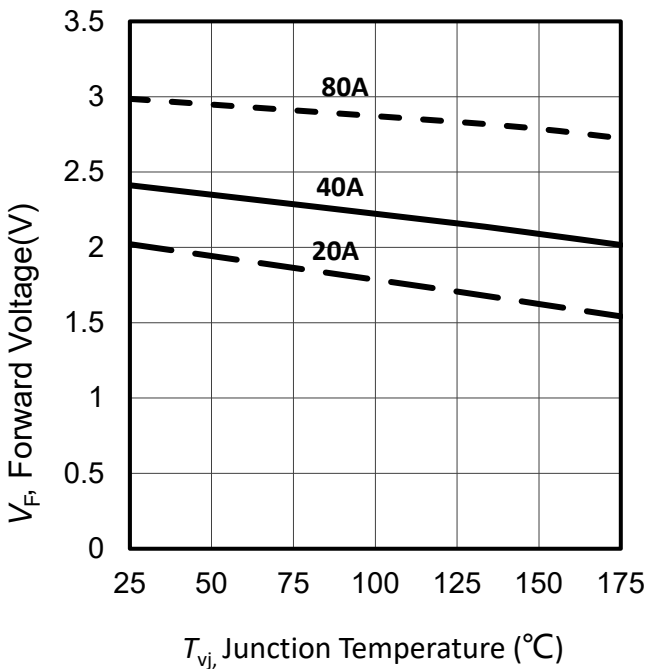


Figure 15. Typical diode forward voltage as a function of junction temperature

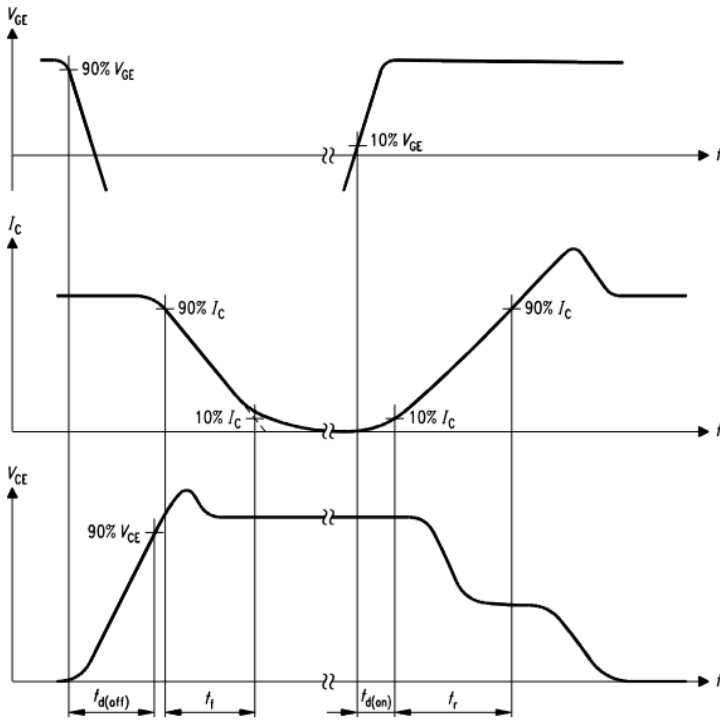


Figure A. Definition of switching times

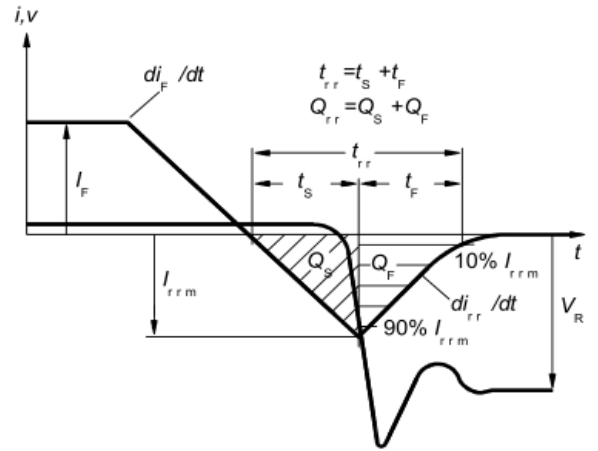


Figure C. Definition of diodes switching characteristics

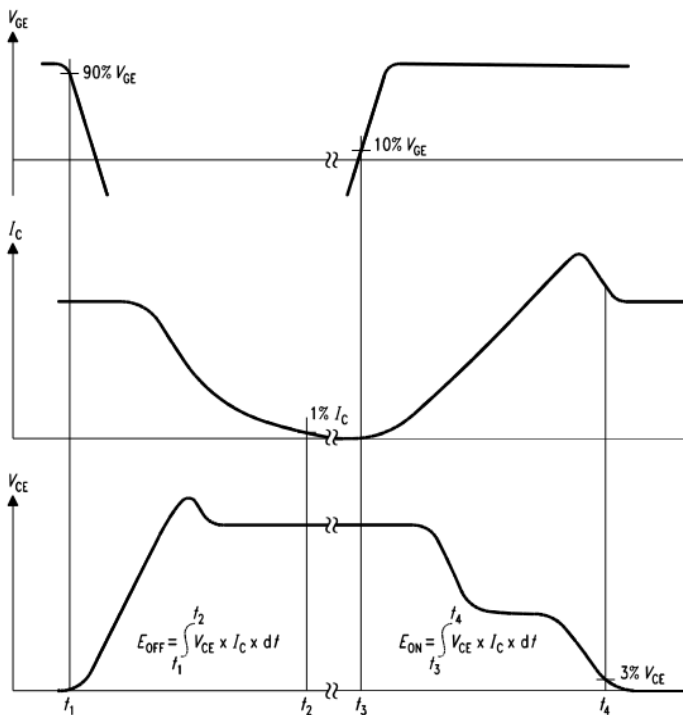


Figure B. Definition of switching losses

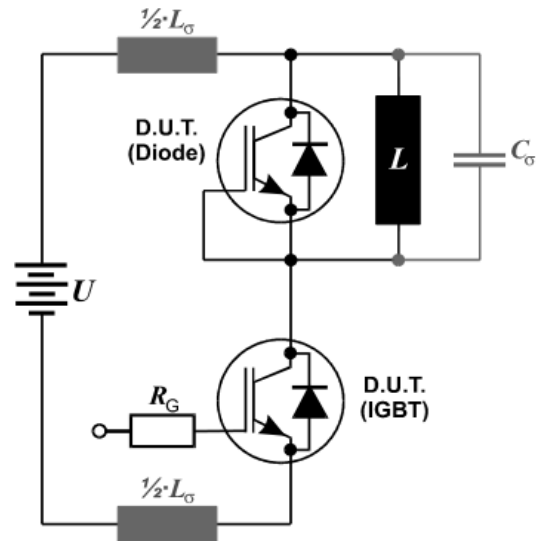
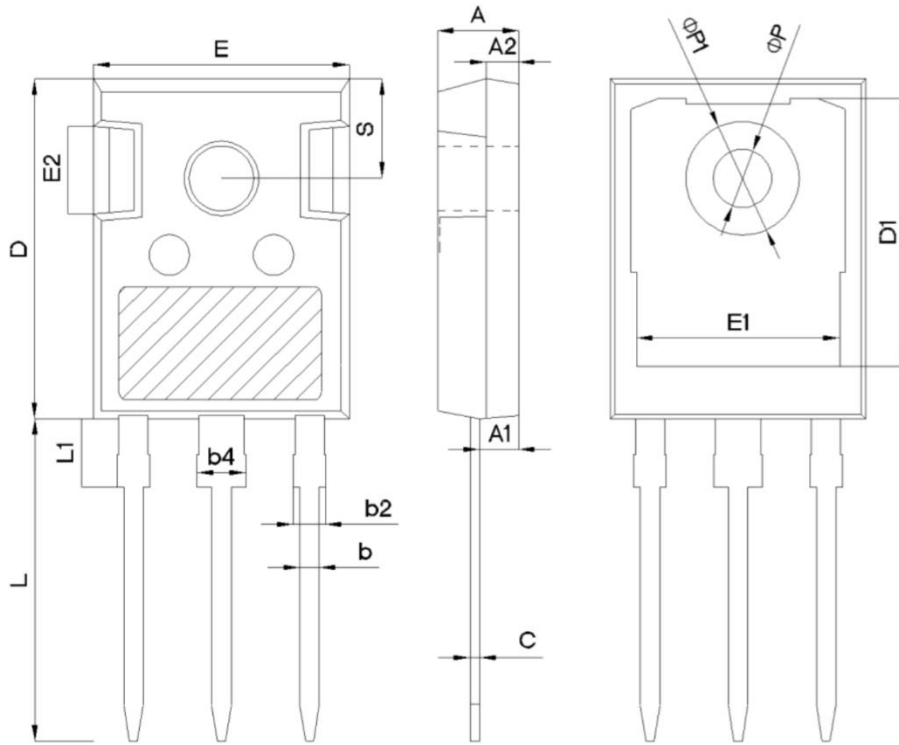


Figure D. Switching test circuit

TO-247-3



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	Subjects (major changes since last revision)	Date
1.0	Initial version	2020.5
1.1	Update characteristics	2022.4
1.2	Update characteristics and charts	2022.6

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