PSI40120BM

1200V 40A Si Trench Gate Field-Stop IGBT

PowerCubeSemi, Inc.
Potential · Convergence · Smart

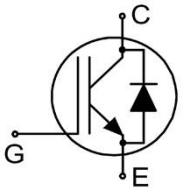
Features

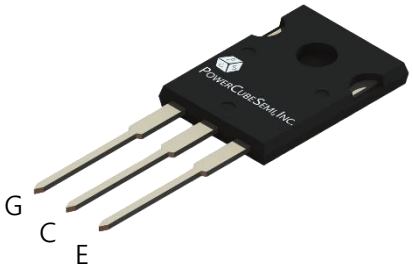
Si Trench Gate Field-Stop IGBT

- Rated to 1200V at 40Amps @T_J = 100℃
- High Speed Switching & Low Power Loss
- VCE(sat)=2.0V @ I_C=40A
- High Input Impedance
- Ultra Soft, Fast Recovery anti-parallel diode
- Ultra narrowed VF distribution control
- Positive Temperature coefficient for east paralleling

Application

- PFC
- UPS
- Inverter





PKG type : TO-247

Description

PSI40120BM is Produced using advanced PowerCubeSemi's Field-Stop Trench IGBT Technology, which provides low $V_{CE(SAT)}$, high switching performance and excellent quality.

Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
BV_{CES}	Collector-Emitter Breakdown Voltage		1200	V
I_C	DC Collector Current	T_C=25℃	80	A
		T_C=100℃	40	
$I_{C, Pulse}$	Pulsed Collector Current		160	A
I_F	Diode Forward Current	T_C=100℃	40	A
$I_{F, Pulse}$	Diode Pulsed Current		160	A
V_{GE}	Gate-Emitter Voltage		±20	V
P_D	Power Dissipation	T_C=25℃	357	W
		T_C=100℃	142	
t_{SC}	Short Circuit Withstand Time		10	μs
T_{vj}	Operating Junction Temperature Range		-55 to 150	℃
T_{stg}	Storage Temperature Range		-55 to 150	

Package Marking and Ordering Information

Device Marking	Device	Package	Packing Method	Tape width	Quantity
PSI40120BM	PSI40120	TO-247	Tube	-	30

Electrical Characteristics

T_{vj}=25℃ Unless Otherwise Specified

Static Characteristics

Symbol	Parameter	Test Condition		Numerical			Unit
				Min	Typ	Max	
BV_{CES}	Collector-Emitter Breakdown Voltage	I_C=1mA, V_{GE}=0V		1200	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A, V_{GE}=15V	T_{vj}=25℃	-	2.0	2.4	V
			T_{vj}=150℃	-	2.45	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_F=40A	T_{vj}=25℃	-	2.4	3.0	V
			T_{vj}=150℃	-	2.45	-	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	V_{CE}=V_{GE}, I_C=1mA		4.5	5.5	6.5	V
I_{CES}	Zero Gate Voltage Collector Current	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25℃		-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=20V, V_{CE}=0V		-	-	±250	nA

Dynamic Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ	Max	
Q_G	Total Gate Charge	V_{CE}=600V, I_C=40A, V_{GE}=15V	-	341	-	nC
Q_{GE}	Gate-Emitter Charge		-	52	-	
Q_{GC}	Gate-Collector Charge		-	126	-	
C_{IES}	Input Capacitance	V_{CE}=30V, V_{GE}=0V, f=1MHz	-	6030	-	pF
C_{OES}	Output Capacitance		-	107	-	
C_{RES}	Reverse Transfer Capacitance		-	206	-	

Electrical Characteristics

T_{vj}=25℃ Unless Otherwise Specified

Switching Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ	Max	
$t_{d(on)}$	Turn-On Delay Time	V_{GE}=15V, V_{CC}=600V, I_C=40A, R_G=10Ω, Inductive Load, T_{vj}=25℃	-	65	-	ns
t_r	Turn-On Rise Time		-	55	-	
$t_{d(off)}$	Turn-Off Delay Time		-	308	-	
t_f	Turn-Off Fall Time		-	40	-	
E_{on}	Turn-On Switching Energy		-	1.96	-	mJ
E_{off}	Turn-Off Switching Energy		-	0.54	-	
E_{ts}	Total Switching Energy		-	2.50	-	
$t_{d(on)}$	Turn-On Delay Time	V_{GE}=15V, V_{CC}=600V, I_C=40A, R_G=10Ω, Inductive Load, T_{vj}=150℃	-	70	-	ns
T_r	Turn-On Rise Time		-	62	-	
$t_{d(off)}$	Turn-Off Delay Time		-	325	-	
t_f	Turn-Off Fall Time		-	62	-	
E_{on}	Turn-On Switching Energy		-	2.35	-	mJ
E_{off}	Turn-Off Switching Energy		-	1.61	-	
E_{ts}	Total Switching Energy		-	3.96	-	
t_{rr}	Reverse Recovery Time	I_F=40A, dI_F/dt=200A/μs, T_{vj}=25℃	-	100	-	ns
I_{rr}	Reverse Recovery Current		-	7	-	A
Q_{rr}	Reverse Recovery Charge		-	350	-	nC
t_{rr}	Reverse Recovery Time	I_F=40A, dI_F/dt=200A/μs, T_{vj}=150℃	-	180	-	ns
I_{rr}	Reverse Recovery Current		-	10	-	A
Q_{rr}	Reverse Recovery Charge		-	900	-	nC

Thermal Characteristics

Symbol	Parameter	Numerical	Unit
$R_{\theta(J-A)}$	Thermal Resistance Junction-to-Ambient	40	℃/W
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for IGBT	0.35	
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for Diode	0.8	

Typical Characteristics

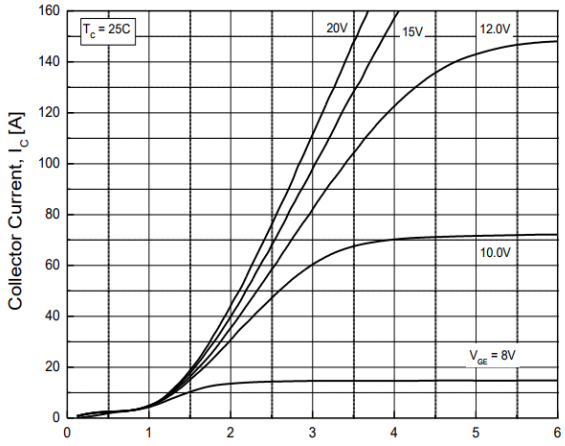


Figure 1. Typical Output Characteristics

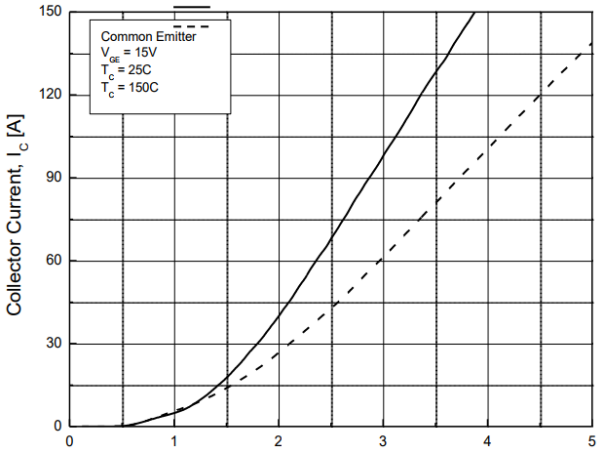


Figure 2. Typical Collector-Emitter Saturation Voltage

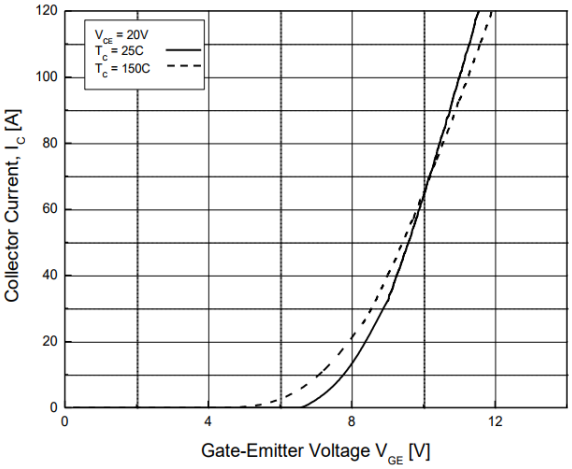


Figure 3. Typical Transfer Characteristics

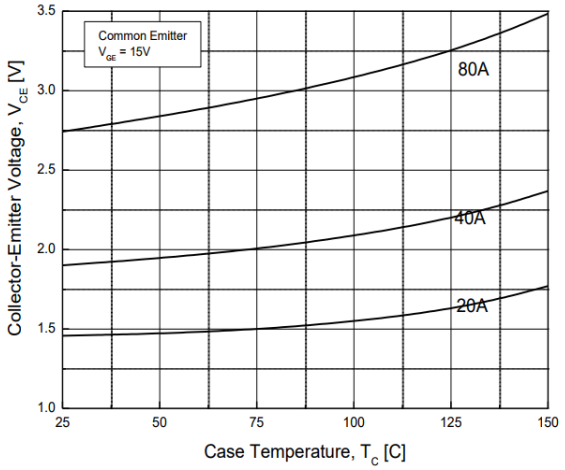


Figure 4. Typical Collector-Emitter Saturation Voltage at Case Temperature

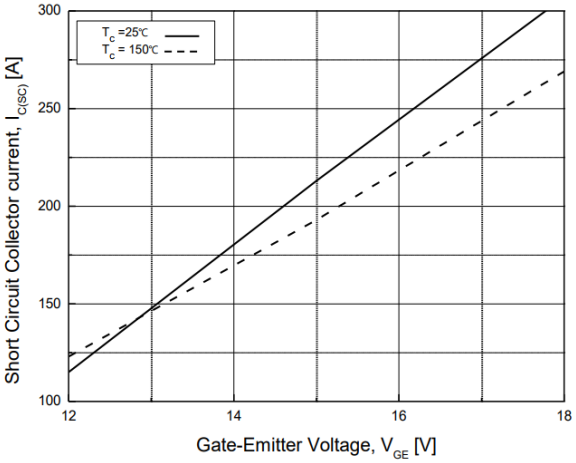


Figure 5. Typical Short Circuit Collector Current

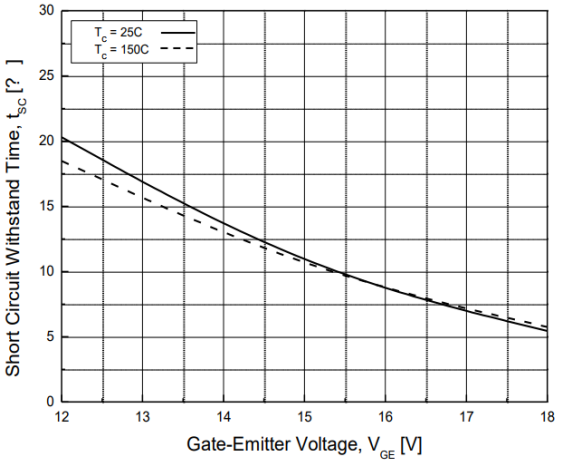


Figure 6. Typical Short Circuit Withstand Time

Typical Characteristics

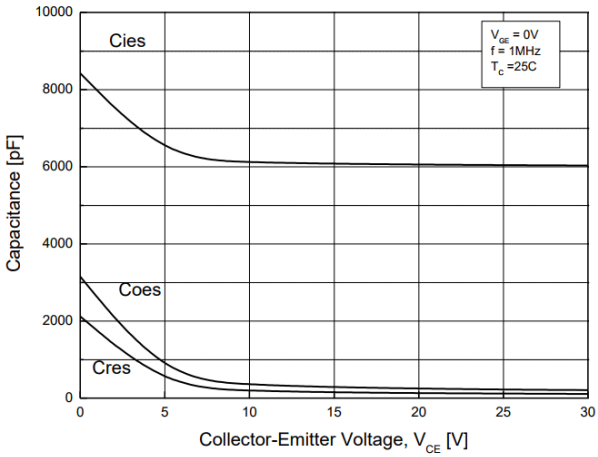


Figure 7. Typical Capacitance

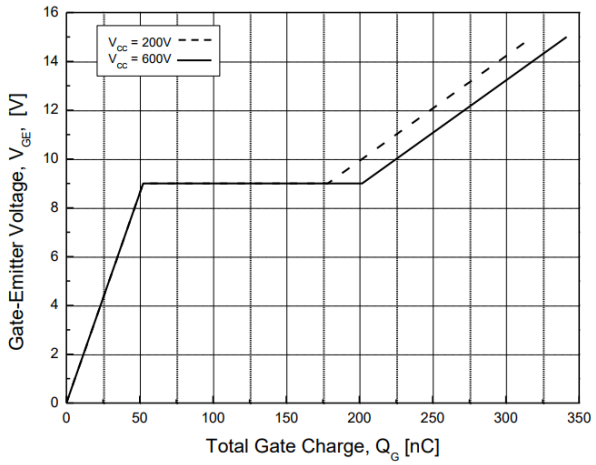


Figure 8. Typical Gate Charge

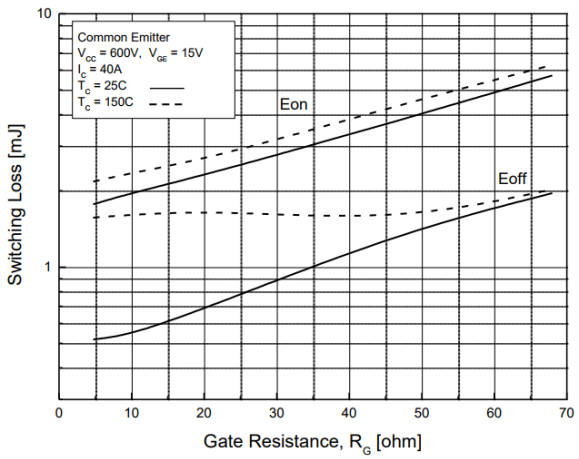


Figure 9. Switching Loss-Gate Resistance

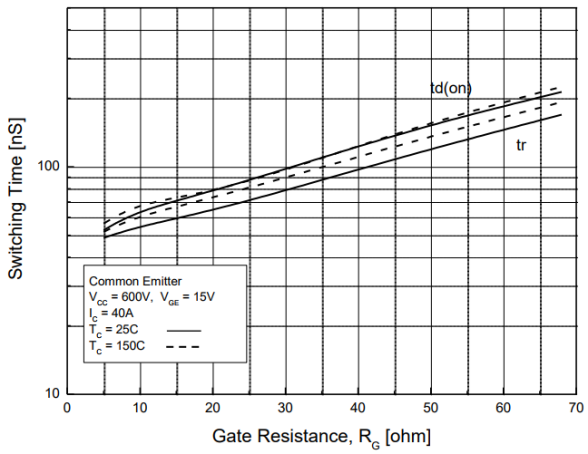


Figure 10. Turn on Characteristics-Gate Resistance

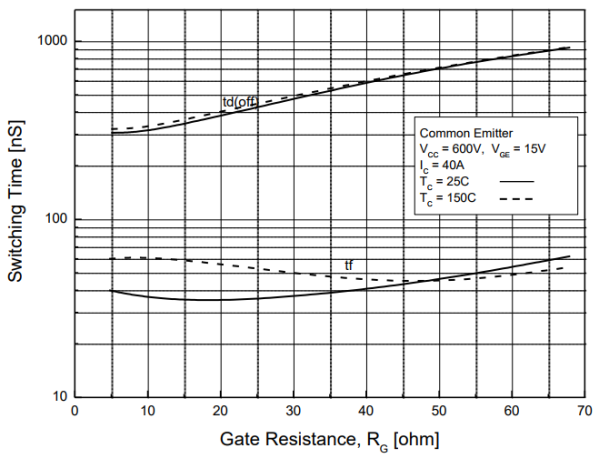


Figure 11. Turn off Characteristics-Gate Resistance

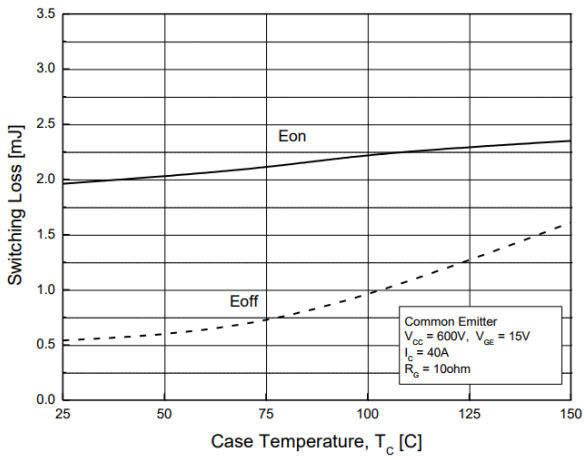


Figure 12. Switching Loss-Case Temperature

Typical Characteristics

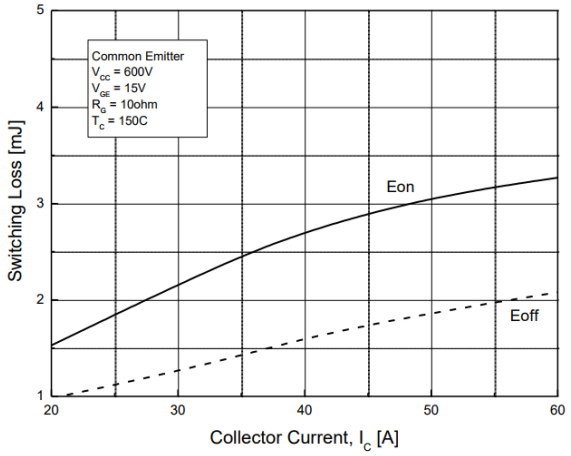


Figure 13. Switching Loss-Collector Current

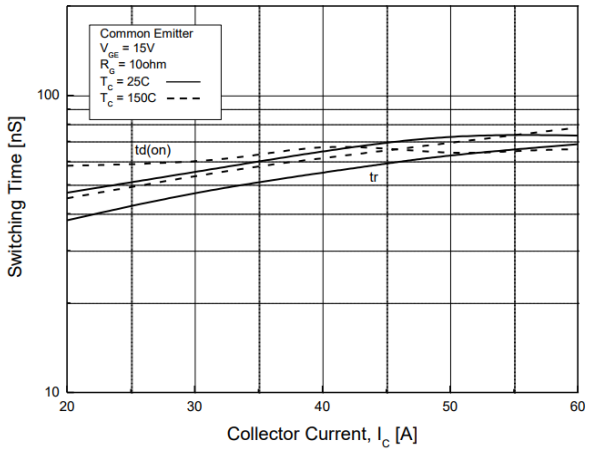


Figure 14. Typical Turn on-Collector Current

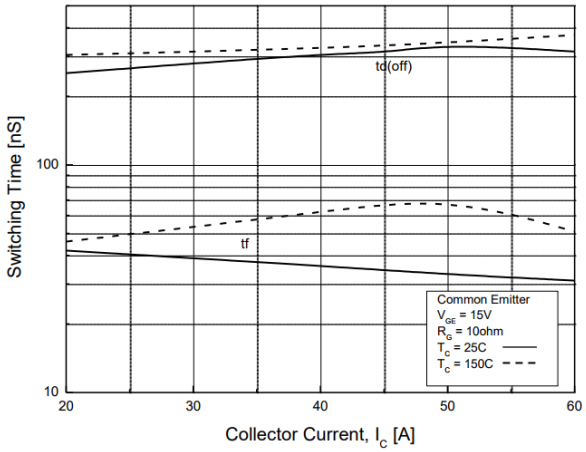


Figure 15. Typical Turn off-Collector Current

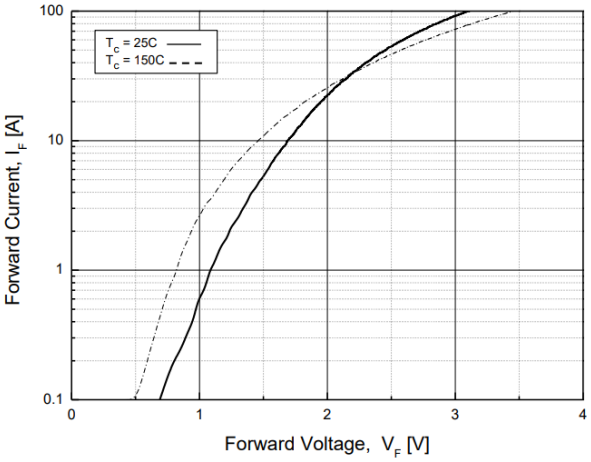


Figure 16. Diode Forward Characteristics

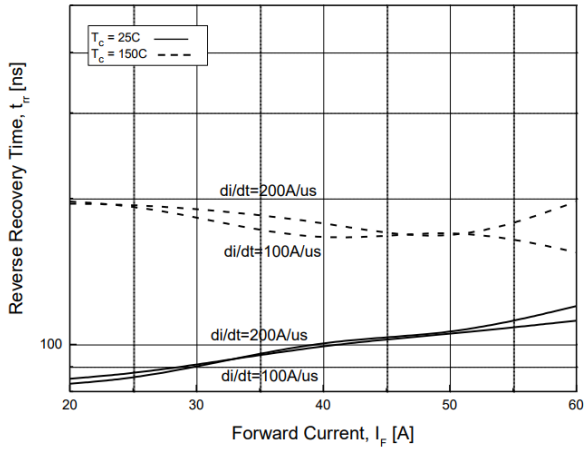


Figure 17. typical Turn off-Collector Current

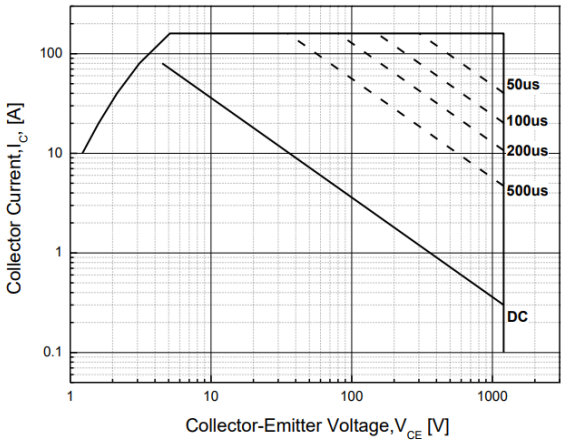


Figure 18. Forward Bias Safe Operating Area

Typical Characteristics

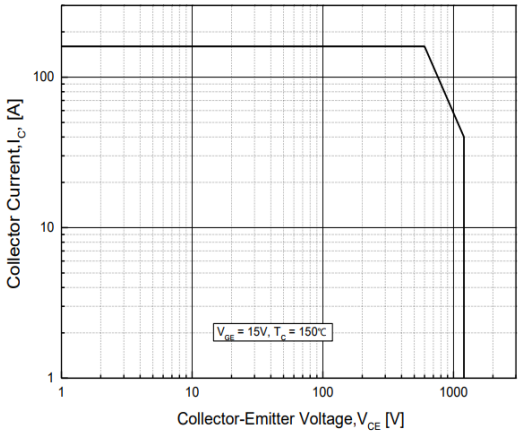


Figure 19. Forward Bias Safe Operating Area

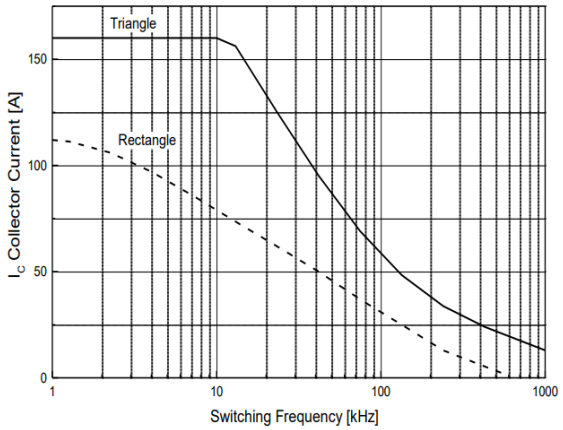


Figure 20. Switching frequency-Collector Current

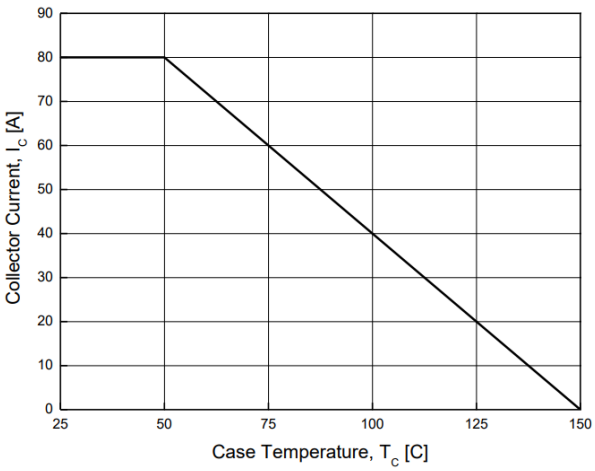


Figure 21. Case Temperature-Collector Current

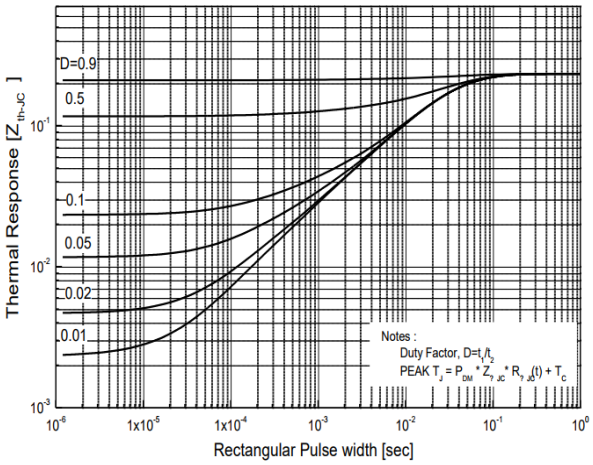
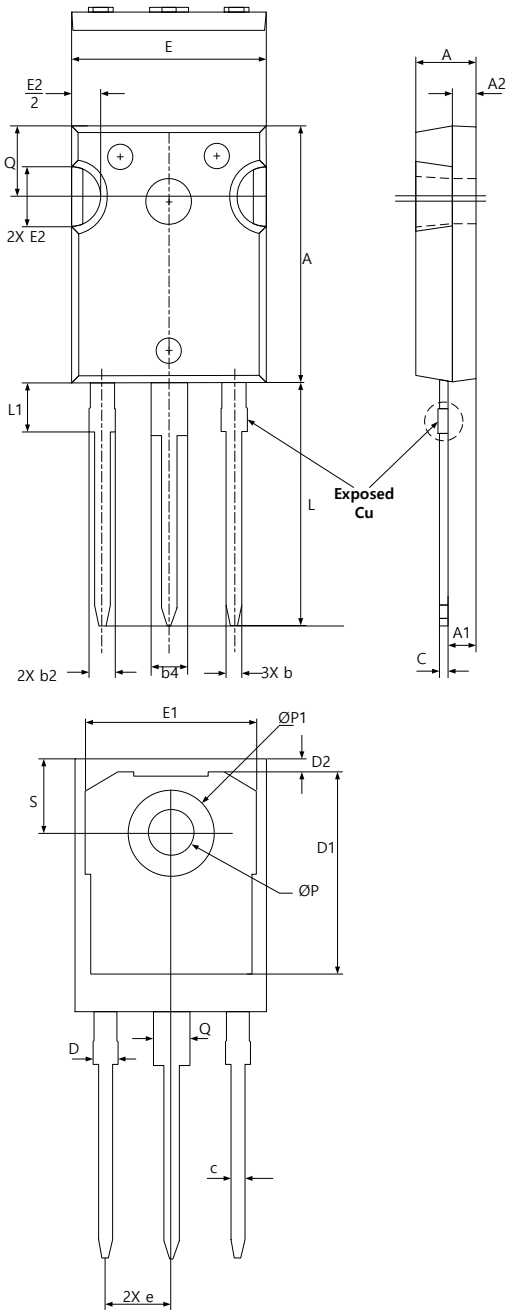


Figure 22. IGBT Transient Thermal Impedance

Package Outline

Unit : mm



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	6.00	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	5.44 BSC			
L	19.81	20.07	20.32	
L1	4.10	4.19	4.40	6
ϕP	3.56	3.61	3.65	7
ϕP1	7.19 REF			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	