

PSI50065BM

650V 50A Si Trench Gate Field-Stop IGBT

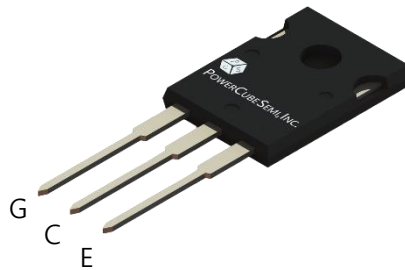
Features

Si Trench Gate Field-Stop IGBT

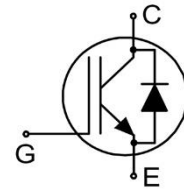
- Rated to 650V at 50Amps @ $T_j = 100^\circ\text{C}$
- $V_{CE(sat)} = 1.8\text{V}$ @ $I_C = 50\text{A}$
- $E_{off} = 0.55\text{mJ}$ @ $T_C = 25^\circ\text{C}$
- High Input Impedance
- $T_{rr} = 80\text{ns}$ (Typ.) @ $di_F/dt = 1000\text{A}/\mu\text{s}$
- Maximum Junction Temperature 175°C

Application

- PFC
- Welder
- UPS
- PV Inverter
- IH Cooker



PKG type : TO-247



Description

PSI50065BM is Produced using advanced PowerCubeSemi's Field-Stop Trench IGBT Technology, which provides high Switching Speed and Excellent quality.

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit	
BV_{CES}	Collector-Emitter Breakdown Voltage	650	V	
I_C	DC Collector Current	$T_C = 25^\circ\text{C}$	100	A
		$T_C = 100^\circ\text{C}$	50	
$I_{C, Pulse}$	Pulsed Collector Current	200	A	
I_F	Diode Forward Current	$T_C = 25^\circ\text{C}$	60	A
		$T_C = 100^\circ\text{C}$	30	
$I_{F, Pulse}$	Diode Pulsed Current	200	A	
V_{GE}	Gate-Emitter Voltage	± 20	V	
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	375	W
		$T_C = 100^\circ\text{C}$	188	
t_{SC}	Short circuit withstand time	5	μs	
T_{vj}	Operating Junction Temperature Range	-40 to 175	$^\circ\text{C}$	
T_{stg}	Storage Temperature Range	-55 to 150		



Package Marking and Ordering Information

Device Marking	Device	Package	Packing Method	Tape width	Quantity
PSI50065BM	PSI50065	TO-247	Tube	-	30

Electrical Characteristics

 $T_{vj}=25^{\circ}\text{C}$ Unless Otherwise Specified

Static Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit	
			Min	Typ	Max		
BV_{CES}	Collector-Emitter Breakdown Voltage	$I_C=2\text{mA}$, $V_{GE}=0\text{V}$	650	-	-	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=50\text{A}$, $V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$	-	1.85	2.4	V
			$T_{vj}=175^{\circ}\text{C}$	-	2.2	-	
V_F	Diode Forward Voltage	$V_{GE}=0\text{V}$, $I_F=30\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.05	V
			$T_{vj}=175^{\circ}\text{C}$	-	1.55	-	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$V_{CE}=V_{GE}$, $I_C=0.5\text{mA}$	3.8	5.0	6.2	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=650\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$	-	-	40	μA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}$, $V_{CE}=0\text{V}$	-	-	± 100	nA	

Dynamic Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ	Max	
Q_G	Total Gate Charge	$V_{CE}=520\text{V}$, $I_C=50\text{A}$, $V_{GE}=15\text{V}$	-	287	-	nC
Q_{GE}	Gate-Emitter Charge		-	42	-	
Q_{GC}	Gate-Collector Charge		-	181	-	
C_{IES}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$	-	4453	-	pF
C_{OES}	Output Capacitance		-	238	-	
C_{RES}	Reverse Transfer Capacitance		-	161	-	
LE	Internal Emitter Inductance measured 5mm (0.197 in.) from Case		-	13.0	-	nH
$I_{C(SC)}$	Short Circuit Collector Current Max. 1000 Short Circuits Time between Short Circuits : $\geq 1.0\text{s}$	$V_{GE}=15\text{V}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $R_G=7.9\Omega$, Inductive Load, $T_{vj}=25^{\circ}\text{C}$	-	140	-	A

Electrical Characteristics

$T_{vj}=25^{\circ}\text{C}$ Unless Otherwise Specified

Switching Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ	Max	
$t_{d(on)}$	Turn-On Delay Time	$V_{GE}=15\text{V}, V_{CC}=400\text{V},$ $I_C=50\text{A}, R_G=7.9\Omega,$ Inductive Load, $T_{vj}=25^{\circ}\text{C}$	-	58	-	ns
t_r	Turn-On Rise Time		-	60	-	
$t_{d(off)}$	Turn-Off Delay Time		-	328	-	
t_f	Turn-Off Fall Time		-	44	-	
E_{on}	Turn-On Switching Energy		-	0.77	-	mJ
E_{off}	Turn-Off Switching Energy		-	0.55	-	
E_{ts}	Total Switching Energy	-	1.32	-		
$t_{d(on)}$	Turn-On Delay Time	$V_{GE}=15\text{V}, V_{CC}=400\text{V},$ $I_C=50\text{A}, R_G=7.9\Omega,$ Inductive Load, $T_{vj}=175^{\circ}\text{C}$	-	51	-	ns
T_r	Turn-On Rise Time		-	66	-	
$t_{d(off)}$	Turn-Off Delay Time		-	350	-	
t_f	Turn-Off Fall Time		-	49	-	
E_{on}	Turn-On Switching Energy		-	1.05	-	mJ
E_{off}	Turn-Off Switching Energy		-	0.55	-	
E_{ts}	Total Switching Energy	-	1.6	-		
t_{rr}	Reverse Recovery Time	$I_F=30\text{A}, dI_F/dt=1000\text{A}/\mu\text{s},$ $T_{vj}=25^{\circ}\text{C}$	-	80	-	ns
I_{rr}	Reverse Recovery Current		-	24	-	A
Q_{rr}	Reverse Recovery Charge		-	0.95	-	nC
t_{rr}	Reverse Recovery Time	$I_F=30\text{A}, dI_F/dt=1000\text{A}/\mu\text{s},$ $T_{vj}=175^{\circ}\text{C}$	-	116	-	ns
I_{rr}	Reverse Recovery Current		-	34	-	A
Q_{rr}	Reverse Recovery Charge		-	1.97	-	nC

Thermal Characteristics

Symbol	Parameter	Numerical	Unit
$R_{\theta(J-A)}$	Thermal Resistance Junction-to-Ambient	40	$^{\circ}\text{C}/\text{W}$
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for IGBT	0.4	
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for Diode	1.2	

Typical Characteristics

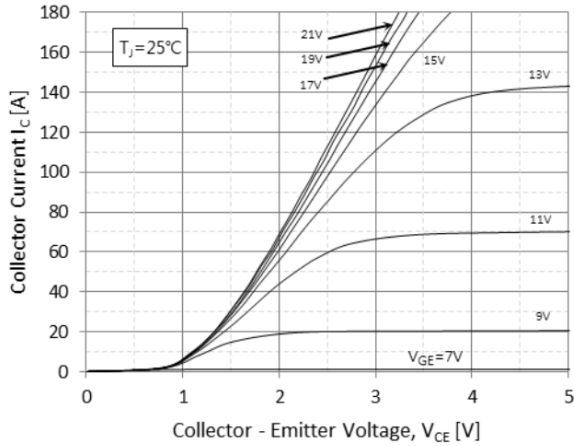


Figure 1. Output Characteristics ($T_j=25^\circ\text{C}$)

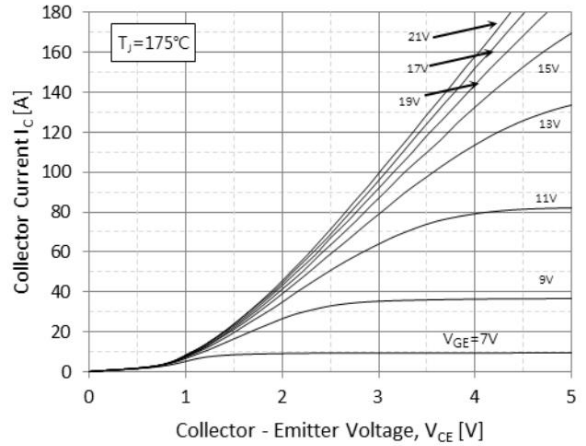


Figure 2. Output Characteristics ($T_j=175^\circ\text{C}$)

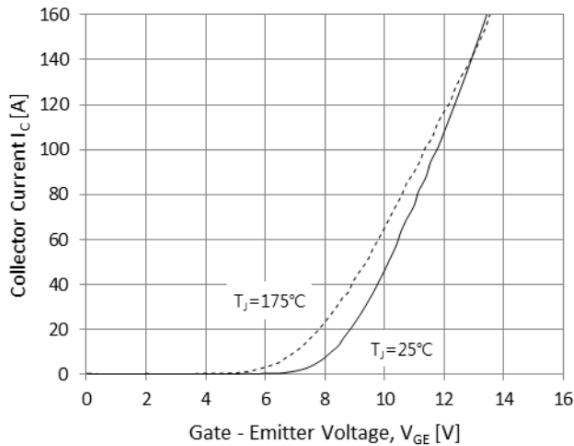


Figure 3. Typical Transfer Characteristics

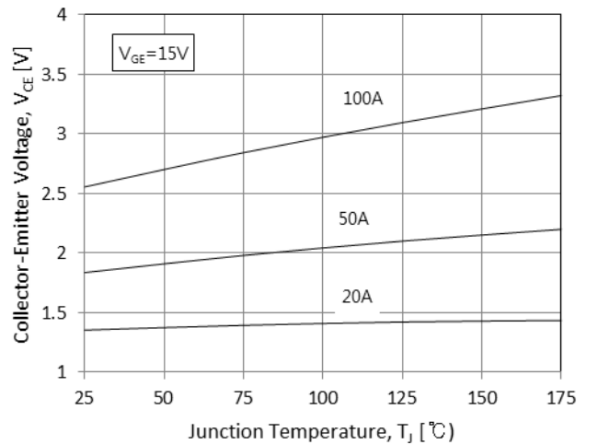


Figure 4. Typical Collector-Emitter Saturation Voltage-Junction Temperature

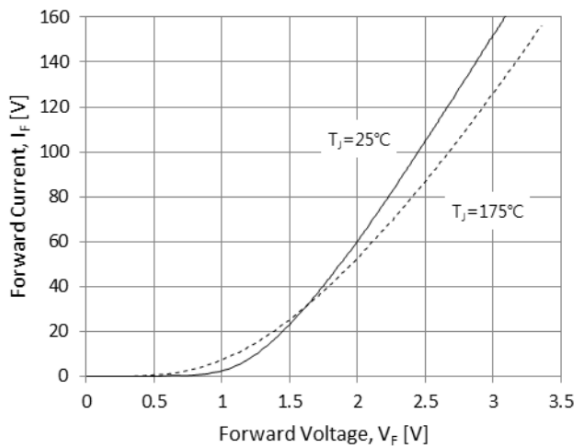


Figure 5. Diode Forward Characteristics

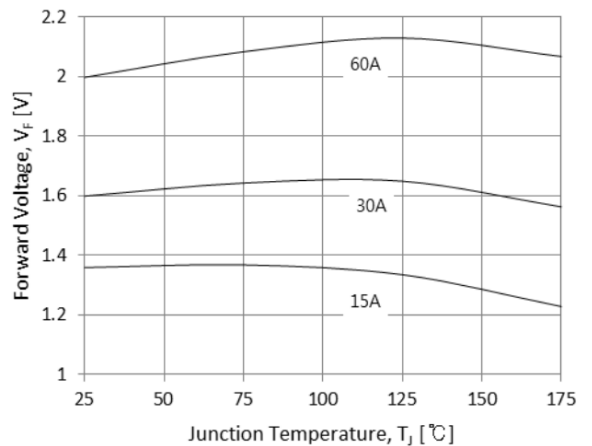


Figure 6. Diode Forward-Junction Temperature

Typical Characteristics

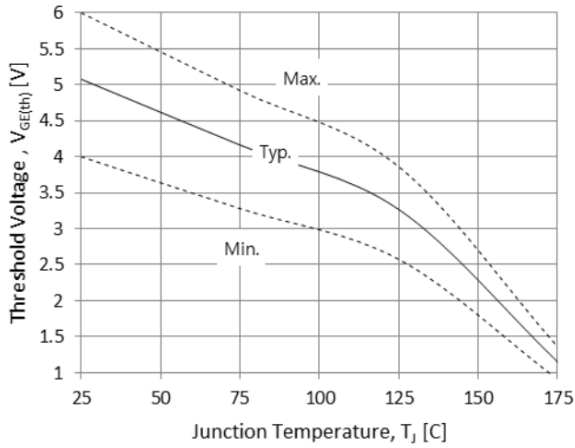


Figure 7. Threshold Voltage-Junction Temperature

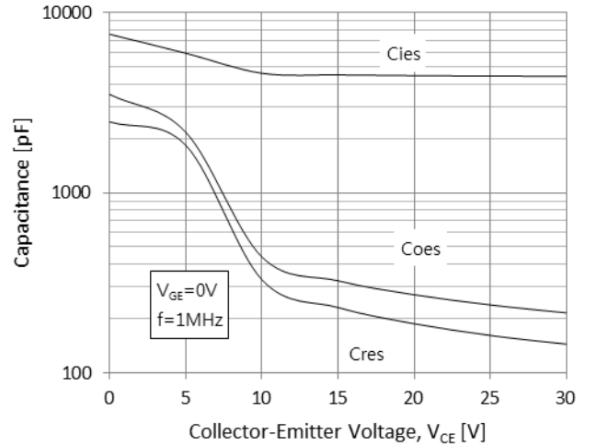


Figure 8. Typical Capacitance

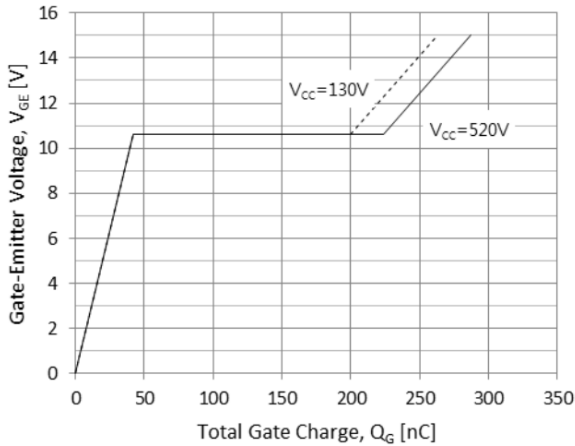


Figure 9. Typical Gate Charge

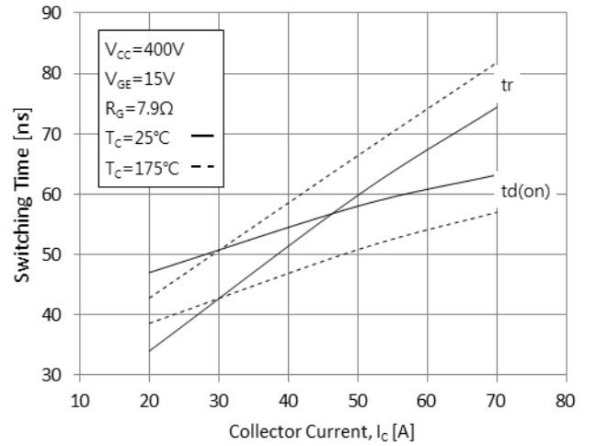


Figure 10. Typical Turn On-Collector Current

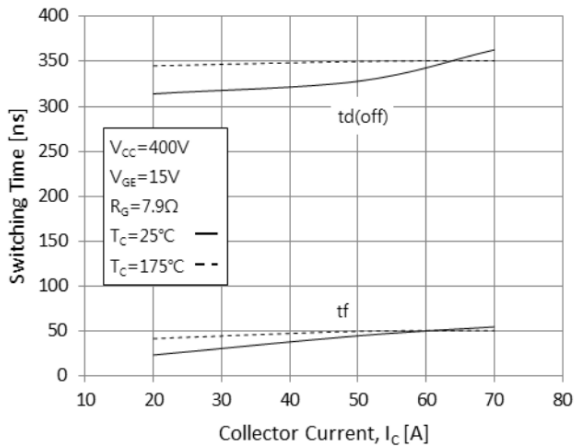


Figure 11. Typical Turn Off-Collector Current

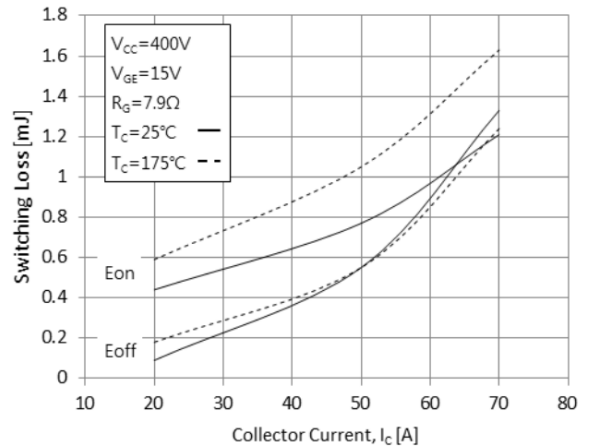


Figure 12. Switching Loss-Collector Current

Typical Characteristics

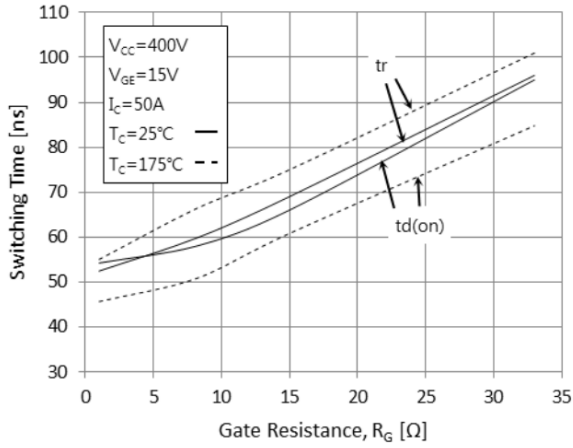


Figure 13. Turn-On Characteristics-Gate Resistance

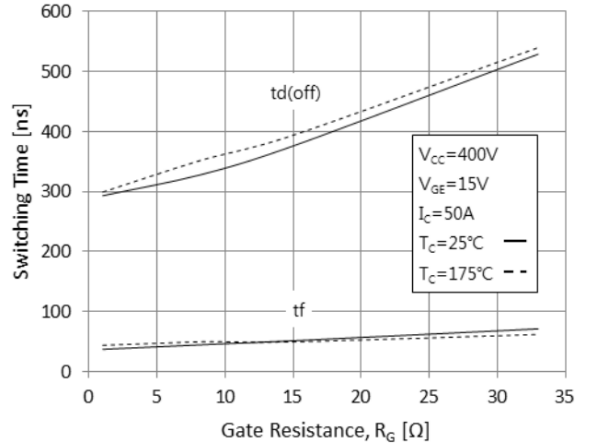


Figure 14. Turn-Off Characteristics-Gate Resistance

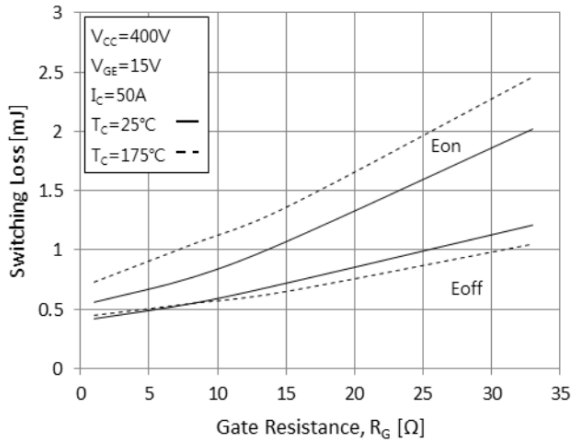


Figure 15. Switching Loss-Gate Resistance

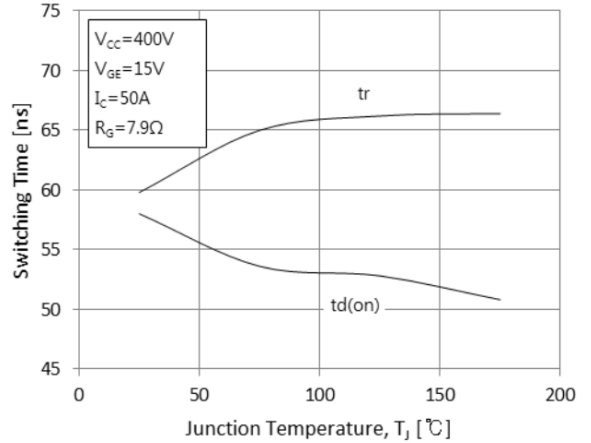


Figure 16. Turn-On Characteristics-Junction Temperature

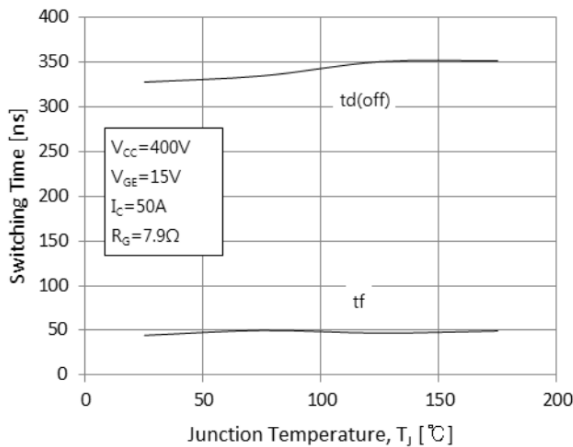


Figure 17. Turn-Off Characteristics-Junction Temperature

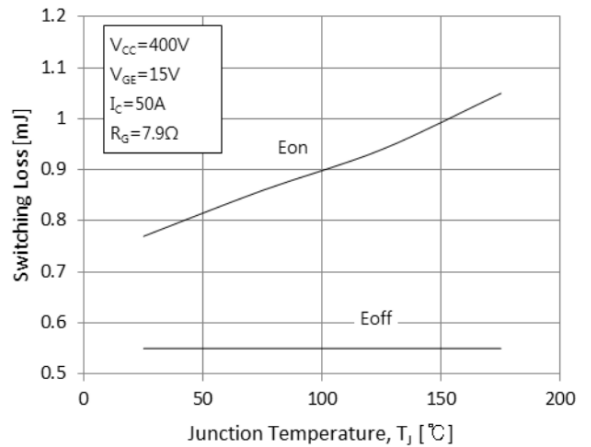


Figure 18. Switching Loss-Junction Temperature

Typical Characteristics

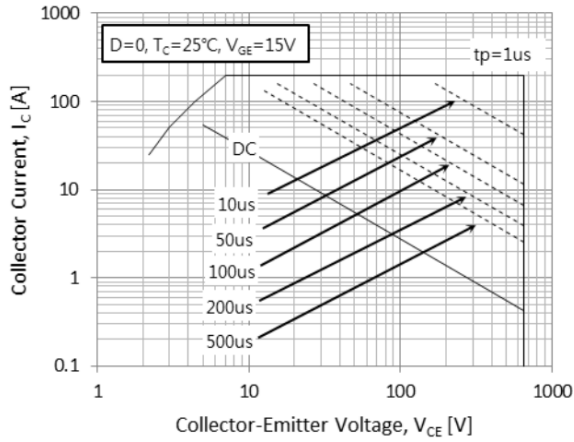


Figure 19. Forward Bias Safe Operating Area

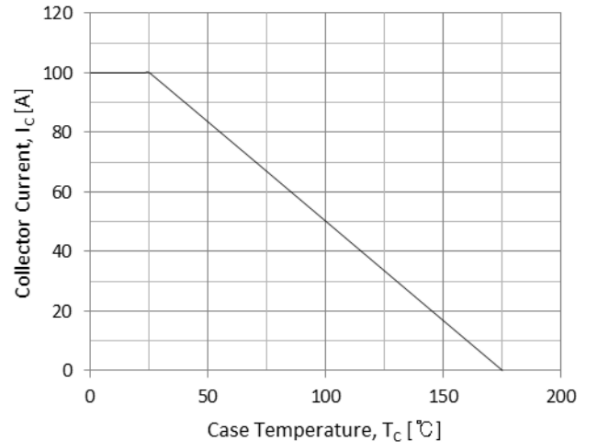


Figure 20. Case Temperature-Collector Current

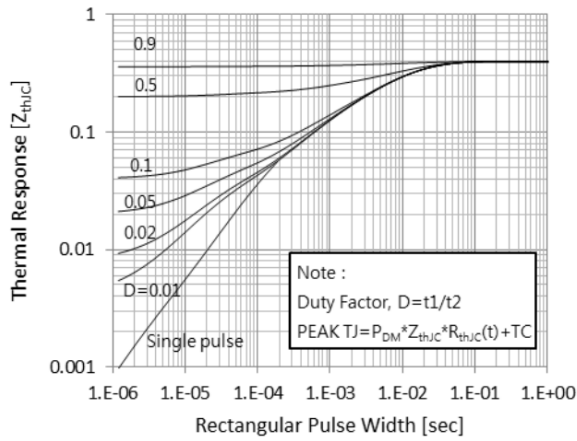


Figure 21. IGBT Transient Thermal Impedance

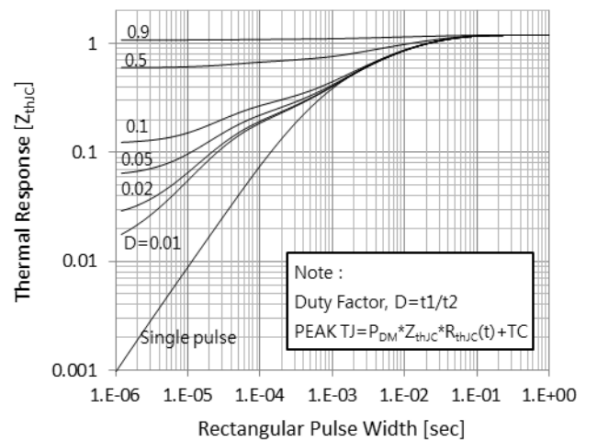
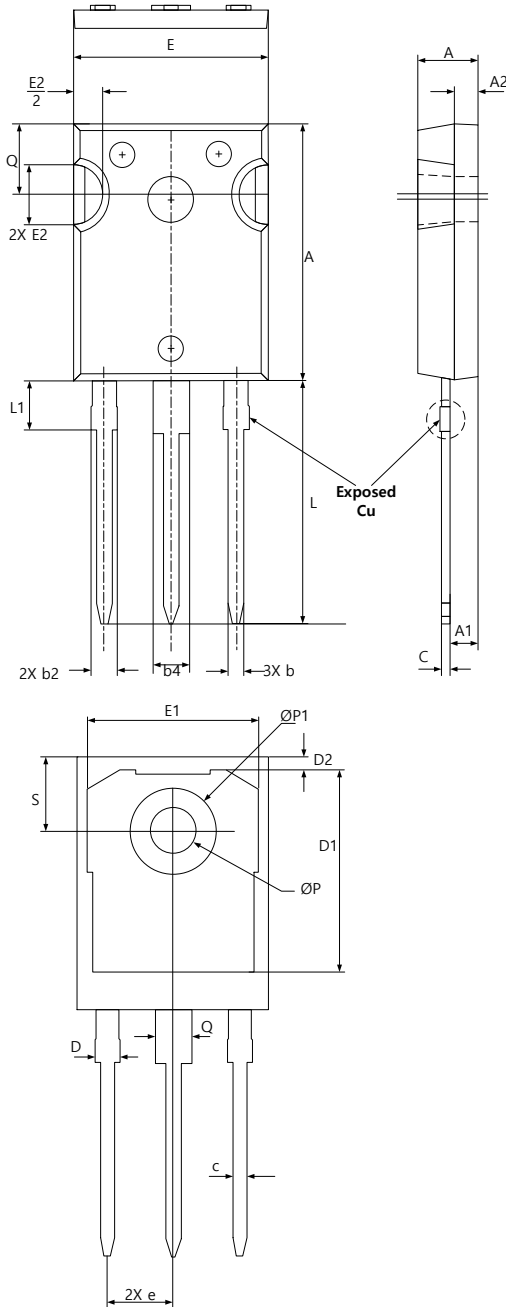


Figure 22. FRD Transient Thermal Impedance

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
$\phi P1$	7.19 REF			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	