

# PSI60065BM



POWERCUBESEMI, INC.

Potential · Convergence · Smart

650V 60A Si Trench Gate Field-Stop IGBT

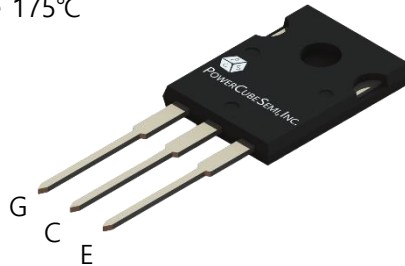
## Features

### Si Trench Gate Field-Stop IGBT

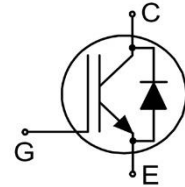
- Rated to 650V at 60Amps @ $T_J = 100^\circ\text{C}$
- High Speed Switching & Low Power Loss
- $V_{CE(sat)}=1.85\text{V}$  @  $I_C=60\text{A}$
- $E_{off}=0.53\text{mJ}$  @  $T_C=25^\circ\text{C}$
- High Input Impedance
- $T_{rr}=110\text{ns}$  (Typ.) @  $di_F/dt=500\text{A/us}$
- Maximum Junction Temperature  $175^\circ\text{C}$

## Application

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



PKG type : TO-247



## Description

PSI60065BM is Produced using advanced PowerCubeSemi's Field-Stop Trench IGBT 2<sup>nd</sup> Generation Technology, which is not only the highest efficiency capable of switching behavior, but also it is high ruggedness and excellent quality for solar inverter, UPS, IH, welder and PFC application where low conduction losses are essential.

## 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
		$T_C=100^\circ\text{C}$	60	
$I_{C, Pulse}$	Pulsed Collector Current	180	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	$\pm 20$	V	
$P_D$	Power Dissipation	$T_C=25^\circ\text{C}$	535	W
		$T_C=100^\circ\text{C}$	267	
$t_{SC}$	Short circuit withstand time	5	$\mu\text{s}$	
$T_{vj}$	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
PSI60065BM	PSI60065	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	$I_C=60\text{A}, V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$	-	1.85	2.4	V
			$T_{vj}=175^{\circ}\text{C}$	-	2.6		
$V_F$	Diode Forward Voltage	$V_{GE}=0\text{V}, I_F=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.45	2.0	V
			$T_{vj}=175^{\circ}\text{C}$	-	1.35	-	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=0.5\text{mA}$	4.0	5.0	6.0	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	$\mu\text{A}$	
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}, V_{CE}=0\text{V}$	-	-	$\pm 100$	nA	

### Dynamic Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit
			Min	Typ	Max	
$Q_G$	Total Gate Charge	$V_{CE}=520\text{V}, I_C=60\text{A}, V_{GE}=15\text{V}$	-	95	-	nC
$Q_{GE}$	Gate-Emitter Charge		-	19	-	
$Q_{GC}$	Gate-Collector Charge		-	47	-	
$C_{IES}$	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	2327	-	pF
$C_{OES}$	Output Capacitance		-	55	-	
$C_{RES}$	Reverse Transfer Capacitance		-	270	-	
$L_E$	Internal Emitter Inductance measured 5mm (0.197 in.) from Case		-	13.0	-	nH



## 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, $T_{vj}=25^{\circ}\text{C}$	-	42	-	ns
$t_r$	Turn-On Rise Time		-	54	-	
$t_{d(off)}$	Turn-Off Delay Time		-	142	-	
$t_f$	Turn-Off Fall Time		-	40	-	
$E_{on}$	Turn-On Switching Energy		-	0.92	-	mJ
$E_{off}$	Turn-Off Switching Energy		-	0.53	-	
$E_{ts}$	Total Switching Energy	-	1.45	-		
$t_{d(on)}$	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, $T_{vj}=175^{\circ}\text{C}$	-	45	-	ns
$T_r$	Turn-On Rise Time		-	58	-	
$t_{d(off)}$	Turn-Off Delay Time		-	152	-	
$t_f$	Turn-Off Fall Time		-	35	-	
$E_{on}$	Turn-On Switching Energy		-	1.43	-	mJ
$E_{off}$	Turn-Off Switching Energy		-	0.53	-	
$E_{ts}$	Total Switching Energy	-	1.96	-		
$t_{rr}$	Reverse Recovery Time	$I_F=30\text{A}, dI_F/dt=1000\text{A}/\mu\text{s},$ $T_{vj}=25^{\circ}\text{C}$	-	110	-	ns
$I_{rr}$	Reverse Recovery Current		-	18	-	A
$Q_{rr}$	Reverse Recovery Charge		-	1.10	-	nC
$t_{rr}$	Reverse Recovery Time	$I_F=30\text{A}, dI_F/dt=1000\text{A}/\mu\text{s},$ $T_{vj}=175^{\circ}\text{C}$	-	205	-	ns
$I_{rr}$	Reverse Recovery Current		-	25	-	A
$Q_{rr}$	Reverse Recovery Charge		-	2.67	-	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	0.28	
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for Diode	1.1	

# Typical Characteristics

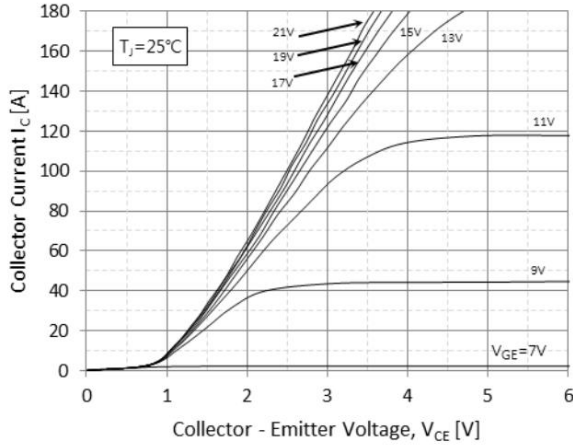


Figure 1. Output Characteristics ( $T_j=25^\circ\text{C}$ )

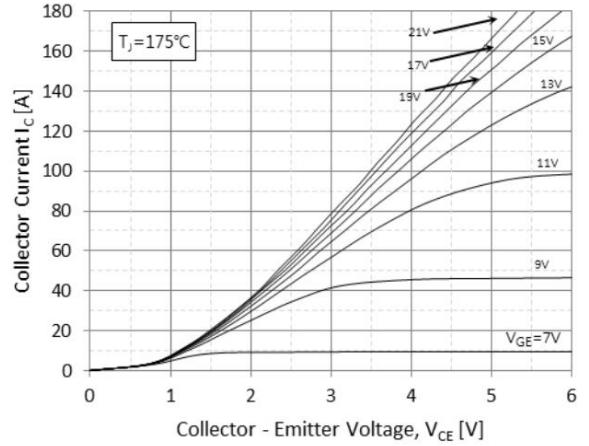


Figure 2. Output Characteristics ( $T_j=175^\circ\text{C}$ )

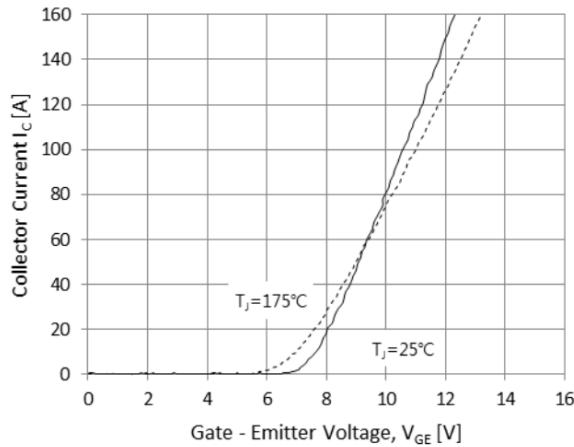


Figure 3. Typical Transfer Characteristics

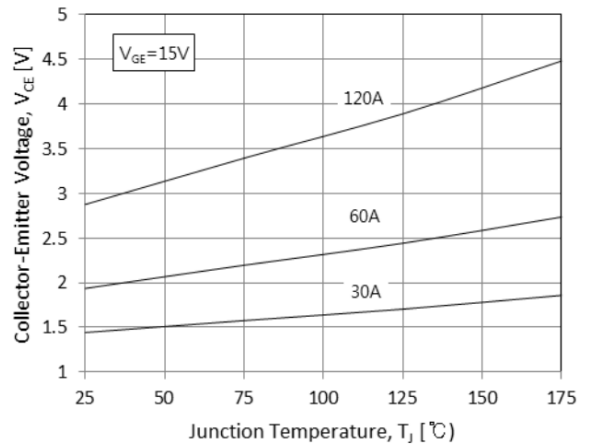


Figure 4. Typical Collector-Emitter Saturation Voltage-Junction Temperature

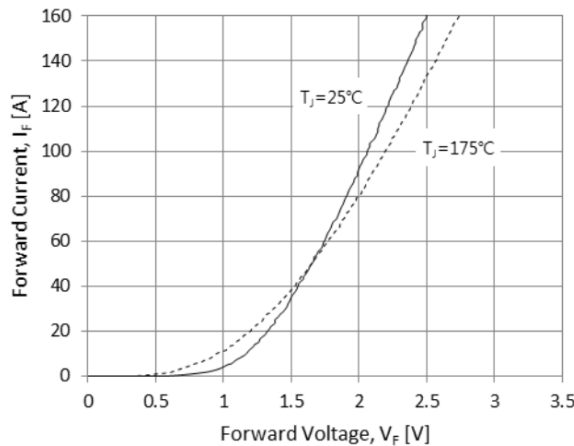


Figure 5. Diode Forward Characteristics

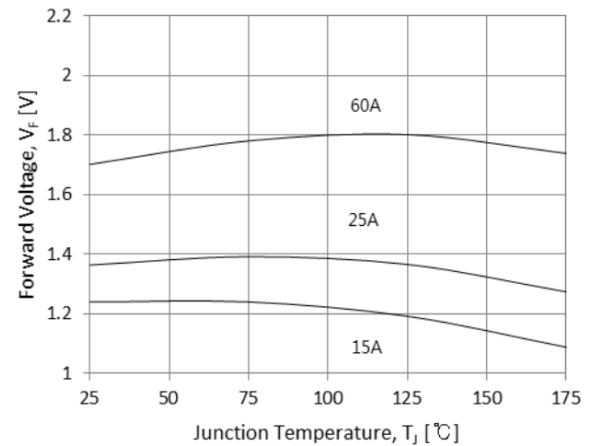


Figure 6. Diode Forward-Junction Temperature

# Typical Characteristics

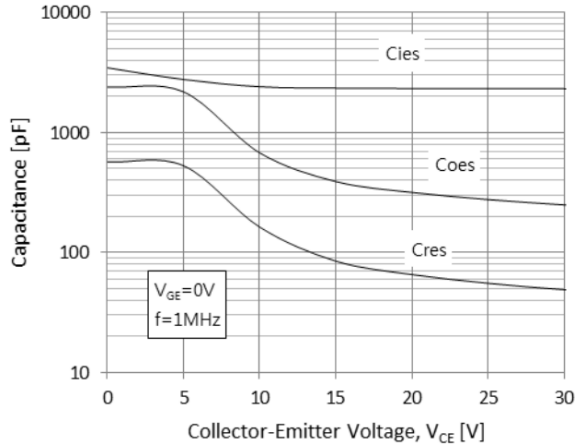


Figure 7. Typical Capacitance

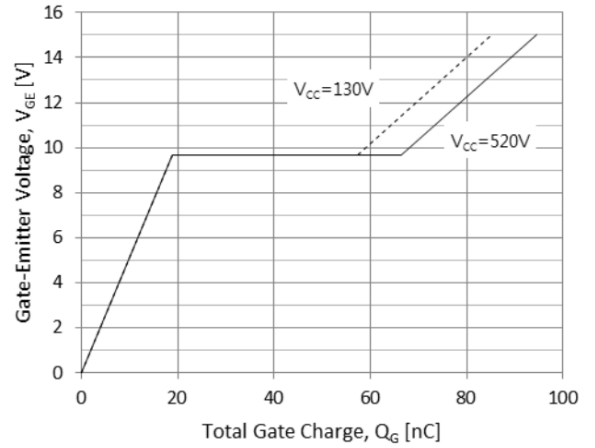


Figure 8. Typical Gate Charge

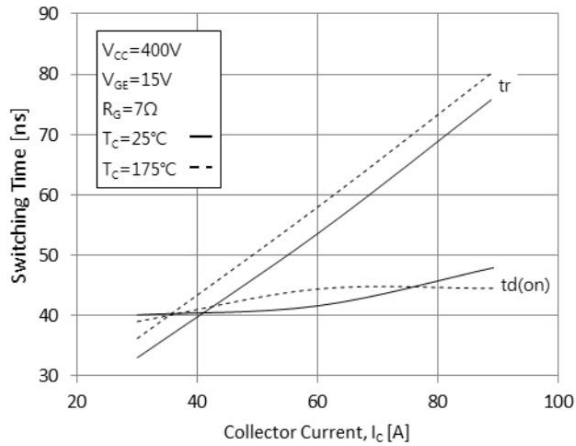


Figure 9. Typical Turn On-Collector Current

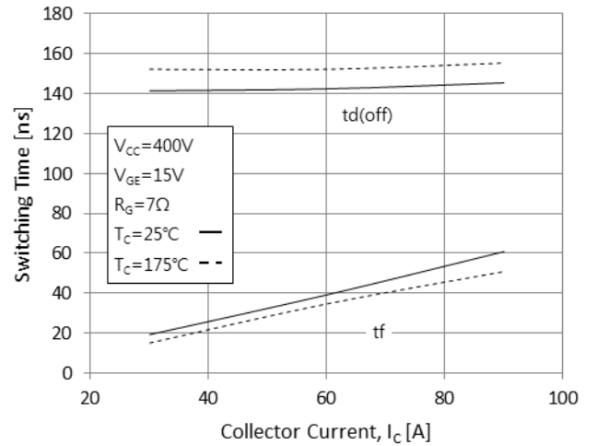


Figure 10. Typical Turn Off-Collector Current

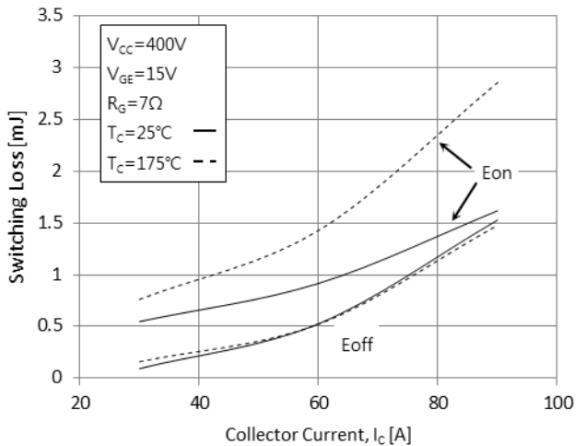


Figure 11. Switching Loss-Collector Current

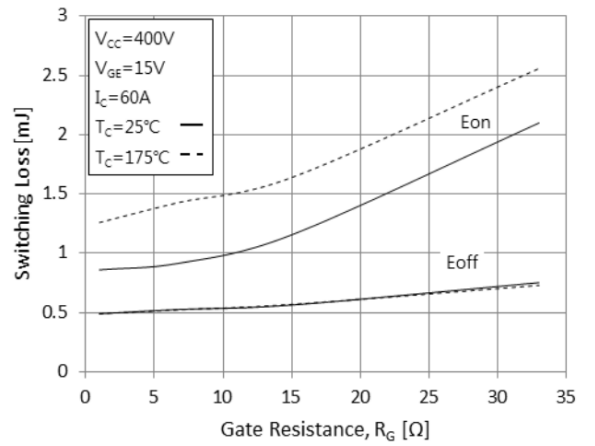


Figure 12. Switching Loss-Gate Resistance

# Typical Characteristics

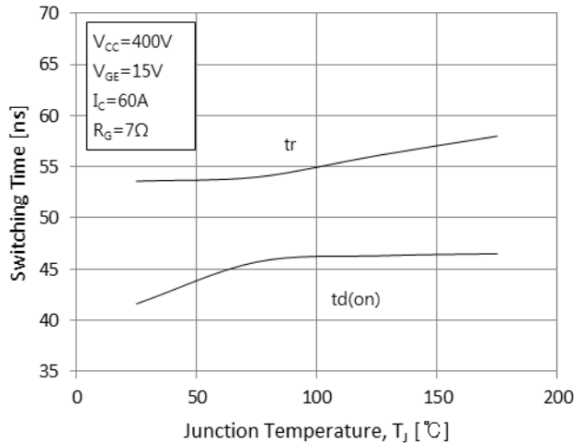


Figure 13. Turn-On Characteristics-Junction Temperature

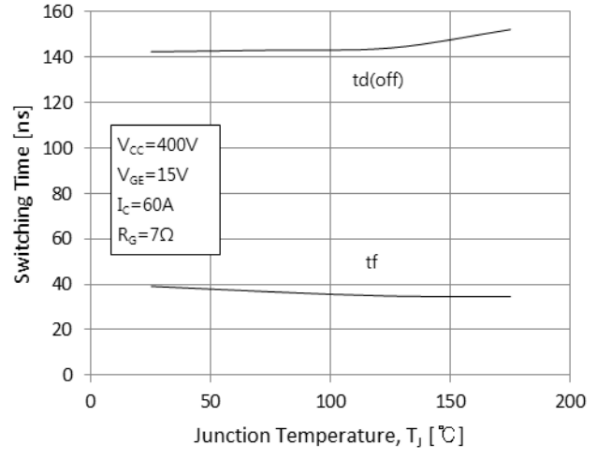


Figure 14. Turn-Off Characteristics-Junction Temperature

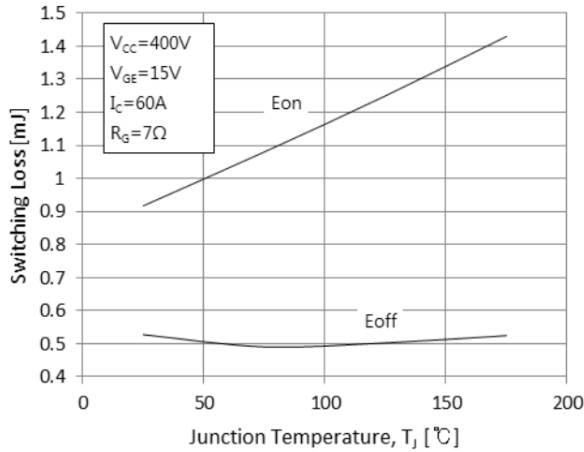


Figure 15. Switching Loss-Junction Temperature

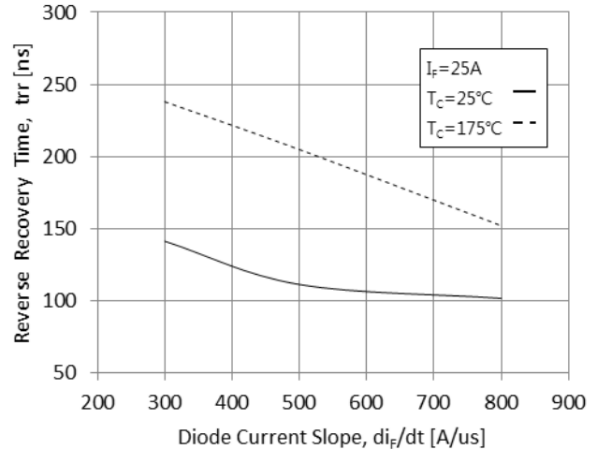


Figure 16. Reverse Recovery Time-Diode Current Slope

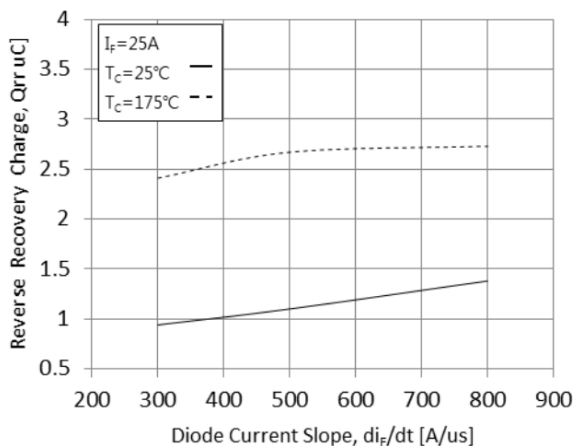


Figure 17. Reverse Recovery Charge-Diode Current Slope

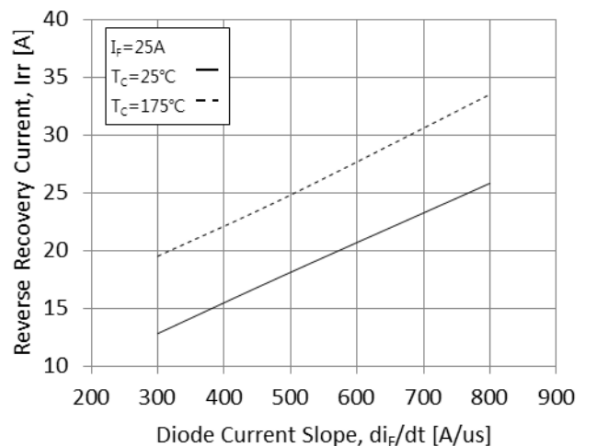


Figure 18. Reverse Recovery Current-Diode Current Slope

# Typical Characteristics

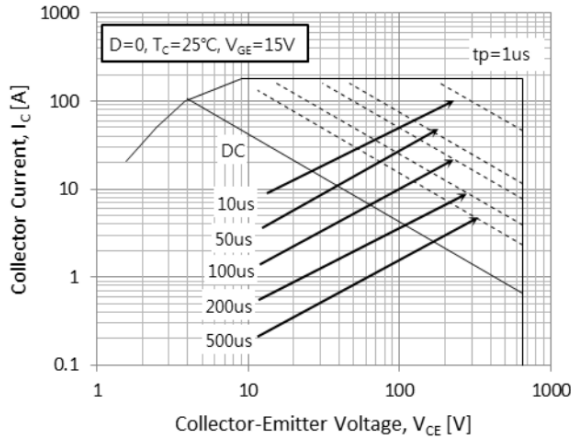


Figure 19. Forward Bias Safe Operating Area

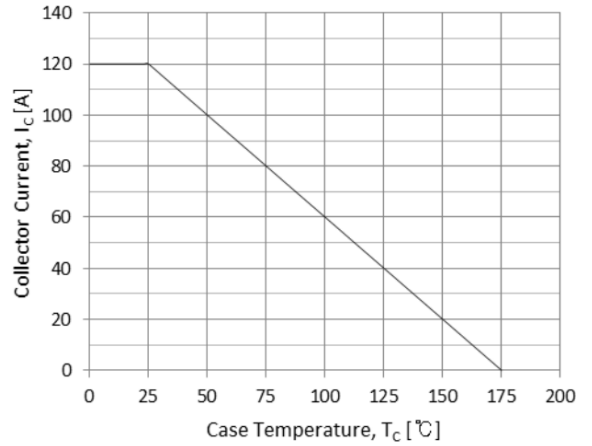


Figure 20. Case Temperature-Collector Current

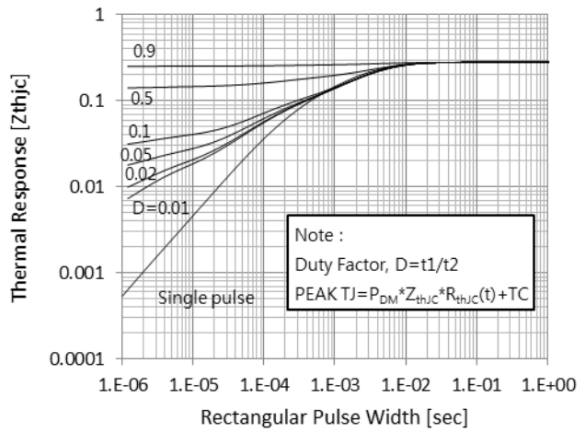


Figure 21. IGBT Transient Thermal Impedance

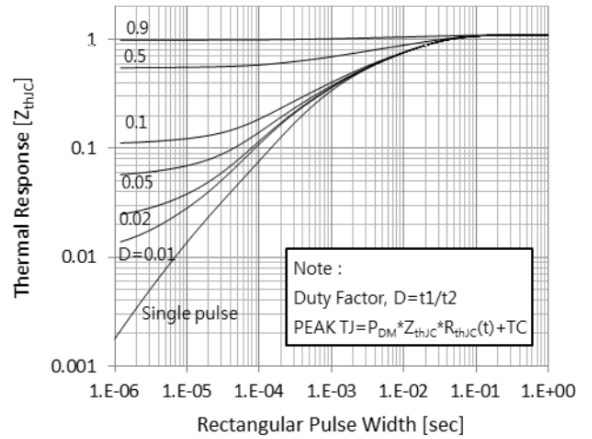


Figure 22. FRD Transient Thermal Impedance

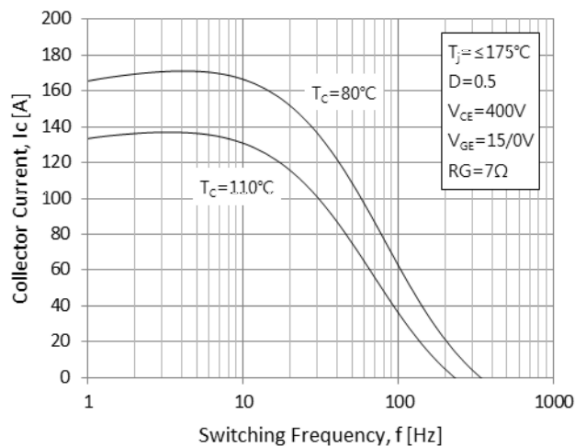
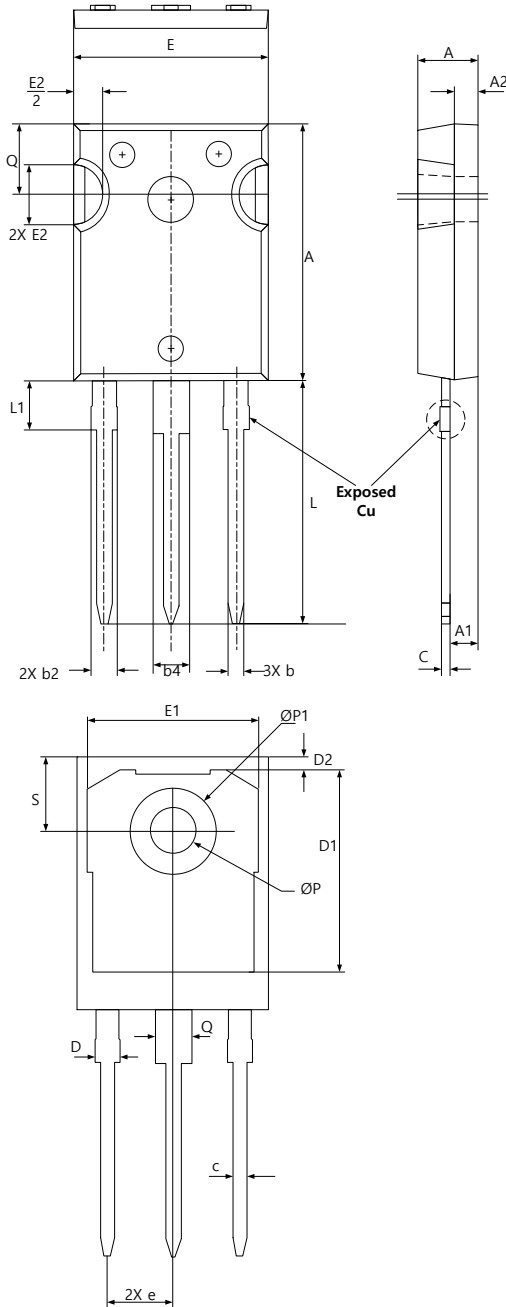


Figure 23. Collector Current-Switching Frequency

## Package Outline

Unit : mm



SYMBOL	DIMENSIONS			NOTES
	MIN	NOM	MAX	
<b>A</b>	4.83	5.02	5.21	
<b>A1</b>	2.29	2.41	2.55	
<b>A2</b>	1.50	2.00	2.49	
<b>b</b>	1.12	1.20	1.33	
<b>b1</b>	1.12	1.20	1.28	
<b>b2</b>	1.91	2.00	2.39	6
<b>b3</b>	1.91	2.00	2.34	
<b>b4</b>	2.87	3.00	3.22	6, 8
<b>b5</b>	2.87	3.00	3.18	
<b>c</b>	0.55	0.60	0.69	6
<b>c1</b>	0.55	6.00	0.65	
<b>D</b>	20.80	20.95	21.10	4
<b>D1</b>	16.25	16.55	17.65	5
<b>D2</b>	0.51	1.19	1.35	
<b>E</b>	15.75	15.94	16.13	4
<b>E1</b>	13.46	14.02	14.16	5
<b>E2</b>	4.32	4.91	5.49	3
<b>e</b>	5.44 BSC			
<b>L</b>	19.81	20.07	20.32	
<b>L1</b>	4.10	4.19	4.40	6
<b><math>\phi P</math></b>	3.56	3.61	3.65	7
<b><math>\phi P1</math></b>	7.19 REF			
<b>Q</b>	5.39	5.79	6.20	
<b>S</b>	6.04	6.17	6.30	