

General Description

This IGBT is produced using advanced Magnachip's Field Stop Trench IGBT 2nd 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

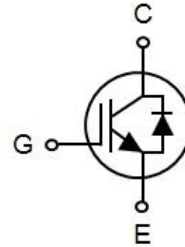
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.85V @ I_c = 60A$
- $E_{off} = 0.53mJ @ T_C = 25^\circ C$
- High Input Impedance
- $t_{rr} = 110ns (typ.) @ di_F/dt = 500A/\mu s$
- Maximum Junction Temperature $175^\circ C$

Applications

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

TO-247



Maximum Rating

Parameter	Symbol	Rating	Unit
Collector-emitter voltage	V_{CE}	650	V
DC collector current, limited by T_{vjmax}	I_c	$T_C=25^\circ C$	100
		$T_C=100^\circ C$	60
Pulsed collector current, t_p limited by T_{vjmax}	I_{cp}	180	A
Turn off safe operating area $V_{CE} \leq 650V, T_{vj} \leq 175^\circ C$	-	180	A
Diode forward current limited by T_{vjmax}	I_F	$T_C=25^\circ C$	60
		$T_C=100^\circ C$	30
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fp}	200	A
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation	P_D	$T_C=25^\circ C$	535
		$T_C=100^\circ C$	267
Short circuit withstand time $V_{CC} \leq 400V, R_G = 7\Omega, V_{GE} = 15V, T_{vj} = 150^\circ C$	tsc	5	μs
Operating Junction temperature range	T_{vj}	-40~175	$^\circ C$
Storage temperature range	T_{stg}	-55~150	$^\circ C$
Soldering temperature Wave soldering 1.6 mm (0.063 in.) from case for 10s		260	$^\circ C$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Characteristic

Parameter	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.28	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.1	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ60T65PESTH	60T65PES	-55~175°C	TO-247	Tube	Halogen Free

Electrical Characteristic (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Static Characteristic							
Collector-emitter breakdown voltage	BV _{CES}	I _C = 2mA, V _{GE} = 0V	650	-	-	V	
Collector-emitter saturation voltage	V _{CES(sat)}	I _C = 60A, V _{GE} = 15V	T _{vj} = 25°C	-	1.85	2.4	V
			T _{vj} = 175°C	-	2.6	-	
Diode forward voltage	V _F	V _{GE} = 0V, I _F = 25A	T _{vj} = 25°C	-	1.45	2.0	V
			T _{vj} = 175°C	-	1.35	-	
Gate-emitter threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 0.5mA	4.0	5.0	6.0	V	
Zero gate voltage collector current	I _{CES}	V _{CE} = 650V, V _{GE} = 0V, T _{vj} = 25°C	-	-	40	μA	
Gate-emitter leakage current	I _{GES}	V _{GE} = 20V, V _{CE} = 0V	-	-	±100	nA	
Dynamic Characteristic							
Total gate charge	Q _g	V _{CE} = 520V, I _C = 60A, V _{GE} = 15V	-	95	-	nC	
Gate-emitter charge	Q _{ge}		-	19	-		
Gate-collector charge	Q _{gc}		-	47	-		
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz	-	2327	-	pF	
Reverse transfer capacitance	C _{res}		-	55	-		
Output capacitance	C _{oes}		-	270	-		
Internal emitter inductance measured 5mm (0.197 in.) from case	LE		-	13.0	-	nH	
Switching Characteristic							
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 60A, R _G = 7Ω, Inductive Load, T _{vj} = 25°C	-	42	-	ns	
Rise time	t _r		-	54	-		
Turn-off delay time	t _{d(off)}		-	142	-		
Fall time	t _f		-	40	-	mJ	
Turn-on switching energy	E _{on}		-	0.92	-		
Turn-off switching energy	E _{off}		-	0.53	-		
Total switching energy	E _{ts}	-	1.45	-			
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 60A, R _G = 7Ω, Inductive Load, T _{vj} = 175°C	-	45	-	ns	
Rise time	t _r		-	58	-		
Turn-off delay time	t _{d(off)}		-	152	-		
Fall time	t _f		-	35	-	mJ	
Turn-on switching energy	E _{on}		-	1.43	-		
Turn-off switching energy	E _{off}		-	0.53	-		
Total switching energy	E _{ts}	-	1.96	-			
Reverse recovery time	t _{rr}	I _F = 25A, di _F /dt = 500A/μs, T _{vj} = 25°C	-	110	-	ns	
Reverse recovery current	I _{rr}		-	18	-	A	
Reverse recovery charge	Q _{rr}		-	1.10	-	μC	
Reverse recovery time	t _{rr}	I _F = 25A, di _F /dt = 500A/μs, T _{vj} = 175°C	-	205	-	ns	
Reverse recovery current	I _{rr}		-	25	-	A	
Reverse recovery charge	Q _{rr}		-	2.67	-	μC	

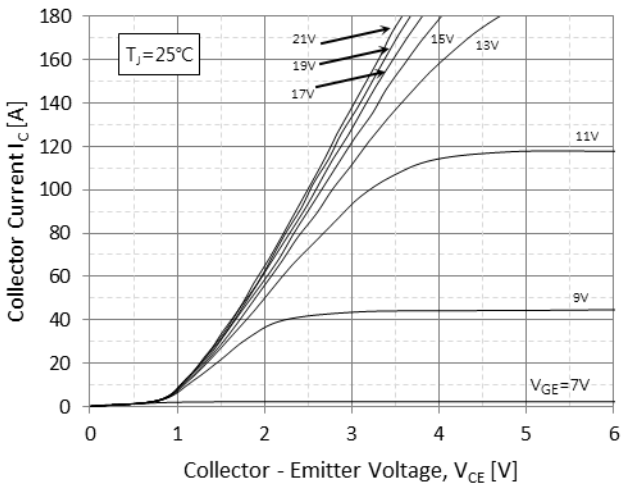


Fig.1 Typical Output Characteristics ($T_J = 25^\circ\text{C}$)

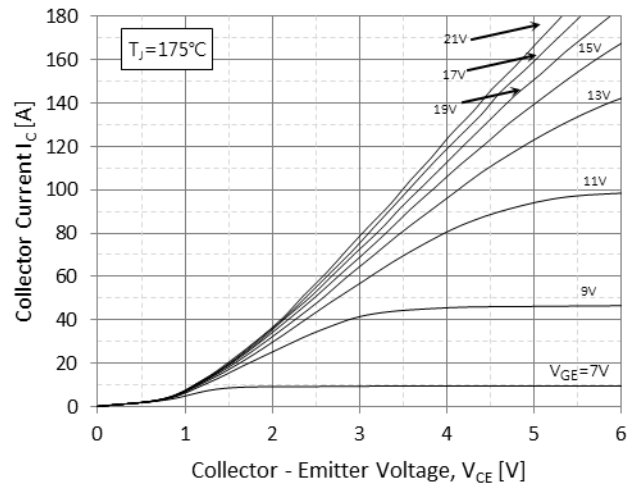


Fig.2 Typical Output Characteristics ($T_J = 175^\circ\text{C}$)

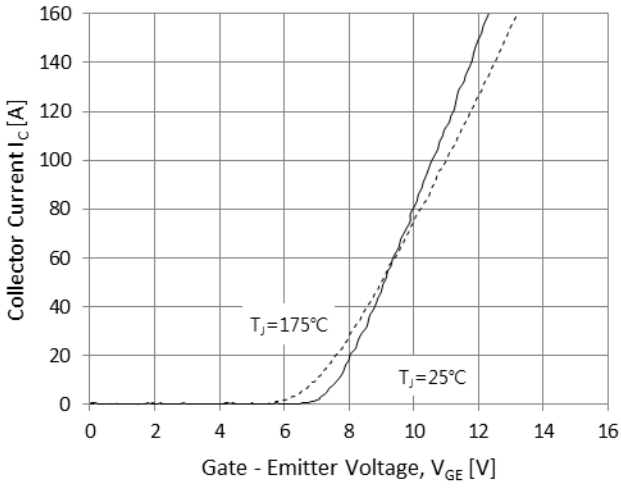


Fig.3 Typical Transfer Characteristics

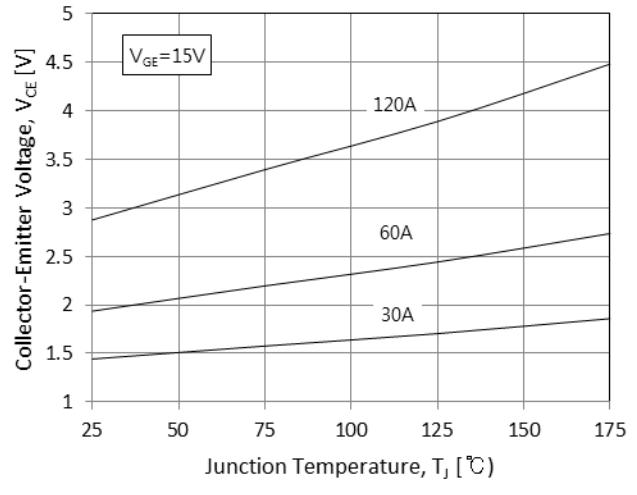


Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature

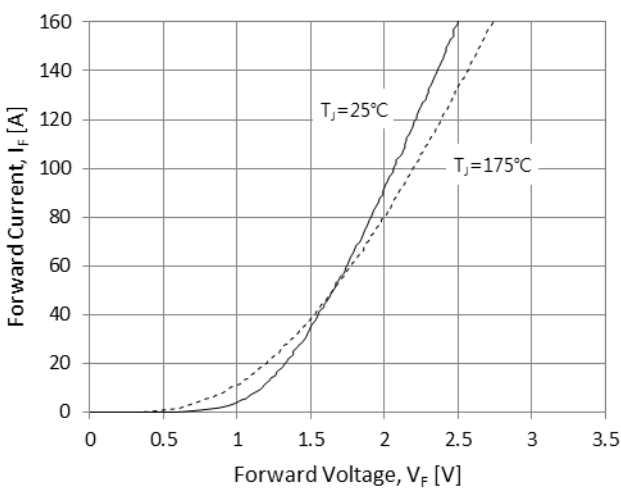


Fig.5 Diode Forward Characteristics

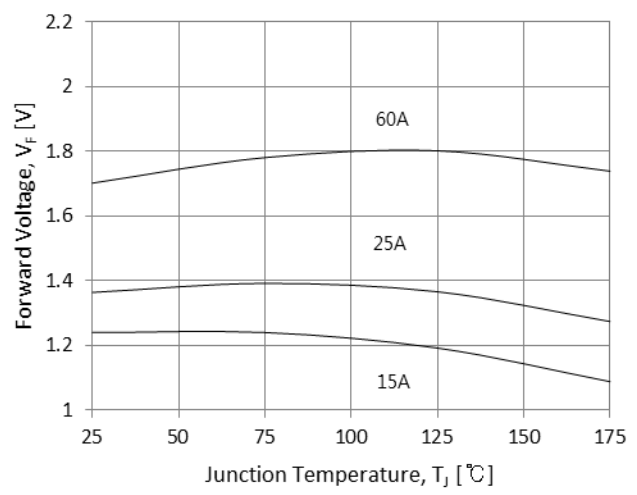


Fig.6 Diode Forward-Junction Temperature

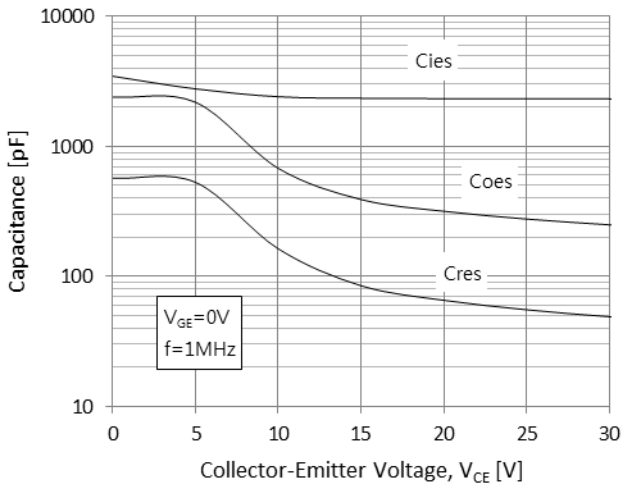


Fig.7 Typical Capacitance

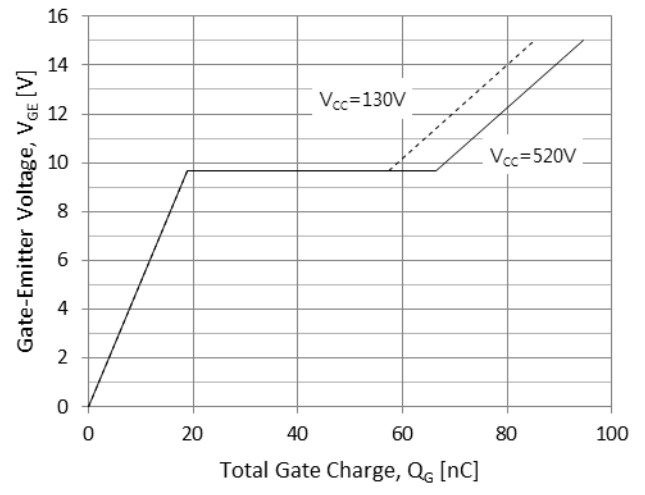


Fig.8 Typical Gate Charge

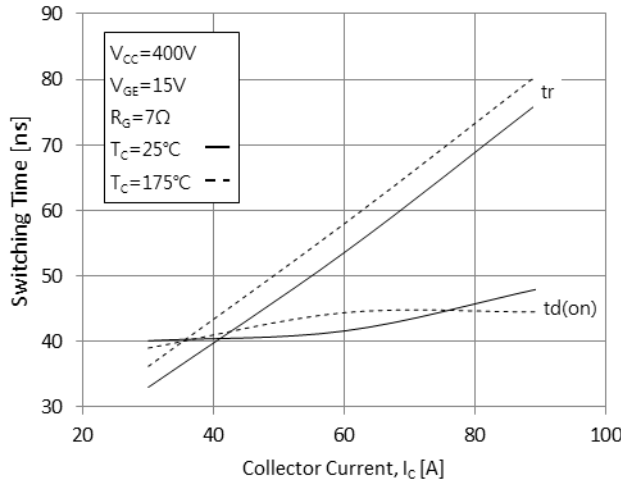


Fig.9 Typical Turn on-Collector Current

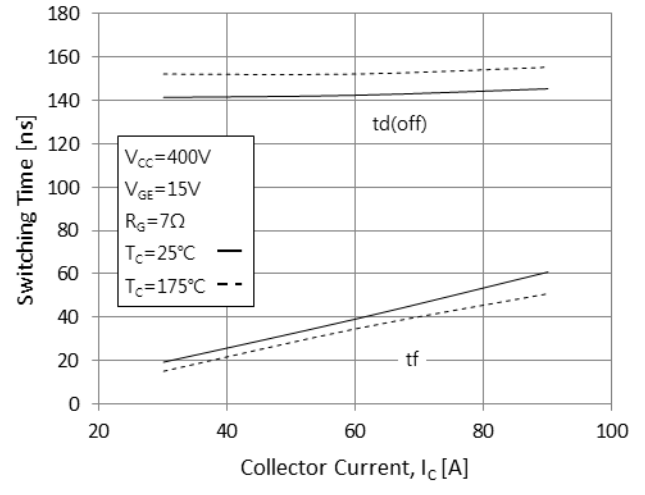


Fig.10 Typical Turn off-Collector Current

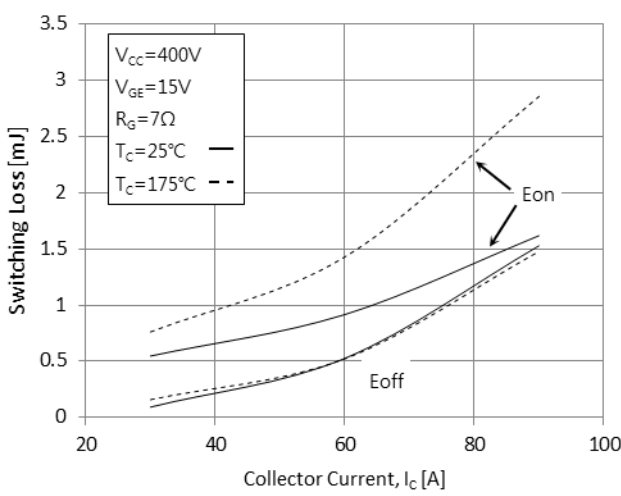


Fig.11 Switching Loss-Collector Current

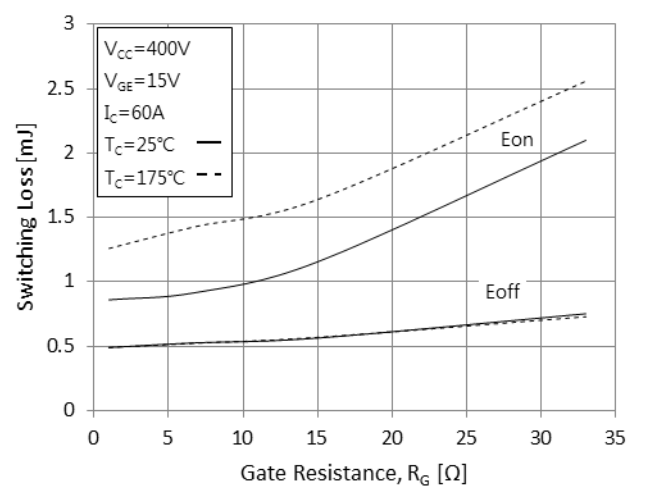


Fig.12 Switching Loss-Gate Resistance

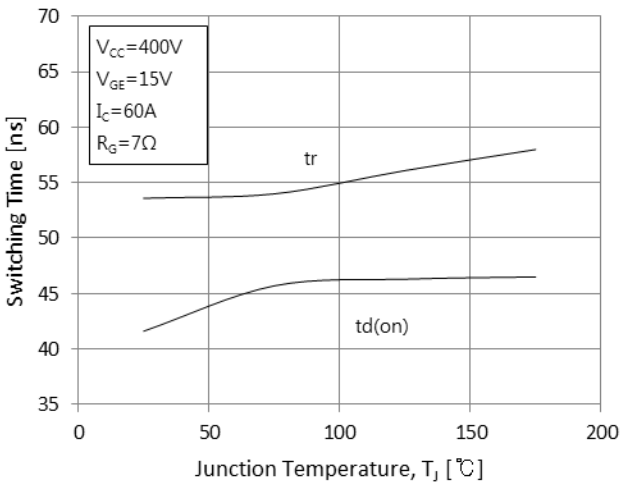


Fig.13 Turn on Characteristics-Junction Temperature

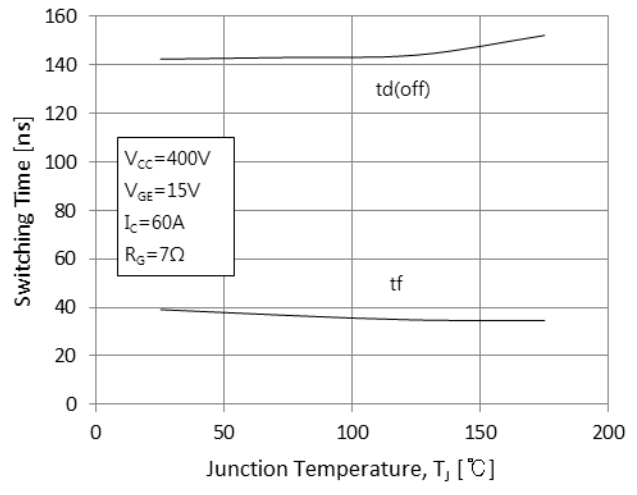


Fig.14 Turn off Characteristics-Junction Temperature

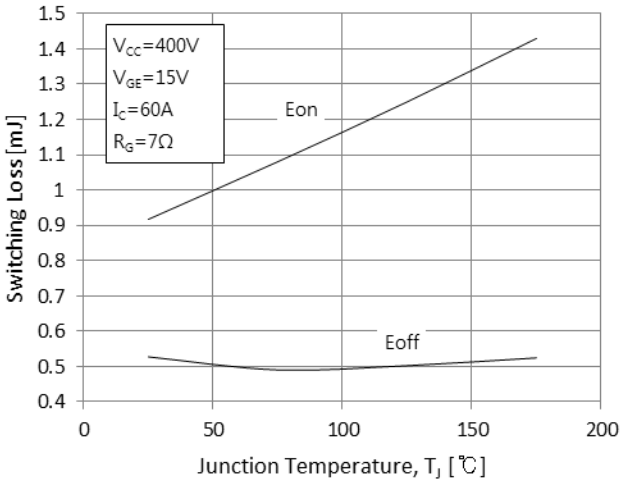


Fig.15 Switching Loss-Junction Temperature

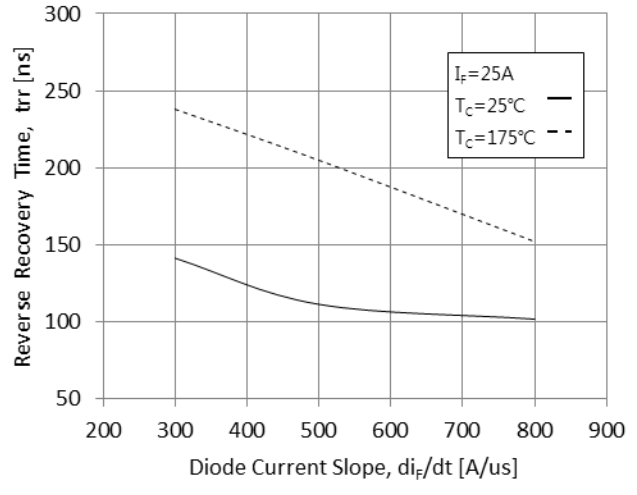


Fig.16 Reverse Recovery Time - Diode Current Slope

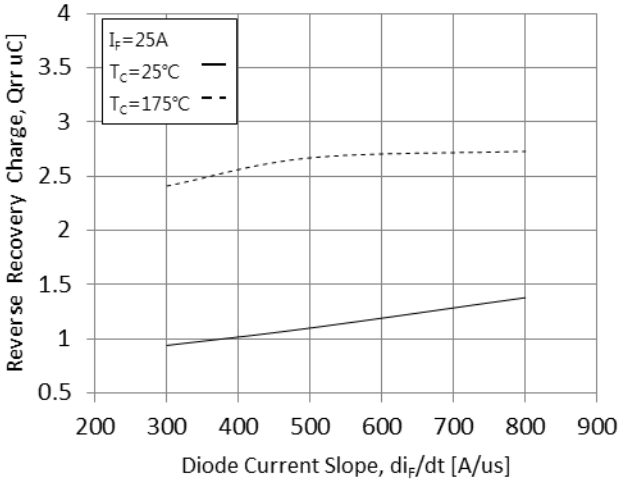


Fig.17 Reverse Recovery Charge - Diode Current Slope

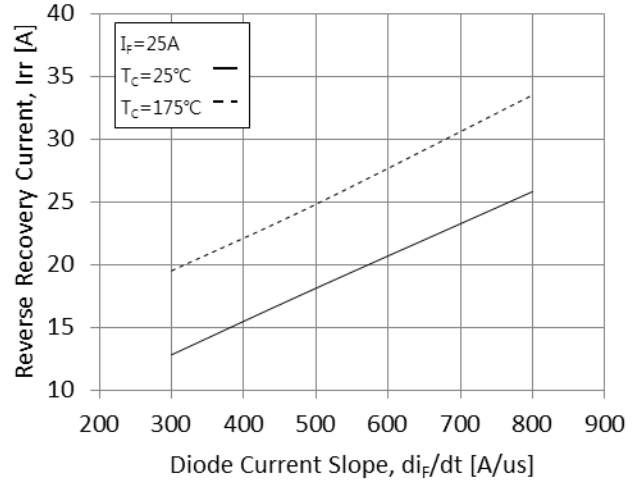


Fig.18 Reverse Recovery Current - Diode Current Slope

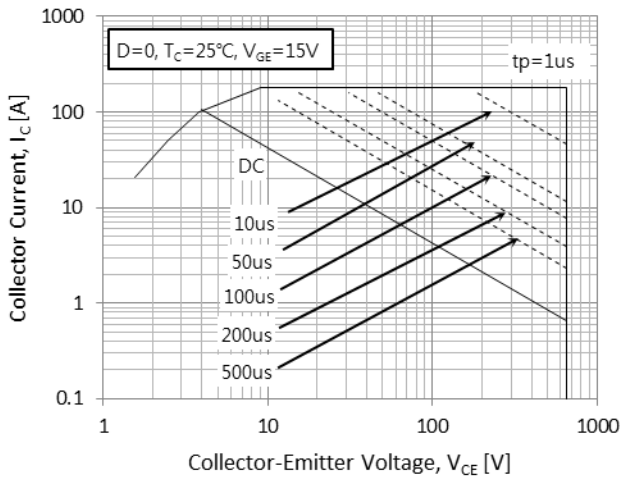


Fig.19 Forward Bias Safe Operating Area

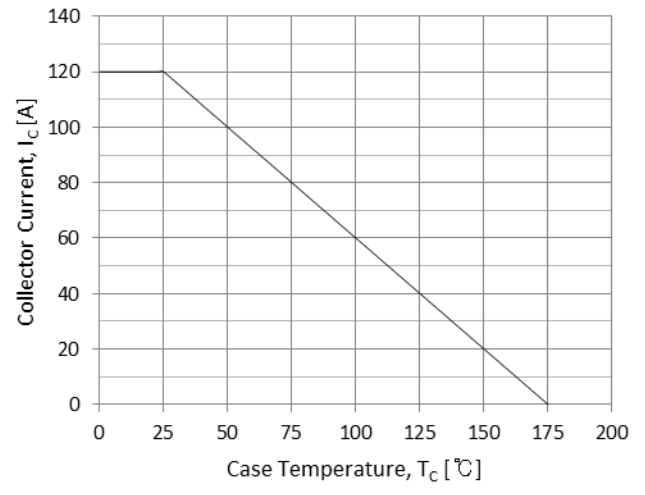


Fig.20 Case Temperature-Collector Current

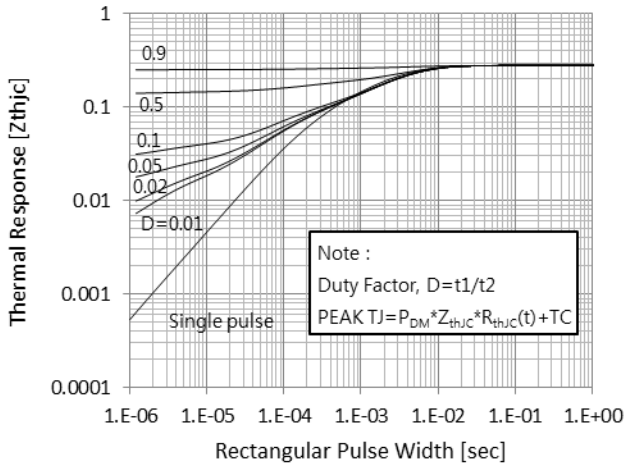


Fig.21 IGBT Transient Thermal Impedance

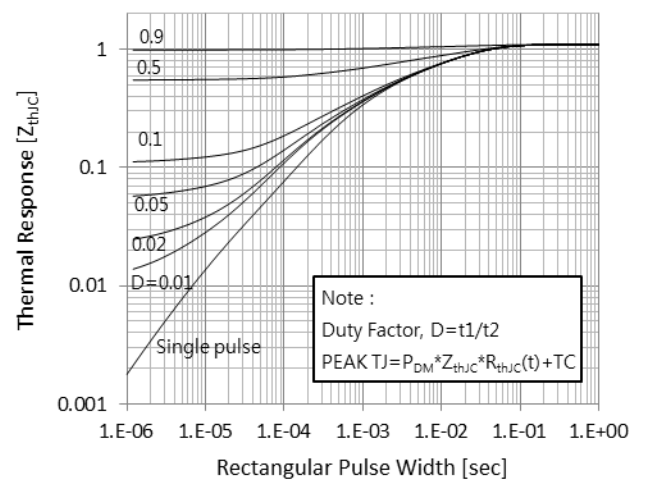


Fig.22 FRD Transient Thermal Impedance

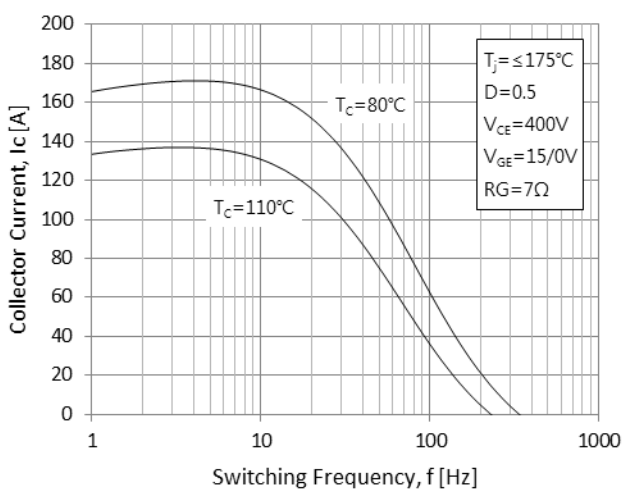
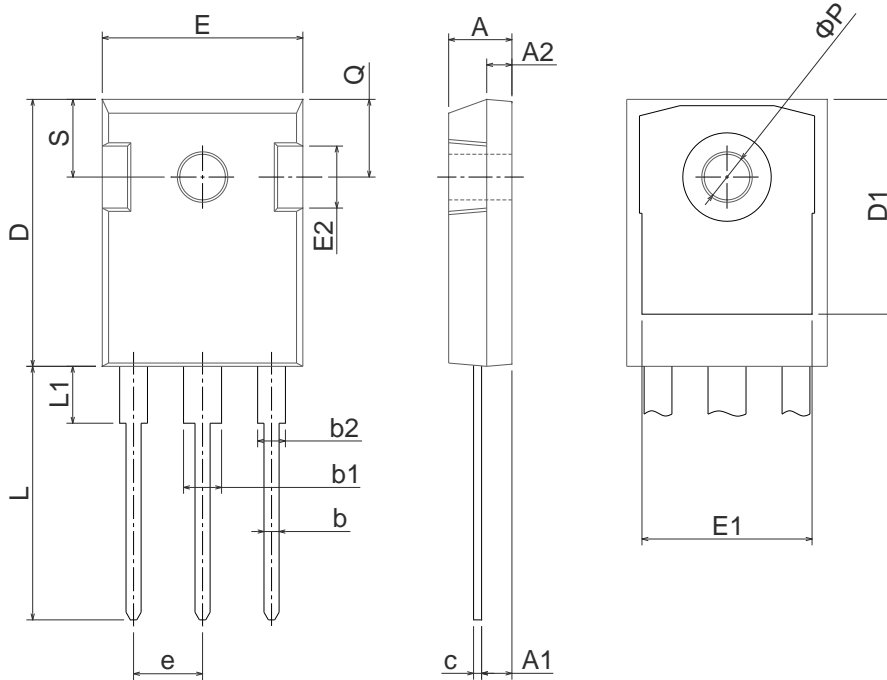


Fig.23 Collector Current - Switching Frequency

Physical Dimension

TO-247

Dimensions are in millimeters, unless otherwise specified




Dimension	Min(mm)	Max(mm)
A	4.70	5.31
A1	2.20	2.60
A2	1.50	2.49
b	0.99	1.40
b1	2.59	3.43
b2	1.65	2.39
c	0.38	0.89
D	20.30	21.46
D1	13.08	-
E	15.45	16.26
E1	13.06	14.02
E2	4.32	5.49
e	5.45BSC	
L	19.81	20.57
L1	-	4.50
ΦP	3.50	3.70
Q	5.38	6.20
S	6.15BSC	

Note : Package body size, length and width do not include mold flash, protrusions and gate burrs.

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