RoHS Compliant

Magnachip

MBQ40T120FES

High speed FieldStop Trench IGBT

General Description

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

This device is for PFC, UPS & Inverter applications.

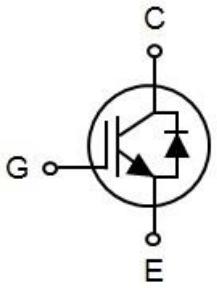
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)}$ = 2.0V @ I_C = 40A
- High Input Impedance
- t_{rr} = 100ns (typ.)
- Ultra Soft, fast recovery anti-parallel diode
- Ultra narrowed VF distribution control
- Positive Temperature coefficient for easy paralleling

Applications

- PFC
- UPS
- Inverter

TO-247



Absolute Maximum Ratings

Characteristics		Symbol	Rating	Unit
Collector-emitter voltage		V_{CES}	1200	V
Gate-emitter voltage		V_{GES}	±20	V
Collector current	T_C=25°C	I_C	80	A
	T_C=100°C		40	A
Pulsed collector current, pulse time limited by T_{jmax}		I_{CM}	160	A
Diode forward current @ T_C = 100°C		I_F	40	A
Diode pulsed current, Pulse time limited by T_{jmax}		I_{FM}	160	A
Power dissipation	T_C=25°C	P_D	357	W
	T_C=100°C		142	W
Short circuit withstand time V_{CE} = 600V, V_{GE} = 15V, T_C = 150°C		tsc	10	μs
Operating Junction and storage temperature range		T_J, T_{stg}	-55~150	°C

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	°C/W
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.35	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	0.8	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ40T120FESTH	40T120FES	-55~150°C	TO-247	Tube	Pb Free

Electrical Characteristics (Tc =25ºC unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Collector-emitter breakdown voltage	BV_{CES}	I_C = 1mA, V_{GE} = 0V	1200	-	-	V
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 1mA	4.5	5.5	6.5	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V	-	-	1	mA
Gate-emitter leakage current	I_{GES}	V_{GE} = 20V, V_{CE} = 0V	-	-	±250	nA
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 40A, V_{GE} = 15V, T_C = 25°C	-	2.0	2.4	V
		I_C = 40A, V_{GE} = 15V, T_C = 150°C	-	2.45	-	
Dynamic and Switching Characteristics						
Total gate charge	Q_g	V_{CE} = 600V, I_C = 40A, V_{GE} = 15V	-	341	-	nC
Gate-emitter charge	Q_{ge}		-	52	-	
Gate-collector charge	Q_{gc}		-	126	-	
Input capacitance	C_{ies}	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	6030	-	pF
Reverse transfer capacitance	C_{res}		-	107	-	
Output capacitance	C_{oes}		-	206	-	
Turn-on delay time	$t_{d(on)}$	V_{GE} = 15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_C = 25°C		65	-	ns
Rise time	t_r			55	-	
Turn-off delay time	$t_{d(off)}$			308	-	
Fall time	t_f			40	-	
Turn-on switching energy	E_{on}			1.96	-	mJ
Turn-off switching energy	E_{off}			0.54	-	
Total switching energy	E_{ts}			2.50	-	
Turn-on delay time	$t_{d(on)}$	V_{GE} = 15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_C = 150°C		70	-	ns
Rise time	t_r			62	-	
Turn-off delay time	$t_{d(off)}$			325	-	
Fall time	t_f			62	-	
Turn-on switching energy	E_{on}			2.35	-	mJ
Turn-off switching energy	E_{off}			1.61	-	
Total switching energy	E_{ts}			3.96	-	

Diode Characteristics (Tc =25ºC unless otherwise specified)

Forward voltage	V_F	I_F = 40A, T_C = 25°C	-	2.4	3.0	V
		I_F = 40A, T_C = 150°C	-	2.45	-	
Reverse recovery time	t_{rr}	I_F = 40A, di/dt = 200A/ μs, T_C = 25°C	-	100	-	ns
Reverse recovery current	I_{rr}		-	7	-	A
Reverse recovery charge	Q_{rr}		-	350	-	nC
Reverse recovery time	t_{rr}	I_F = 40A, di/dt = 200A/ μs, T_C = 150°C	-	180	-	ns
Reverse recovery current	I_{rr}		-	10	-	A
Reverse recovery charge	Q_{rr}		-	900	-	nC

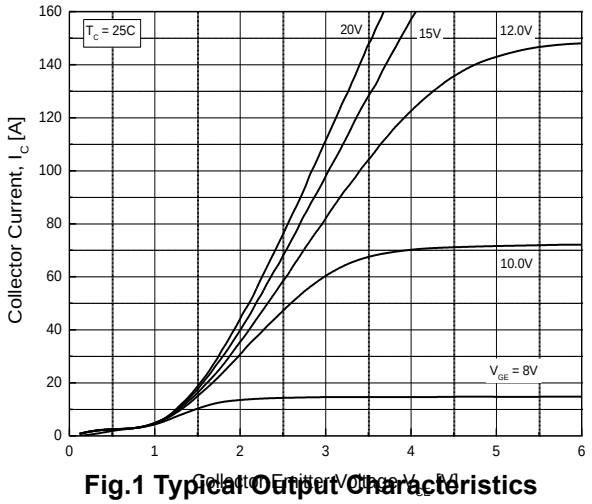


Fig.1 Typical Output Characteristics

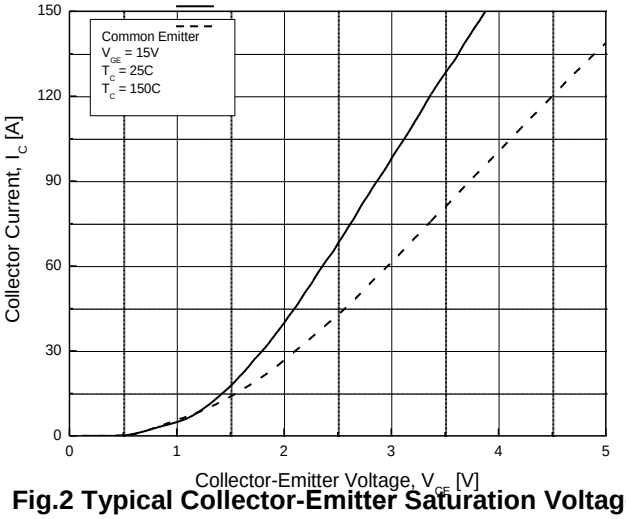


Fig.2 Typical Collector-Emitter Saturation Voltage

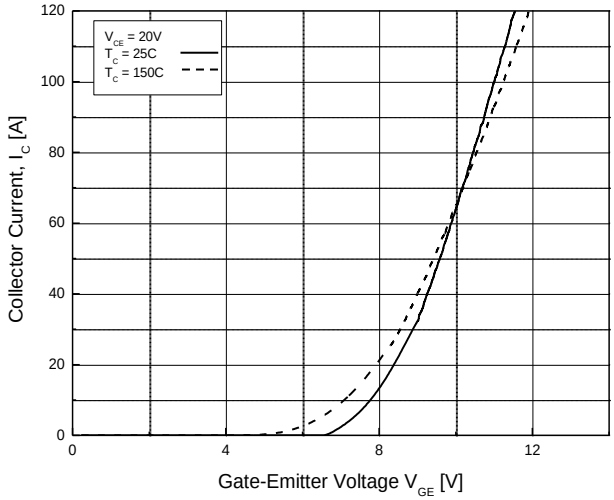


Fig.3 Typical Transfer Characteristics

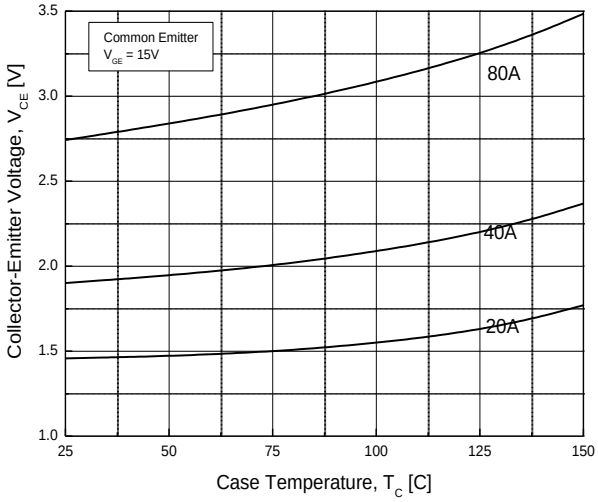


Fig.4 Typical Collector-Emitter Saturation Voltage at Case Temperature

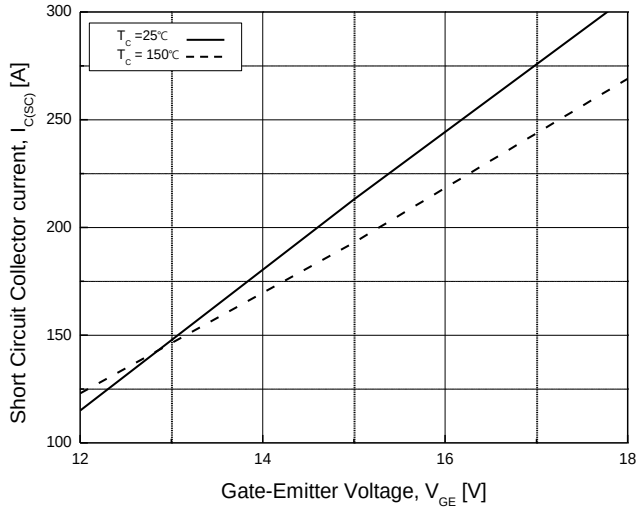


Fig.5 Typical Short Circuit Collector Current

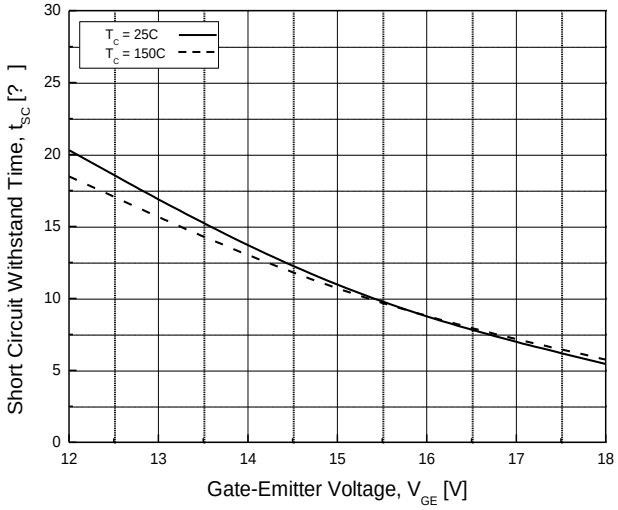


Fig.6 Typical Short Circuit Withstand Time

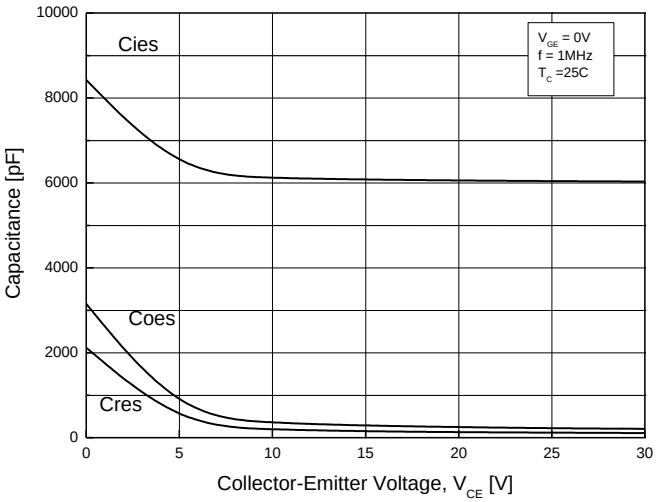


Fig.7 Typical Capacitance

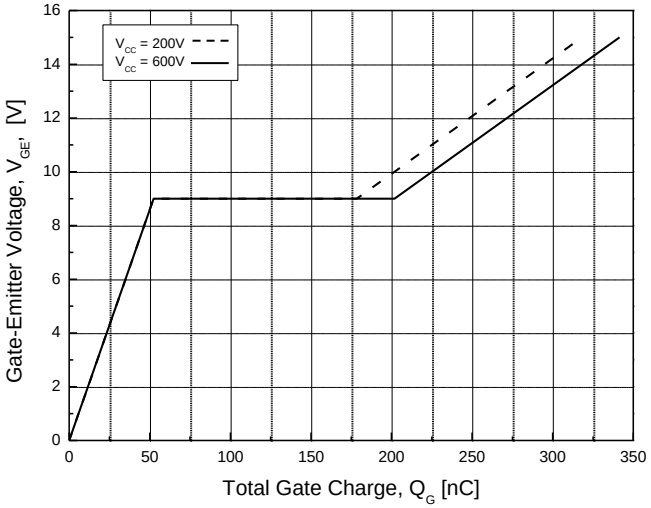


Fig.8 Typical Gate Charge

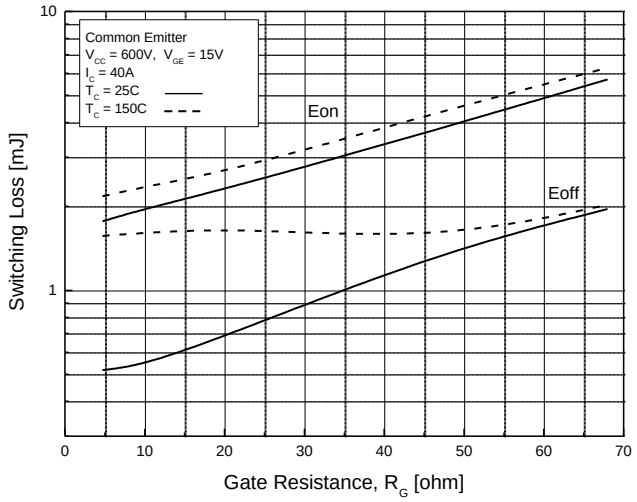


Fig.9 Switching Loss-Gate Resistance

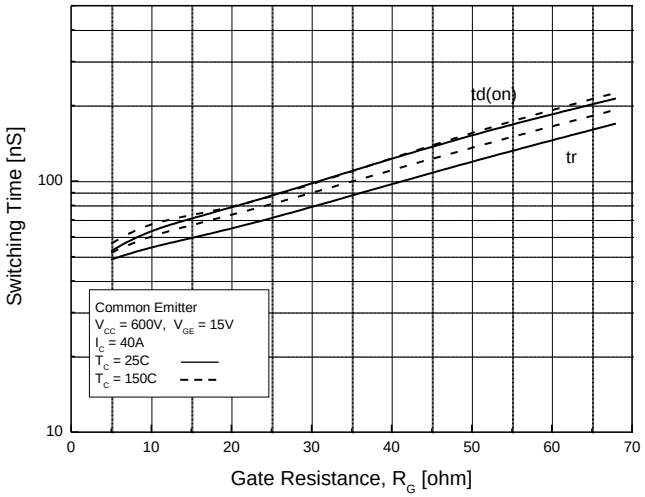


Fig.10 Turn on Characteristics-Gate Resistance

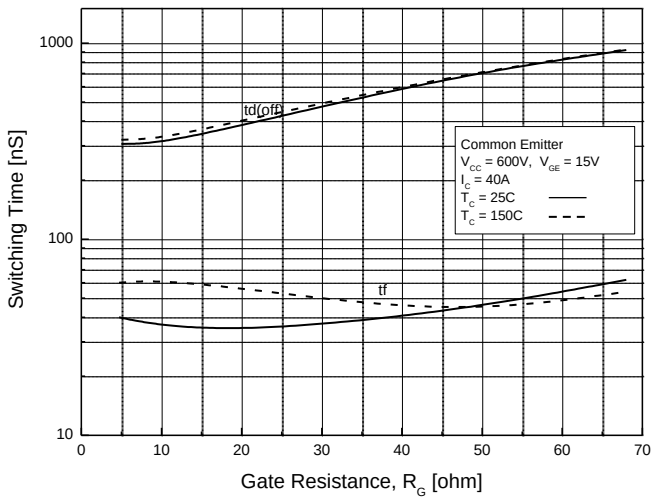


Fig.11 Turn off Characteristics-Gate Resistance

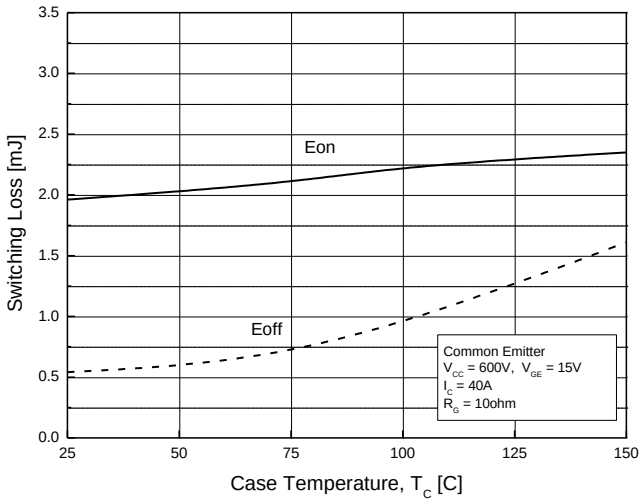


Fig.12 Switching Loss-Case Temperature

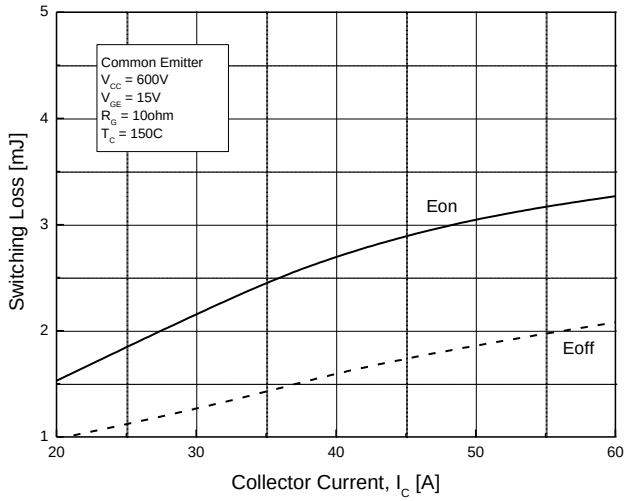


Fig.13 Switching Loss-Collector Current

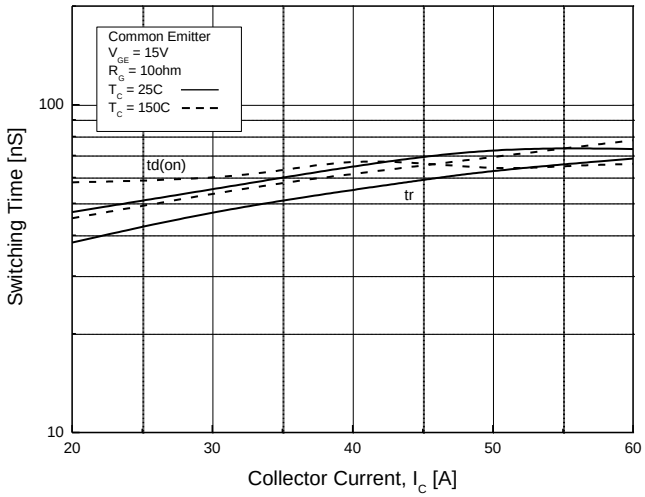


Fig.14 Typical Turn on-Collector Current

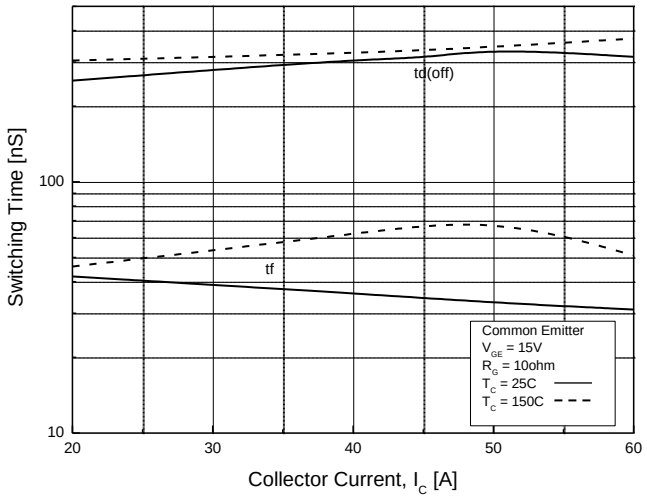


Fig.15 Typical Turn off-Collector Current

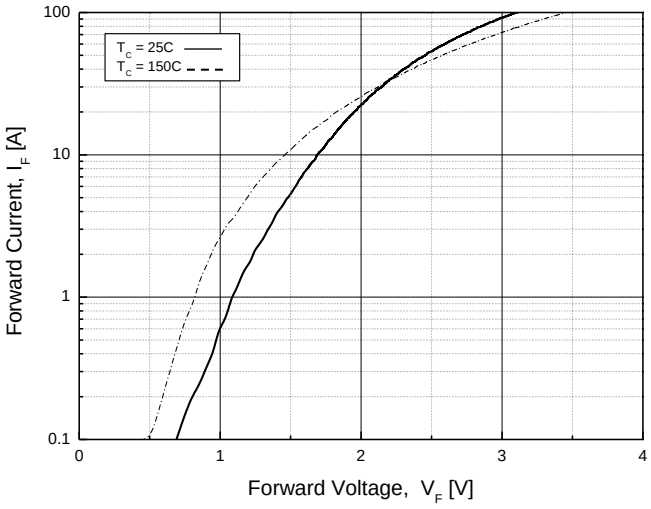


Fig.16 Diode Forward Characteristics

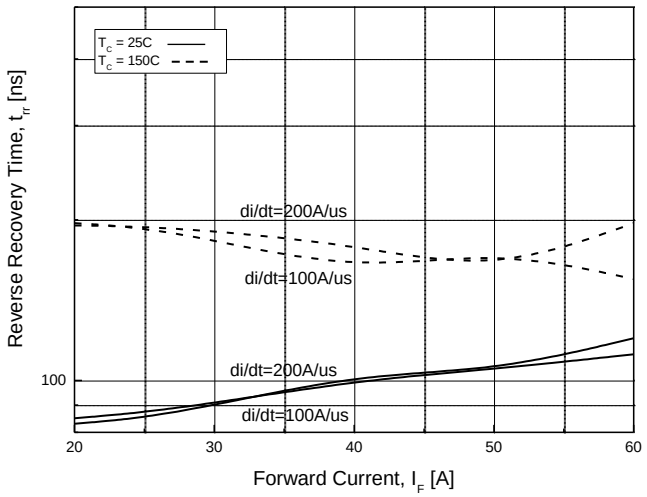


Fig.17 Typical Turn off-Collector Current

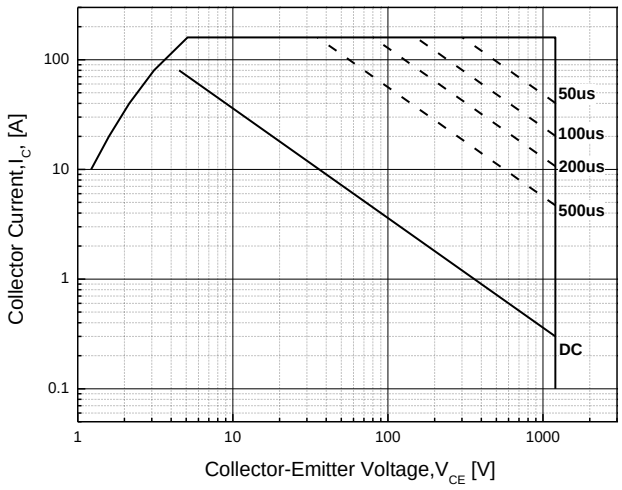


Fig.18 Forward Bias Safe Operating Area

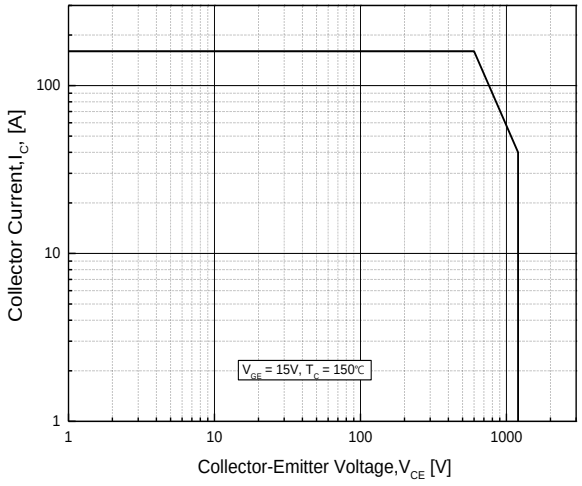


Fig.19 Reverse Bias Safe Operating Area

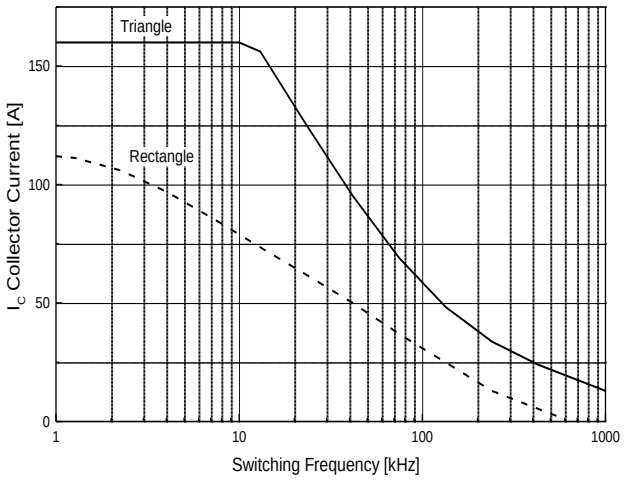


Fig.20 Switching frequency – Collector current

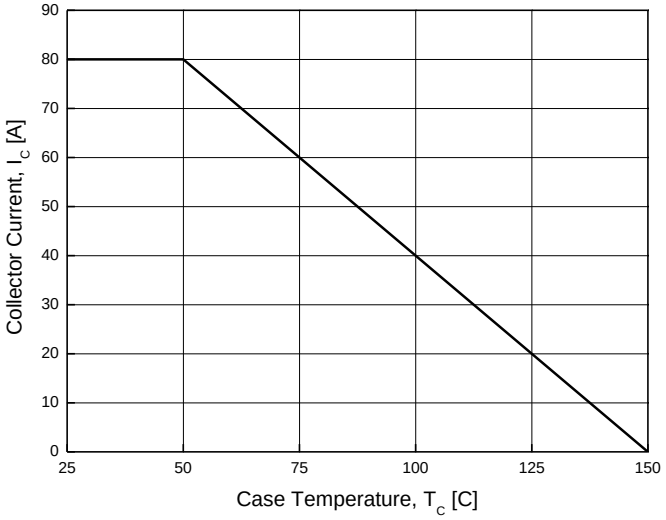


Fig.21 Case Temperature – Collector Current

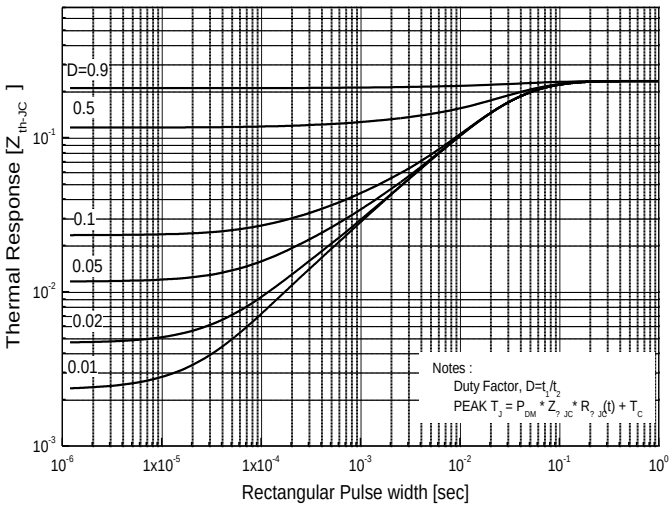
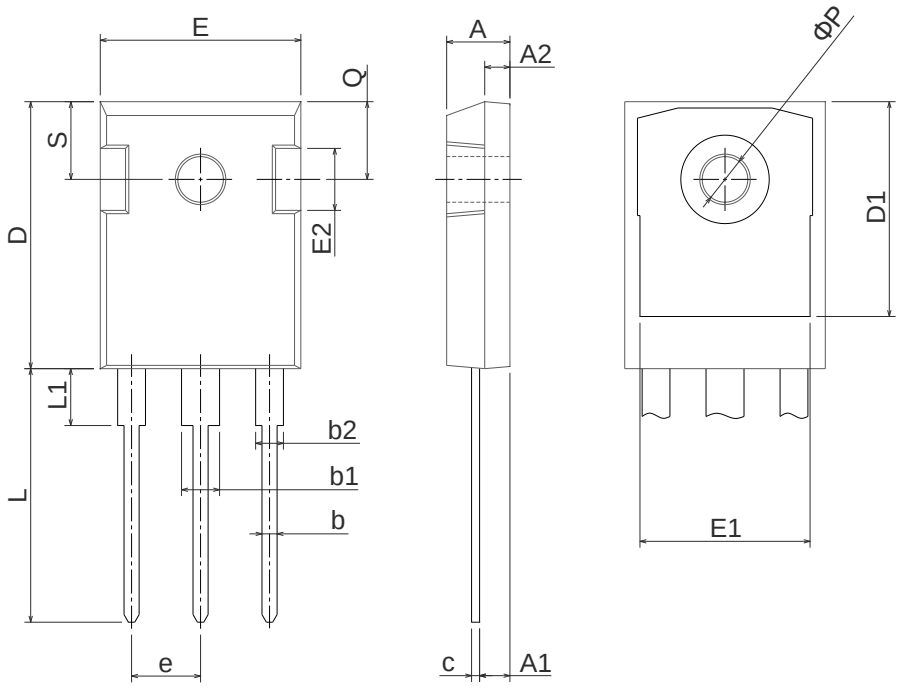


Fig.22 IGBT Transient Thermal Impedance

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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