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.

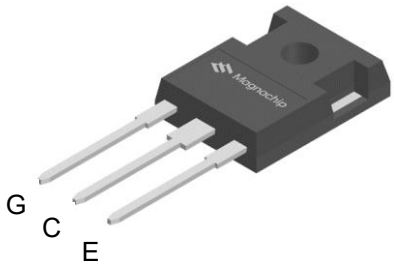
Applications

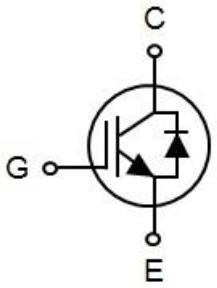
- PFC
- UPS
- Inverter

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

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

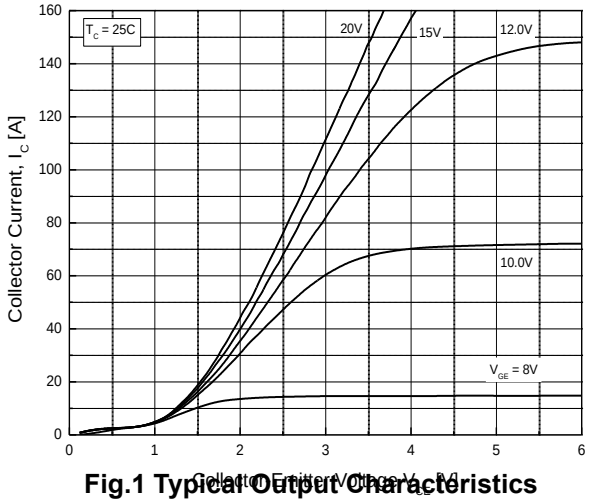


Fig.1 Typical Output Characteristics

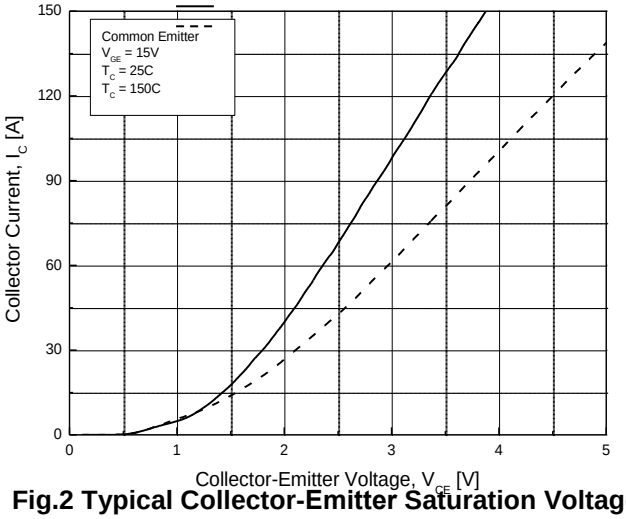


Fig.2 Typical Collector-Emitter Saturation Voltage

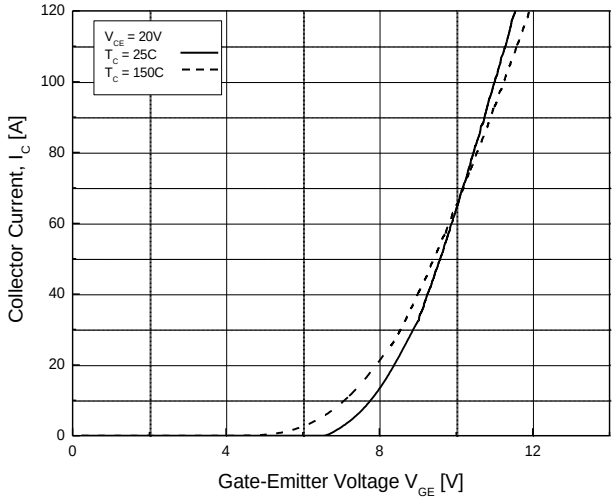


Fig.3 Typical Transfer Characteristics

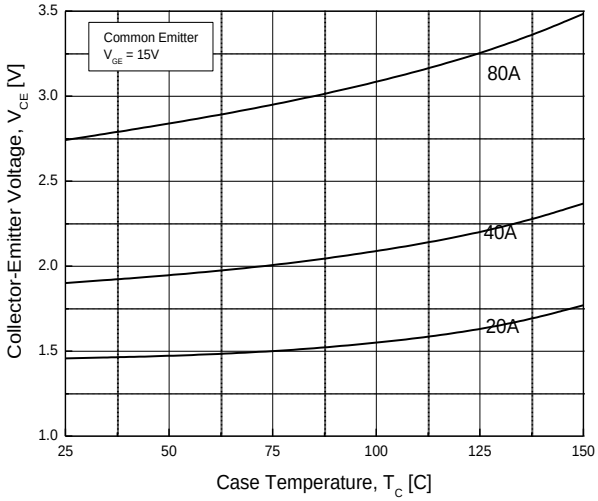


Fig.4 Typical Collector-Emitter Saturation Voltage at Case Temperature

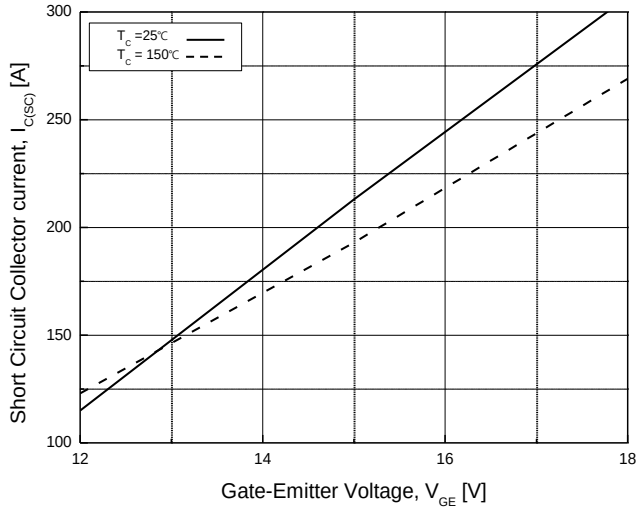


Fig.5 Typical Short Circuit Collector Current

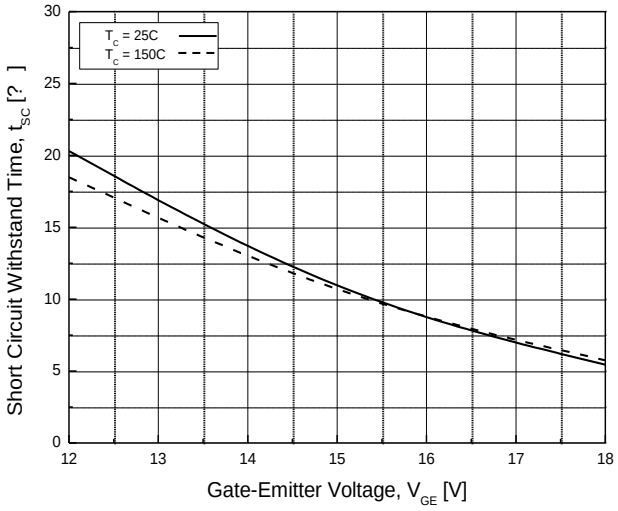


Fig.6 Typical Short Circuit Withstand Time

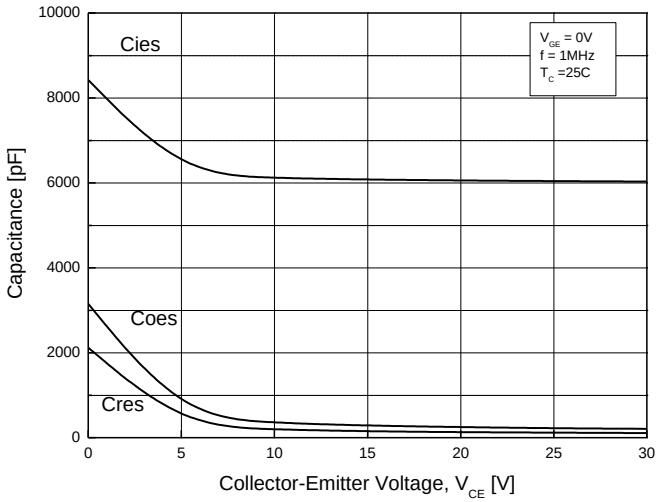


Fig.7 Typical Capacitance

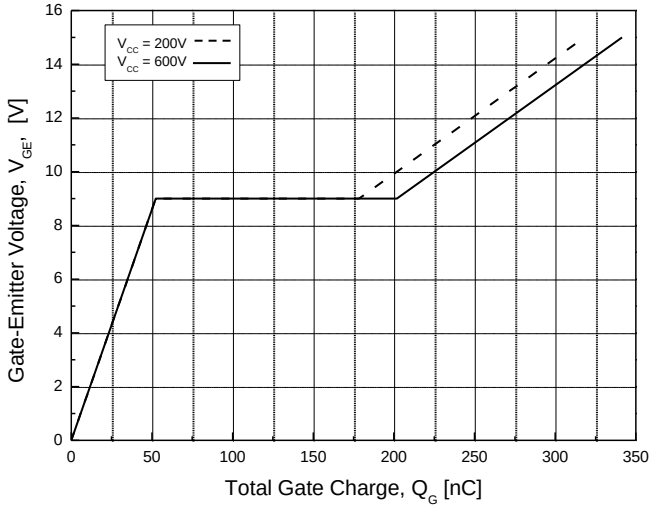


Fig.8 Typical Gate Charge

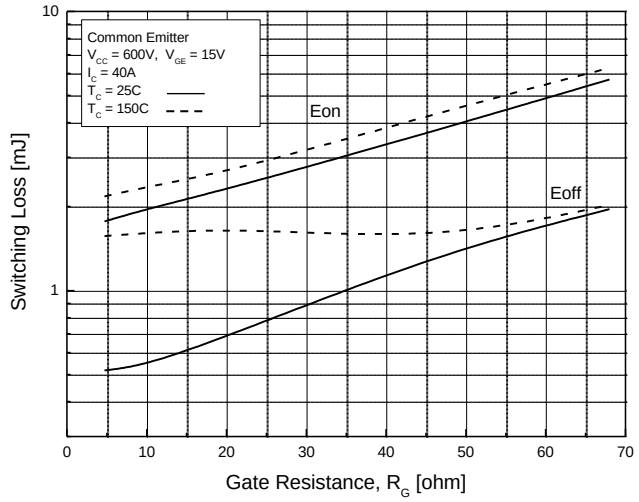


Fig.9 Switching Loss-Gate Resistance

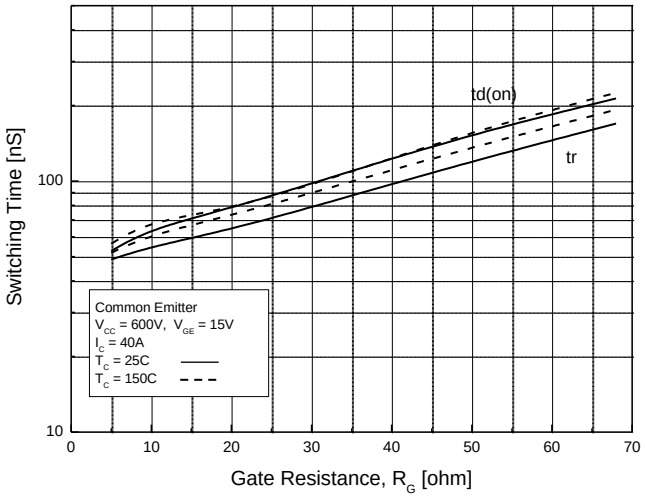


Fig.10 Turn on Characteristics-Gate Resistance

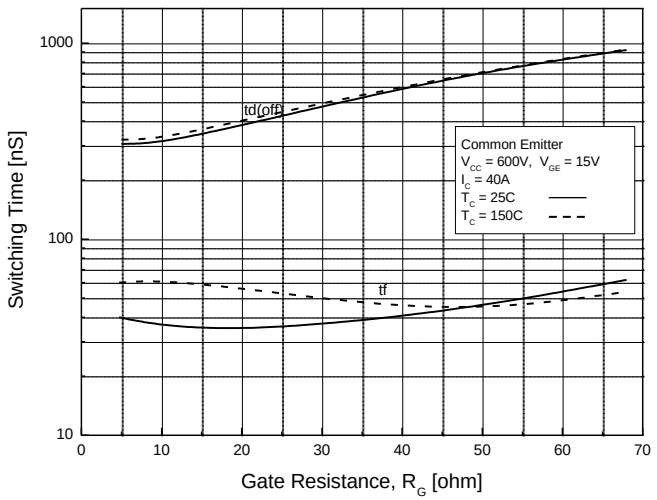


Fig.11 Turn off Characteristics-Gate Resistance

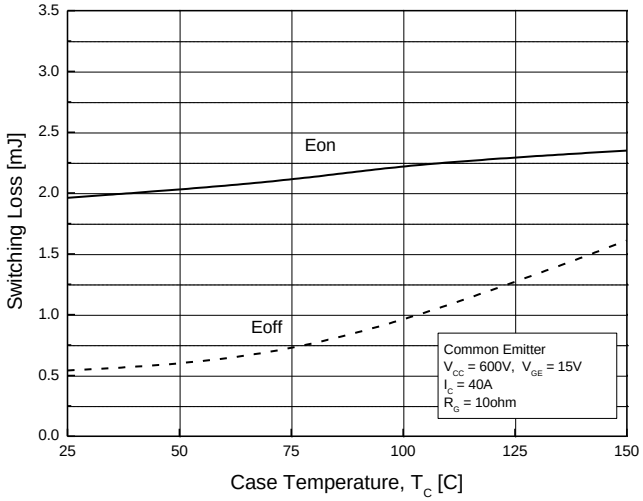


Fig.12 Switching Loss-Case Temperature

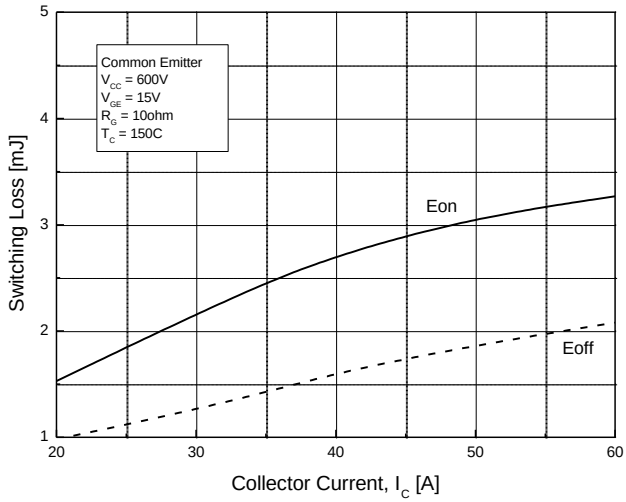


Fig.13 Switching Loss-Collector Current

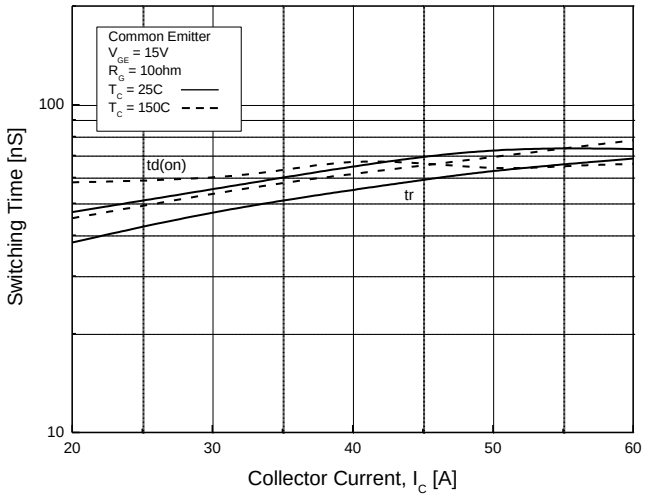


Fig.14 Typical Turn on-Collector Current

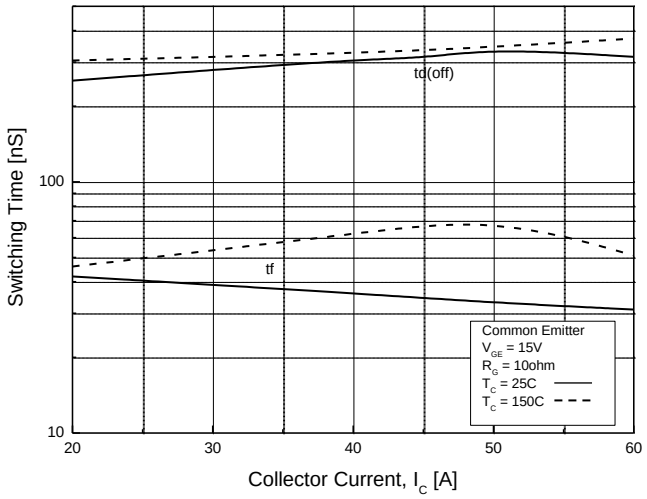


Fig.15 Typical Turn off-Collector Current

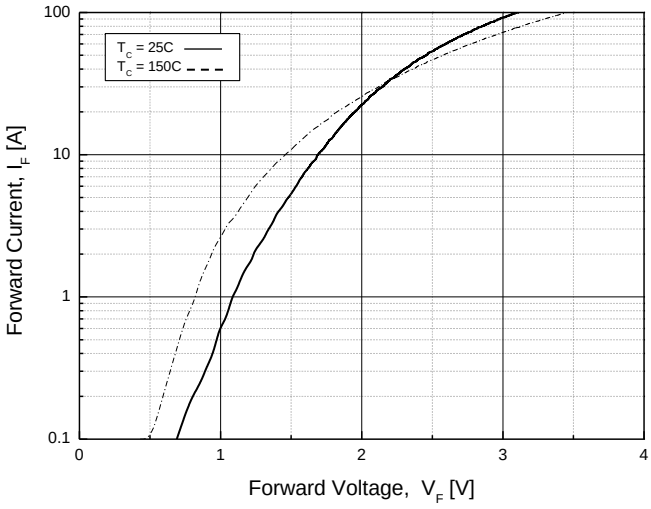


Fig.16 Diode Forward Characteristics

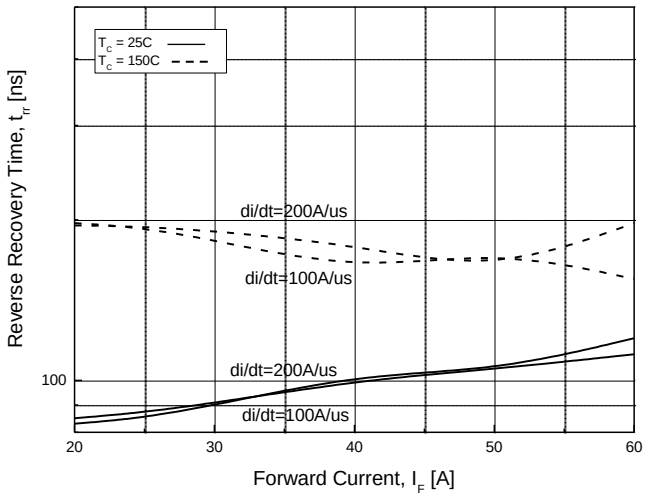


Fig.17 Typical Turn off-Collector Current

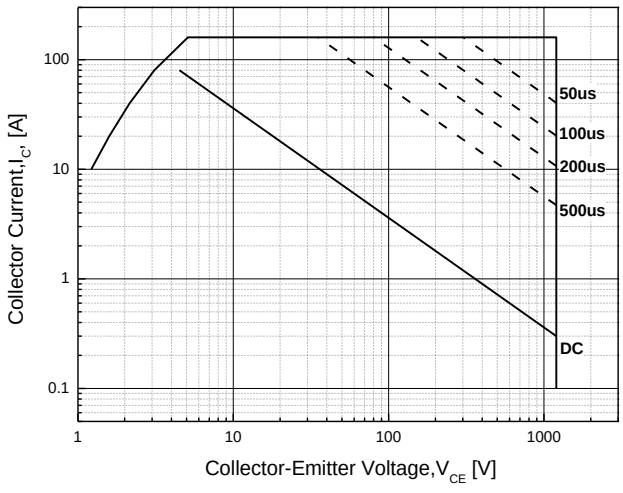


Fig.18 Forward Bias Safe Operating Area

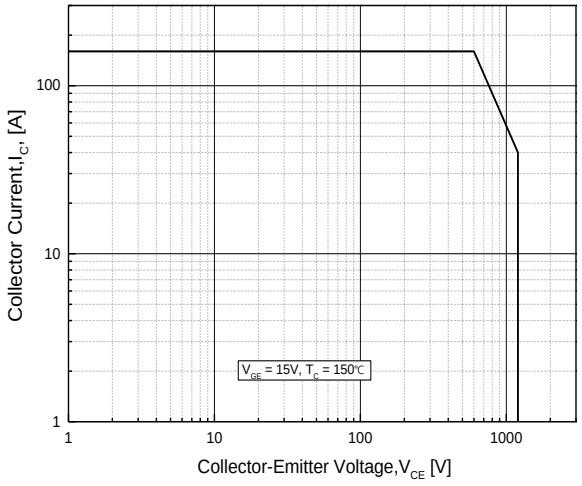


Fig.19 Reverse Bias Safe Operating Area

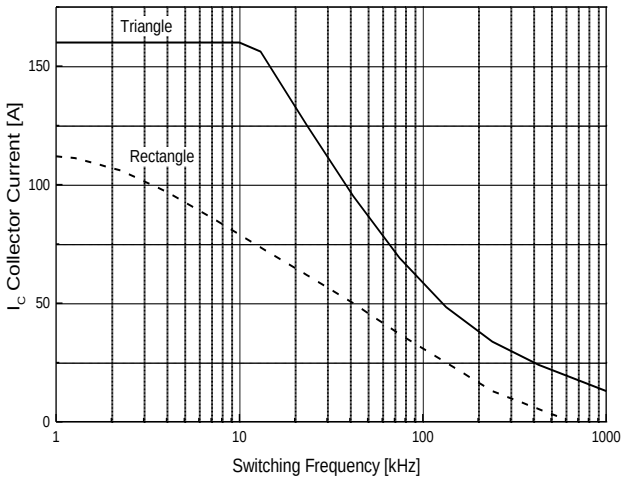


Fig.20 Switching frequency – Collector current

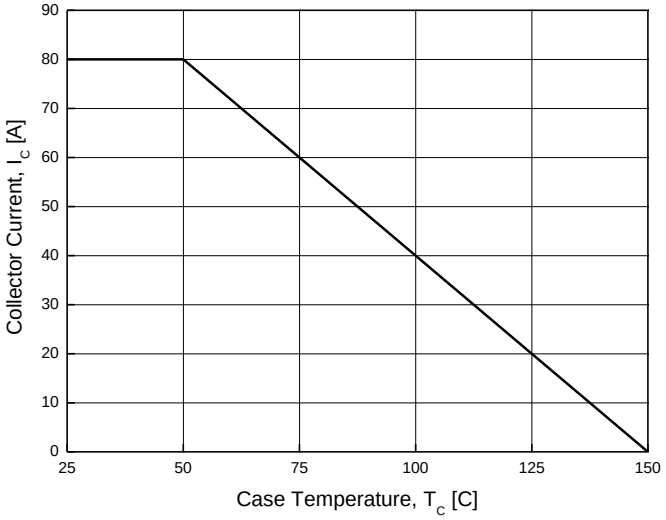


Fig.21 Case Temperature – Collector Current

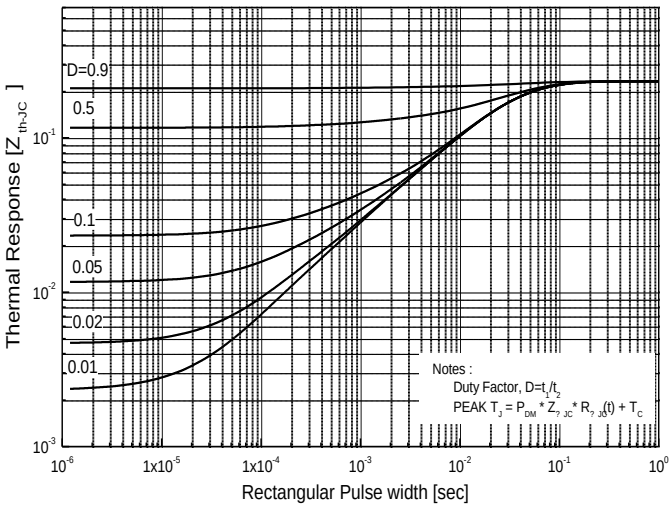
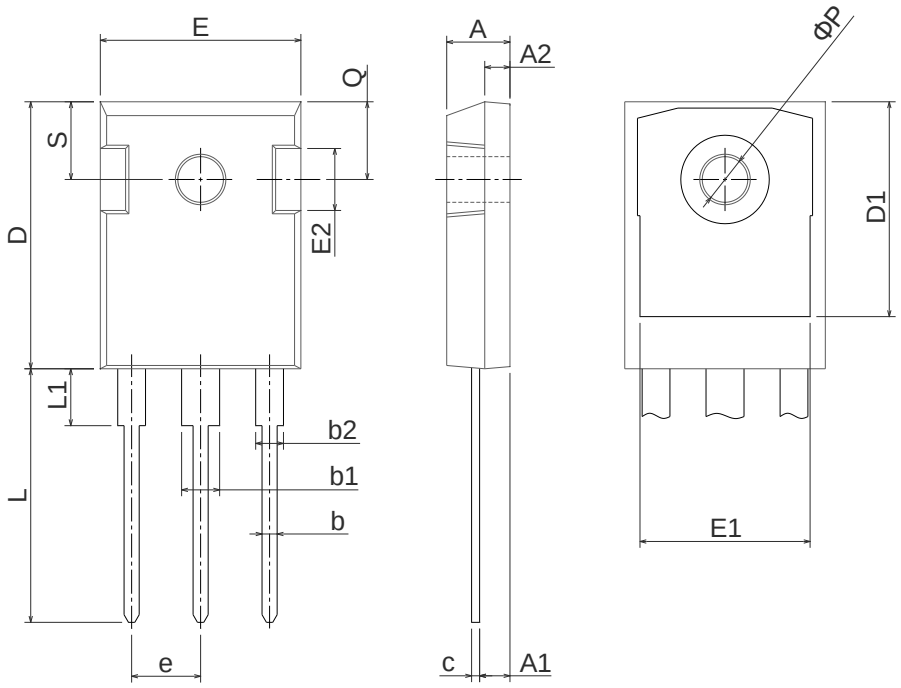


Fig.22 IGBT Transient Thermal Impedance

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.

DISCLAIMER:

The Products are not designed for use in hostile environments, including, without limitation, aircraft, nuclear power generation, medical appliances, and devices or systems in which malfunction of any Product can reasonably be expected to result in a personal injury. Seller's customers using or selling Seller's products for use in such applications do so at their own risk and agree to fully defend and indemnify Seller.