

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.

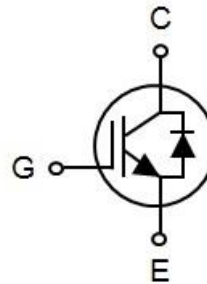
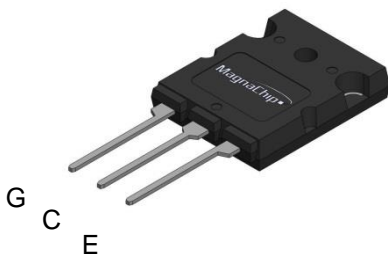
Applications

- 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	I_C	$T_C = 25^\circ C$	80	A
		$T_C = 100^\circ C$	40	A
Pulsed collector current, pulse time limited by T_{jmax}	I_{CM}	160	A	
Diode forward current @ $T_C = 100^\circ C$	I_F	40	A	
Diode pulsed current, Pulse time limited by T_{jmax}	I_{FM}	160	A	
Power dissipation	P_D	$T_C = 25^\circ C$	357	W
		$T_C = 100^\circ C$	142	W
Short circuit withstand time $V_{CE} = 600V, V_{GE} = 15V, T_C = 150^\circ C$ Allowed number of short circuit < 1000 Time between short circuits $\geq 1.0s$	tsc	10	μs	
Operating Junction and storage temperature range	T_J, T_{stg}	-55~150	$^\circ C$	

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.35	
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 (T_c =25°C 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 (T_c =25°C 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

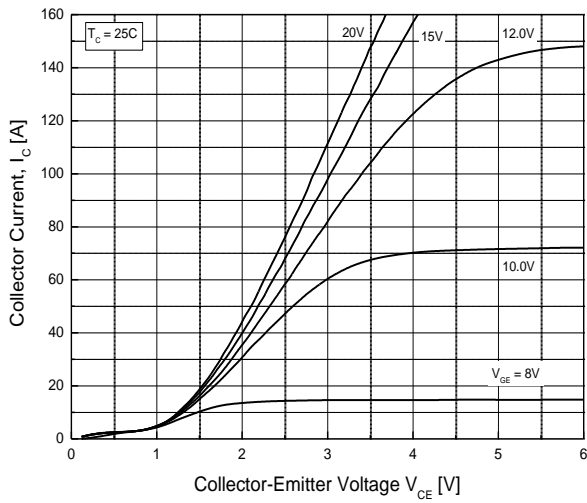


Fig.1 Typical Output Characteristics

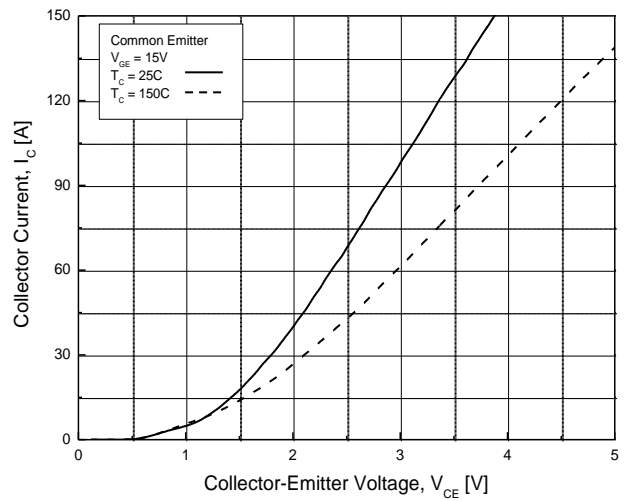


Fig.2 Typical Collector-Emitter Saturation Voltage

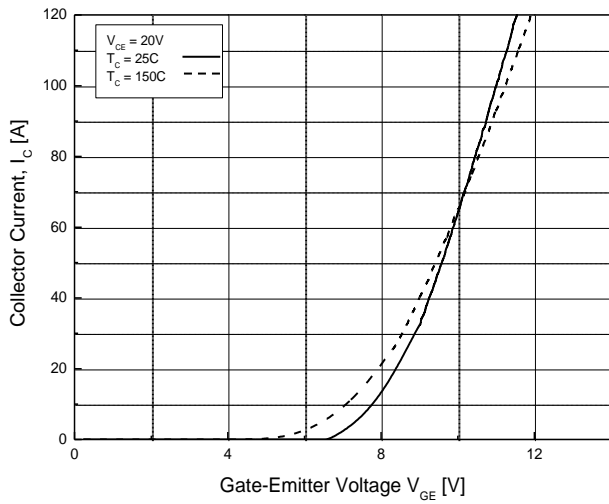


Fig.3 Typical Transfer Characteristics

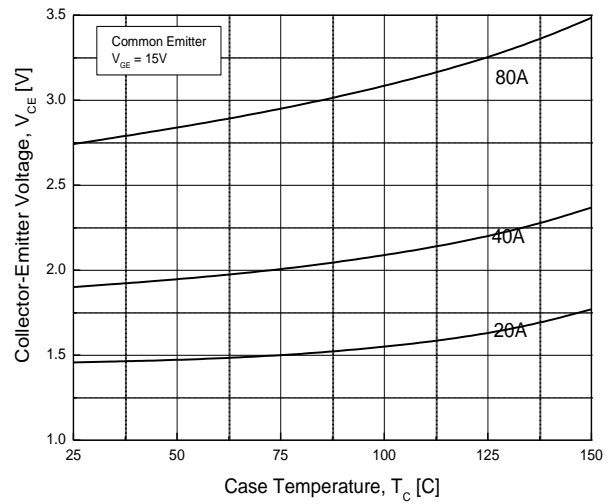


Fig.4 Typical Collector-Emitter Saturation Voltage at Case Temperature

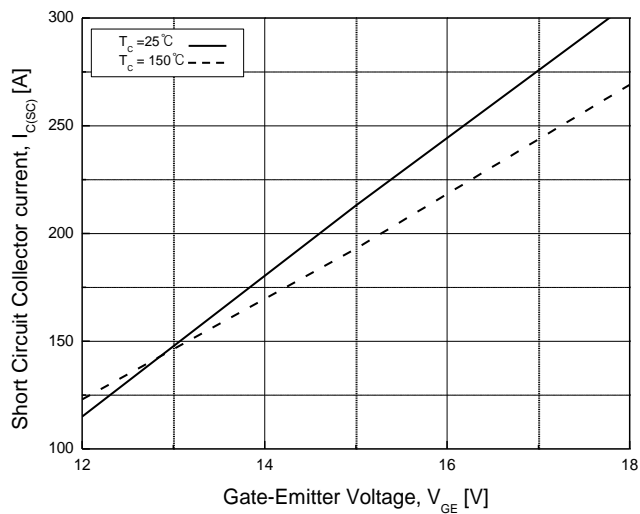


Fig.5 Typical Short Circuit Collector Current

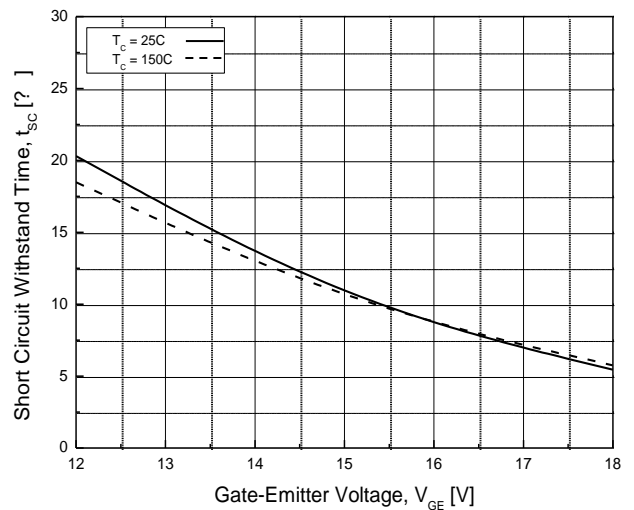


Fig.6 Typical Short Circuit Withstand Time

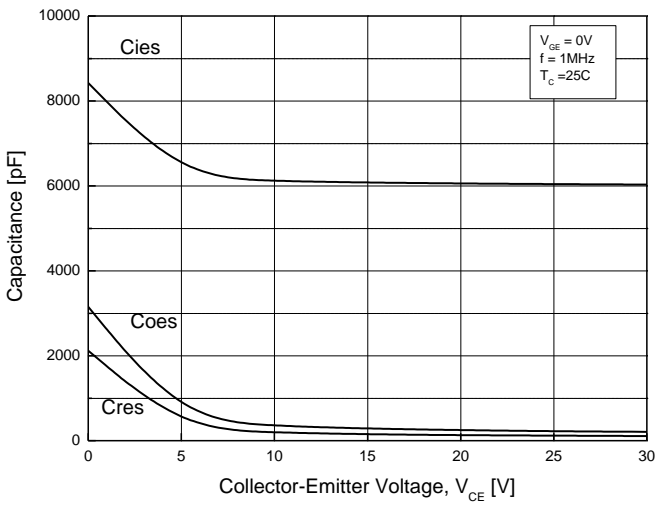


Fig.7 Typical Capacitance

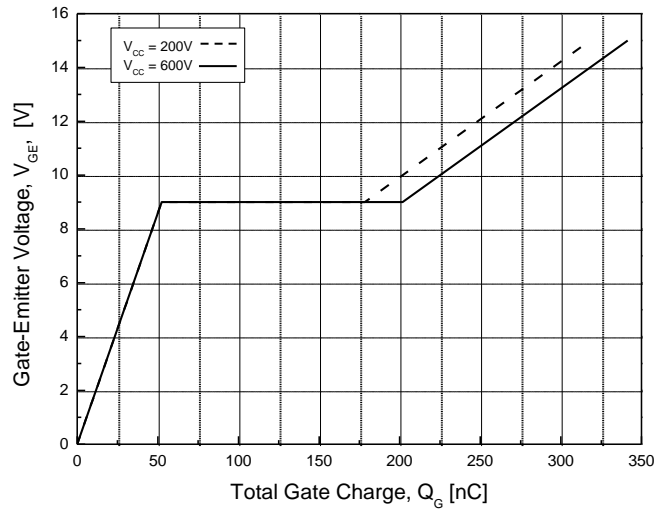


Fig.8 Typical Gate Charge

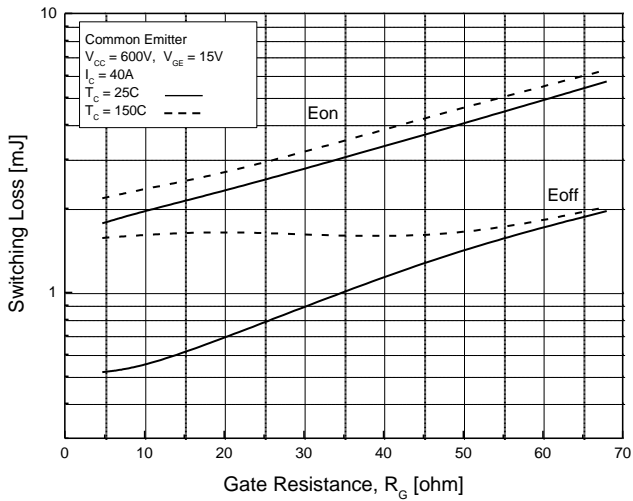


Fig.9 Switching Loss-Gate Resistance

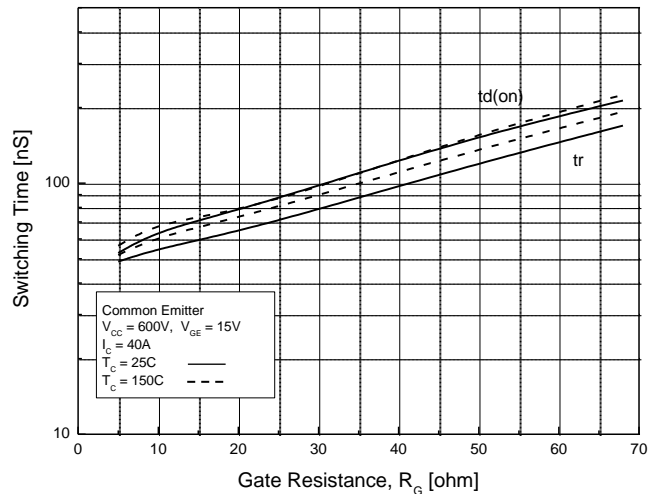


Fig.10 Turn on Characteristics-Gate Resistance

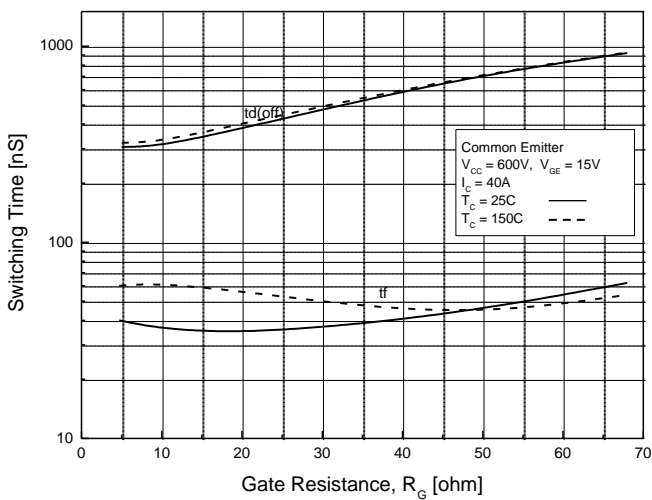


Fig.11 Turn off Characteristics-Gate Resistance

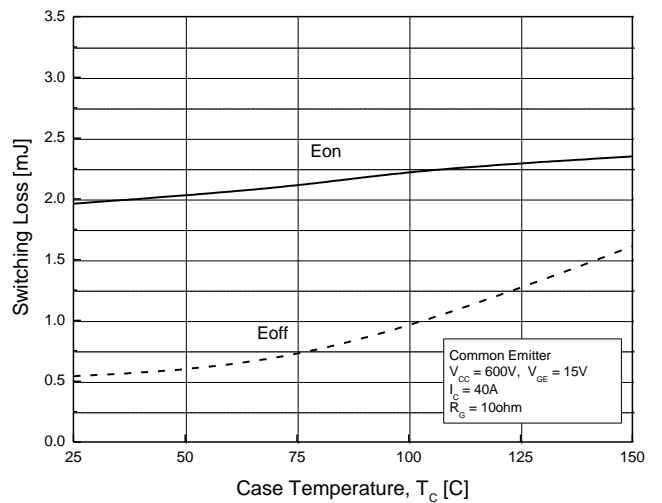


Fig.12 Switching Loss-Case Temperature

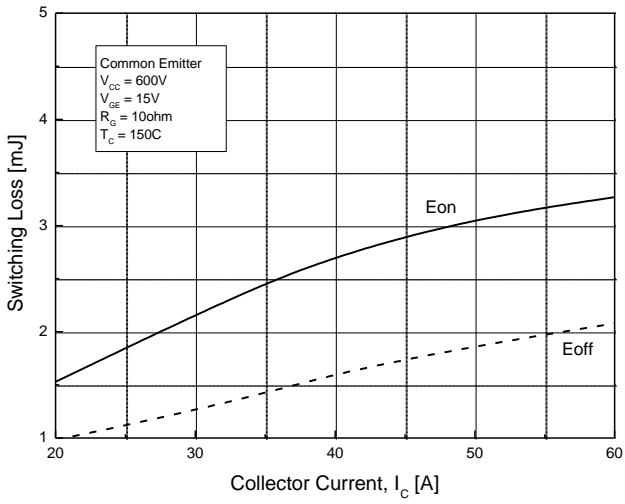


Fig.13 Switching Loss-Collector Current

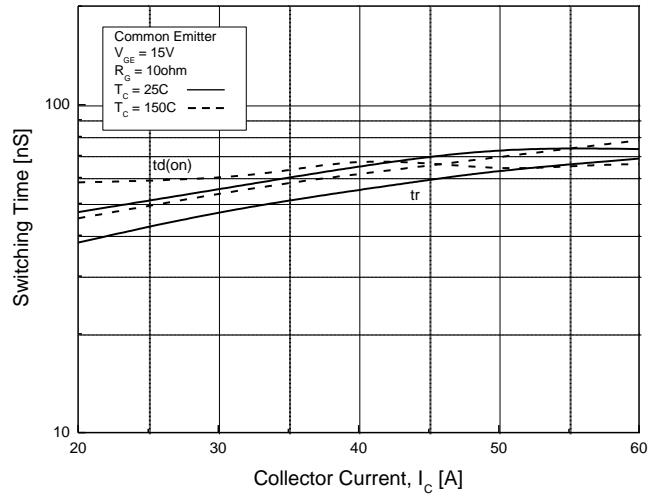


Fig.14 Typical Turn on-Collector Current

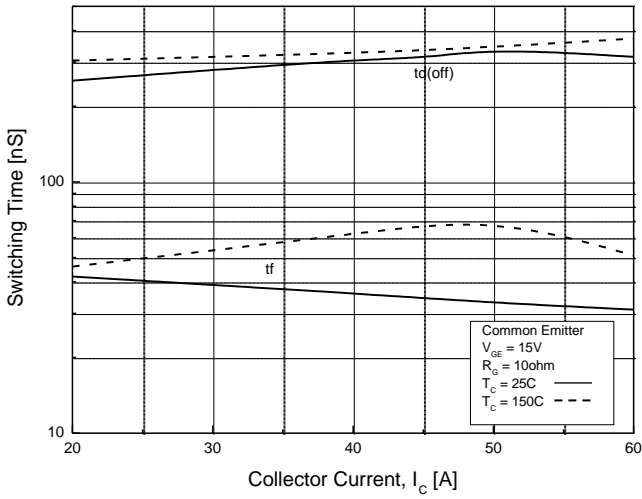


Fig.15 Typical Turn off-Collector Current

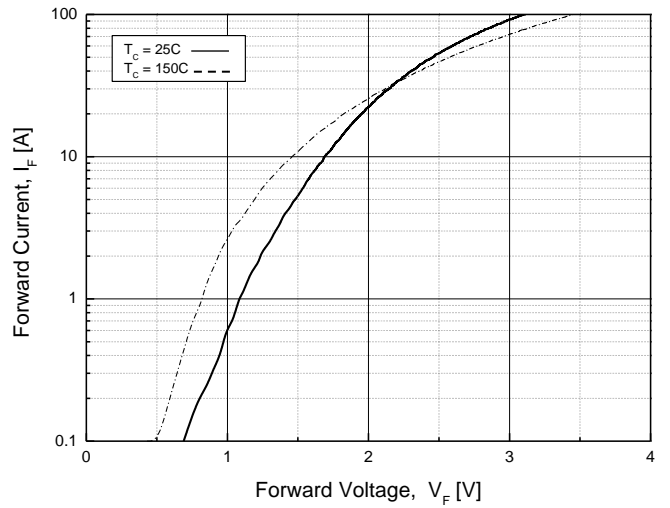


Fig.16 Diode Forward Characteristics

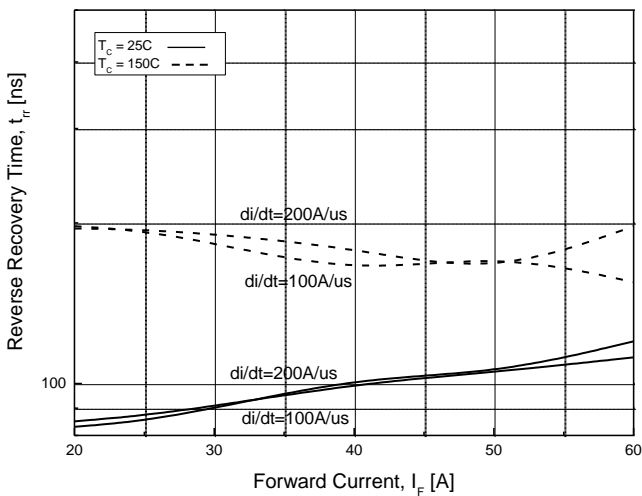


Fig.17 Typical Turn off-Collector Current

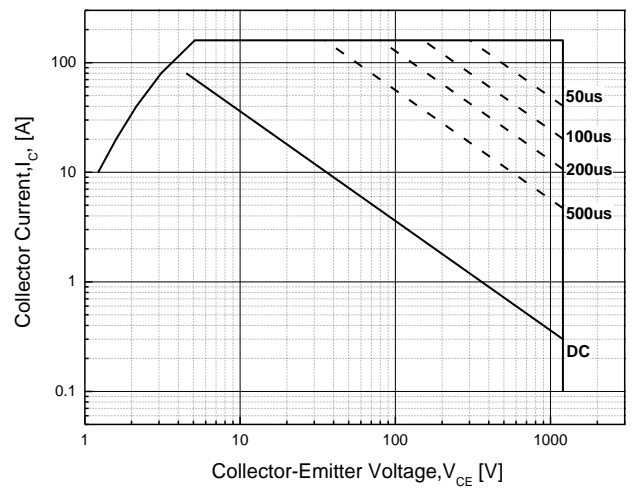


Fig.18 Forward Bias Safe Operating Area

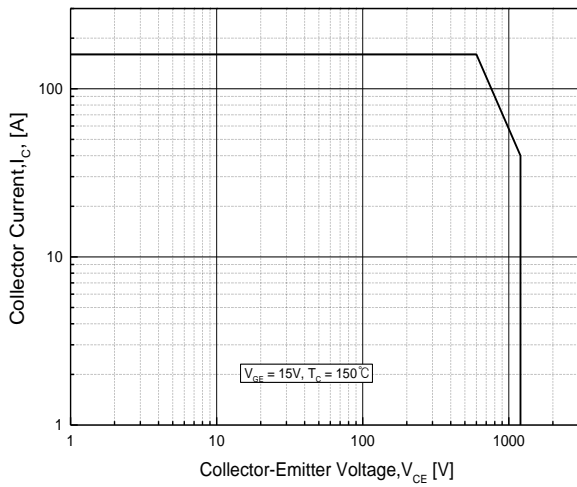


Fig.19 Reverse Bias Safe Operating Area

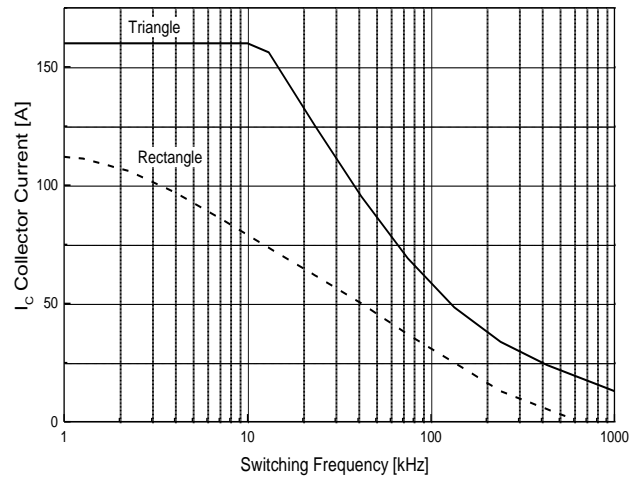


Fig.20 Switching frequency – Collector current

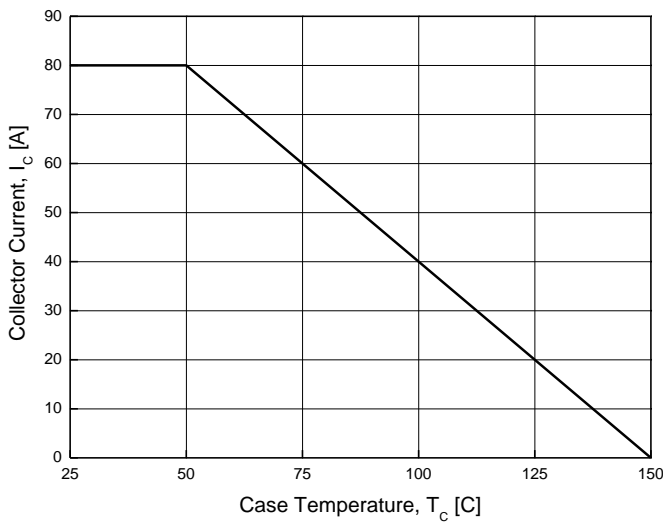


Fig.21 Case Temperature – Collector Current

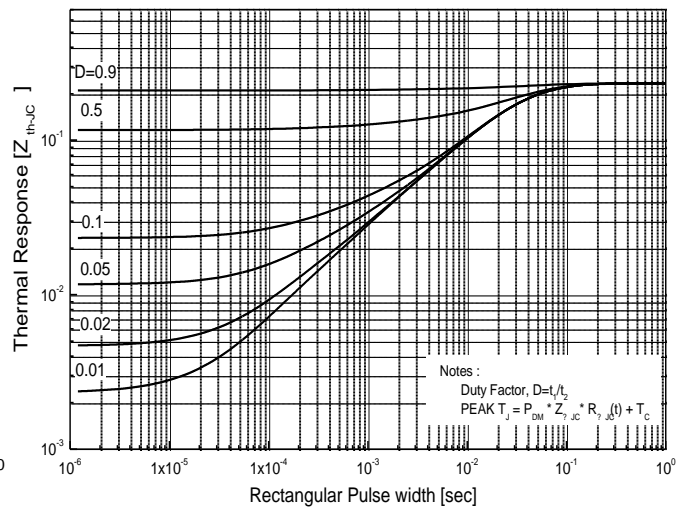
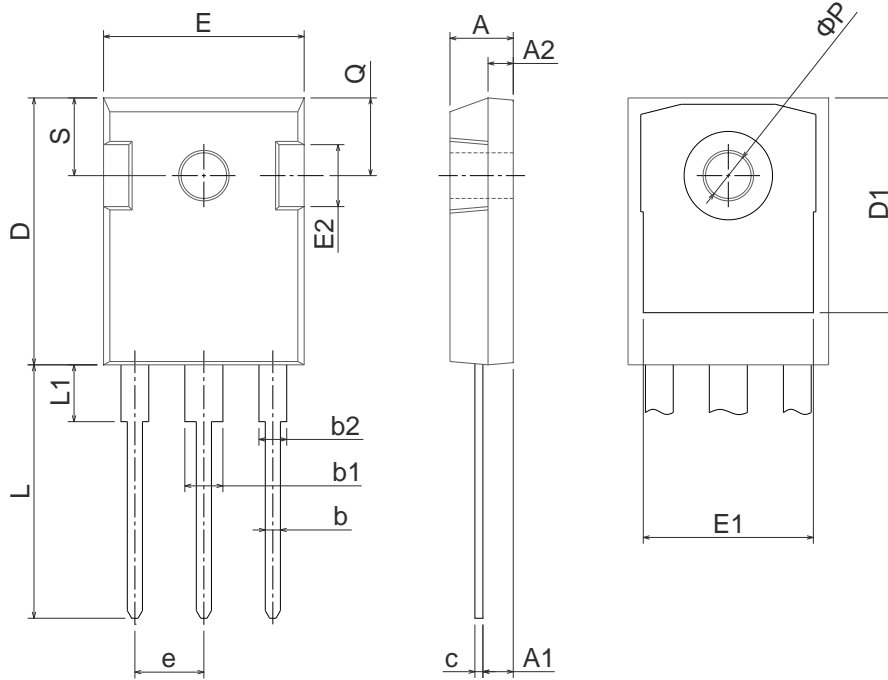


Fig.22 IGBT Transient Thermal Impedance

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	

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.

MagnaChip reserves the right to change the specifications and circuitry without notice at any time. MagnaChip does not consider responsibility for use of any circuitry other than circuitry entirely included in a MagnaChip product. [MagnaChip](#) is a registered trademark of MagnaChip Semiconductor Ltd.