

General Description

This IGBT is produced using advanced MagnaChip's Field Stop Trench IGBT Technology, which provides high switching series and excellent quality.

This device is for PFC, UPS & Inverter applications.

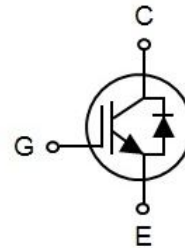
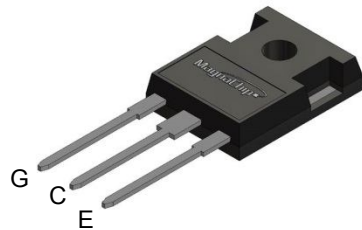
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.95V @ I_C = 40A$
- $E_{off} = 0.3mJ @ T_C = 25^\circ C$
- High Input Impedance
- $t_{rr} = 80ns (typ.) @ di_F/dt = 1000A/\mu s$
- 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	$T_C=25^\circ C$	80
		$T_C=100^\circ C$	40
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	160	A
Turn off safe operating area $V_{CE} \leq 600V, T_{vj} \leq 175^\circ C$	-	160	A
Diode forward current limited by T_{vjmax}	I_F	$T_C=25^\circ C$	40
		$T_C=100^\circ C$	20
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	160	A
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation	P_D	$T_C=25^\circ C$	341
		$T_C=100^\circ C$	170
Short circuit withstand time $V_{CC} \leq 400V, V_{GE} = 15V, T_{vj} = 150^\circ C$ Allowed number of short circuits < 1000 Time between short circuits $\geq 1.0s$	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	$R_{\theta JC}$	0.44	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.2	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ40T65FESC	40T65FESC	-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 _{CE(sat)}	I _C = 40A, V _{GE} = 15V	T _{vj} = 25°C	1.95	2.4	V
			T _{vj} = 175°C	2.3		
Diode forward voltage	V _F	V _{GE} = 0V, I _F = 20A	T _{vj} = 25°C	1.5	1.9	V
			T _{vj} = 175°C	1.4		
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 = 40A, V _{GE} = 15V	-	218		nC
Gate-emitter charge	Q _{ge}		-	33		
Gate-collector charge	Q _{gc}		-	136		
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz	-	3342	-	pF
Reverse transfer capacitance	C _{res}		-	120	-	
Output capacitance	C _{oes}		-	198	-	
Internal emitter inductance measured 5mm (0.197 in.) from case	L _E		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: ≥ 1.0s	I _{C(SC)}	V _{GE} = 15V, V _{CC} = 400V, t _{SC} ≤ 5μs, T _{vj} = 150°C	-	120	-	A
Switching Characteristic						
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 40A, R _G = 7.9Ω, Inductive Load, T _{vj} = 25°C	-	50	-	ns
Rise time	t _r		-	49	-	
Turn-off delay time	t _{d(off)}		-	318	-	
Fall time	t _f		-	36	-	mJ
Turn-on switching energy	E _{on}		-	0.68	-	
Turn-off switching energy	E _{off}		-	0.30	-	
Total switching energy	E _{ts}	-	0.98	-		
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 40A, R _G = 7.9Ω, Inductive Load, T _{vj} = 175°C	-	45	-	ns
Rise time	t _r		-	57	-	
Turn-off delay time	t _{d(off)}		-	366	-	
Fall time	t _f		-	47	-	mJ
Turn-on switching energy	E _{on}		-	0.95	-	
Turn-off switching energy	E _{off}		-	0.36	-	
Total switching energy	E _{ts}	-	1.31	-		
Reverse recovery time	t _{rr}	I _F = 20A, di _F /dt = 1000A/μs, T _{vj} = 25°C	-	80	-	ns
Reverse recovery current	I _{rr}		-	20	-	A
Reverse recovery charge	Q _{rr}		-	0.8	-	μC
Reverse recovery time	t _{rr}	I _F = 20A, di _F /dt = 1000A/μs, T _{vj} = 175°C	-	92	-	ns
Reverse recovery current	I _{rr}		-	28	-	A
Reverse recovery charge	Q _{rr}		-	1.3	-	nC

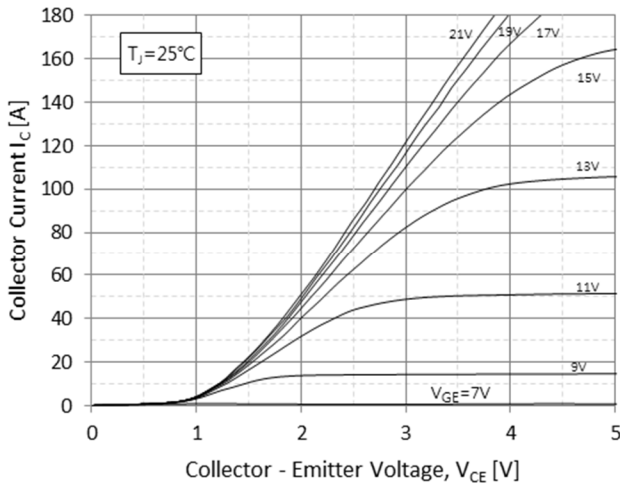


Fig.1 Typical Output Characteristics ($T_J = 25^\circ\text{C}$)

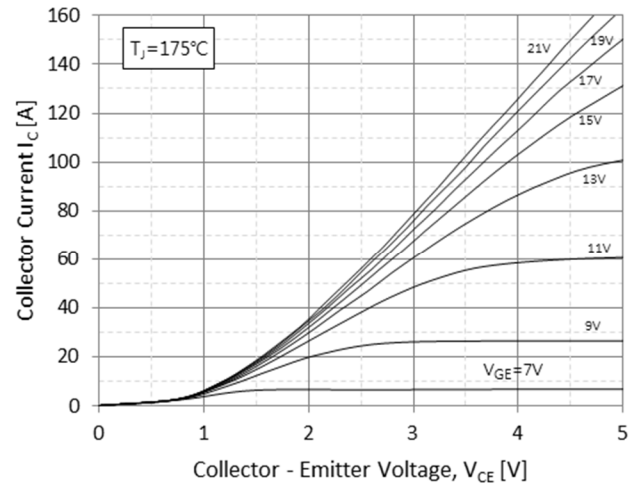


Fig.2 Typical Output Characteristics ($T_J = 175^\circ\text{C}$)

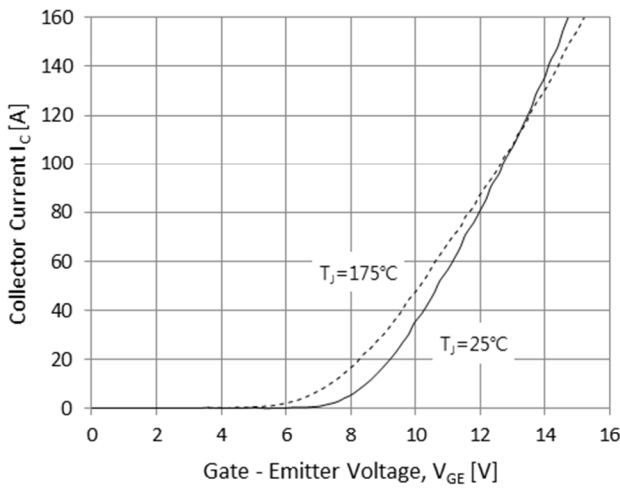


Fig.3 Typical Transfer Characteristics

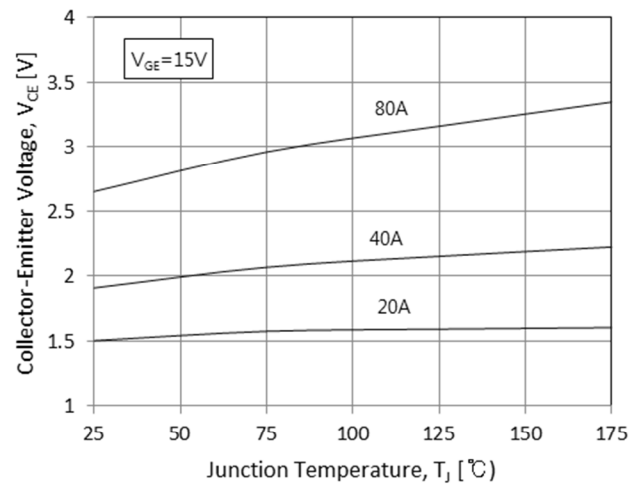


Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature

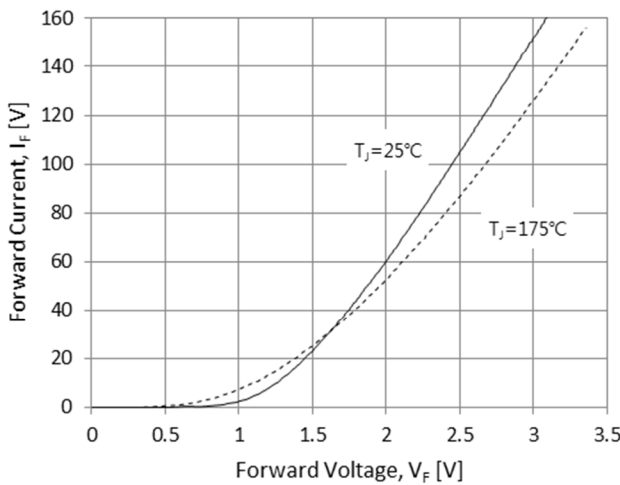


Fig.5 Diode Forward Characteristics

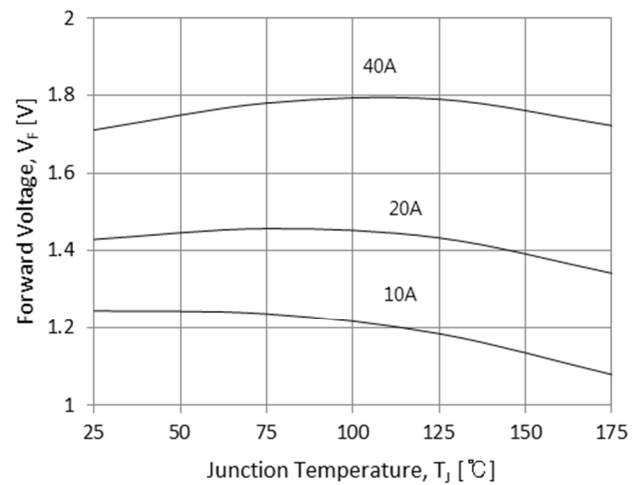


Fig.6 Diode Forward-Junction Temperature

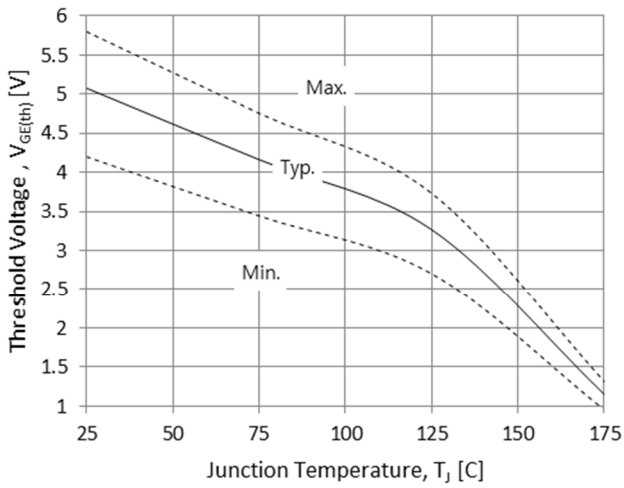


Fig.7 Threshold Voltage-Junction Temperature

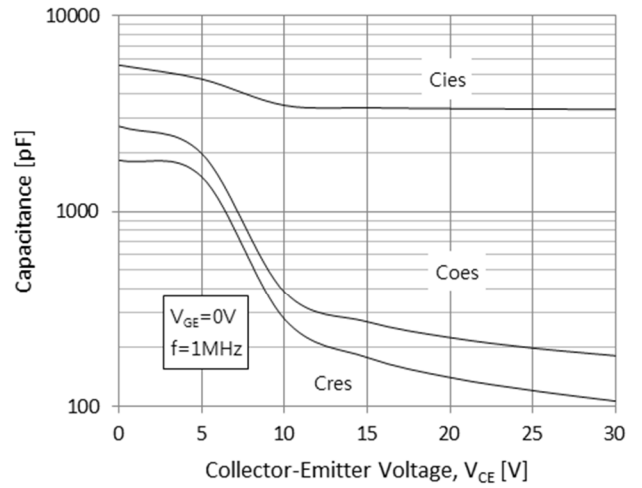


Fig.8 Typical Capacitance

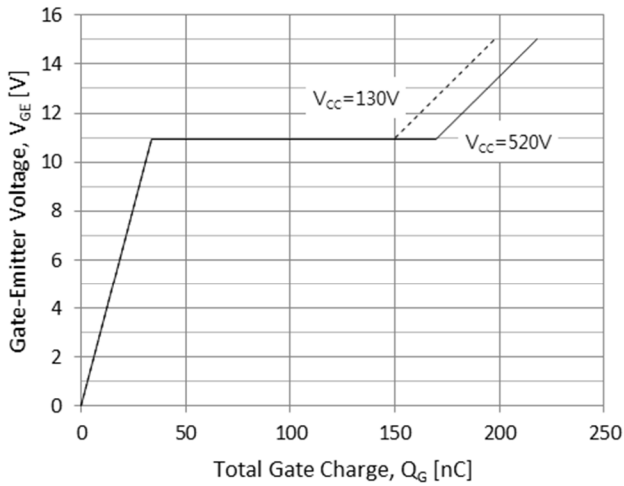


Fig.9 Typical Gate Charge

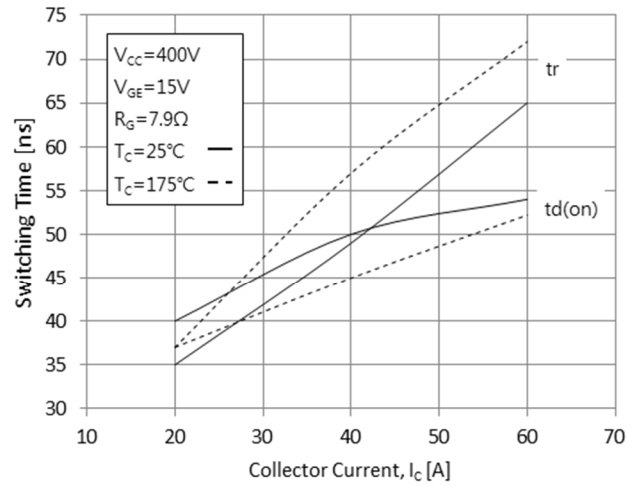


Fig.10 Typical Turn on-Collector Current

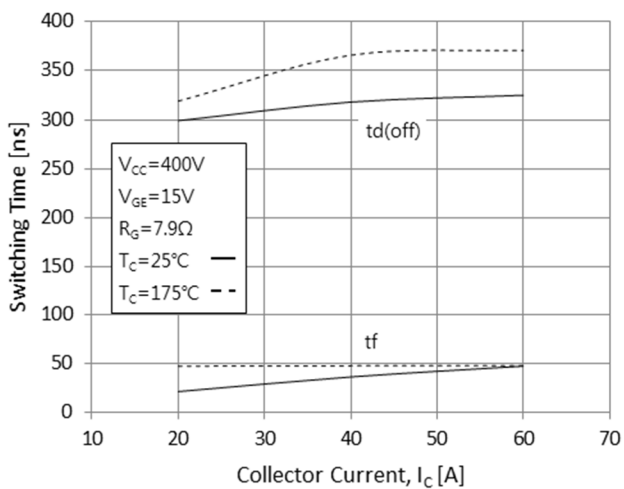


Fig.11 Typical Turn off-Collector Current

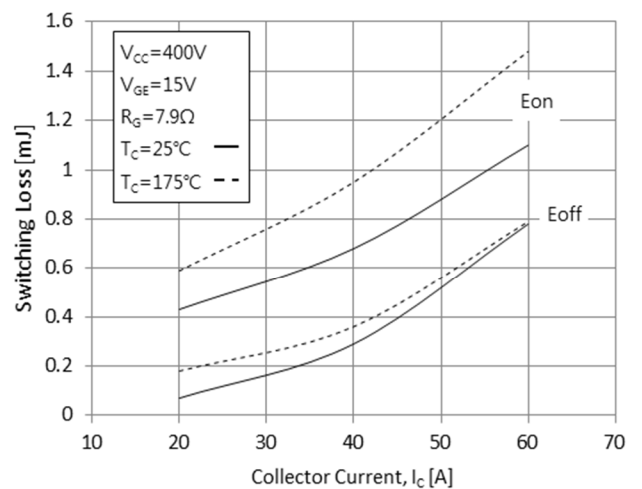


Fig.12 Switching Loss-Collector Current

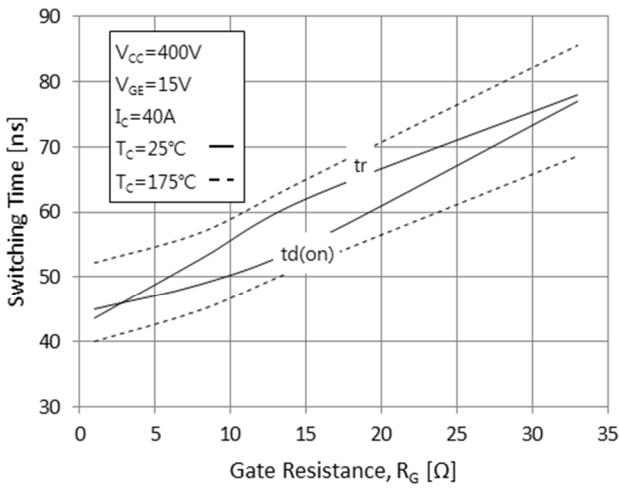


Fig.13 Turn on Characteristics-Gate Resistance

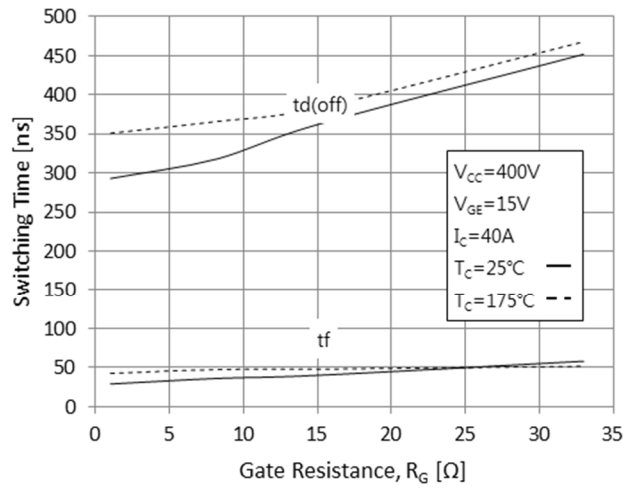


Fig.14 Turn off Characteristics-Gate Resistance

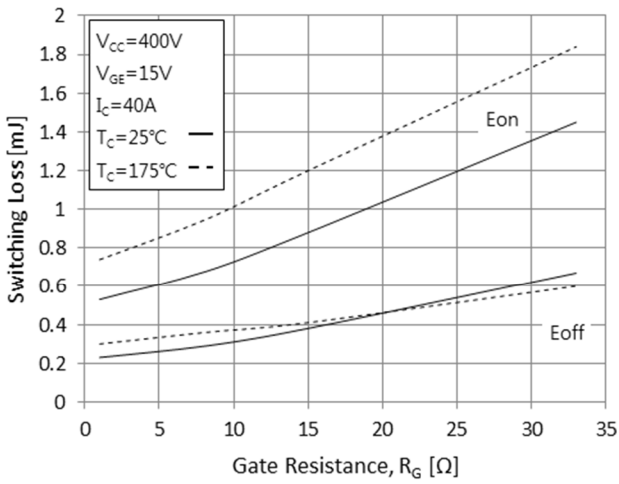


Fig.15 Switching Loss-Gate Resistance

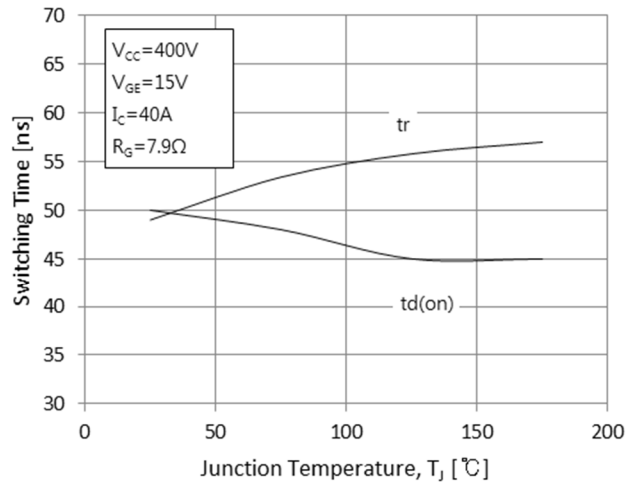


Fig.16 Turn on Characteristics-Junction Temperature

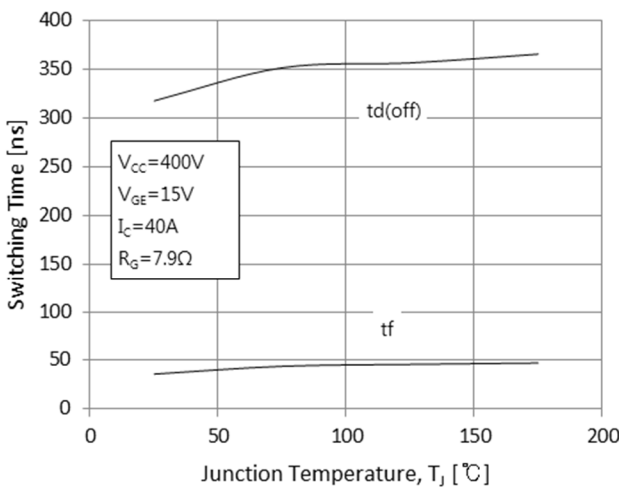


Fig.17 Turn off Characteristics-Junction Temperature

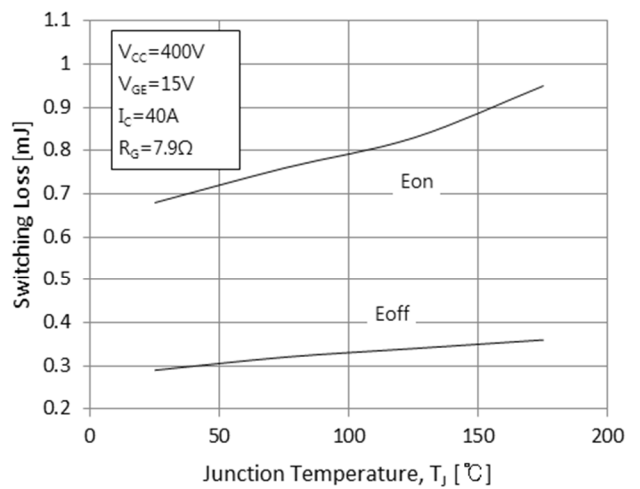


Fig.18 Switching Loss-Junction Temperature

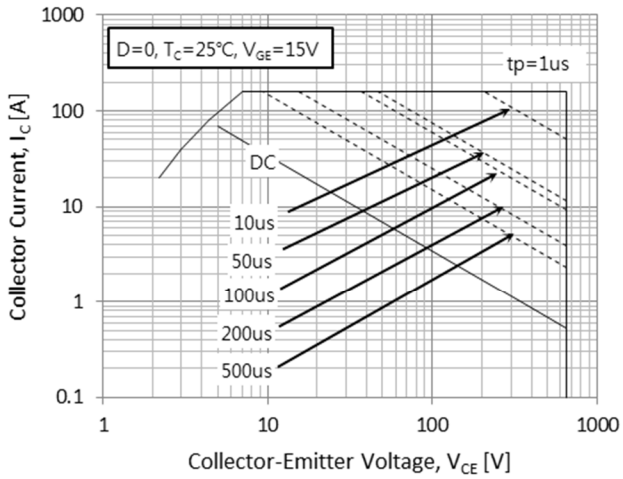


Fig.19 Forward Bias Safe Operating Area

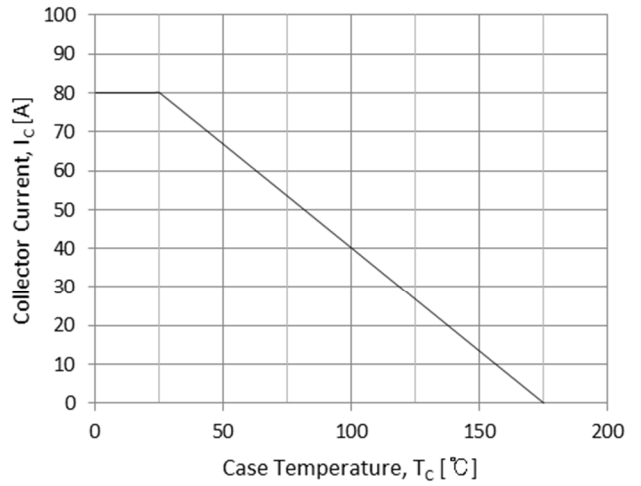


Fig.20 Case Temperature-Collector Current

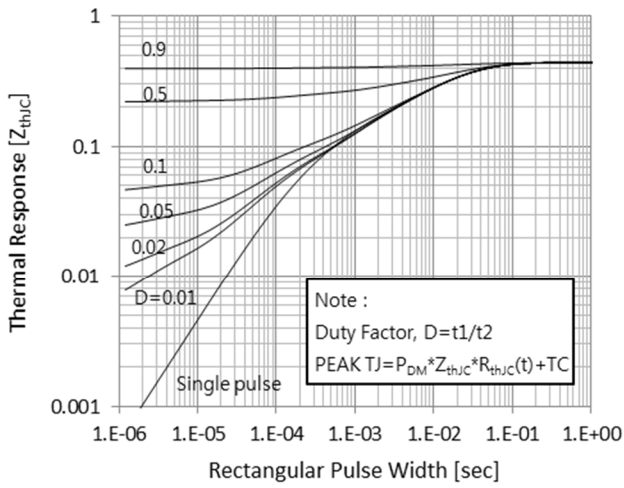


Fig.21 IGBT Transient Thermal Impedance

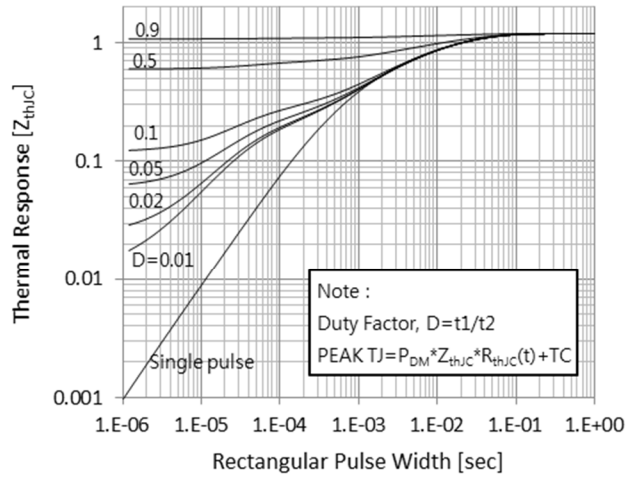
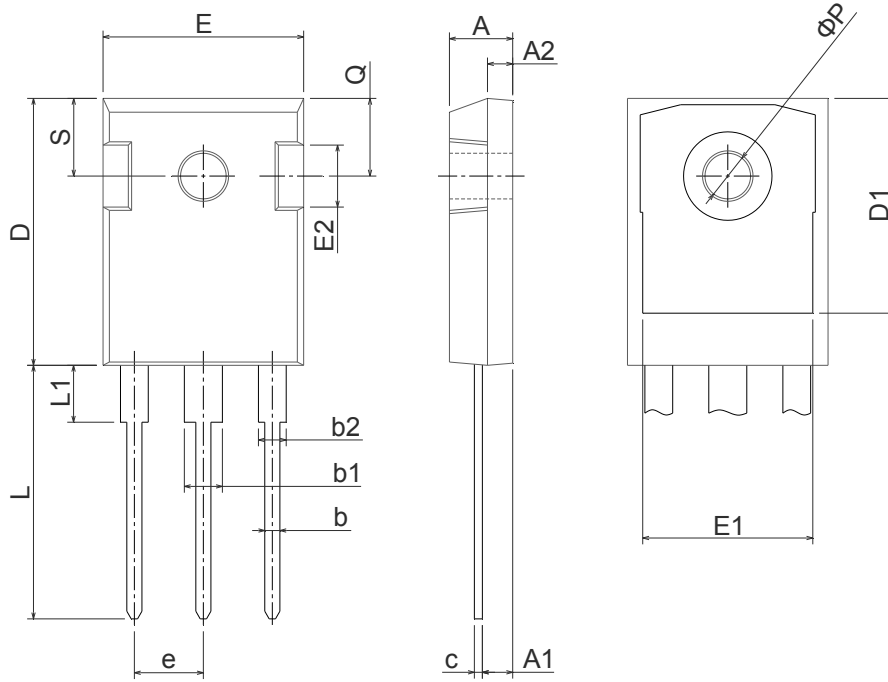


Fig.22 FRD Transient Thermal Impedance

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.