

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.

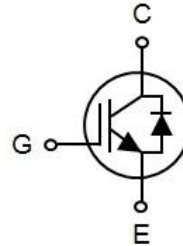
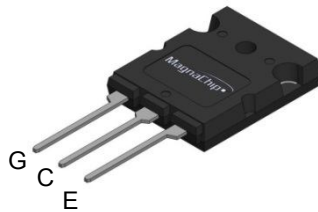
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.95V @ I_C = 40A$
- $E_{off} = 0.35mJ @ T_C = 25^\circ C$
- 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	$T_C=25^\circ C$	375
		$T_C=100^\circ C$	188
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	$R_{\theta JC}$	0.4	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.2	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ40T65FDSC	40T65FDSC	-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	
		I _C = 40A, V _{GE} = 15V, T _{vj} = 175°C		2.3			
Diode forward voltage	V _F	V _{GE} = 0V, I _F = 20A	T _{vj} = 25°C		1.3	1.9	V
			T _{vj} = 125°C		1.15		
			T _{vj} = 175°C		1.1		
Gate-emitter threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 0.58mA	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
			T _{vj} = 175°C	-	-	1000	
Gate-emitter leakage current	I _{GES}	V _{GE} = 20V, V _{CE} = 0V	-	-	±100	nA	
Transconductance	g _{fs}	V _{CE} = 20V, I _C = 40A,		17.0		S	
Dynamic Characteristic							
Total gate charge	Q _g	V _{CE} = 520V, I _C = 40A, V _{GE} = 15V	-	219		nC	
Gate-emitter charge	Q _{ge}		-	26			
Gate-collector charge	Q _{gc}		-	115			
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz	-	2818	-	pF	
Reverse transfer capacitance	C _{res}		-	131	-		
Output capacitance	C _{oes}		-	209	-		
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	-	180	-	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	-	58	-	ns	
Rise time	t _r		-	54	-		
Turn-off delay time	t _{d(off)}		-	245	-		
Fall time	t _f		-	40	-	mJ	
Turn-on switching energy	E _{on}		-	1.15	-		
Turn-off switching energy	E _{off}		-	0.35	-		
Total switching energy	E _{ts}		-	1.50	-		
Reverse recovery time	t _{rr}	I _F = 20A, di _F /dt = 1000A/μs, T _{vj} = 25°C	-	80	-	ns	
Reverse recovery current	I _{rr}		-	25	-	A	
Reverse recovery charge	Q _{rr}		-	1.0	-	μC	
Rate of fall of reverse recovery current during t _b	di _{rr} /dt		-	-950	-	A/μs	

Switching Characteristic						
Turn-on delay time	$t_{d(on)}$	$V_{GE} = 15V, V_{CC} = 400V,$ $I_C = 40A, R_G = 7.9\Omega,$ Inductive Load, $T_{vj} = 175^\circ C$	-	61	-	ns
Rise time	t_r		-	60	-	
Turn-off delay time	$t_{d(off)}$		-	260	-	
Fall time	t_f		-	38	-	
Turn-on switching energy	E_{on}		-	1.80	-	mJ
Turn-off switching energy	E_{off}	-	0.38	-		
Total switching energy	E_{ts}	-	2.18	-		
Reverse recovery time	t_{rr}	$I_F = 20A, di_F/dt = 1000A/\mu s,$ $T_{vj} = 175^\circ C$	-	145	-	ns
Reverse recovery current	I_{rr}		-	44	-	A
Reverse recovery charge	Q_{rr}		-	3.2	-	nC
Rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-680	-	A/ μs

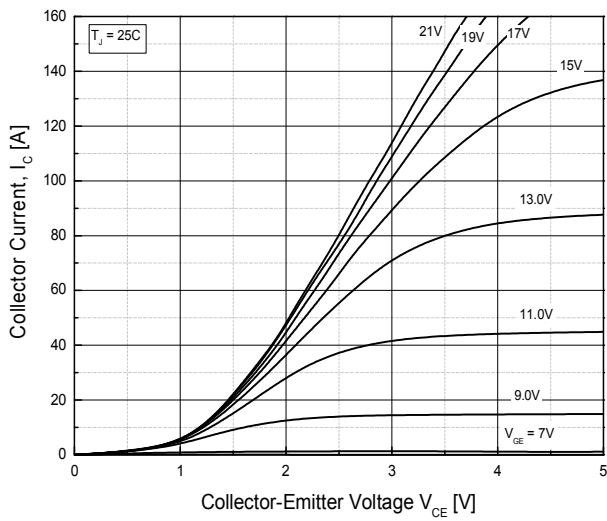


Fig.1 Typical Output Characteristics ($T_j = 25^\circ\text{C}$)

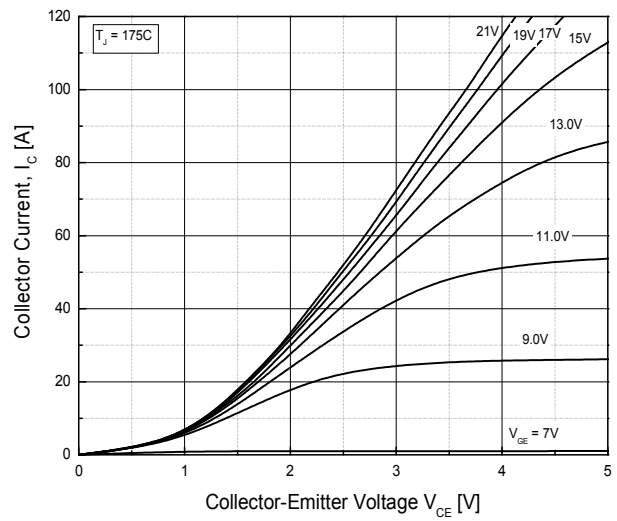


Fig.2 Typical Output Characteristics ($T_j = 175^\circ\text{C}$)

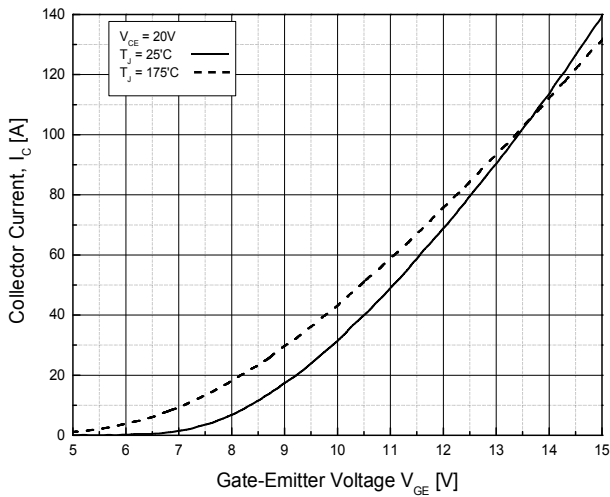


Fig.3 Typical Transfer Characteristics

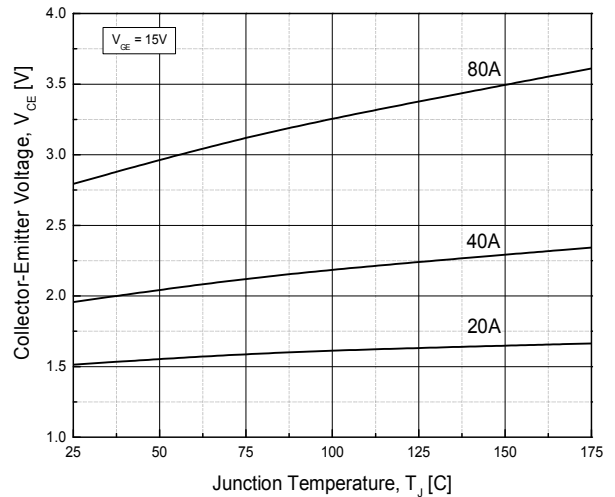


Fig.4 Typical Collector-Emitter Saturation Voltage - Junction Temperature

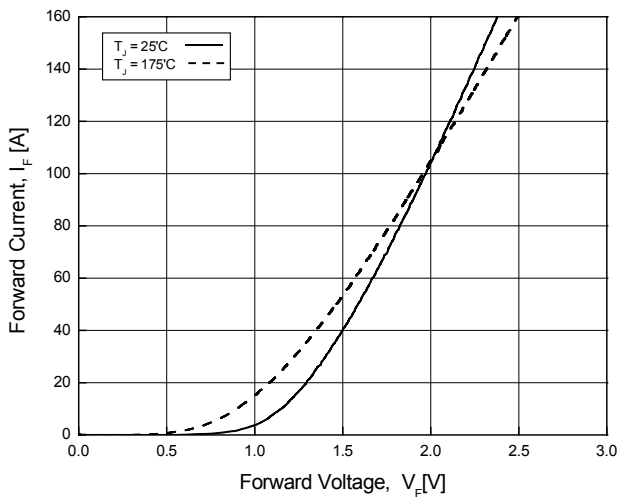


Fig.5 Diode Forward Characteristics

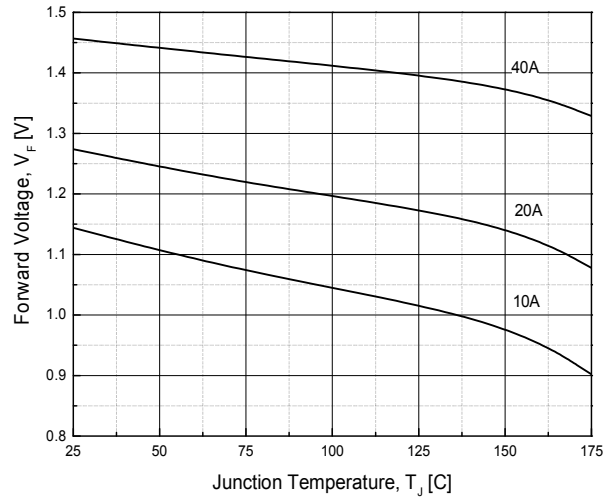


Fig.6 Diode Forward-Junction Temperature

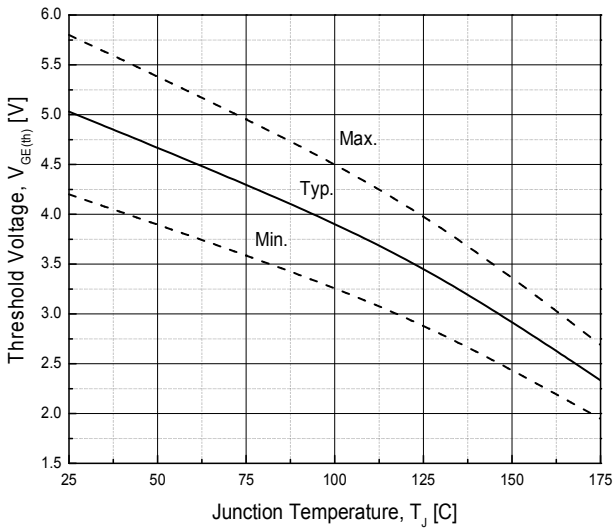


Fig.7 Threshold Voltage-Junction Temperature

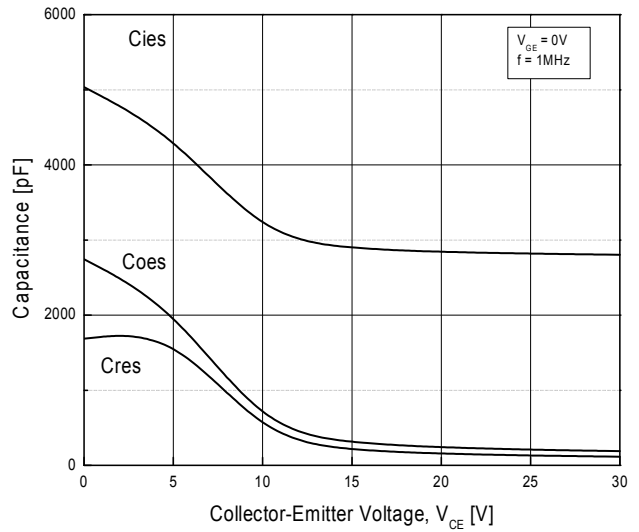


Fig.8 Typical Capacitance

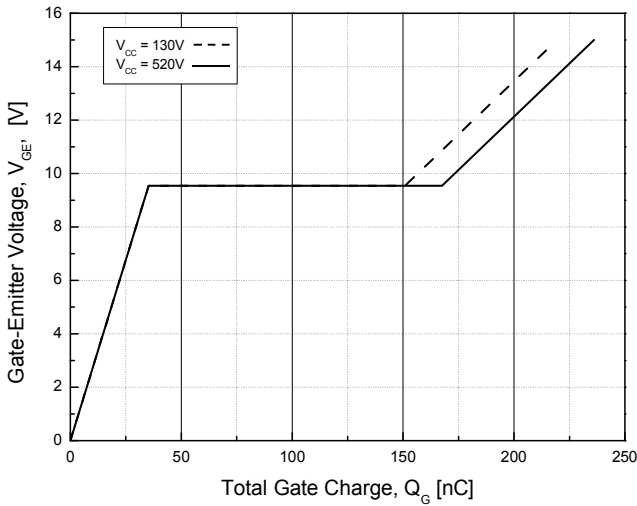


Fig.9 Typical Gate Charge

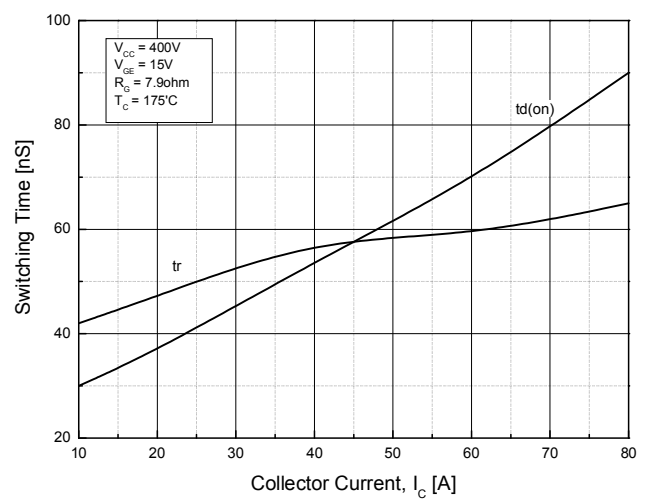


Fig.10 Typical Turn on-Collector Current

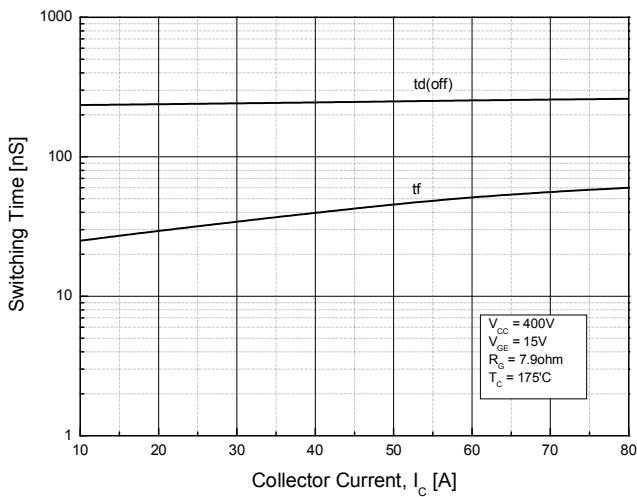


Fig.11 Typical Turn off-Collector Current

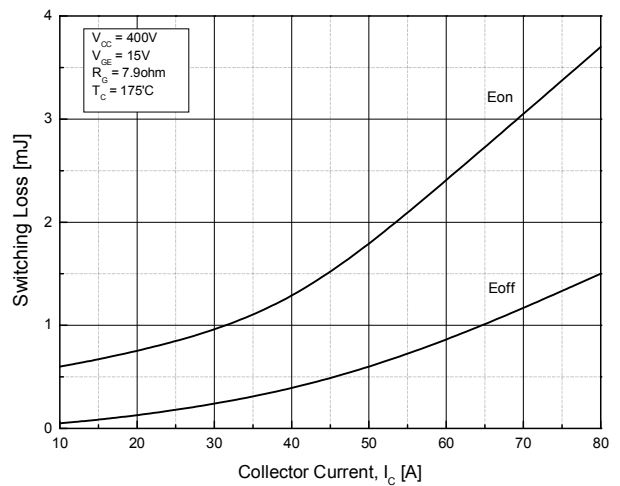


Fig.12 Switching Loss-Collector Current

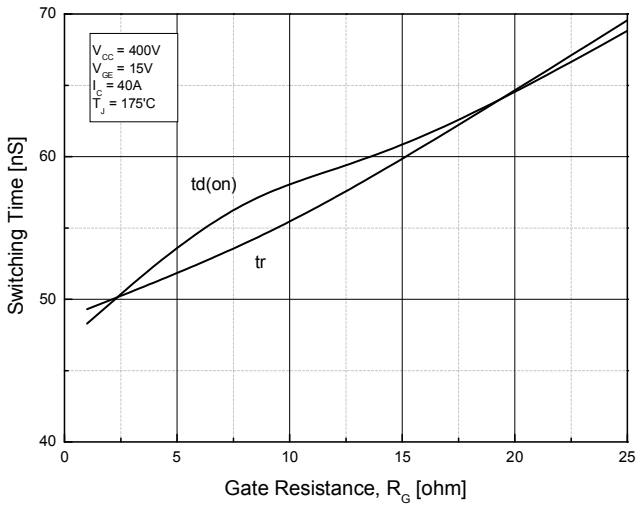


Fig.13 Turn on Characteristics-Gate Resistance

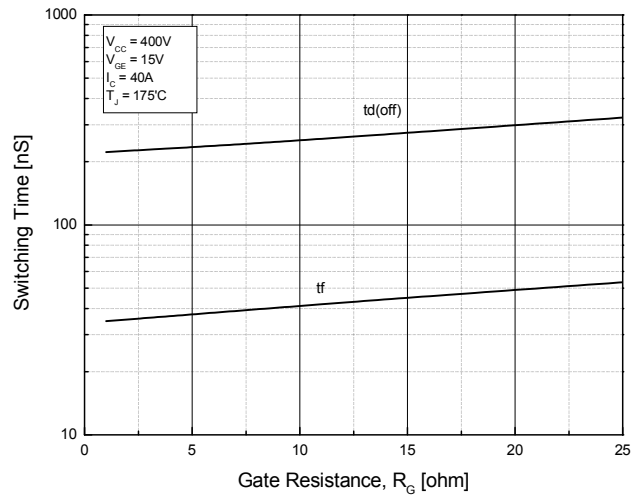


Fig.14 Turn off Characteristics-Gate Resistance

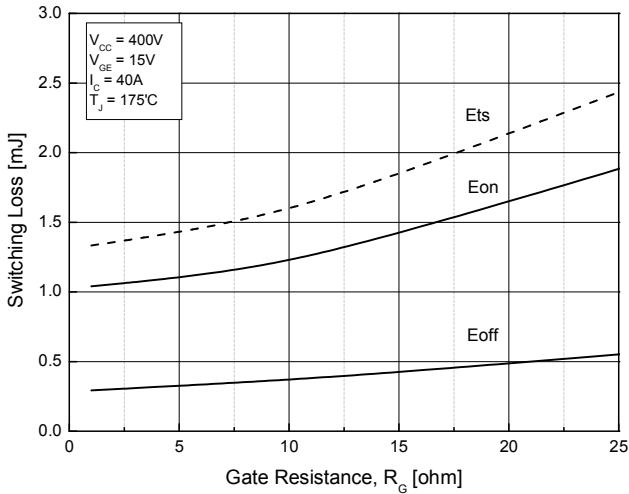


Fig.15 Switching Loss-Gate Resistance

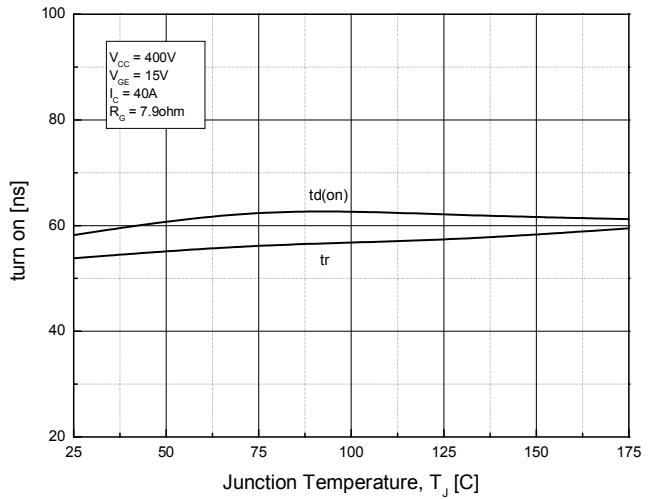


Fig.16 Turn on Characteristics -Junction Temperature

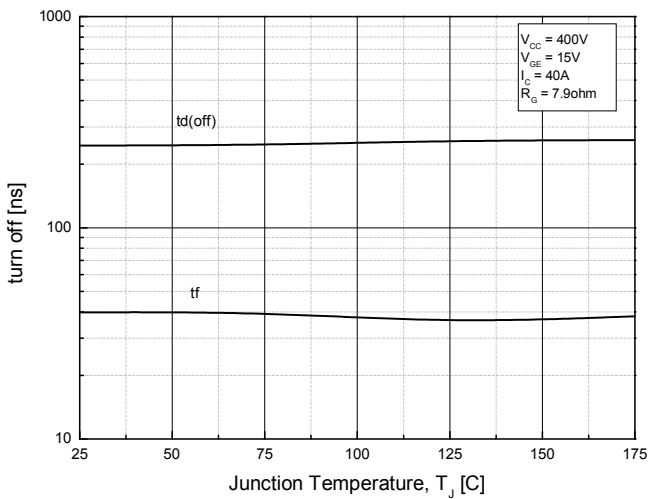


Fig.17 Turn off Characteristics -Junction Temperature

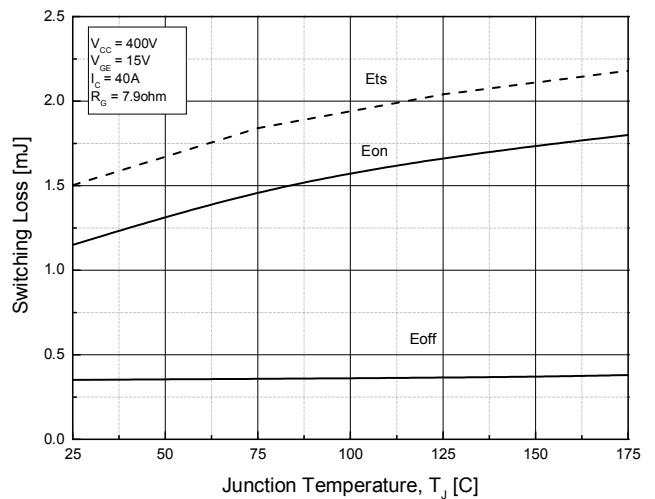


Fig.18 Switching Loss-Junction Temperature

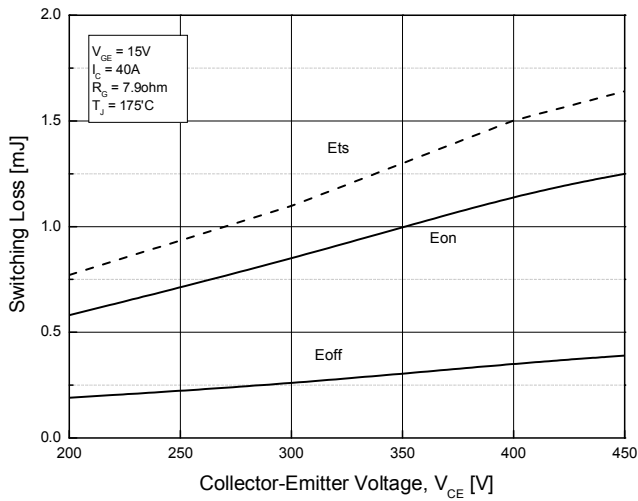


Fig.19 Switching Loss-Collector Emitter Voltage

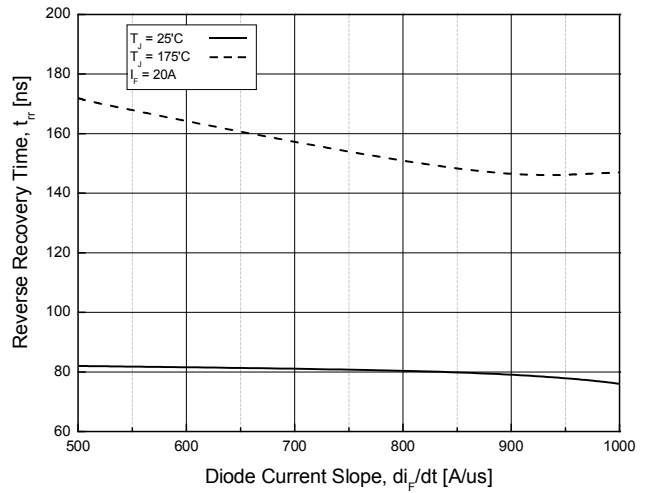


Fig.20 Reverse Recovery Time -Diode current slope

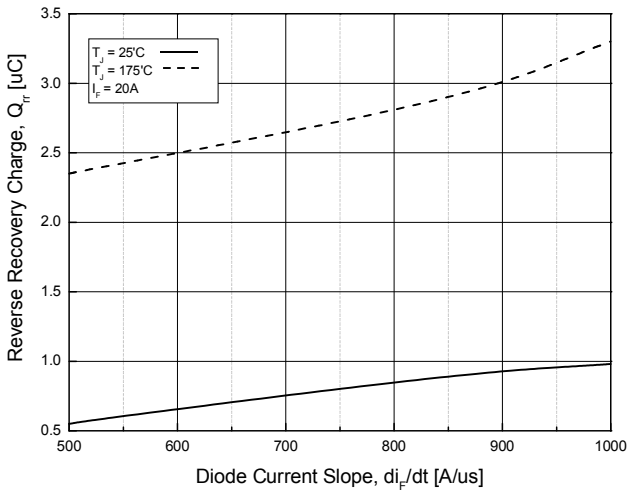


Fig.21 Reverse Recovery Charge -Diode Current Slope

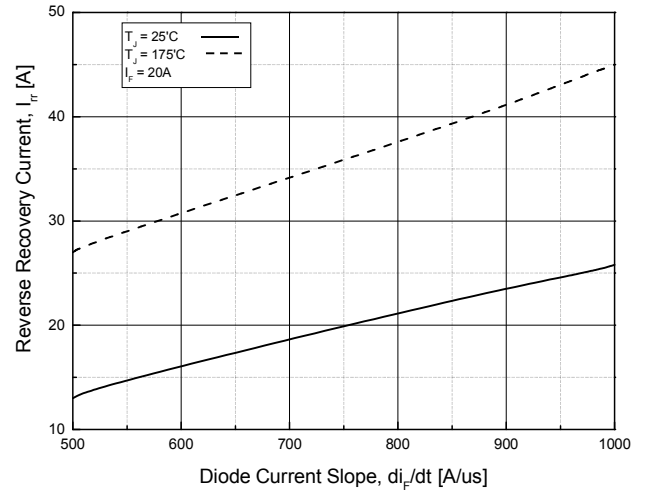


Fig.22 Reverse Recovery Current -Diode current slope

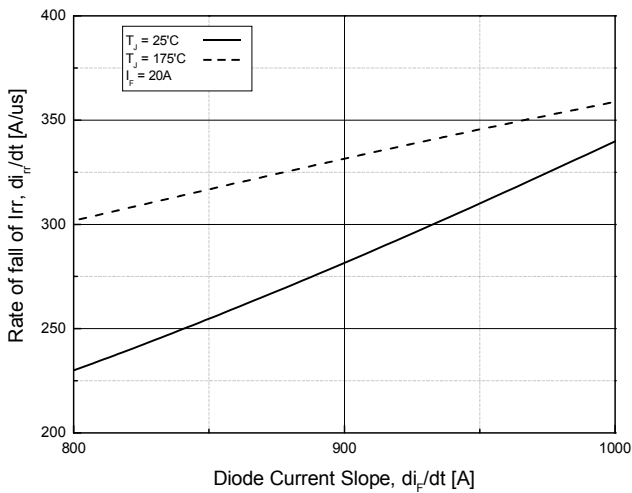


Fig.23 Rate of fall of reverse recovery current -Diode Current Slope

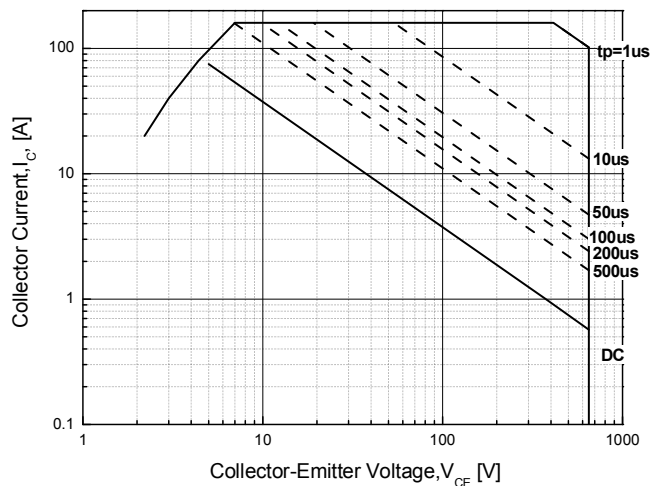


Fig.24 Forward Bias Safe Operating Area

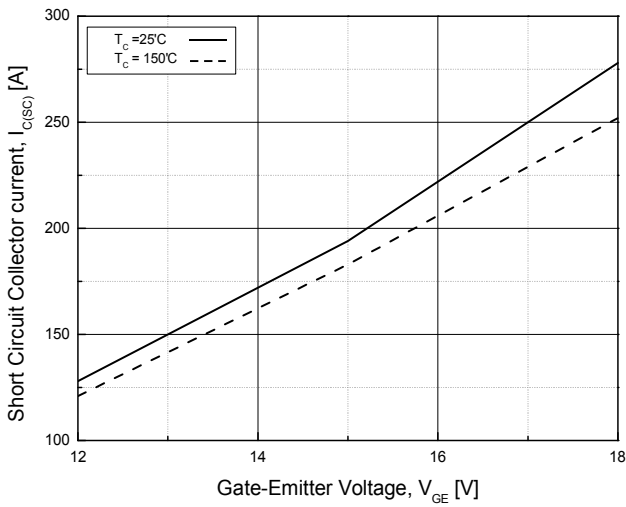


Fig.25 Typical Short Circuit Collector Current

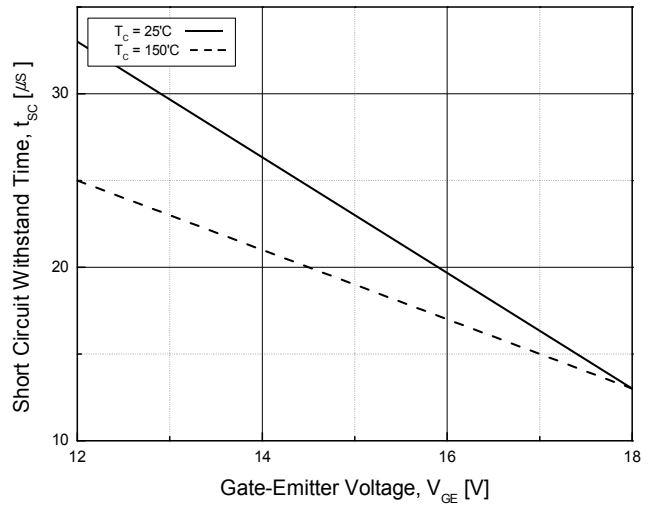


Fig.26 Typical Short Circuit Withstand Time

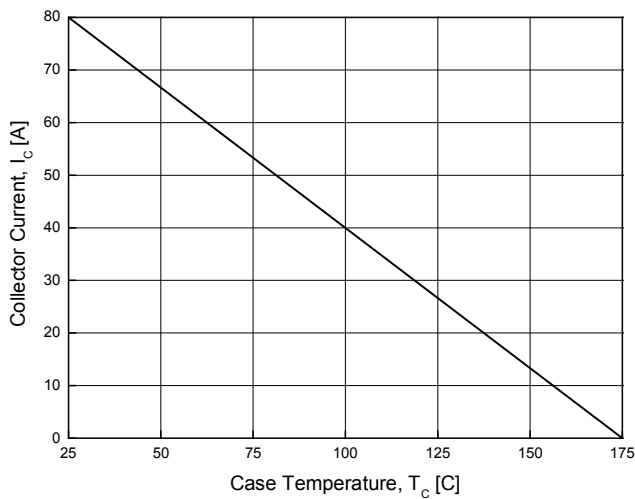


Fig.27 Case Temperature-Collector Current

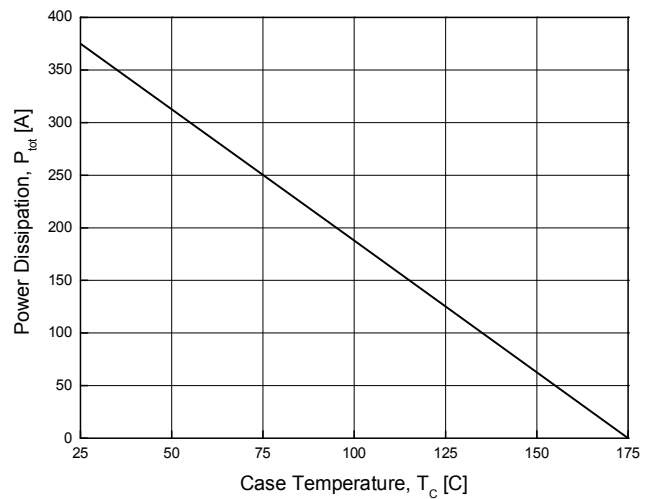


Fig.28 Power Dissipation-Case Temperature

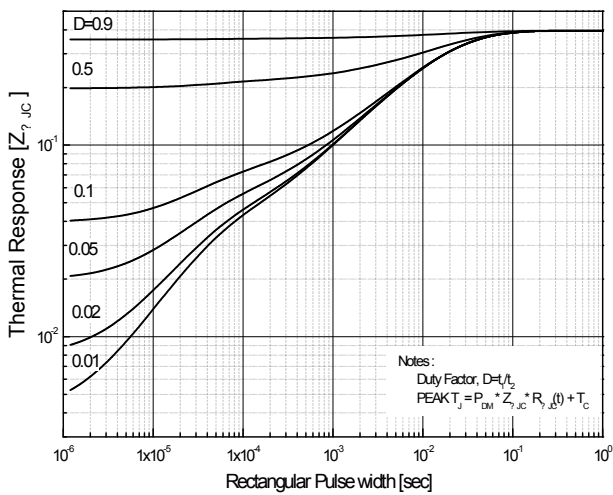


Fig.29 IGBT Transient Thermal Impedance

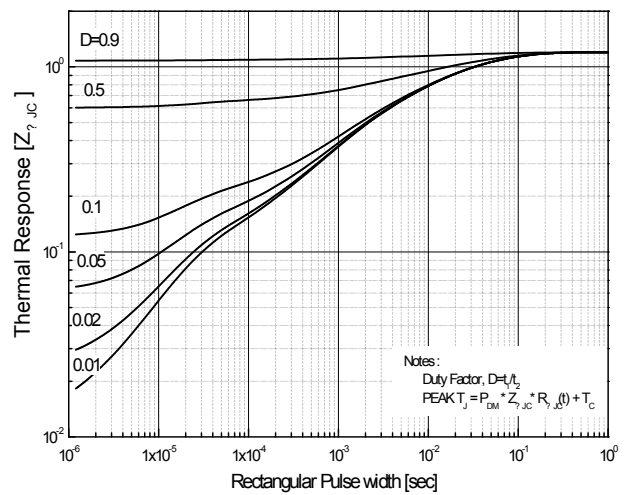
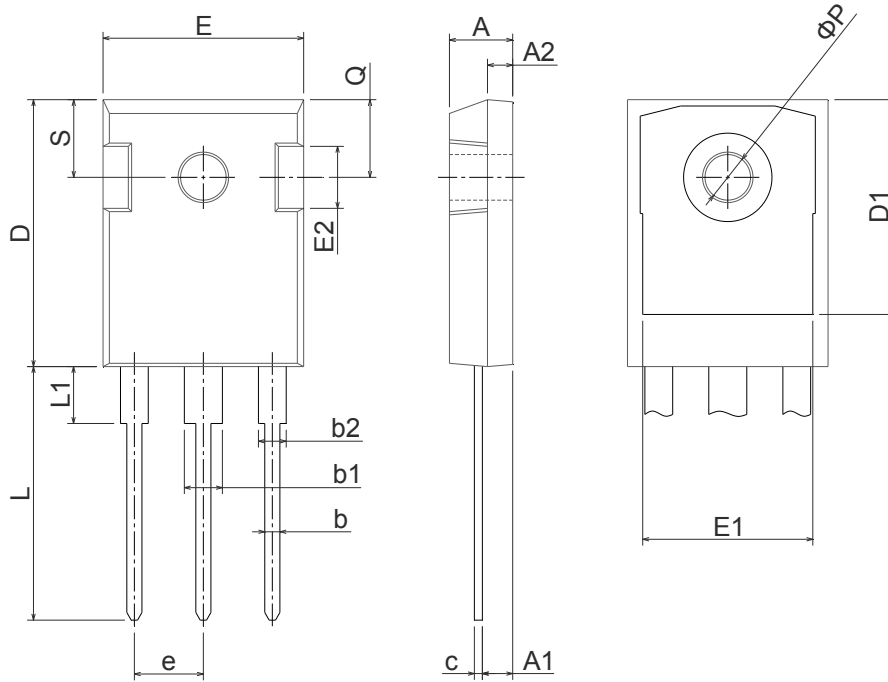


Fig.30 FRD Transient Thermal Impedance

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.

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