

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.

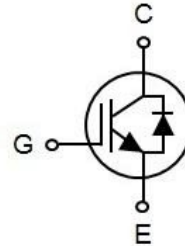
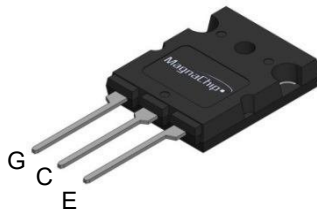
Features

- 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
- UPS
- PV Inverter
- Welder
- IH Cooker

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	A
		$T_C=100^\circ C$ 40	A
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	A
		$T_C=100^\circ C$ 20	A
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	W
		$T_C=100^\circ C$ 188	W
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 $\geq 1.0s$	t_{sc}	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	-	
Turn-on switching energy	E _{on}		-	1.15	-	mJ
Turn-off switching energy	E _{off}	I _F = 20A, di _F /dt = 1000A/μs, T _{vj} = 25°C	-	0.35	-	
Total switching energy	E _{ts}		-	1.50	-	
Reverse recovery time	t _{rr}		-	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

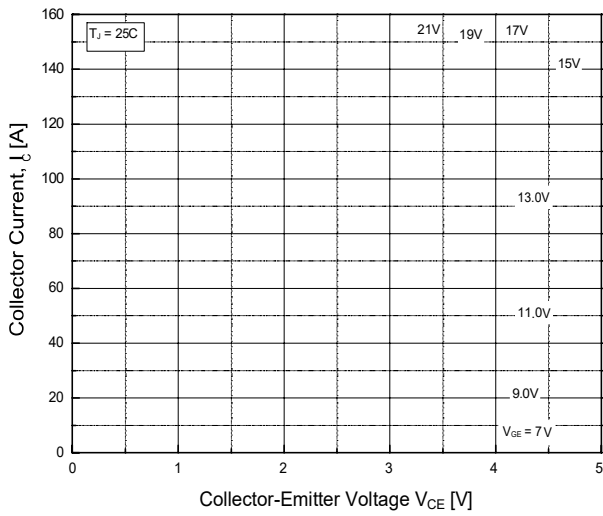


Fig.1 Typical Output Characteristics($T_J=25^\circ\text{C}$)

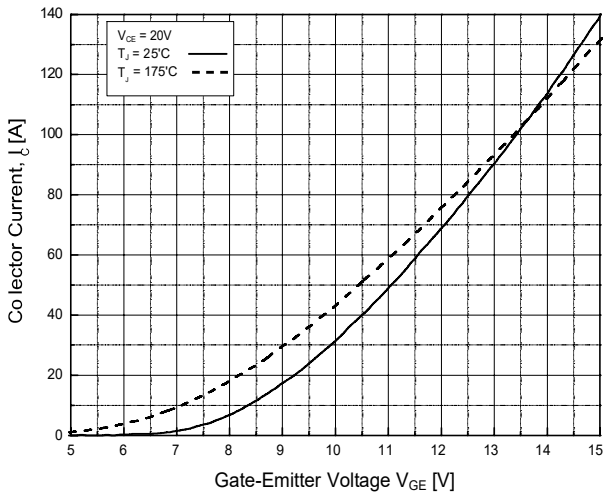


Fig.3 Typical Transfer Characteristics

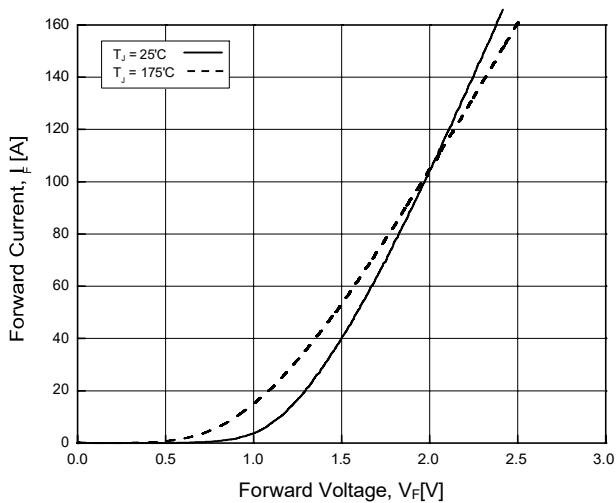


Fig.5 Diode Forward Characteristics

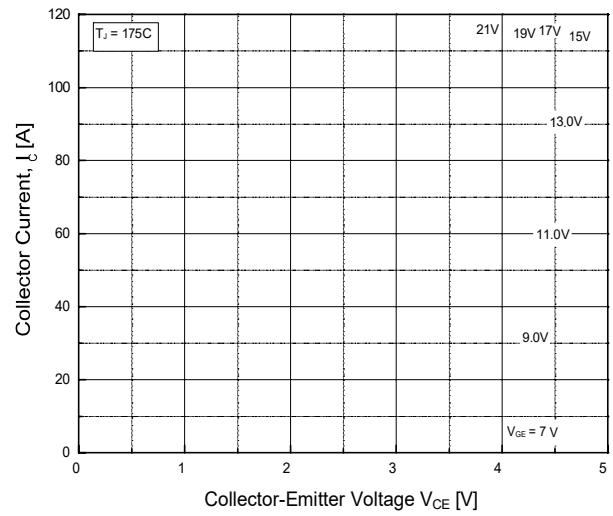


Fig.2 Typical Output Characteristics($T_J=175^\circ\text{C}$)

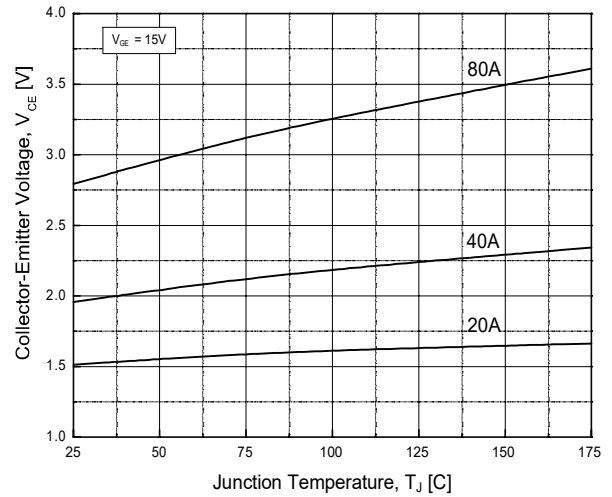


Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature

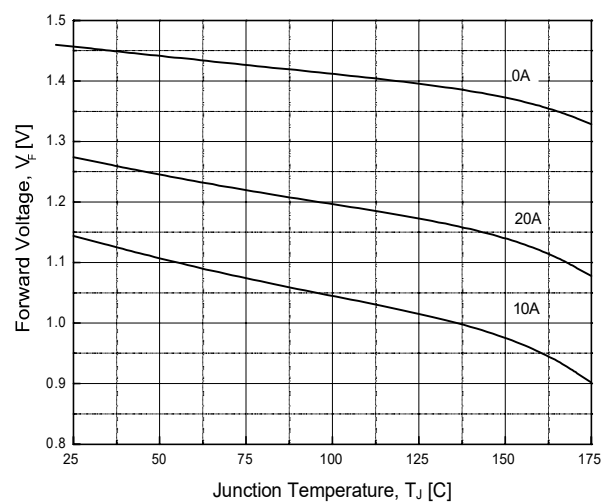


Fig.6 Diode Forward-Junction Temperature

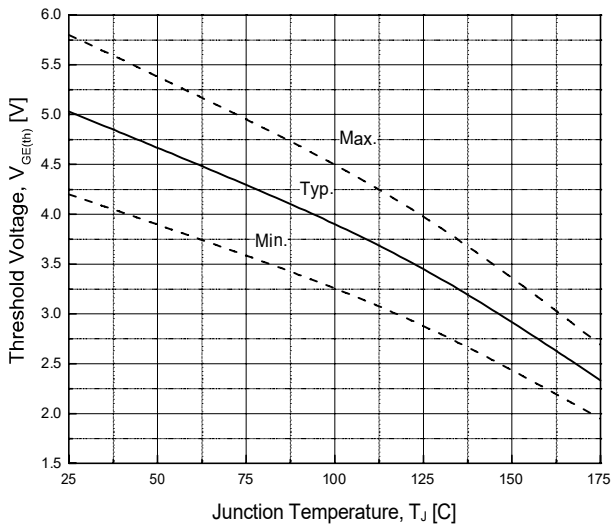


Fig.7 Threshold Voltage-Junction Temperature

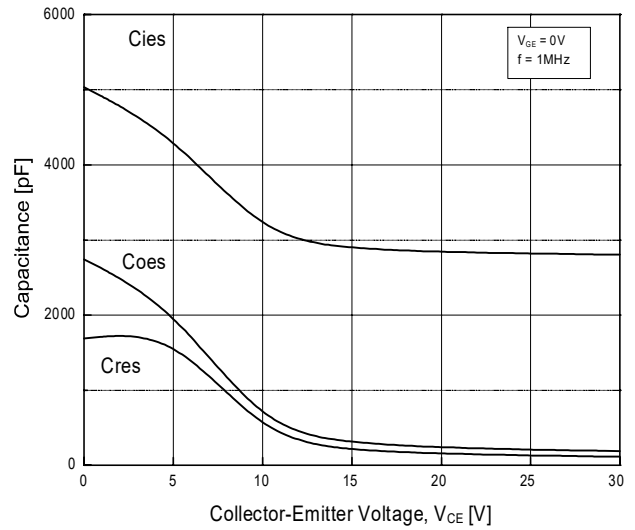


Fig.8 Typical Capacitance

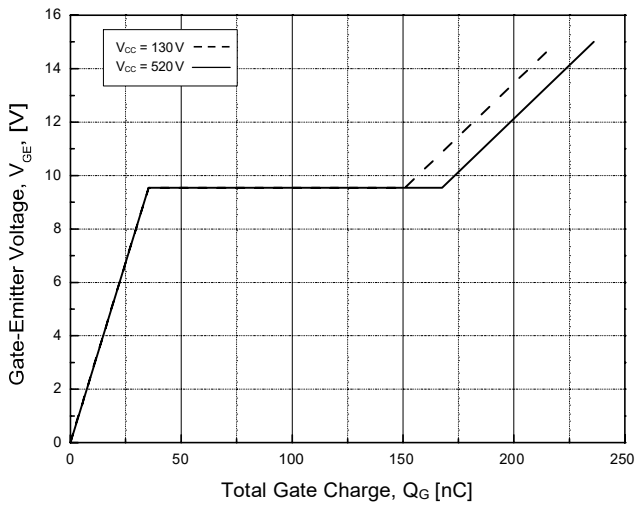


Fig.9 Typical Gate Charge

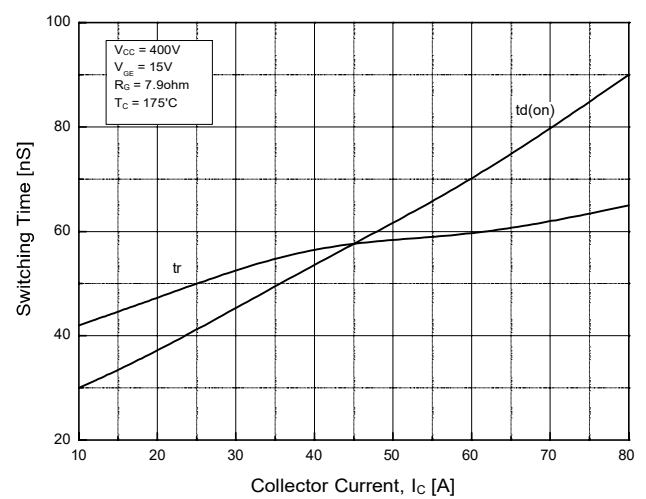


Fig.10 Typical Turn on-Collector Current

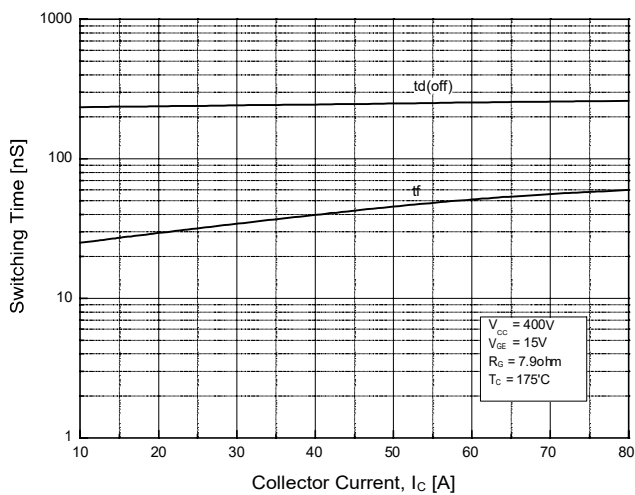


Fig.11 Typical Turn off-Collector Current

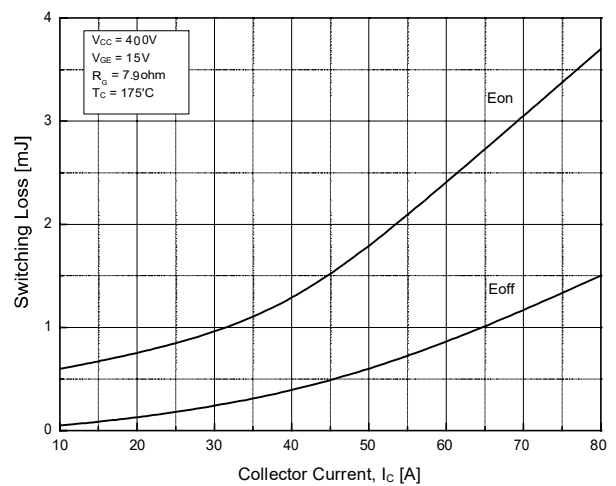


Fig.12 Switching Loss-Collector Current

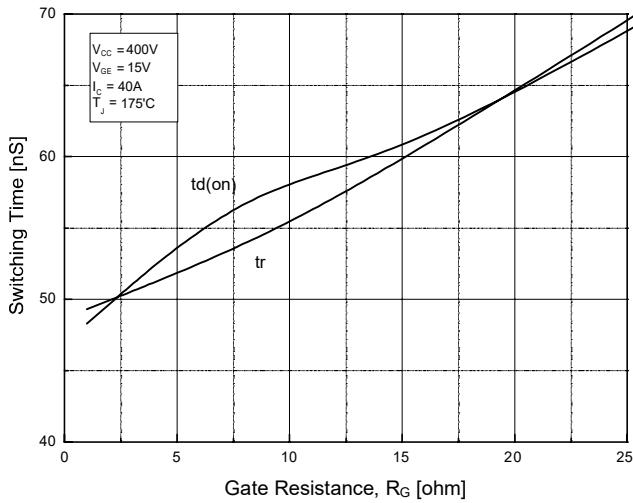


Fig.13 Turn on Characteristics-Gate Resistance

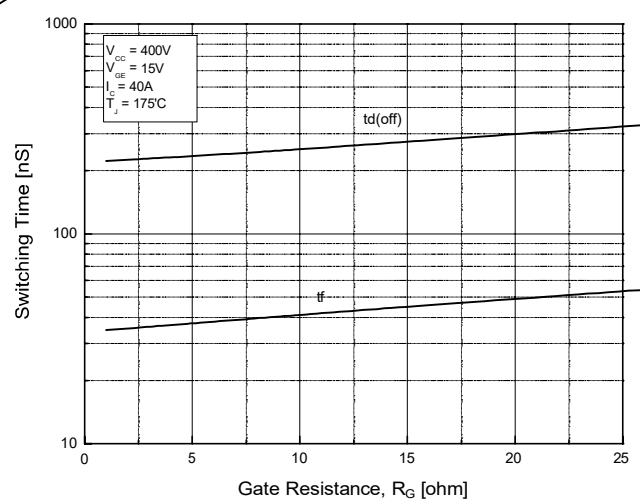


Fig.14 Turn off Characteristics-Gate Resistance

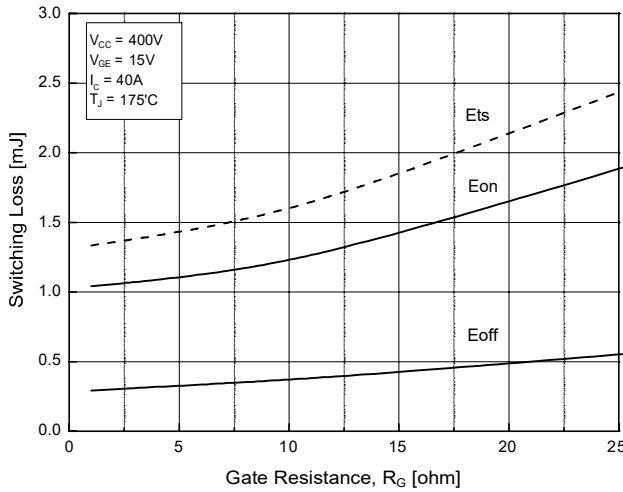


Fig.15 Switching Loss-Gate Resistance

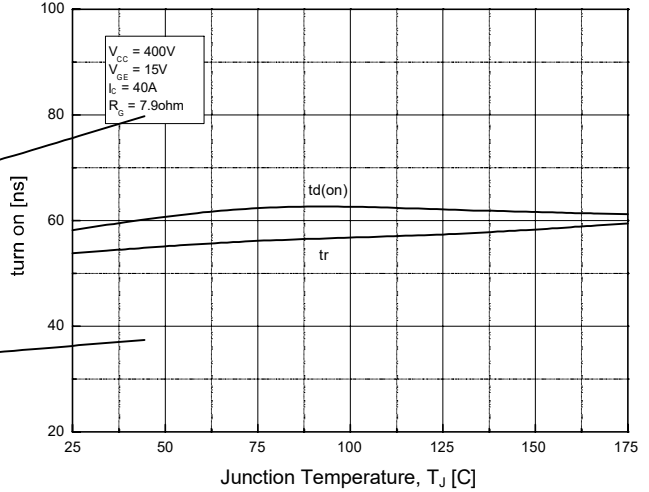


Fig.16 Turn on Characteristics-Junction Temperature

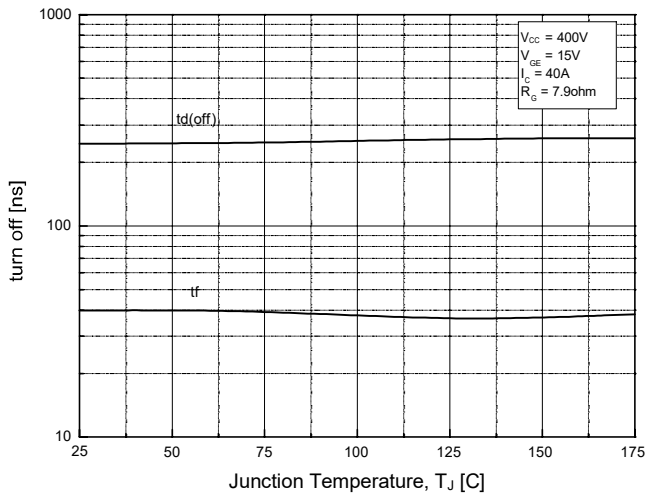


Fig.17 Turn off Characteristics-Junction Temperature

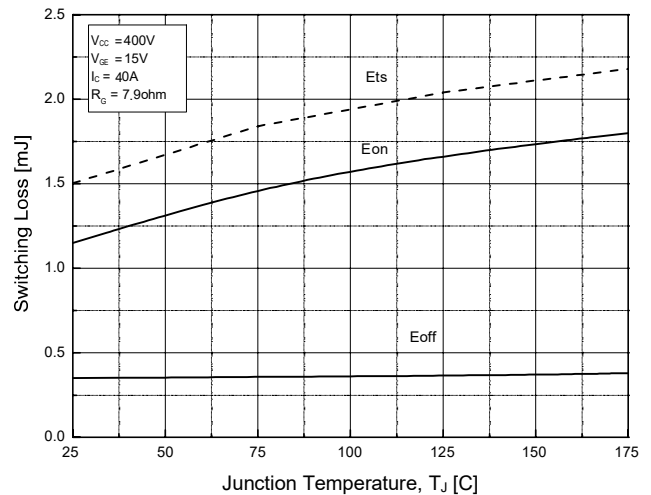


Fig.18 Switching Loss-Junction Temperature

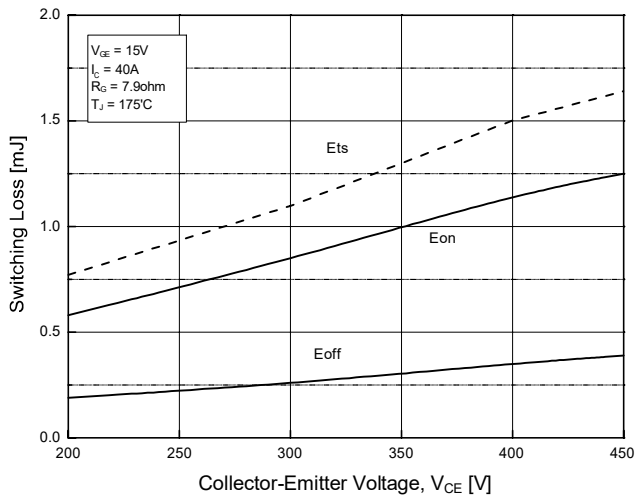


Fig.19 Switching Loss-Collector Emitter Voltage

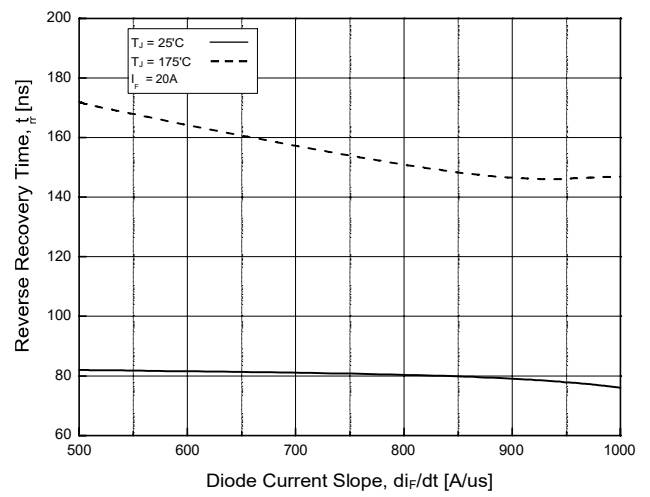


Fig.20 Reverse Recovery Time -Diode current slope

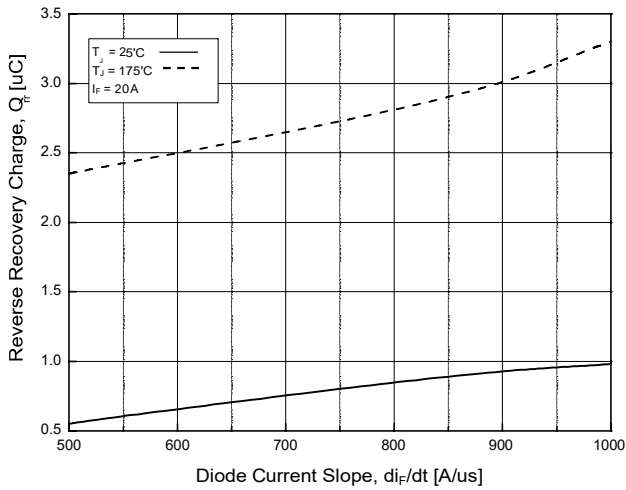


Fig.21 Reverse Recovery Charge -Diode Current Slope

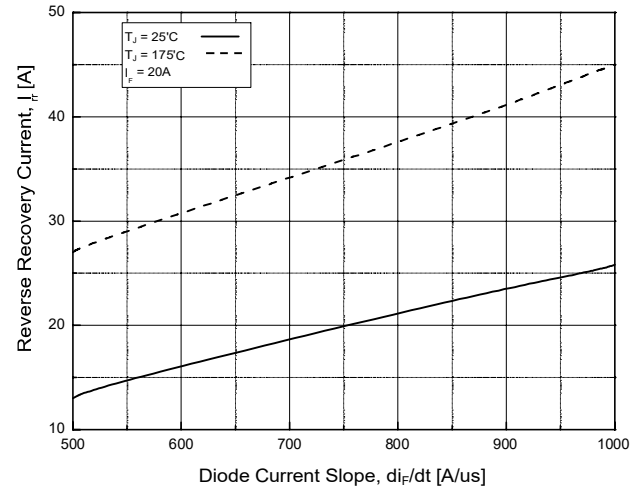


Fig.22 Reverse Recovery Current -Diode current slope

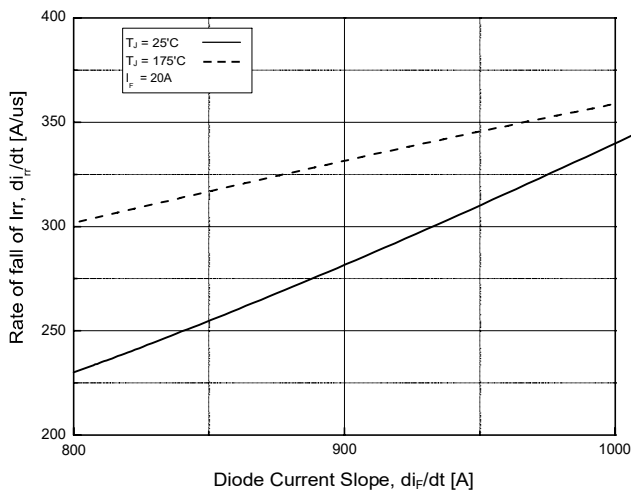


Fig.23 Rate of fall of reverse recovery current -Diode Current Slope

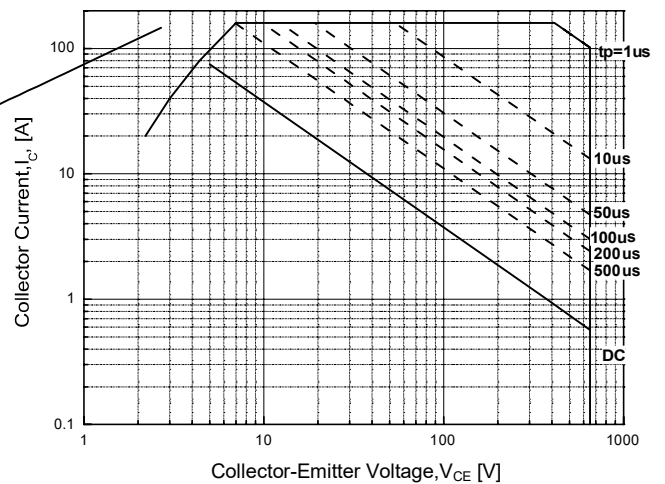


Fig.24 Forward Bias Safe Operating Area

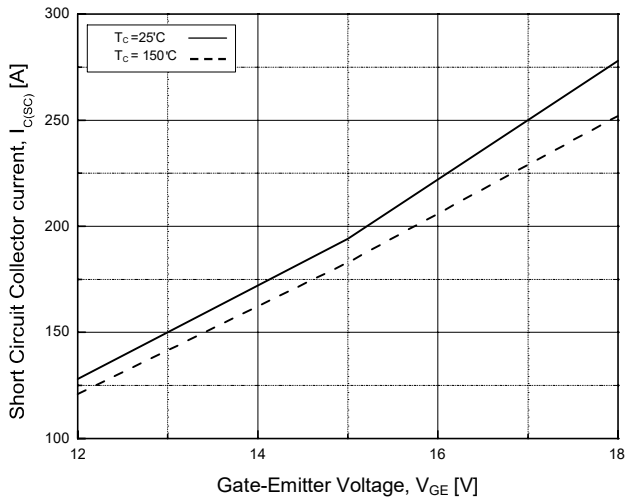


Fig.25 Typical Short Circuit Collector Current

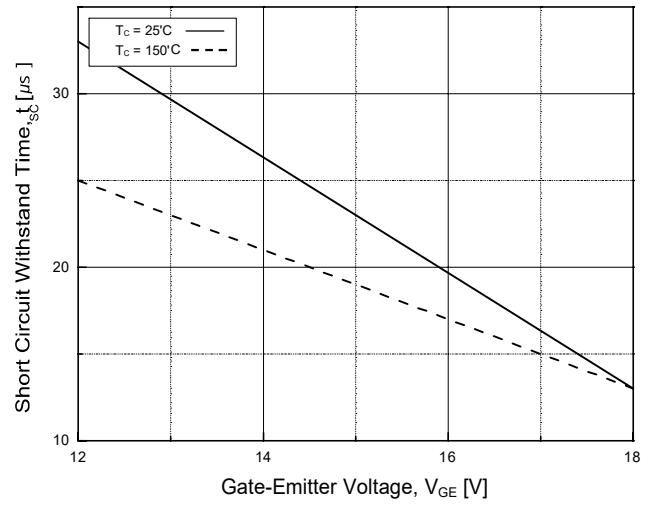


Fig.26 Typical Short Circuit Withstand Time

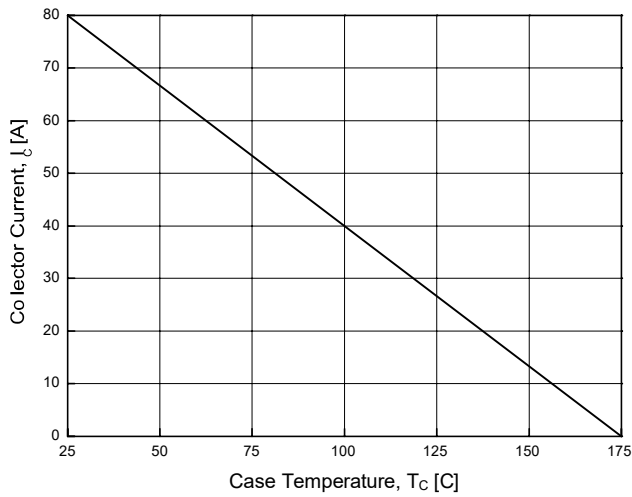


Fig.27 Case Temperature-Collector Current

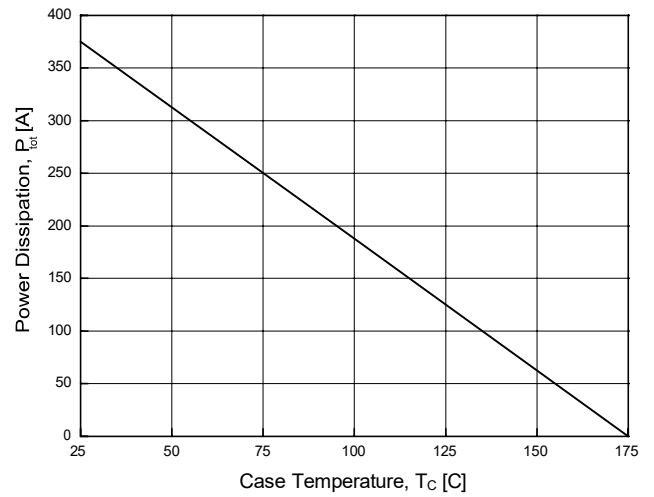


Fig.28 Power Dissipation-Case Temperature

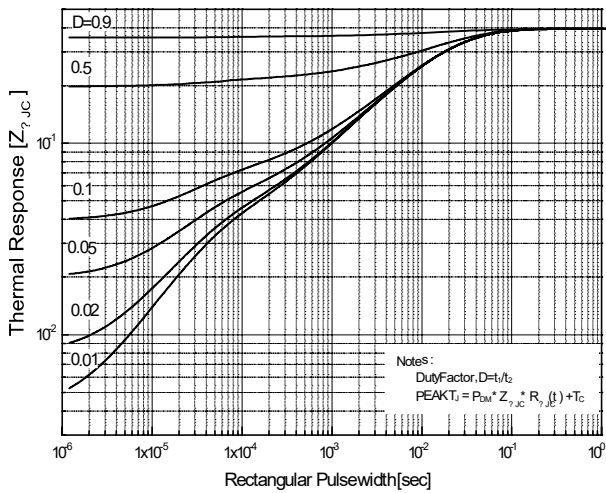


Fig.29 IGBT Transient Thermal Impedance

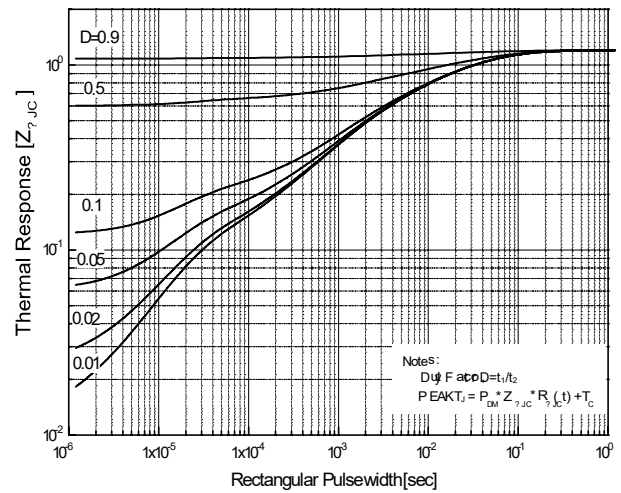
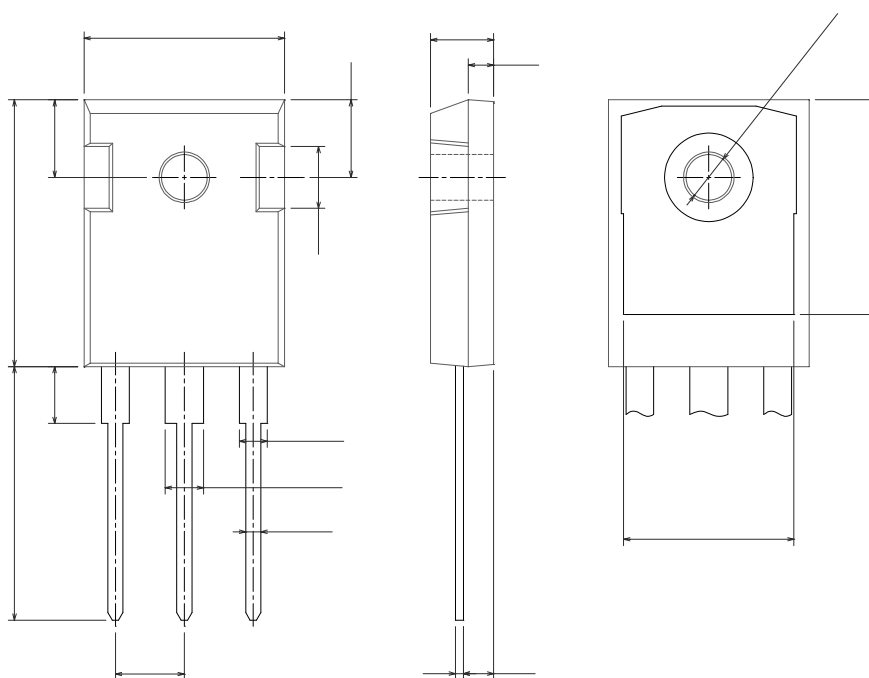


Fig.30 FRD Transient Thermal Impedance

Physical Dimension



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	