MBQ40T65FDSC

650V Field Stop IGBT

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.

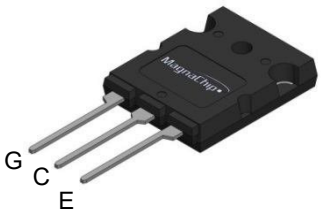
Features

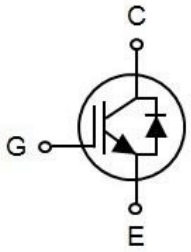
- High Speed Switching & Low Power Loss
- $V_{CE(sat)}$ = 1.95V @ I_C = 40A
- E_{off} = 0.35mJ @ T_C = 25°C
- High Input Impedance
- t_{rr} = 80ns (typ.) @di_F/dt = 1000A/ μs
- Maximum junction temperature 175°C

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}	T_C=25°C	I_C	80	A
	T_C=100°C		40	A
Pulsed collector current, t_p limited by T_{jvjmax}		I_{Cpuls}	160	A
Turn off safe operating area $V_{CE} \leq$ 600V, $T_{vj} \leq$ 175°C		-	160	A
Diode forward current limited by T_{vjmax}	T_C=25°C	I_F	40	A
	T_C=100°C		20	
Diode pulsed current, t_p limited by T_{vjmax}		I_{Fpuls}	160	A
Gate-emitter voltage		V_{GE}	±20	V
Power dissipation	T_C=25°C	P_D	375	W
	T_C=100°C		188	W
Short circuit withstand time $V_{CC} \leq$ 400V, V_{GE} = 15V, T_{vj} = 150°C Allowed number of short circuits < 1000 Time between short circuits ≥ 1.0s		tsc	5	μs
Operating Junction temperature range		T_{vj}	-40~175	°C
Storage temperature range		T_{stg}	-55~150	°C
Soldering temperature Wave soldering 1.6 mm (0.063 in.) from case for 10s			260	°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	°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
MBQ40T65FDSCTH	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}			-	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 = 7.9Ω, Inductive Load, T_{vj} = 175°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/ μs, T_{vj} = 175°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

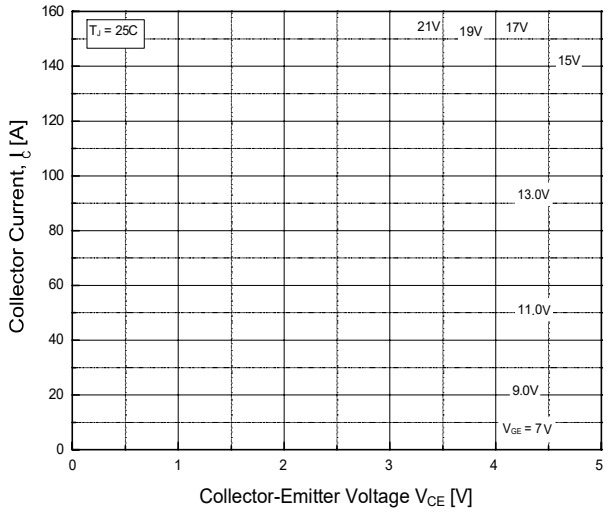


Fig.1 Typical Output Characteristics(T_J=25℃)

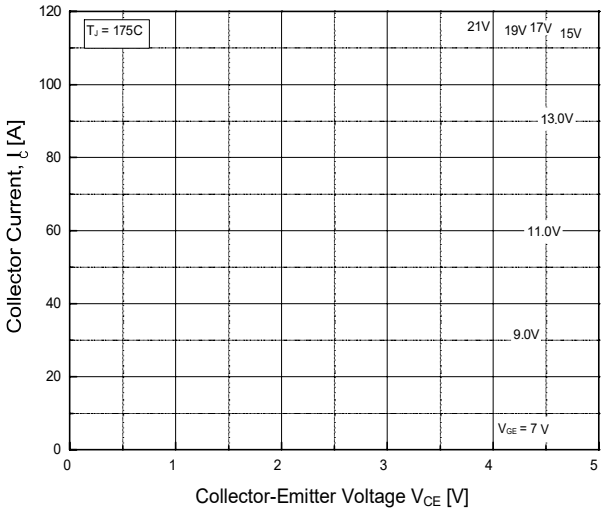


Fig.2 Typical Output Characteristics(T_J=175℃)

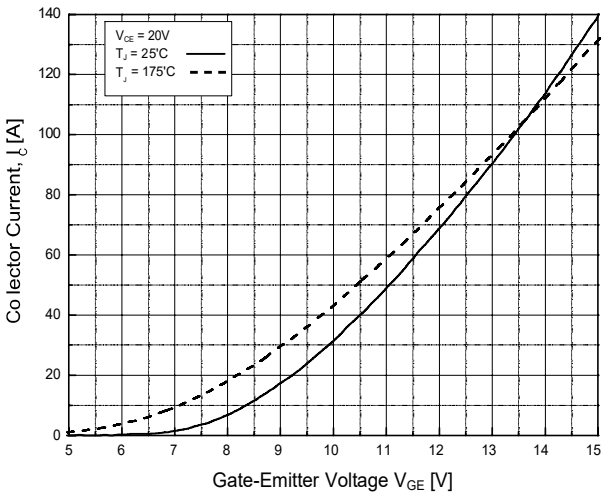


Fig.3 Typical Transfer Characteristics

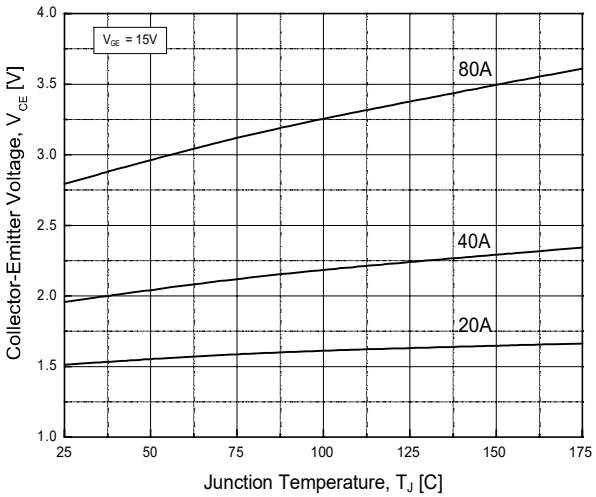


Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature

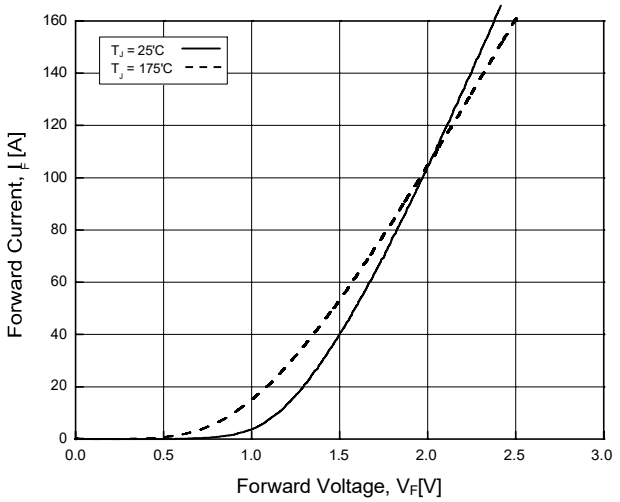


Fig.5 Diode Forward Characteristics

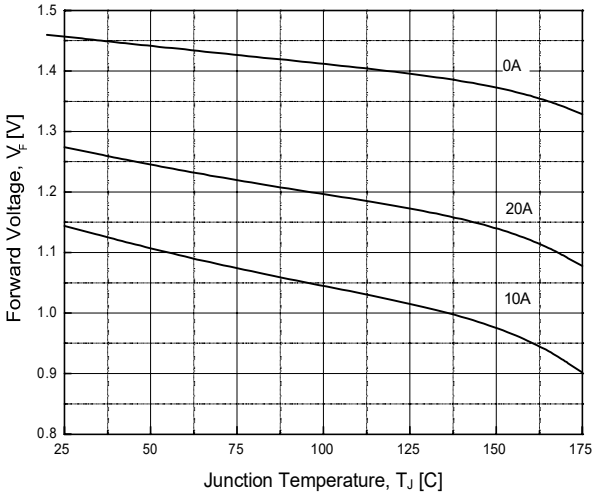


Fig.6 Diode Forward-Junction Temperature

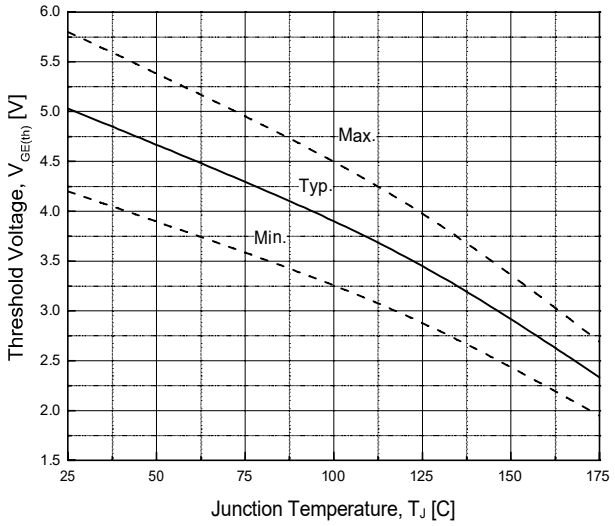


Fig.7 Threshold Voltage-Junction Temperature

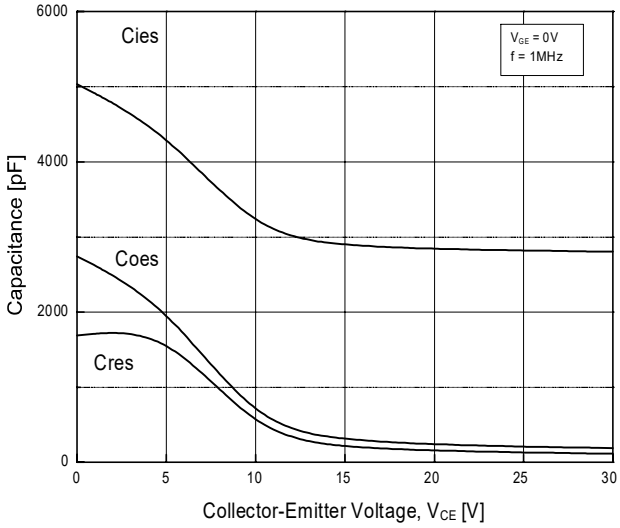


Fig.8 Typical Capacitance

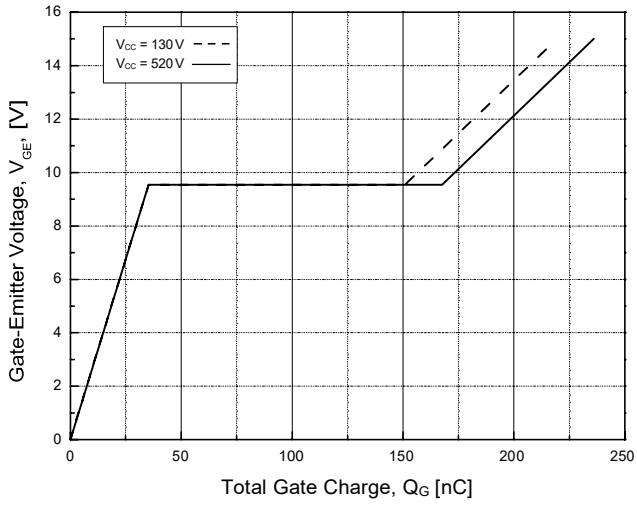


Fig.9 Typical Gate Charge

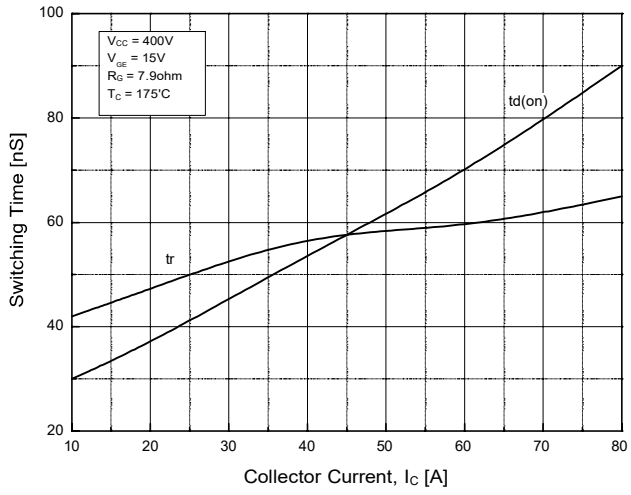


Fig.10 Typical Turn on-Collector Current

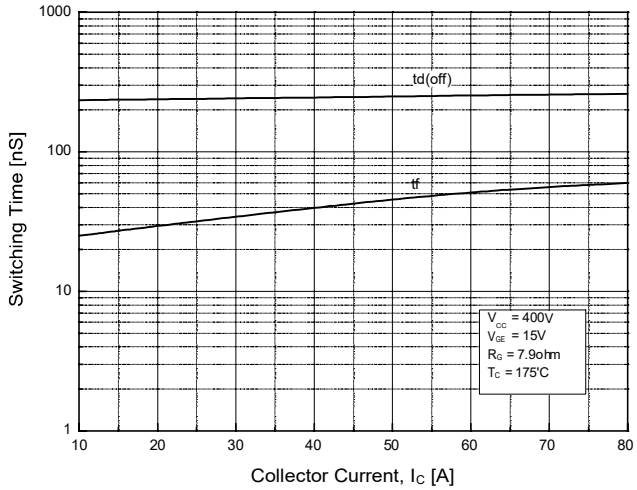


Fig.11 Typical Turn off-Collector Current

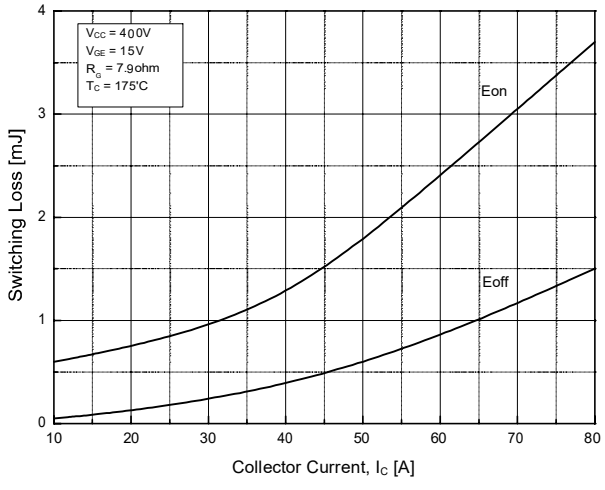


Fig.12 Switching Loss-Collector Current

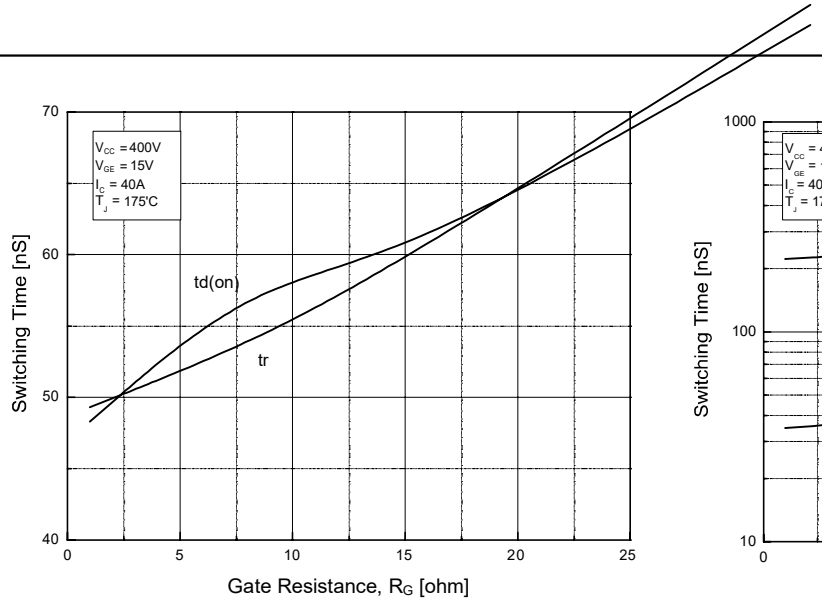


Fig.13 Turn on Characteristics-Gate Resistance

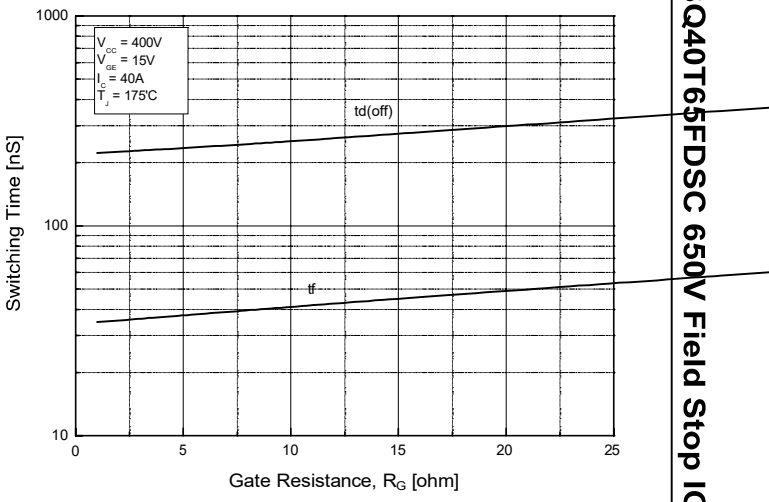


Fig.14 Turn off Characteristics-Gate Resistance

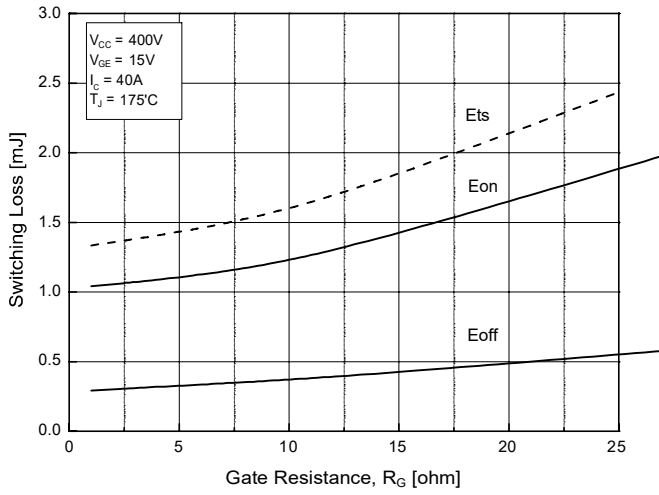


Fig.15 Switching Loss-Gate Resistance

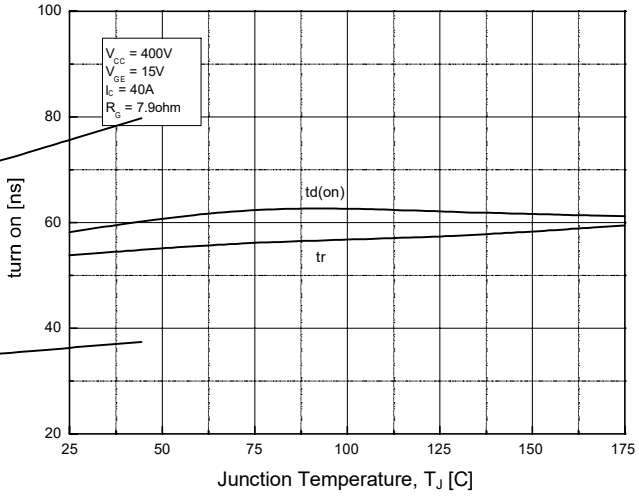


Fig.16 Turn on Characteristics -Junction Temperature

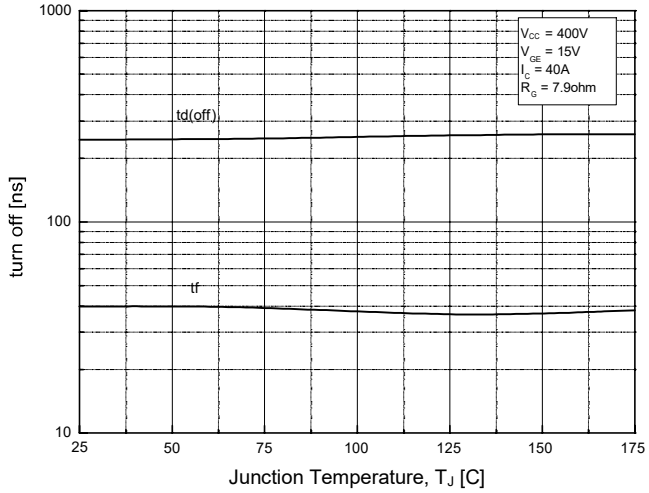


Fig.17 Turn off Characteristics -Junction Temperature

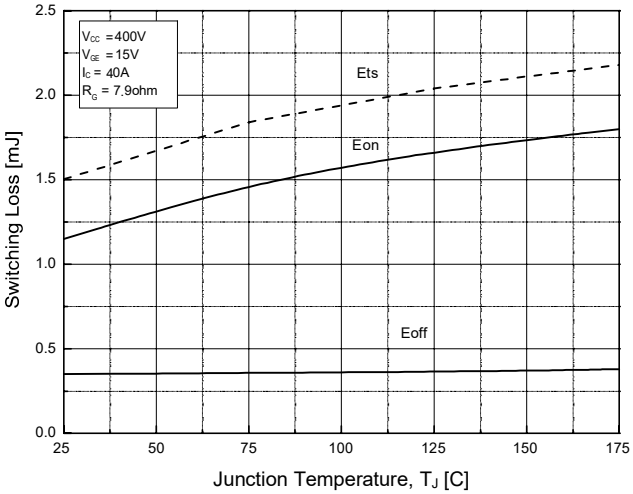


Fig.18 Switching Loss-Junction Temperature

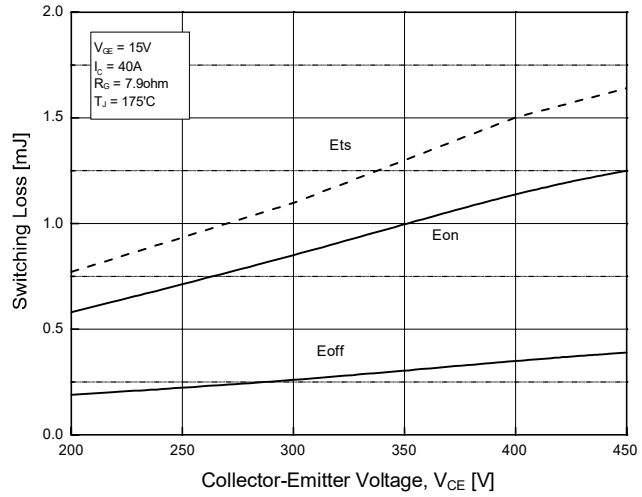


Fig.19 Switching Loss-Collector Emitter Voltage

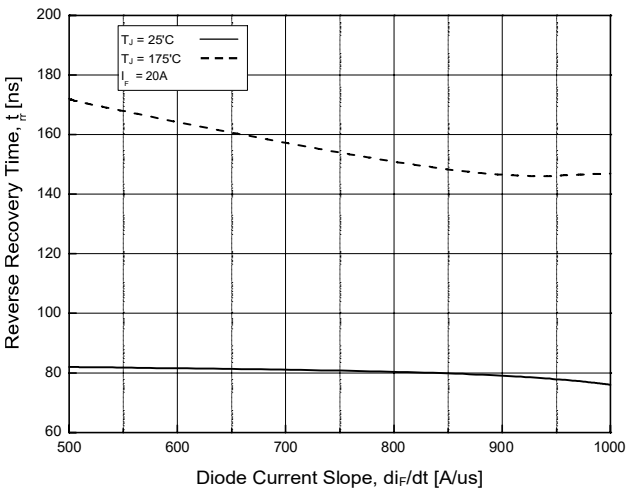


Fig.20 Reverse Recovery Time -Diode current slope

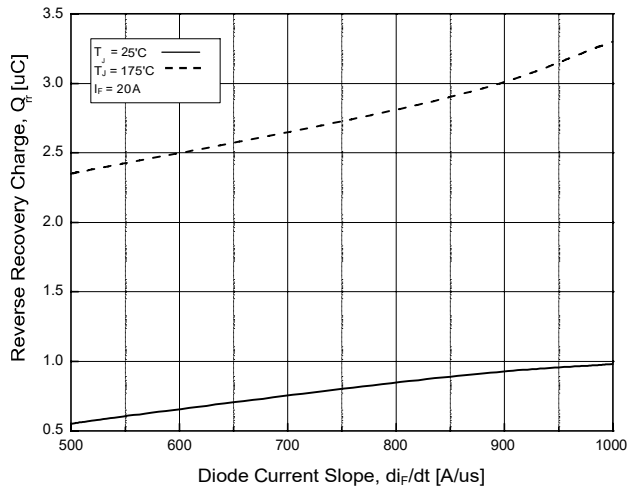


Fig.21 Reverse Recovery Charge -Diode Current Slope

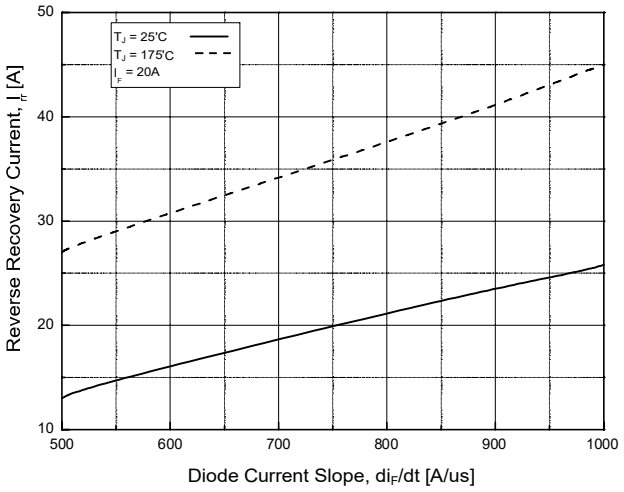


Fig.22 Reverse Recovery Current -Diode current slope

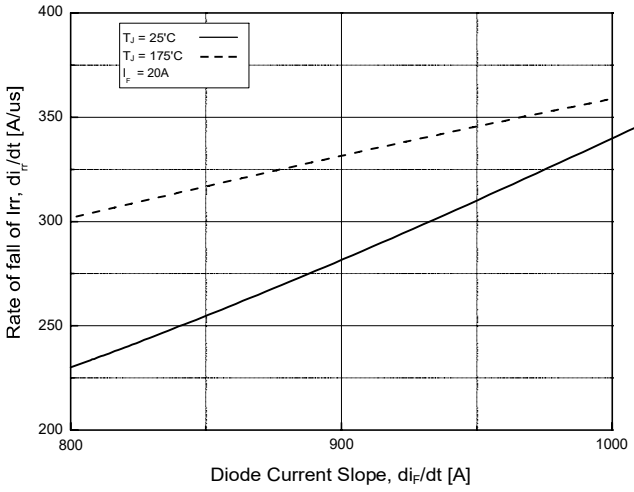


Fig.23 Rate of fall of reverse recovery current -Diode Current Slope

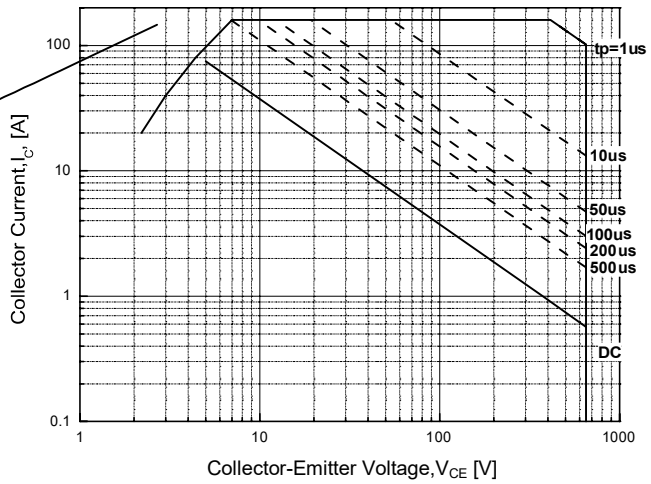


Fig.24 Forward Bias Safe Operating Area

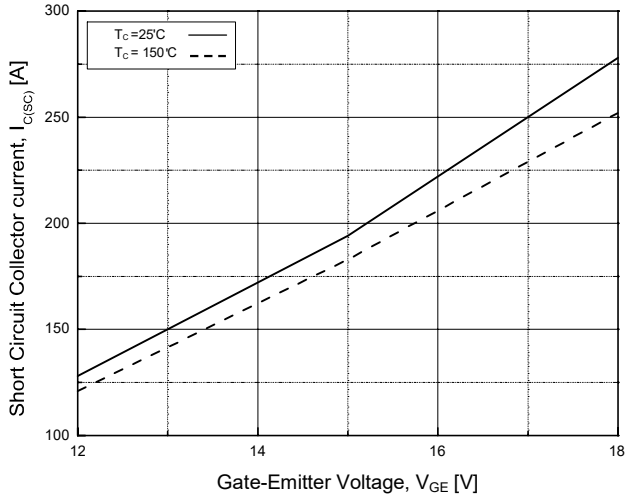


Fig.25 Typical Short Circuit Collector Current

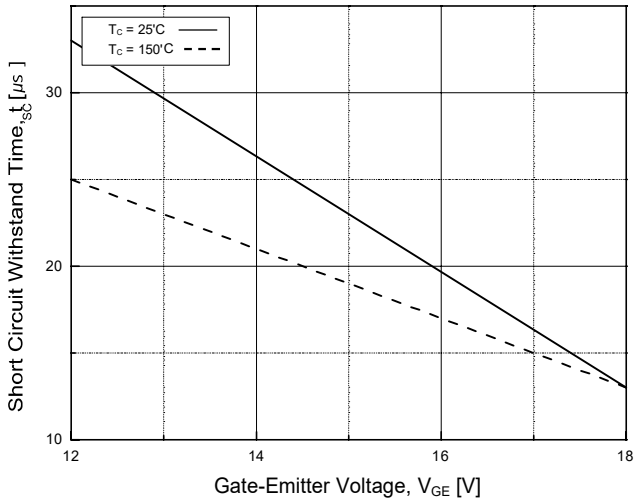


Fig.26 Typical Short Circuit Withstand Time

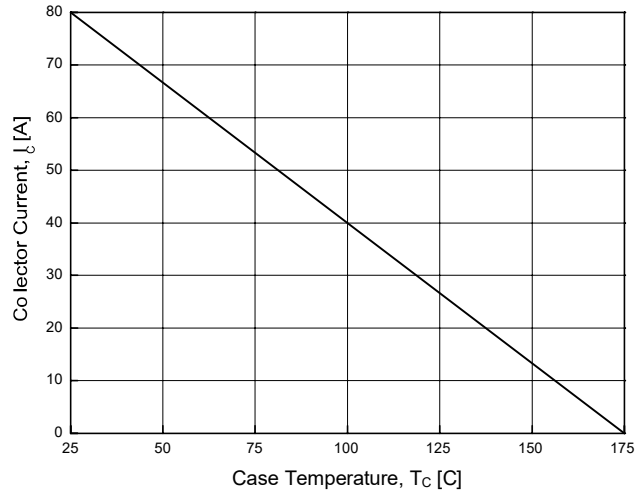


Fig.27 Case Temperature-Collector Current

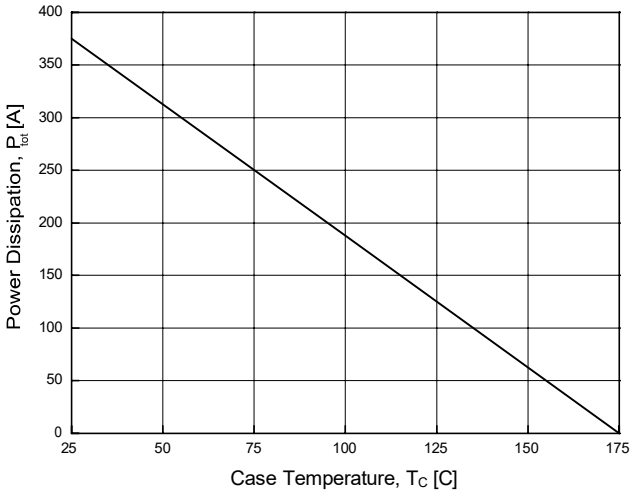


Fig.28 Power Dissipation-Case Temperature

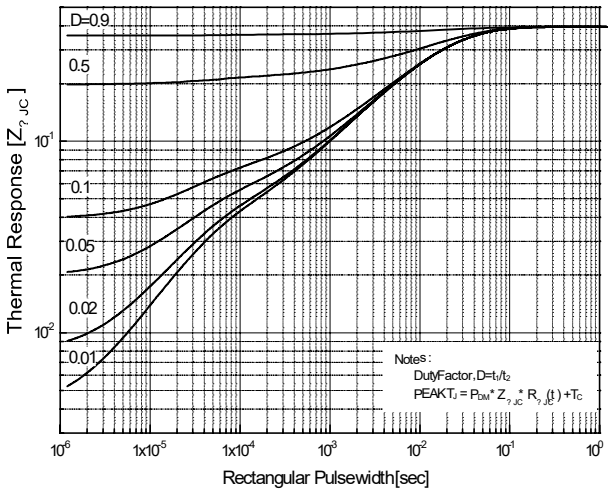


Fig.29 IGBT Transient Thermal Impedance

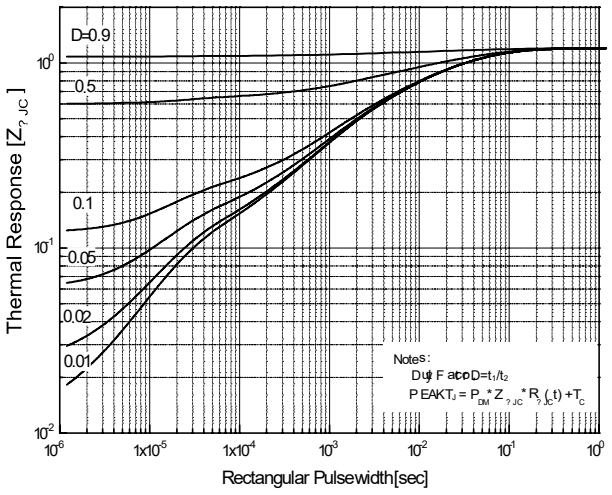
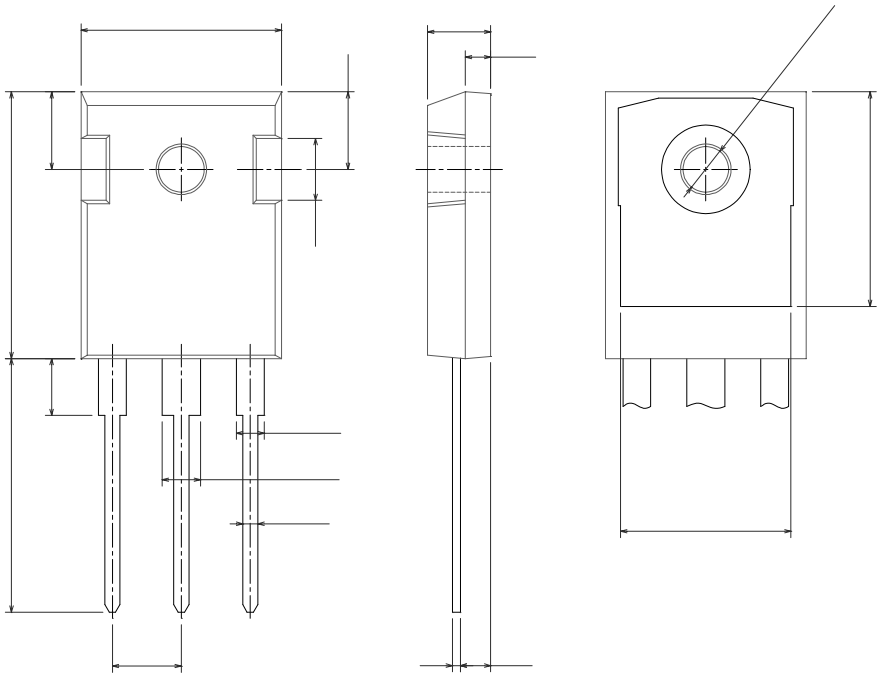


Fig.30 FRD Transient Thermal Impedance

Physical Dimension



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	