MBQ40T120RFSTH

Field Stop Trench IGBT

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.

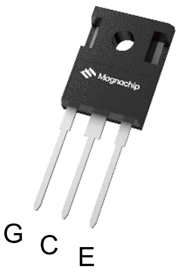
Features

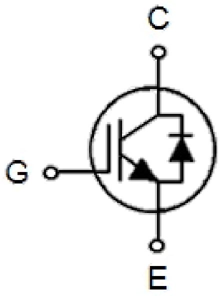
- High Speed Switching
- $V_{CE(sat)}$ positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- Maximum junction temperature 175°C

Applications

- Solar inverter

TO-247





- G : Gate
- C : Collector
- E : Emitter

Absolute Maximum Ratings

Characteristics		Symbol	Rating	Unit
Collector-emitter voltage		V_{CES}	1200	V
Gate-emitter voltage		V_{GE}	±20	V
DC collector current[1]	T_C=25℃	I_C	80	A
	T_C=100℃		61	A
Pulsed collector current, t_p limited by T_{vjmax}		I_{Cpuls}	120	A
Diode forward current[1]	T_C=25℃	I_F	80	A
	T_C=100℃		40	A
Diode pulsed current, Pulse time limited by T_{vjmax}		I_{Fpuls}	120	A
Power dissipation	T_C=25℃	P_{tot}	429	W
	T_C=100℃		214	W
Operating Junction temperature range		T_{vj}	-40~175	℃
Storage temperature range		T_{stg}	-55~150	℃

Note 1) Current is limited by junction temperature & bondwires.

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{th(j-a)}$	40	℃/W
Thermal resistance junction-to-case for IGBT	$R_{th(j-c)}$	0.35	
Thermal resistance junction-to-case for FRD	$R_{th(j-c)}$	0.80	

RoHS Compliant

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ40T120RFS	40T120RFS	-55~175℃	TO-247	Tube	Compliant

Electrical Characteristics (*T_{vj}* = 25℃ unless otherwise specified)

Characteristics	Symbol	Conditions		Min	Typ	Max	Unit
Static Characteristics							
Collector-emitter breakdown voltage	BV_{CES}	I_C = 1mA, V_{GE} = 0V		1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 40A, V_{GE} = 15V	T_{vj} = 25℃	-	1.85	2.35	V
			T_{vj} = 175℃	-	2.50	-	
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 40A	T_{vj} = 25℃	-	2.40	2.90	V
			T_{vj} = 175℃	-	2.35	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 0.4mA		4.2	5.2	6.2	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V		-	-	250	μA
Gate-emitter leakage current	I_{GES}	V_{GE} = 20V, V_{CE} = 0V		-	-	±250	nA
Dynamic Characteristics							
Total gate charge	Q_G	V_{CE} = 960V, I_C = 40A, V_{GE} = 15V		-	371	-	nC
Gate-emitter charge	Q_{GE}			-	58	-	
Gate-collector charge	Q_{GC}			-	150	-	
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 80kHz		-	8546	-	pF
Output capacitance	C_{oes}			-	160	-	
Reverse transfer capacitance	C_{res}			-	96	-	
Switching Characteristics							
Turn-on delay time	$t_{d(on)}$	V_{GE} = 0/15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_{vj} = 25℃		-	63.5		ns
Rise time	t_r			-	49.3		
Turn-off delay time	$t_{d(off)}$			-	248.6		
Fall time	t_f			-	68.5		
Turn-on switching energy	E_{on}			-	2.50		mJ
Turn-off switching energy	E_{off}			-	0.69		
Total switching energy	E_{ts}			-	3.19		
Turn-on delay time	$t_{d(on)}$	V_{GE} = 0/15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_{vj} = 175℃		-	58.5		ns
Rise time	t_r			-	50.5		
Turn-off delay time	$t_{d(off)}$			-	263.6		
Fall time	t_f			-	110.7		
Turn-on switching energy	E_{on}			-	3.83		mJ
Turn-off switching energy	E_{off}			-	0.96		
Total switching energy	E_{ts}			-	4.79		
Reverse recovery time	t_{rr}	I_F = 40A, di_F/dt = 400A/μs, T_{vj} = 25℃		-	131.8	-	ns
Reverse recovery current	I_{rr}			-	12.7	-	A
Reverse recovery charge	Q_{rr}			-	0.98	-	μC
Reverse recovery time	t_{rr}	I_F = 40A, di_F/dt = 400A/μs, T_{vj} = 175℃		-	244.4	-	ns
Reverse recovery current	I_{rr}			-	22.0	-	A
Reverse recovery charge	Q_{rr}			-	2.93	-	μC

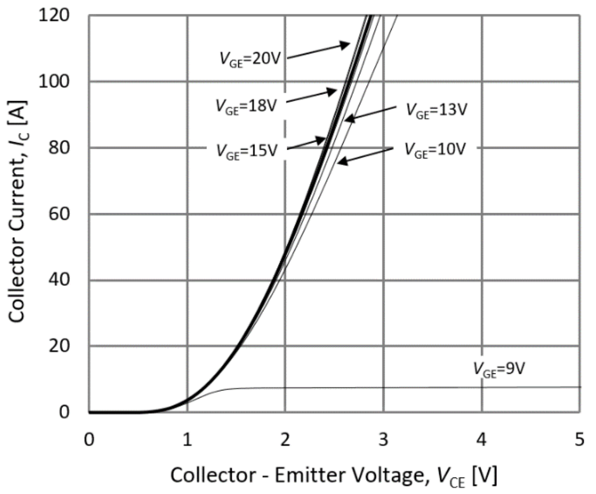


Fig.1. Typical output characteristics(T_{vj}=25℃)

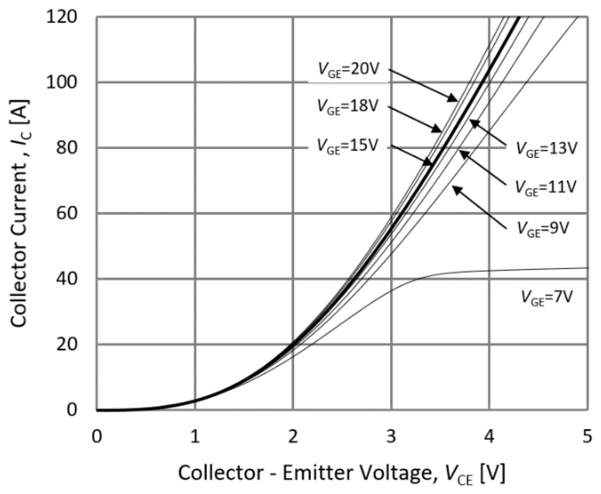


Fig.2. Typical output characteristics(T_{vj}=175℃)

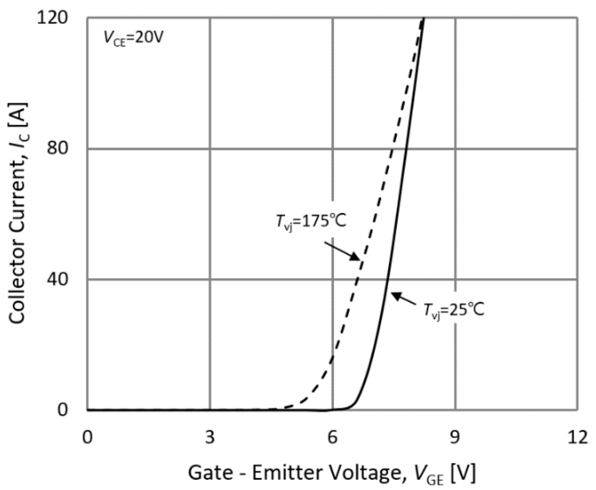


Fig.3. Typical transfer characteristics

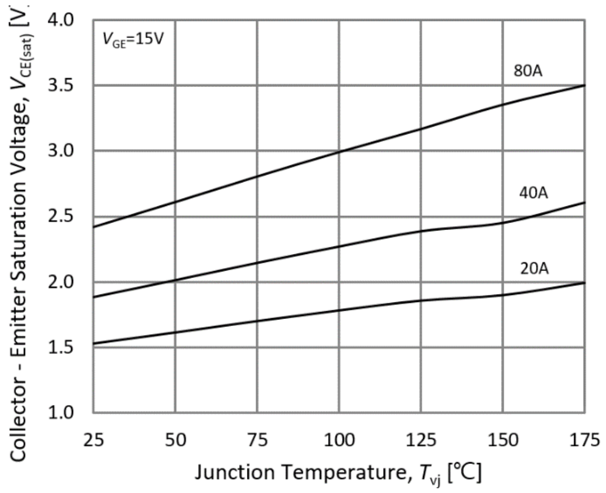


Fig.4. Typical collector emitter saturation voltage-junction temperature

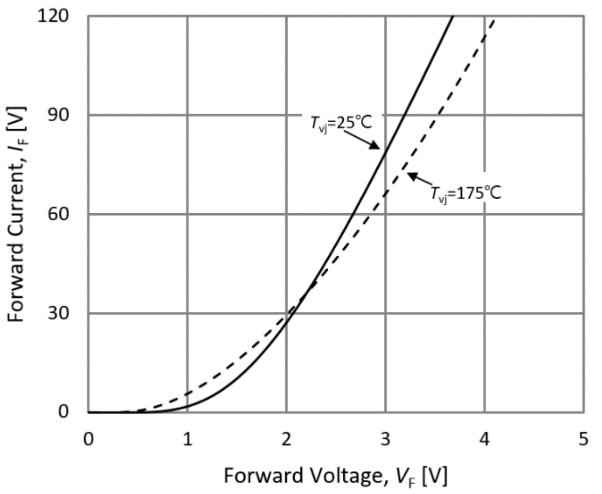


Fig.5. Diode Forward Characteristics

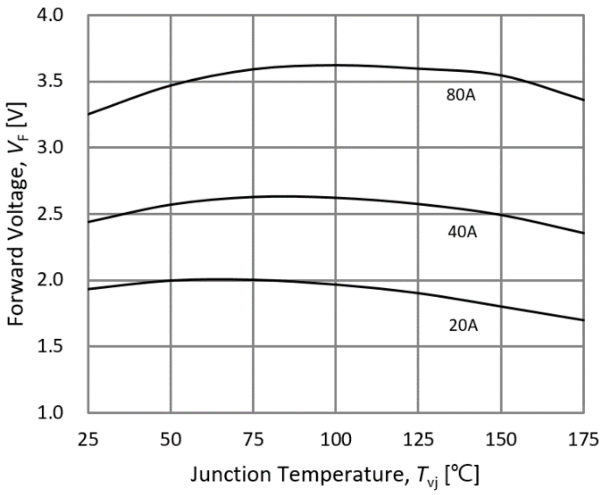


Fig.6. Diode Forward-Junction Temperature

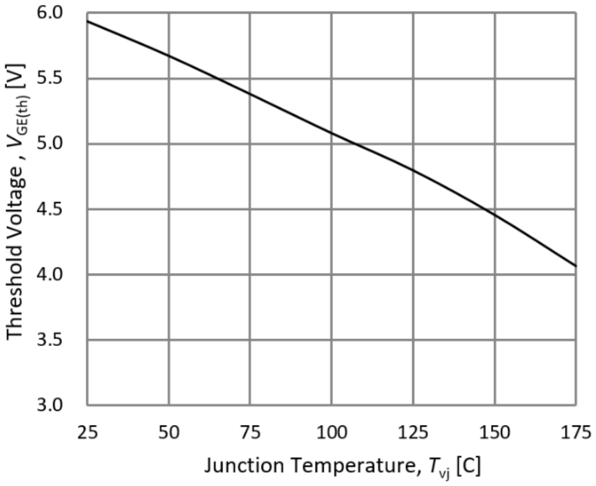


Fig.7. Threshold voltage-junction temperature

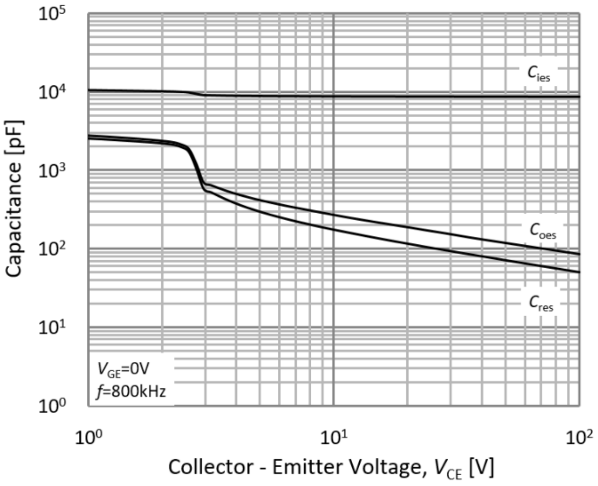


Fig.8. Typical capacitance

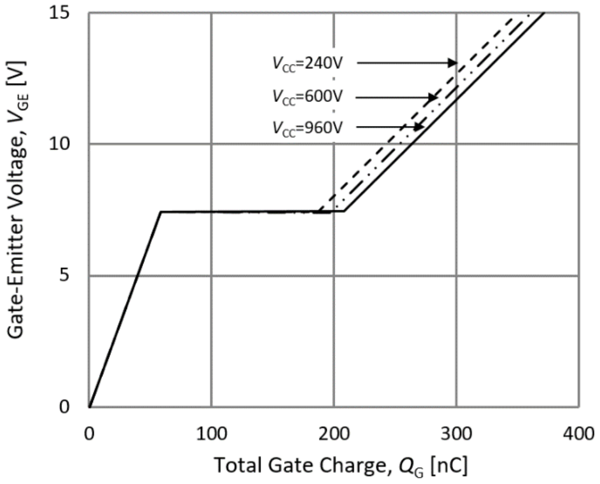


Fig.9. Typical gate charge

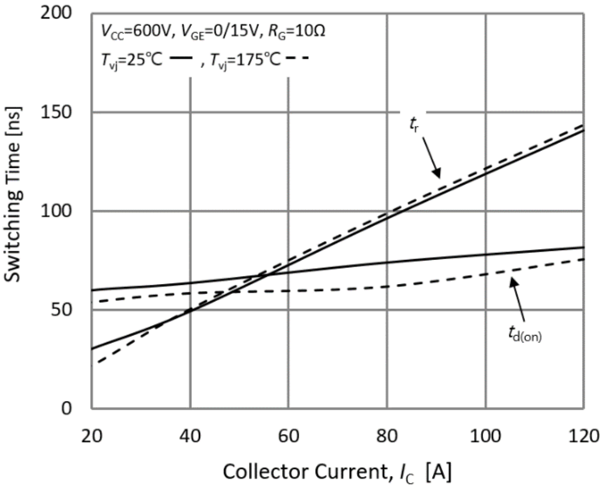


Fig.10. Typical turn on times-collector current

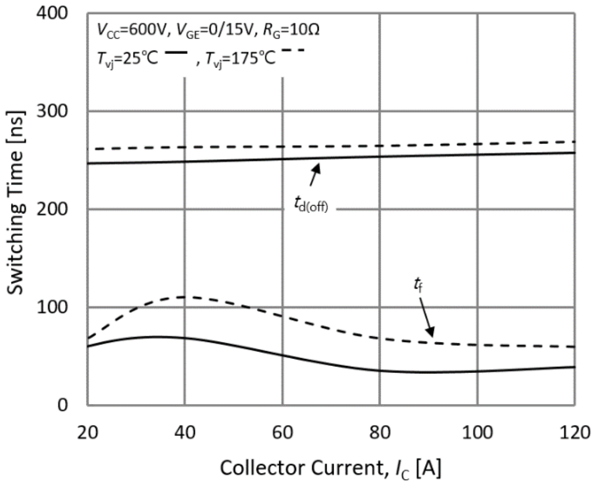


Fig.11. Typical turn off times-collector current

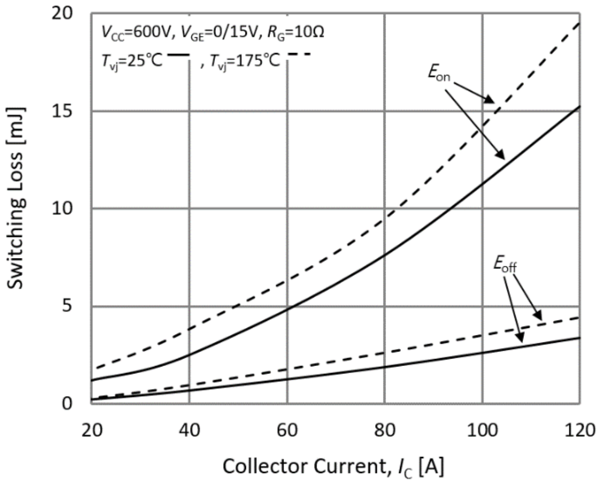


Fig.12. Switching losses-collector current

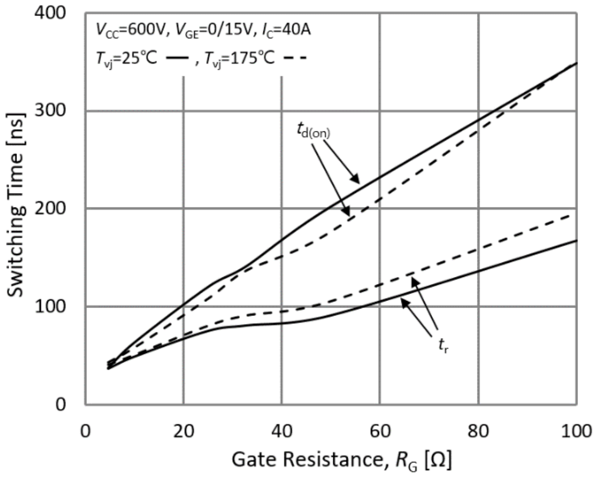


Fig.13. Typical turn on times-gate resistance

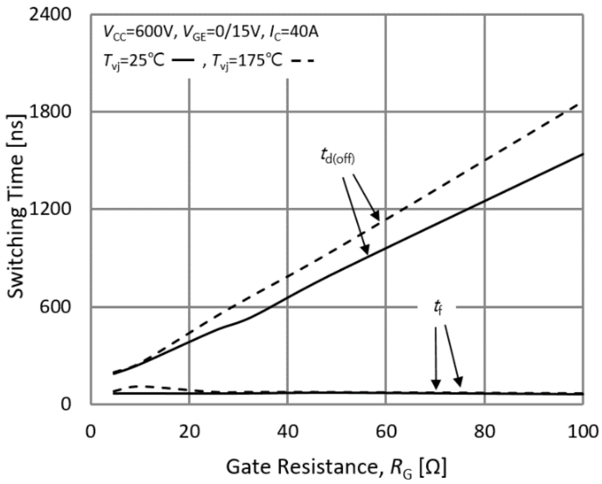


Fig.14. Typical turn off times-gate resistance

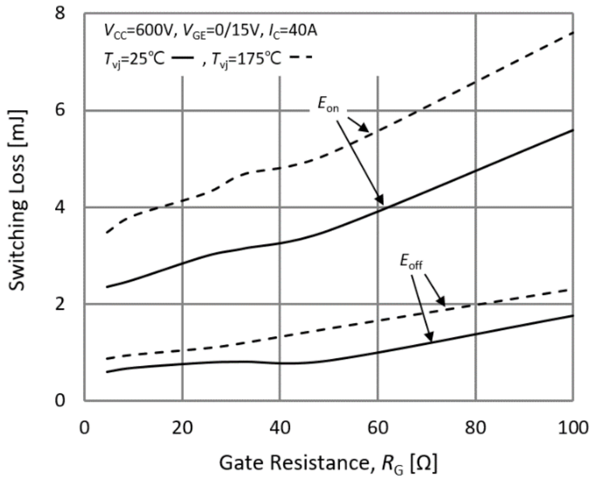


Fig.15. Switching losses-gate resistance

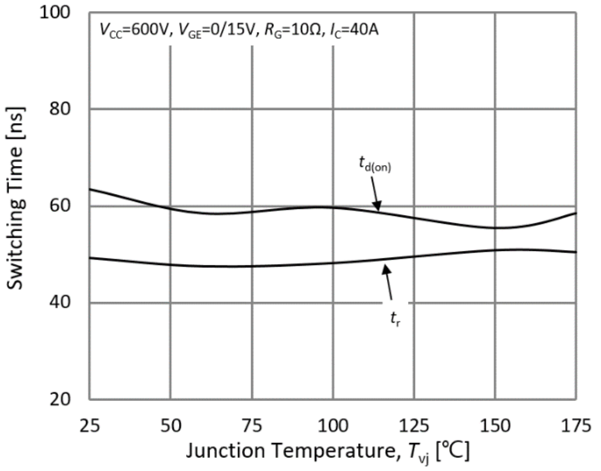


Fig.16. Typical turn on times-junction temperature

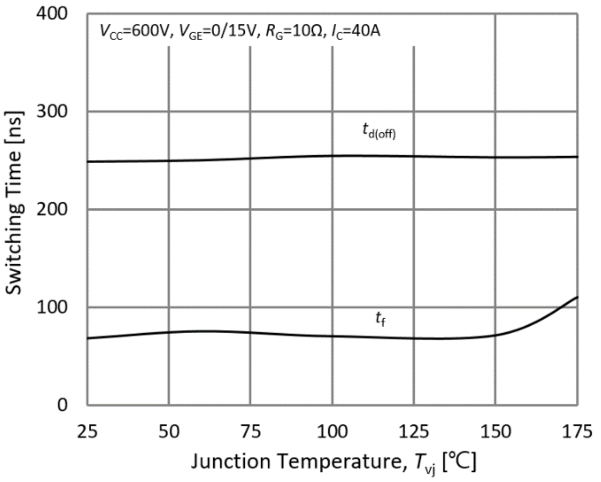


Fig.17. Typical turn off times-junction temperature

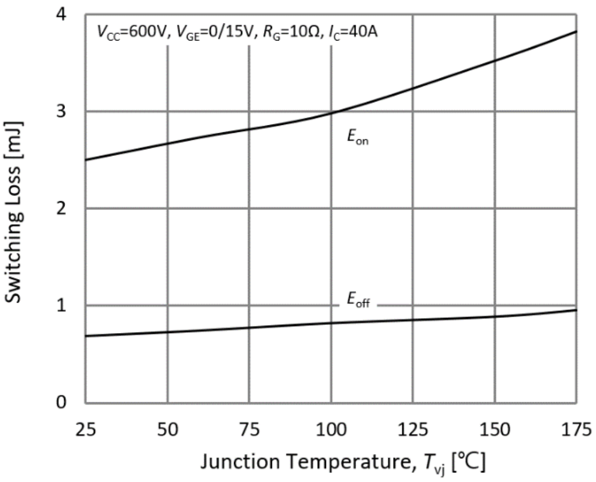


Fig.18. Switching losses-junction temperature

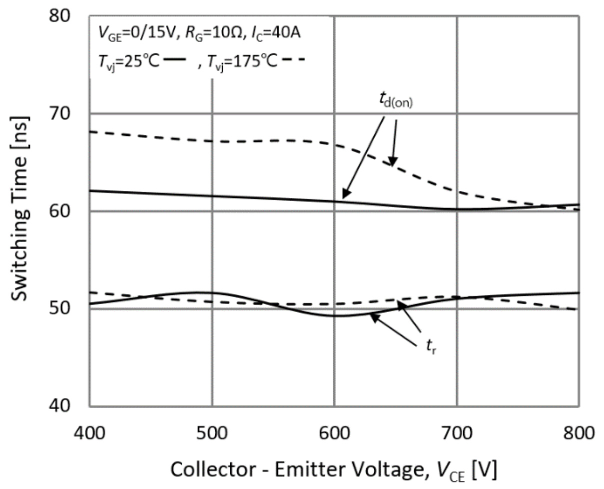


Fig.19. Typical turn on times-collector emitter voltage

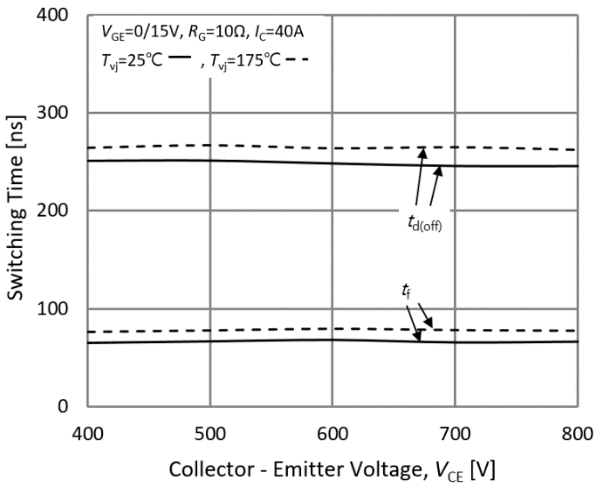


Fig.20. Typical turn off times-collector emitter voltage

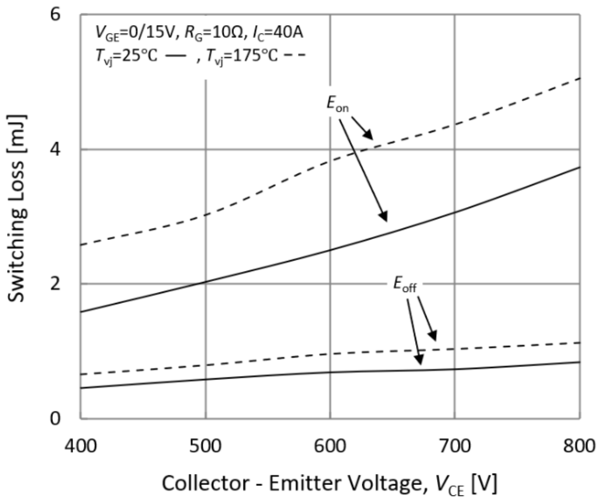


Fig.21. Switching losses-collector emitter voltage

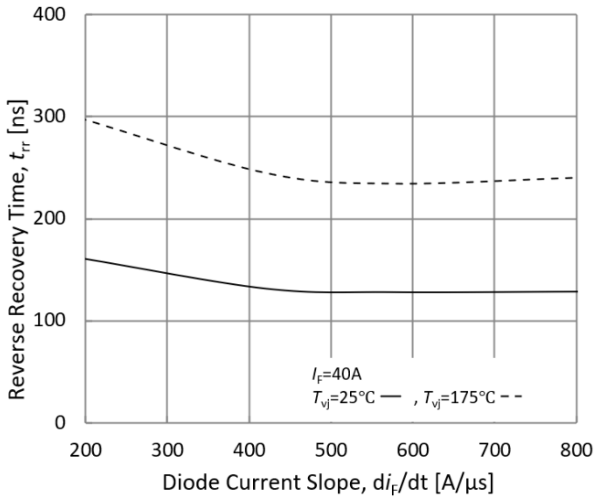


Fig.22. Reverse recovery time-diode current slope

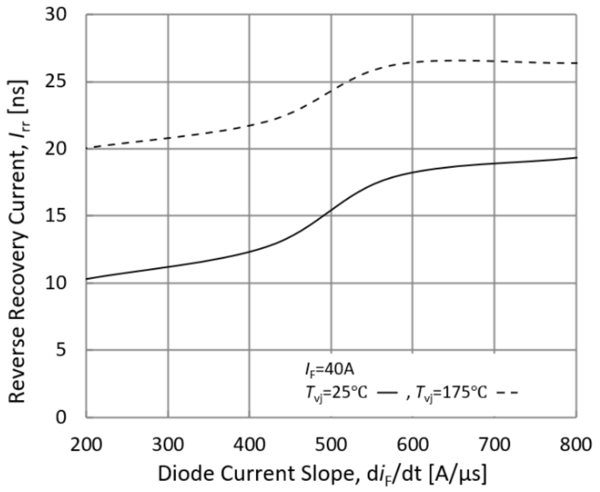


Fig.23. Reverse recovery current-diode current slope

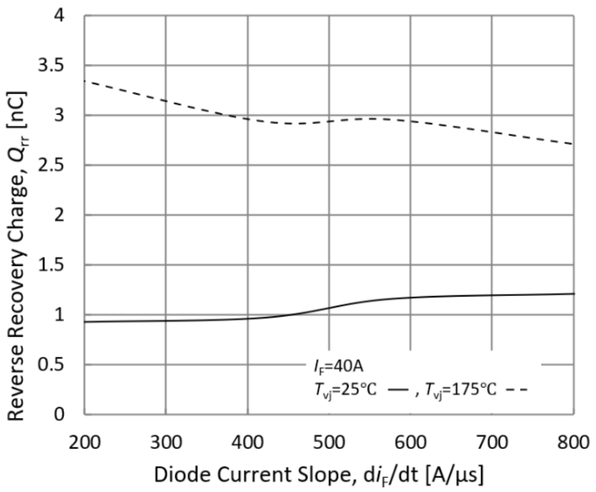


Fig.24. Reverse recovery charge-diode current slope

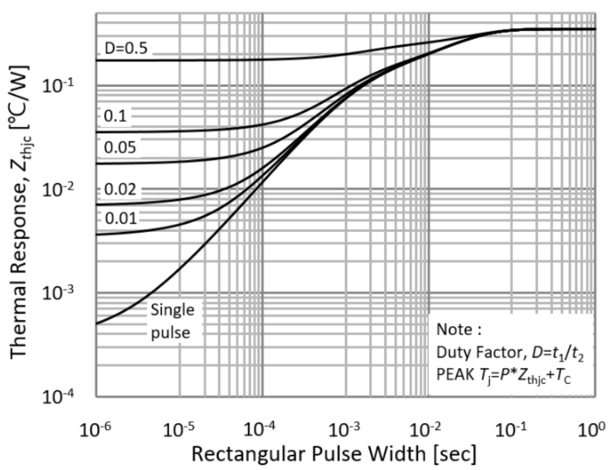


Fig.25. IGBT transient thermal impedance

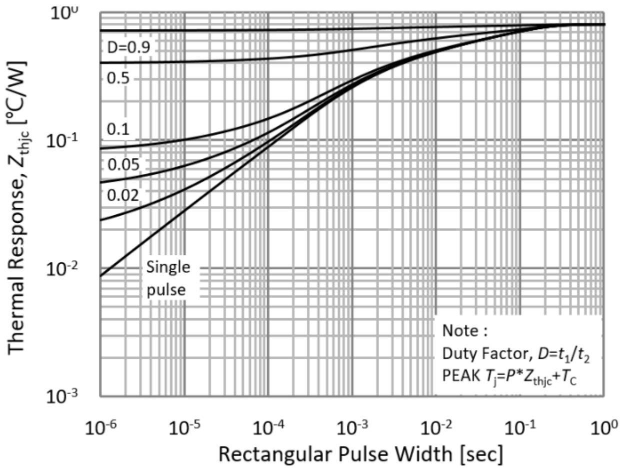


Fig.26. FRD transient thermal impedance

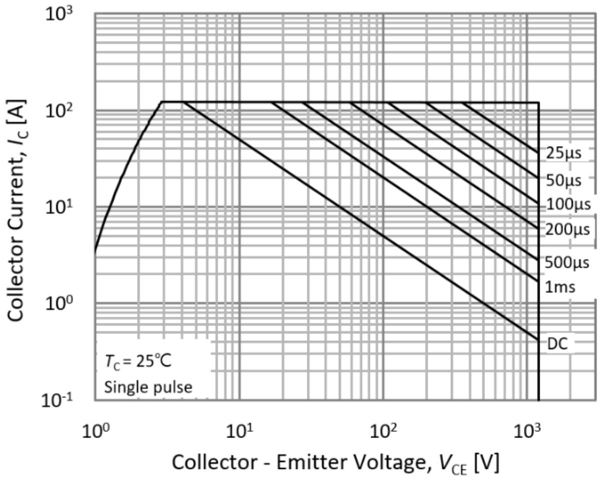


Fig.27. FBSOA

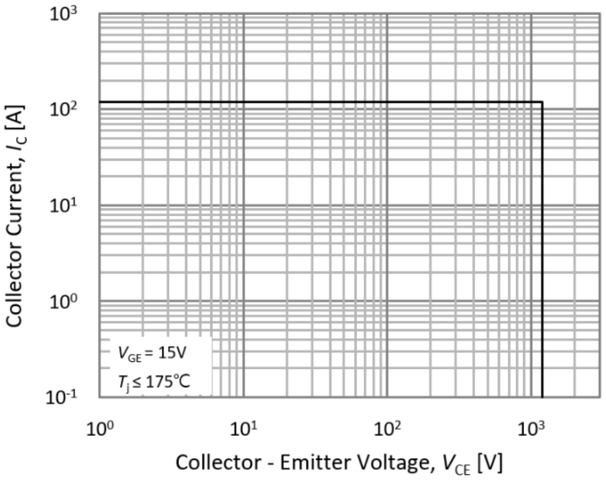
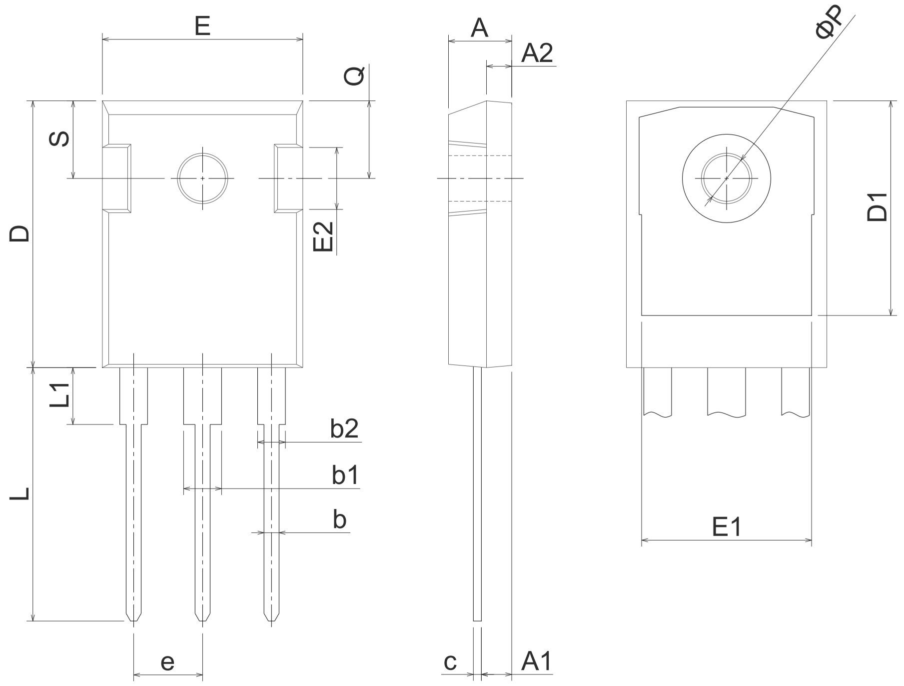


Fig.28. RBSOA

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	

Note: Package body size, length and width do not include mold flash, protrusions and gate burrs.

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.