RoHS Compliant

Magnachip

AMBQ40T120RFRTH

FieldStop Trench IGBT

General Description

This IGBT is produced using advanced Magnachip's Field Stop Trench IGBT Technology, which provides low $V_{CE(sat)}$, high speed switching and high ruggedness performance and excellent quality.

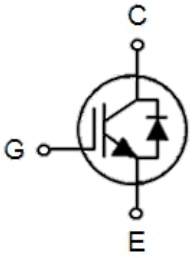
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)}$ = 1.75V @ I_C = 40A
- High Input Impedance
- t_{rr} = 285ns (typ.)
- Ultra-Soft, fast recovery anti-parallel diode
- Ultra-narrowed V_F distribution control
- Positive Temperature coefficient for easy paralleling
- AEC-Q101 qualified

Applications

- E-compressor
- PTC Heater

TO-247



Package outline and symbol

- 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}	±25	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_{vjmax}		I_{Cpuls}	160	A
Diode forward current, limited by T_{vjmax}	T_C=25°C	I_F	80	A
	T_C=100°C		40	A
Diode pulsed current, Pulse time limited by T_{vjmax}		I_{Fpuls}	160	A
Power dissipation	T_C=25°C	P_D	482	W
	T_C=100°C		242	W
Short circuit withstand time V_{CE} = 600V, V_{GE} = 15V, T_C = 150°C		t_{SC}	10	μs
Operating Junction temperature range		T_{vj}	-40~175	°C
Storage temperature range		T_{stg}	-55~150	°C

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{th(j-a)}$	40	°C/W
Thermal resistance junction-to-case for IGBT	$R_{th(j-c)}$	0.31	
Thermal resistance junction-to-case for Diode	$R_{th(j-c)}$	0.8	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
AMBQ40T120RFR	40T120RFR	-55~150°C	TO-247	Tube	Compliant

Electrical Characteristics (T_{vj} = 25°C 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°C	-	1.75	2.2	V
			T_{vj} = 175°C	-	2.35	-	
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 40A	T_{vj} = 25°C	-	1.95	2.50	V
			T_{vj} = 175°C	-	2.05	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 1mA		4.2	5.2	6.2	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V		-	-	1	mA
Gate-emitter leakage current	I_{GES}	V_{GE} = 25V, V_{CE} = 0V		-	-	±250	nA
Dynamic Characteristics							
Total gate charge	Q_G	V_{CE} = 960V, I_C = 40A, V_{GE} = 15V		-	417	-	nC
Gate-emitter charge	Q_{GE}			-	79	-	
Gate-collector charge	Q_{GC}			-	189	-	
Input capacitance	C_{ies}	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz		-	9741	-	pF
Output capacitance	C_{oes}			-	170	-	
Reverse transfer capacitance	C_{res}			-	109	-	
Switching Characteristics							
Turn-on delay time	$t_{d(on)}$	V_{GE} = 15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_{vj} = 25°C		-	76	-	ns
Rise time	t_r			-	150	-	
Turn-off delay time	$t_{d(off)}$			-	366	-	
Fall time	t_f			-	231	-	
Turn-on switching energy	E_{on}			-	5.10	-	mJ
Turn-off switching energy	E_{off}			-	2.19	-	
Total switching energy	E_{ts}			-	7.29	-	
Turn-on delay time	$t_{d(on)}$	V_{GE} = 15V, V_{CC} = 600V, I_C = 40A, R_G = 10Ω, Inductive Load, T_{vj} = 175°C		-	72	-	ns
Rise time	t_r			-	154	-	
Turn-off delay time	$t_{d(off)}$			-	392	-	
Fall time	t_f			-	313	-	
Turn-on switching energy	E_{on}			-	7.14	-	mJ
Turn-off switching energy	E_{off}			-	3.39	-	
Total switching energy	E_{ts}			-	10.53	-	
Reverse recovery time	t_{rr}	I_F = 40A, di_F/dt = 300A/μs, T_{vj} = 25°C		-	285	-	ns
Reverse recovery current	I_{rr}			-	15	-	A
Reverse recovery charge	Q_{rr}			-	2.09	-	uC
Reverse recovery time	t_{rr}	I_F = 40A, di_F/dt = 300A/μs, T_{vj} = 175°C		-	472	-	ns
Reverse recovery current	I_{rr}			-	20	-	A
Reverse recovery charge	Q_{rr}			-	4.55	-	uC

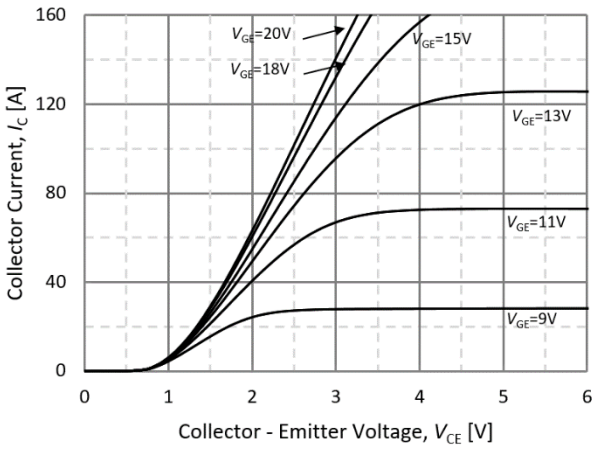


Fig.1 Typical Output Characteristics(T_{vj}=25℃)

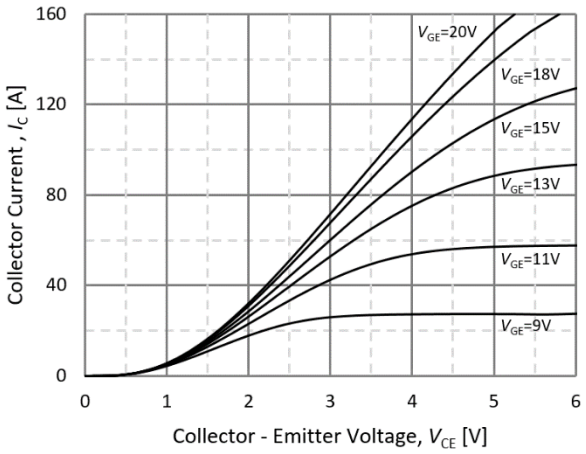


Fig.2 Typical Output Characteristics(T_{vj}=175℃)

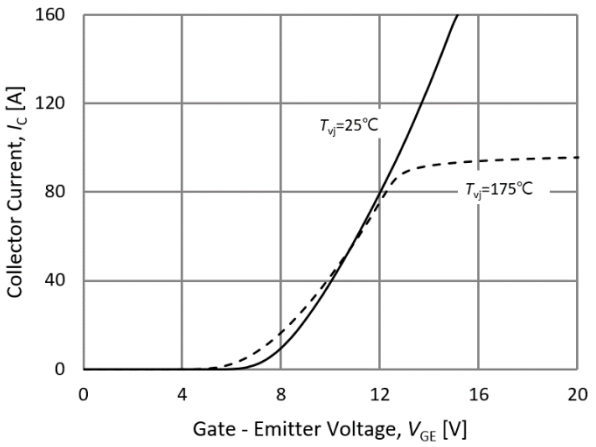


Fig.3 Typical Transfer Characteristics

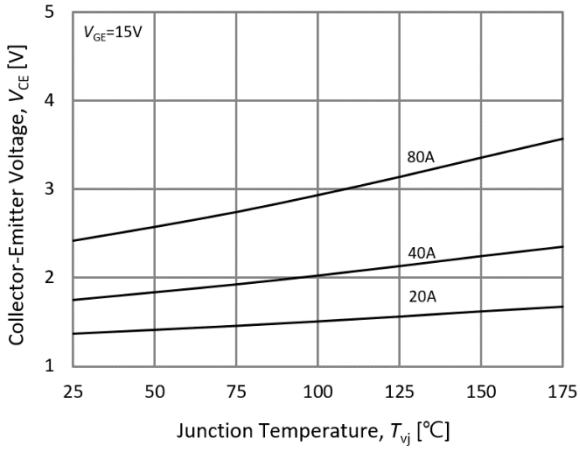


Fig.4 Typical Collector-Emitter Saturation Voltage -Junction Temperature

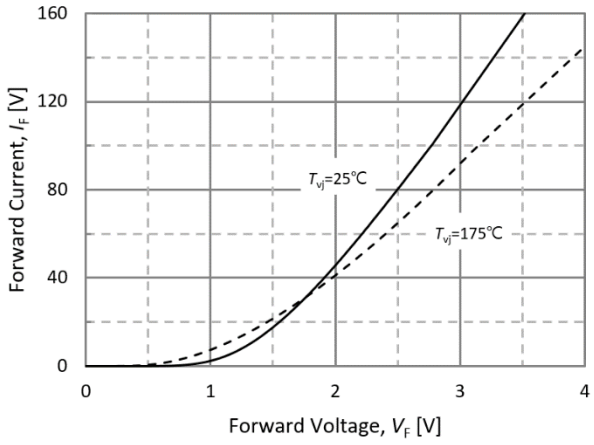


Fig.5 Diode Forward Characteristics

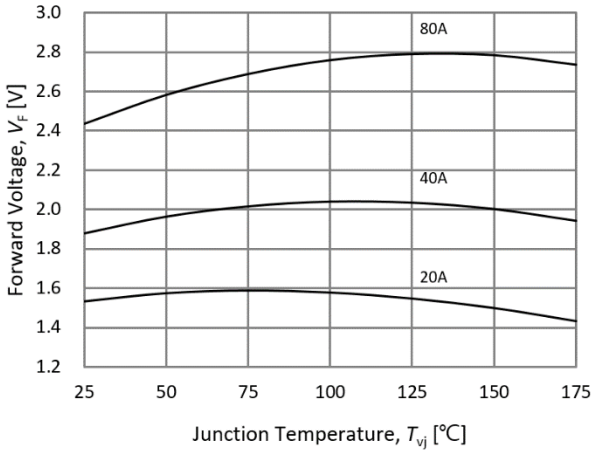


Fig.6 Diode Forward-Junction Temperature

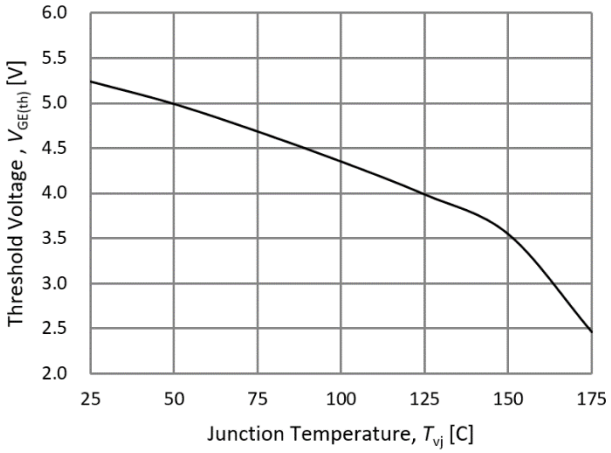


Fig.7 Threshold Voltage-Junction Temperature

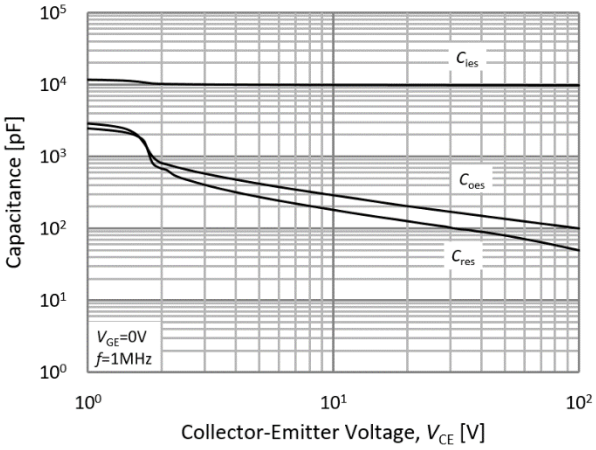


Fig.8 Typical Capacitance

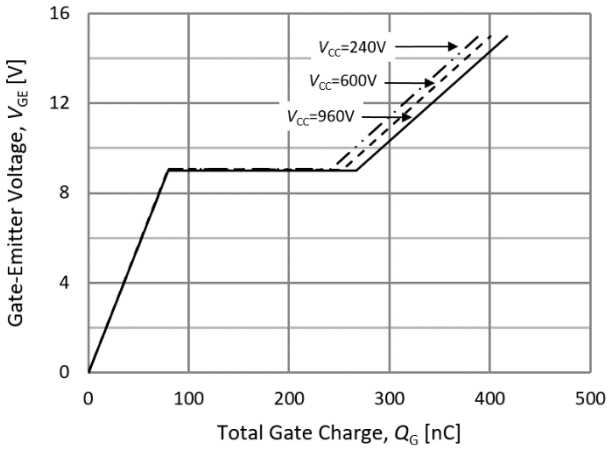


Fig.9 Typical Gate Charge

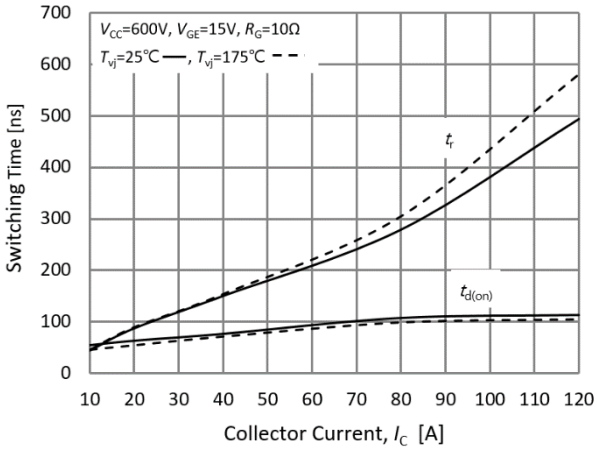


Fig.10 Typical Turn on-Collector Current

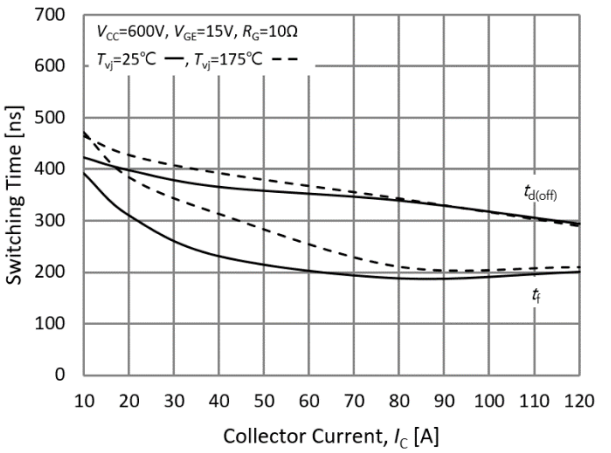


Fig.11 Typical Turn off-Collector Current

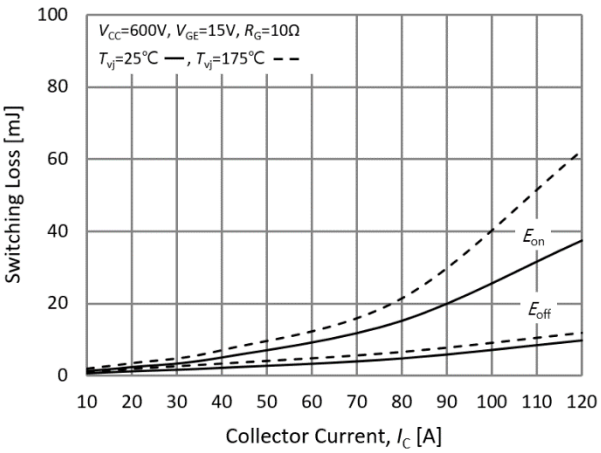


Fig.12 Switching Loss-Collector Current

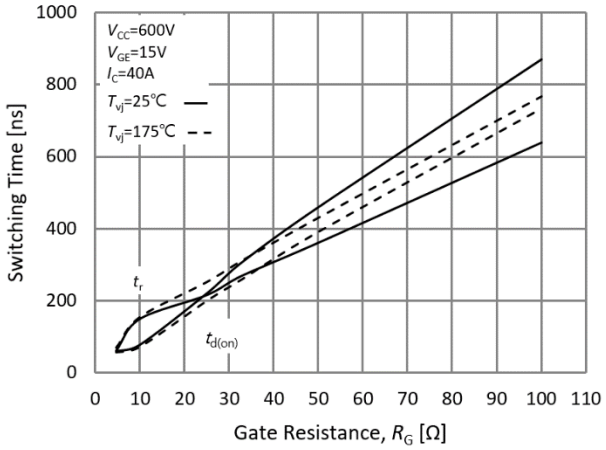


Fig.13 Turn on Characteristics-Gate Resistance

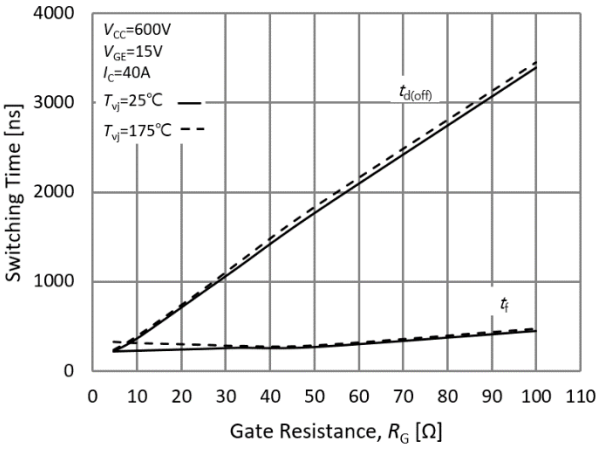


Fig.14 Turn off Characteristics-Gate Resistance

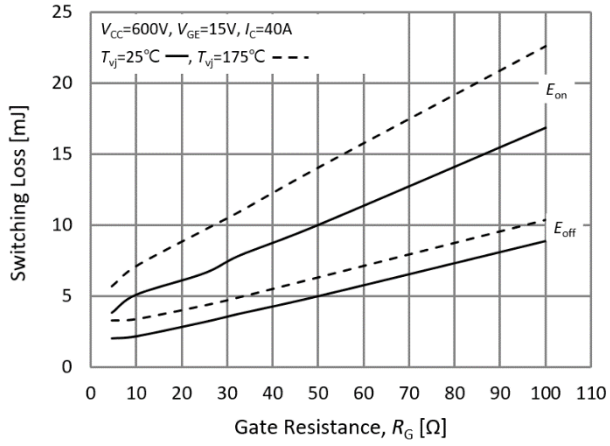


Fig.15 Switching Loss-Gate Resistance

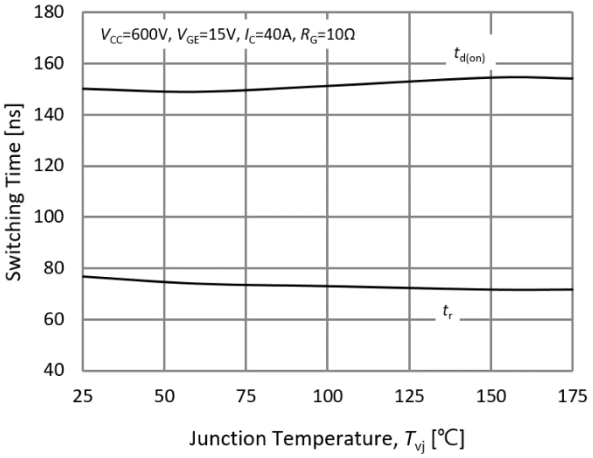


Fig.16 Turn on Characteristics-Junction Temperature

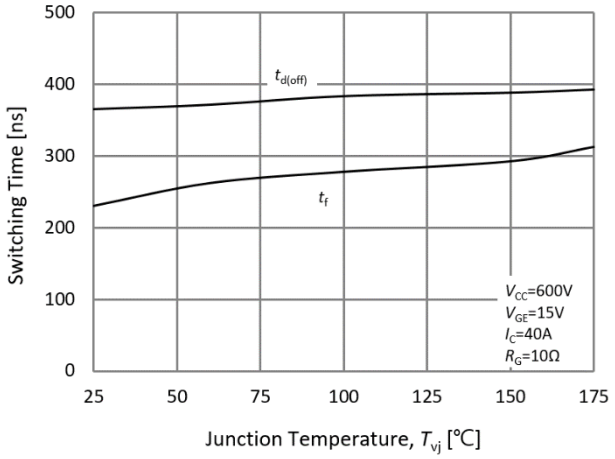


Fig.17 Turn off Characteristics -Junction Temperature

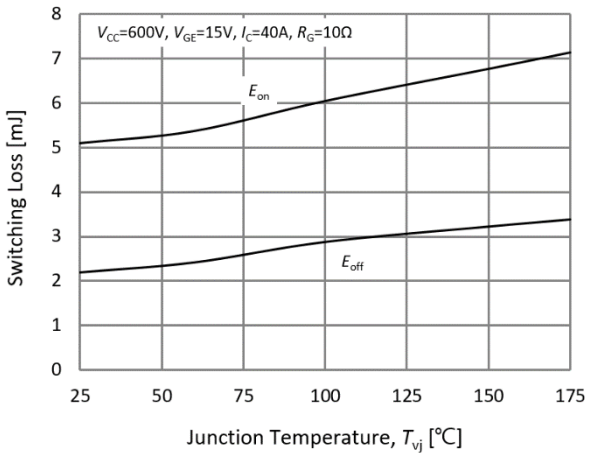


Fig.18 Switching Loss-Junction Temperature

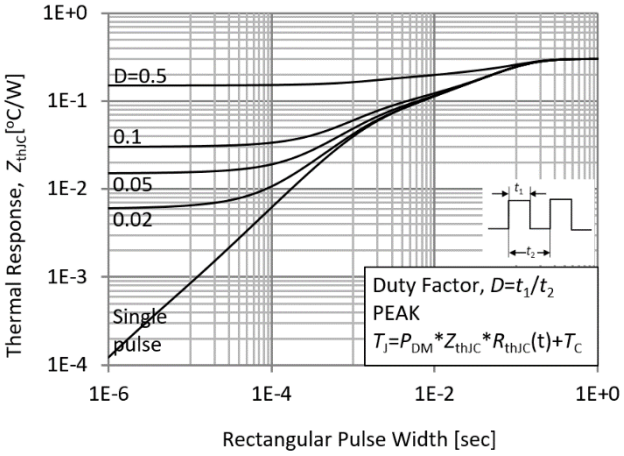


Fig.19 IGBT Transient Thermal Impeadeance

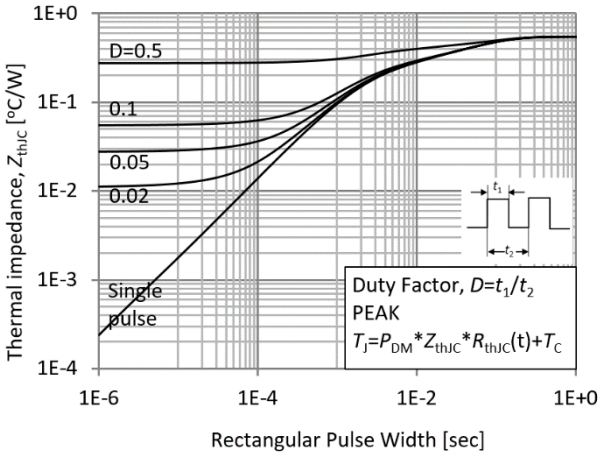


Fig.20 FRD Transient Thermal Impeadeance

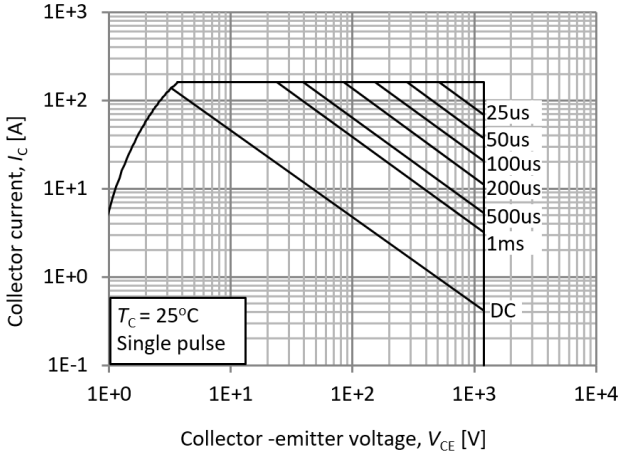


Fig.21 FBSOA

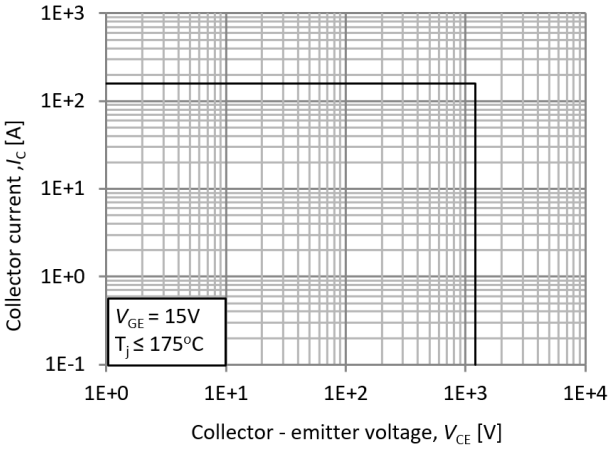
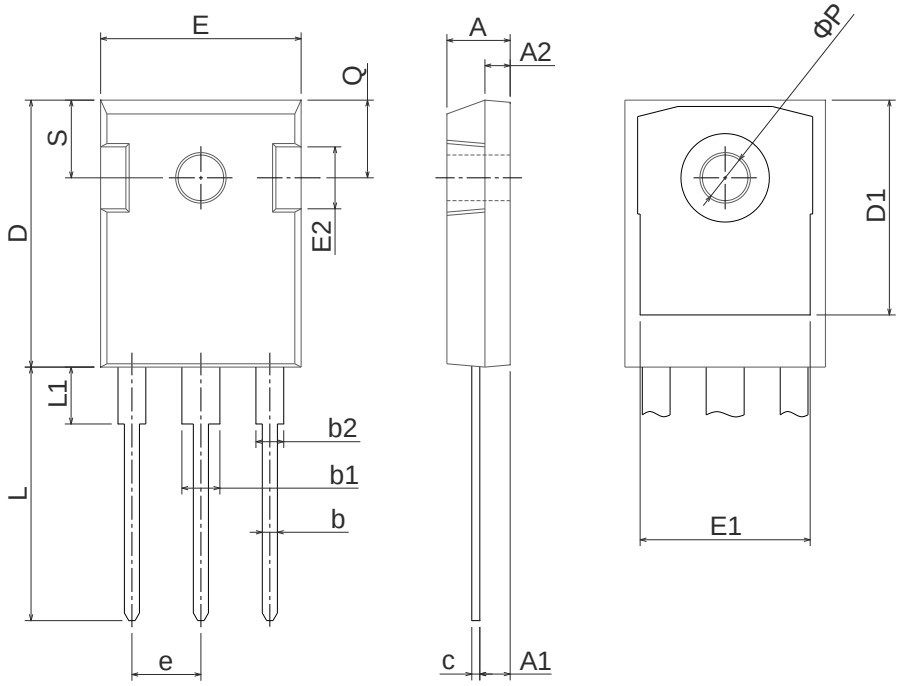


Fig.22 RBSOA

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.