Silicon FS Trench IGBT

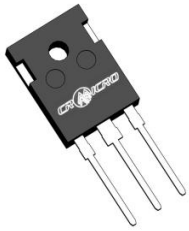
CRG40T120CK3LDQ

General Description：

Using owner proprietary trench design and advanced Field Stop (FS) technology, offering superior conduction and switching performances. RoHS Compliant.

V_{CES}	1200	V
I_C	40	A
P_{tot} （T_C=25℃）	550	W
$V_{CE(sat)}$	1.80	V

Outline ： TO-247



Features：

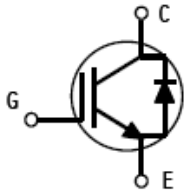
- Qualified to AEC-Q101
- Short Circuit Withstand Time 10μs
- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage：

  $V_{CE(sat)}$,TYP=1.80V @I_C=40A,V_{GE}=15V；

Applications

- Electric Automotive Air-Condition Compressor
- PTC heater
- General Inverter

Inner Circuit：



Package Parameters

Type	Marking	Package	Packing
CRG40T120CK3LDQ	G40T120CK3LDQ	TO-247	Tube

Absolute Maximum Ratings（T_C= 25℃ unless otherwise specified）:

Symbol	Parameter	Rating	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate- Emitter Voltage	±20	V
V_{GES}	Gate- Emitter Voltage（tp≤10us,D<0.01）	±30	V
I_C	Collector Current @T_C = 25 ℃	80	A
	Collector Current @T_C = 100 ℃	40	
I_{CM}[a1]	Pulsed Collector Current	160	A
I_F	Diode Continuous Forward Current @T_C =25 ℃	80	A
	Diode Continuous Forward Current @T_C = 100 ℃	40	
I_{FM}	Diode Maximum Forward Current	160	A
Tsc	Short Circuit Withstand Time @V_{GE}=15V,V_{CE}=600V	10	μs
P_D	Power Dissipation @ T_C = 25℃	550	W
	Power Dissipation @ T_C = 100℃	275	W
T_{vjop}[a2]	Operating Junction temperature range	-40～175	℃
T_{stg}	Storage Temperature Range	−55～150	℃
T_L	Maximum Temperature for Soldering	270	℃

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R\theta_{JC}$	Thermal Resistance, Junction to case for IGBT	--	0.27	℃/W
$R\theta_{JC}$	Thermal Resistance, Junction to case for Diode	--	1.0	℃/W
$R\theta_{JA}$	Thermal Resistance, Junction to Ambient	--	40	℃/W

Electrical Characteristics of the IGBT（T_C= 25℃ unless otherwise specified）:

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ	Max.	
OFF Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=250uA	1200	--	--	V
I_{CES}	Collector Cut-off Current	V_{GE}=0V,V_{CE}=1200V	--	--	100	uA
$I_{GES(F)}$	Gate-Emitter Forward Leakage Current	V_{GE}=+20V	--	--	+250	nA
$I_{GES(R)}$	Gate-Emitter Reverse Leakage Current	V_{GE} =-20V	--	--	-250	nA
ON Characteristics						
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A ,V_{GE}=15V @ T_C = 25 ℃	--	1.80	2.4	V
		I_C=40A ,V_{GE}=15V @ T_C =175 ℃	--	2.50	--	V

$V_{GE(th)}$	Gate - Emitter Threshold Voltage	I_C=250uA ,V_{CE}=V_{GE}	4.5	5.8	7.0	V
Pulse width tp≤300μs,δ≤2%						
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V f=1MHz	--	4067	--	pF
C_{oes}	Output Capacitance		--	167	--	
C_{res}	Reverse Transfer Capacitance		--	90	--	
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=600V,I_C=40A, R_g=10Ω,V_{GE}=15V, Inductive Load, T_J=25℃,	--	46.5	--	ns
t_r	Rise Time		--	40.4	--	
$t_{d(off)}$	Turn-Off Delay Time		--	273	--	
t_f	Fall Time		--	36.1	--	
E_{on}	Turn-On Switching Loss		--	4.2	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.47	--	
E_{ts}	Total Switching Loss		--	5.67	--	
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=600V,I_C=40A, R_g=10Ω,V_{GE}=15V, Inductive Load, T_J=175℃	--	41	--	ns
t_r	Rise Time		--	43	--	
$t_{d(off)}$	Turn-Off Delay Time		--	292	--	
t_f	Fall Time		--	92	--	
E_{on}	Turn-On Switching Loss		--	4.44	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.83	--	
E_{ts}	Total Switching Loss		--	6.27	--	
Qg	Total Gate Charge	V_{CE}=600V,I_C=40A, V_{GE}=15V,	--	225	--	nC
Qge	Gate to Emitter Charge		--	23	--	
Qgc	Gate to Collector Charge		--	130	--	
Electrical Characteristics of the DIODE						
V_F	Diode Forward Voltage	I_F=40A TC=25℃	--	2.4	3.2	V
		I_F=40A TC=175℃	--	1.85	--	V
t_{rr}	Reverse Recovery Time	I_F=40A di/dt=100A/μS	--	123	--	ns
I_{rrm}	Reverse Recovery Current		--	3.6	--	A
Q_{rr}	Reverse Recovery Charge		--	223	--	nC

Notes：

a1：Repetitive rating; pulse width limited by maximum junction temperature

a2：Overload condition, it is allowed to operate under the maximum junction temperature Tvjop = 175℃, the maximum duty cycle is less than 20% (lasting for 60s at most)

Typical Performance Characteristics

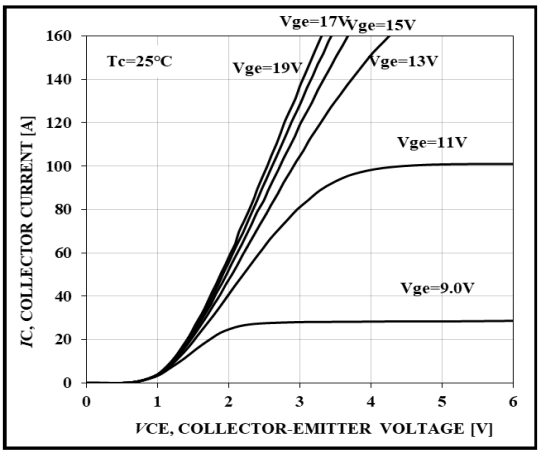


Figure 1. Output Characteristics

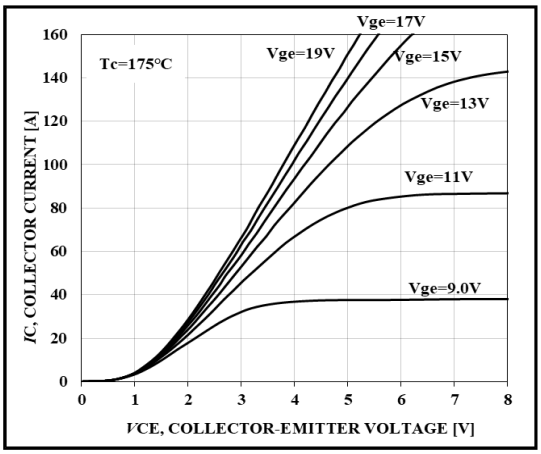


Figure 2. Output Characteristics

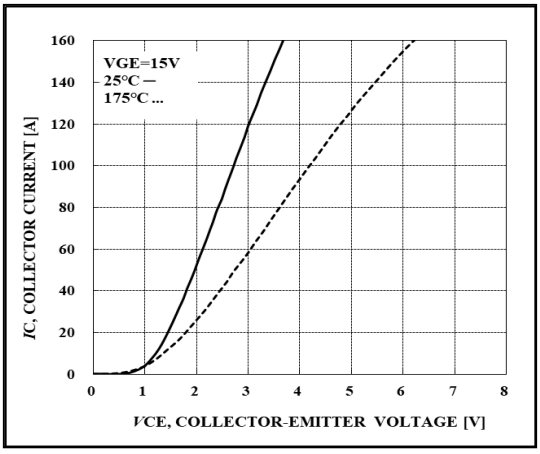


Figure 3. Saturation Voltage Characteristics

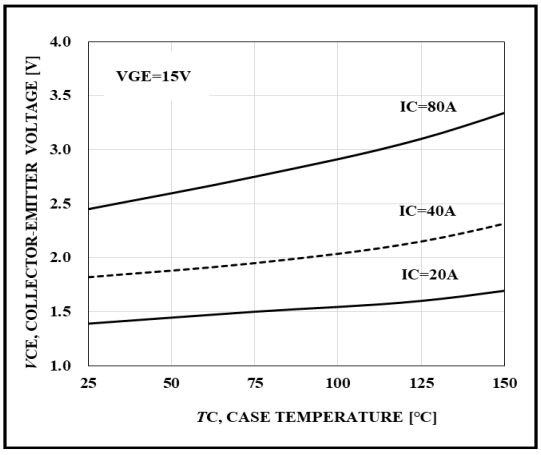


Figure 4. Saturation Voltage -T_C Characteristics

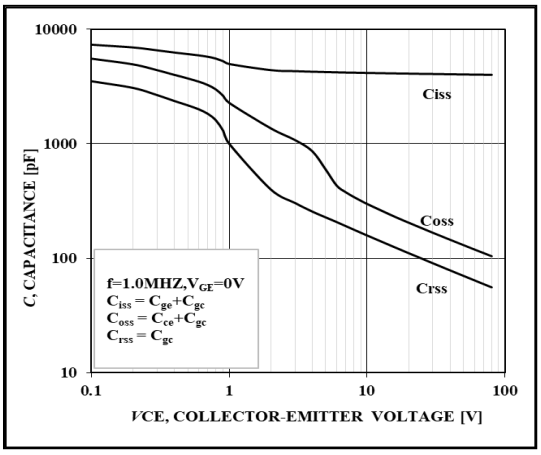


Figure 5. Capacitance Characteristics

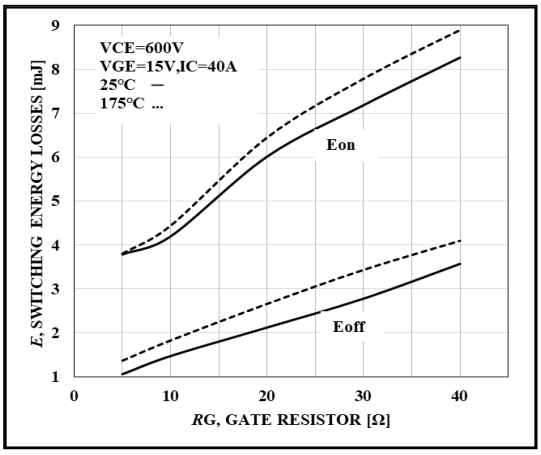


Figure 6. Switching Loss-R_G Characteristics

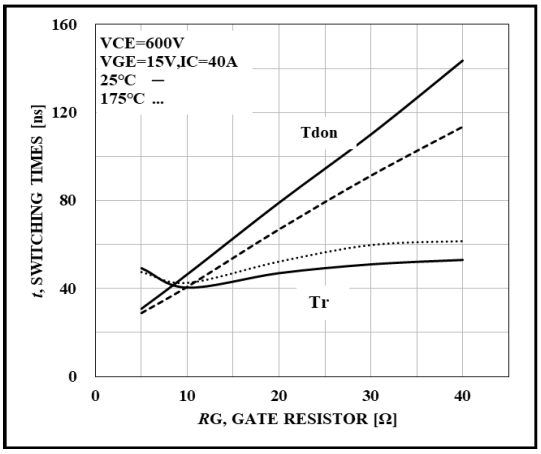


Figure 7. Switching Time-R_G Characteristics

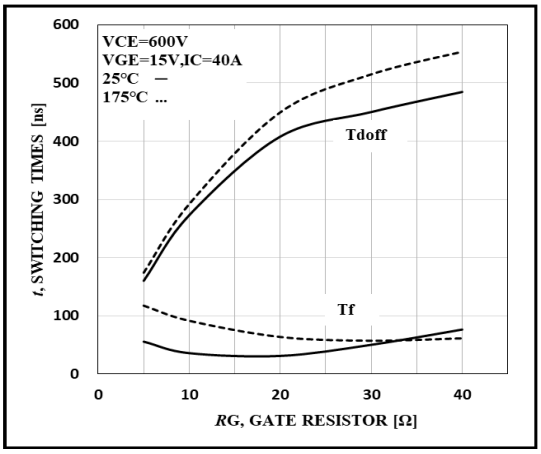


Figure 8. Switching Time-R_G Characteristics

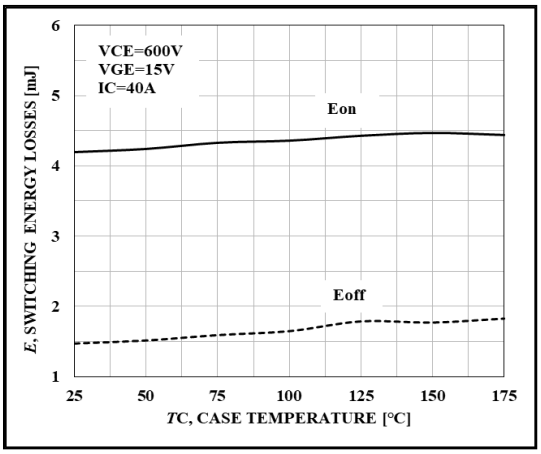


Figure 9. Switching Loss-Tc Characteristics

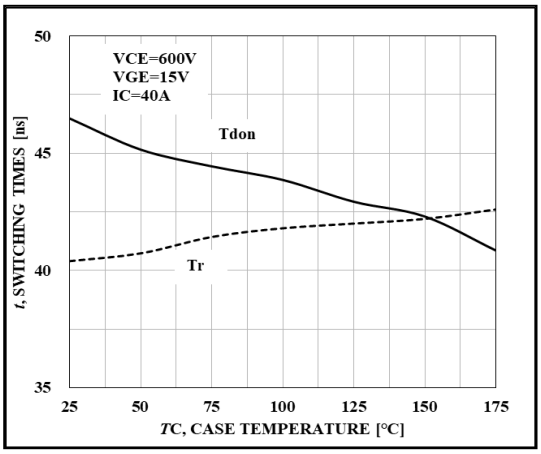


Figure 10. Switching Time-Tc Characteristics

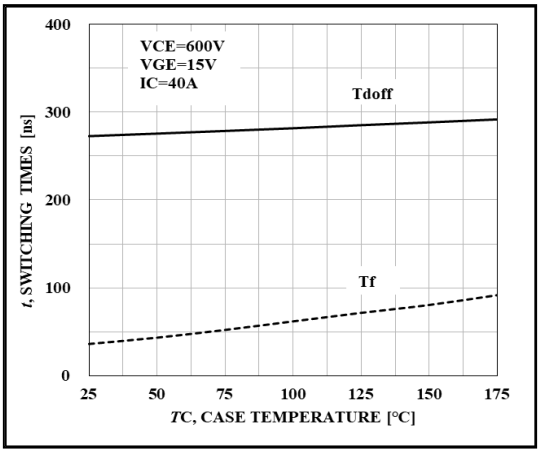


Figure 11. Switching Time-Tc Characteristics

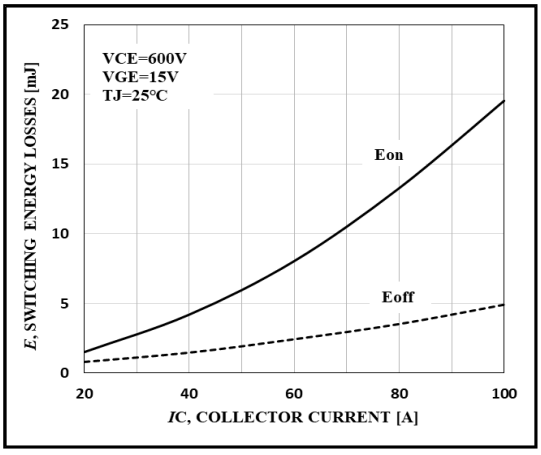


Figure 12. Switching Loss-I_C Characteristics

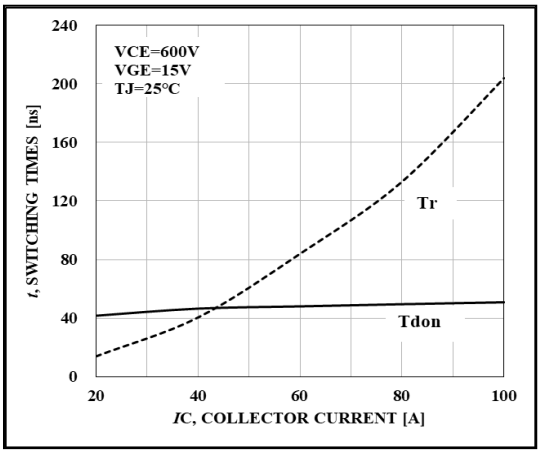


Figure 13. Switching Time-I_C Characteristics

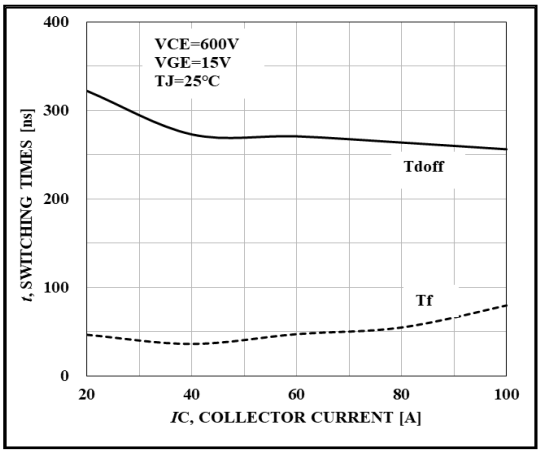


Figure 14. Switching Time-I_C Characteristics

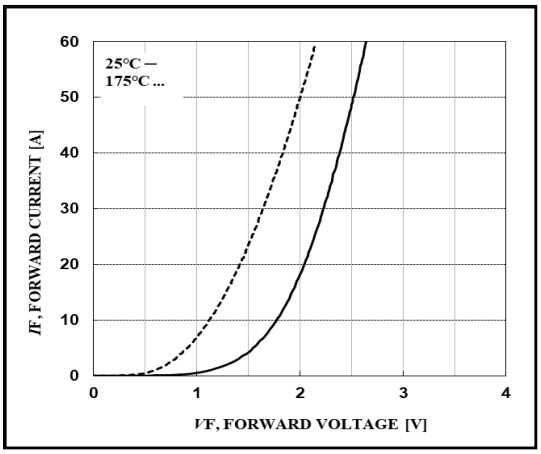


Figure 15. Diode Forward Characteristics

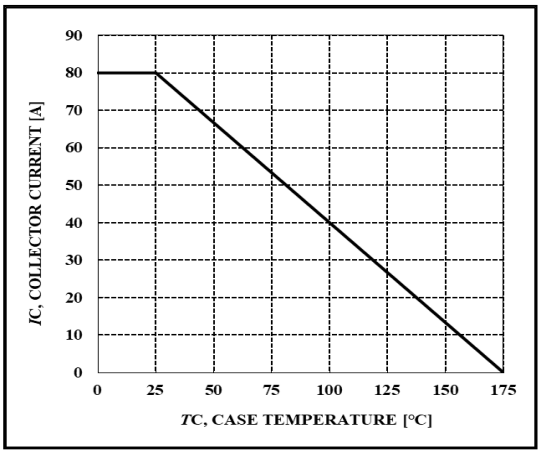


Figure 16. Collector Current-Tc Characteristics

(Tj ≤175℃)

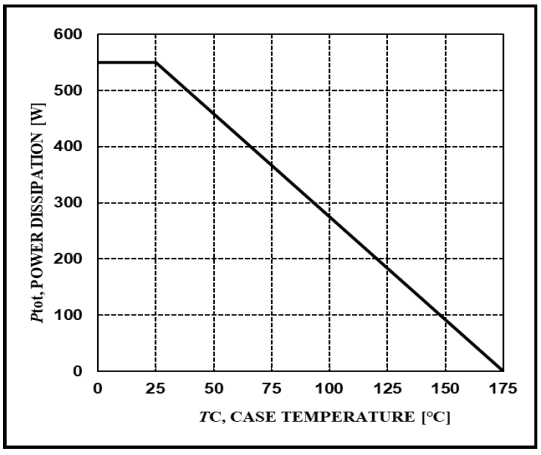


Figure 17. Power Dissipation-Tc Characteristics

(Tj ≤175℃)

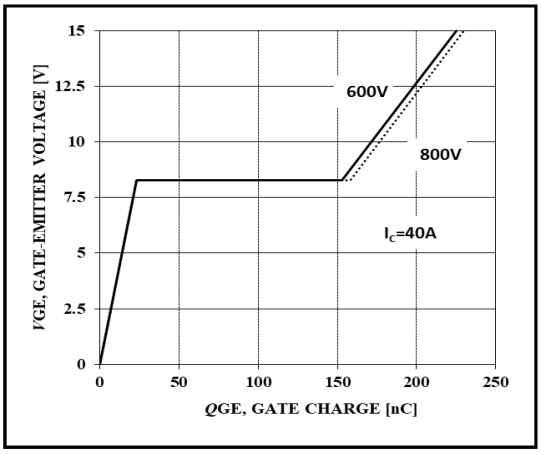


Figure 18. Gate Charge Characteristics

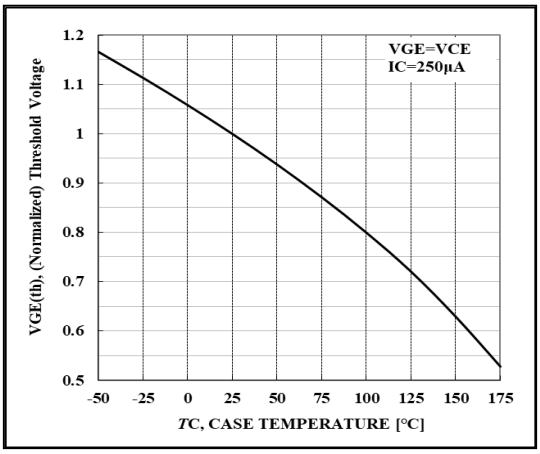


Figure 19. Threshold Voltage -Tc Characteristics

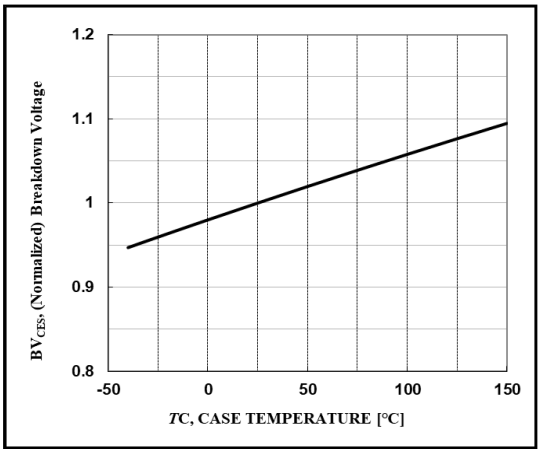


Figure 20. Breakdown Voltage-Tc Characteristics

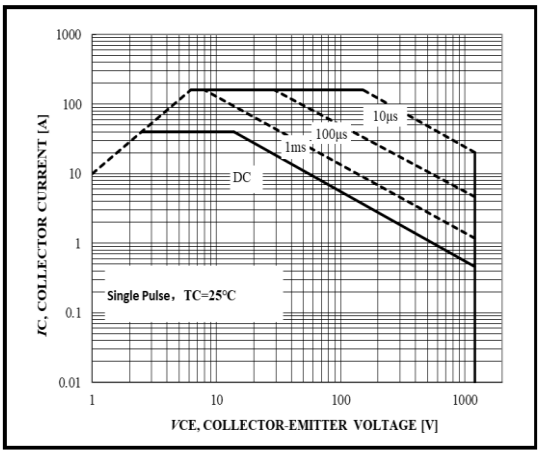


Figure 21. Forward Bias Safe Operating Area

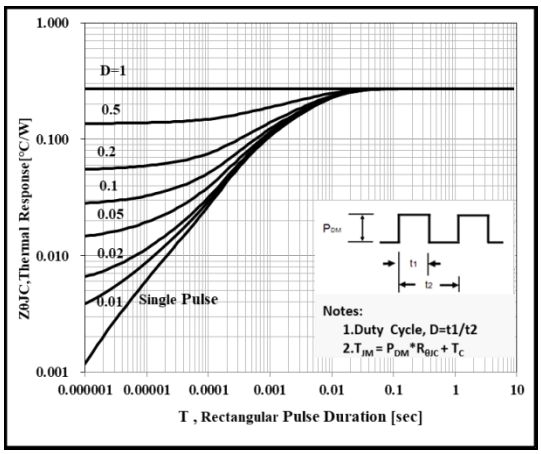
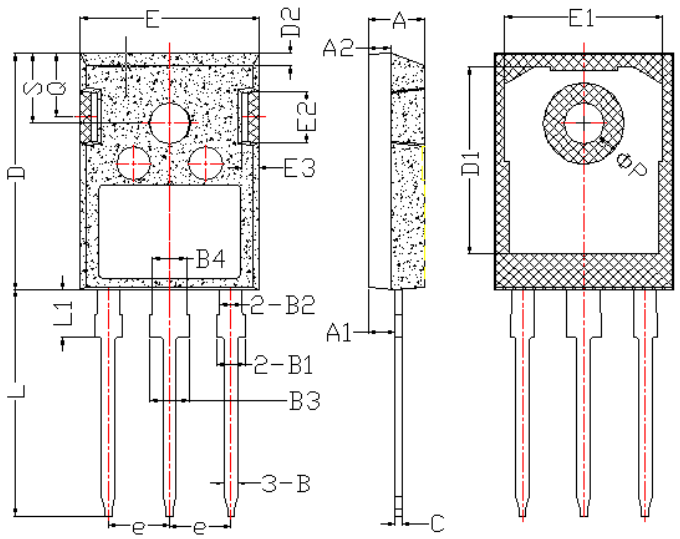


Figure 22. IGBT Transient Thermal Impedance

Package Information



Item	Value (mm)	
	MIN	MAX
A	4.6	5.2
A1	2.2	2.6
B	0.9	1.4
B1	1.75	2.35
B2	1.75	2.15
B3	2.8	3.35
B4	2.8	3.15
C	0.5	0.7
D	20.60	21.30
D1	16	18
E	15.5	16.10
E1	13	14.7
E2	3.80	5.3
E3	0.8	2.60
e	5.2	5.7
L	19	20.5
L1	3.9	4.6
ΦP	3.3	3.70
Q	5.2	6.00
S	5.8	6.6

TO-247 Package

The name and content of poisonous and harmful material in products

Part's Name Limit	Hazardous Substance									
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE	DIBP	DEHP	DBP	BBP
	≤0.1%	≤0.1%	≤0.01%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○	○	○	○	○
Molding	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○	○	○	○	○
Solder	×	○	○	○	○	○	○	○	○	○
Note	○：Means the hazardous material is under the criterion of 2011/65/EU. ×：Means the hazardous material exceeds the criterion of 2011/65/EU. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.									

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3. The product is not intended for use in applications that require extraordinary levels of quality and reliability, such as aviation/aerospace and life-support devices or systems.
4. Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

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