Silicon FS Trench IGBT

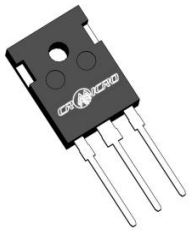
CRG40T120CK3SDQ

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℃）	514	W
$V_{CE(sat)}$	1.78	V

Outline ： TO-247



Features：

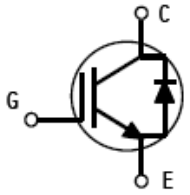
- Qualified to AEC-Q101
- Short Circuit Withstand Time 10μs
- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage：

  $V_{CE(sat)}$,TYP=1.78V @I_C=40A,V_{GE}=15V；

Applications

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

Inner Circuit：



Package Parameters

Type	Marking	Package	Packing
CRG40T120CK3SDQ	G40T120CK3SDQ	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 ℃	514	W
	Power Dissipation @ T_C = 100 ℃	257	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	--	0.29	℃/W
$R\theta_{JC}$	Thermal Resistance, Junction to case for Diode	--	1.5	℃/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 ℃	--	1.78	2.4	V
		I_C=40A ,V_{GE}=15V @ T_C =175 ℃	--	2.5	--	V

$V_{GE(th)}$	Gate - Emitter Threshold Voltage	I_C=250uA ,V_{CE}=V_{GE}	4.5	5.7	7.0	V
Pulse width tp≤300μs,δ≤2%						
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V f=1MHz	--	2508	--	pF
C_{oes}	Output Capacitance		--	147	--	
C_{res}	Reverse Transfer Capacitance		--	68	--	
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℃,	--	18	--	ns
t_r	Rise Time		--	34	--	
$t_{d(off)}$	Turn-Off Delay Time		--	188	--	
t_f	Fall Time		--	115	--	
E_{on}	Turn-On Switching Loss		--	2.2	--	mJ
E_{off}	Turn-Off Switching Loss		--	2.08	--	
E_{ts}	Total Switching Loss		--	4.28	--	
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=600V,I_C=40A, R_g=10Ω,V_{GE}=15V, Inductive Load, T_J=175℃	--	16	--	ns
t_r	Rise Time		--	37	--	
$t_{d(off)}$	Turn-Off Delay Time		--	251	--	
t_f	Fall Time		--	208	--	
E_{on}	Turn-On Switching Loss		--	2.74	--	mJ
E_{off}	Turn-Off Switching Loss		--	3.35	--	
E_{ts}	Total Switching Loss		--	6.09	--	
Qg	Total Gate Charge	V_{CE}=960V,I_C=40A, V_{GE}=15V,	--	139.5	--	nC
Qge	Gate to Emitter Charge		--	14.7	--	
Qgc	Gate to Collector Charge		--	89.5	--	
Electrical Characteristics of the DIODE						
V_F	Diode Forward Voltage	I_F=40A TC=25℃	--	1.9	3.2	V
		I_F=40A TC=175℃	--	1.7	--	V
t_{rr}	Reverse Recovery Time	I_F=40A di/dt=100A/μS	--	123	--	ns
I_{rrm}	Reverse Recovery Current		--	4.7	--	A
Q_{rr}	Reverse Recovery Charge		--	289	--	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

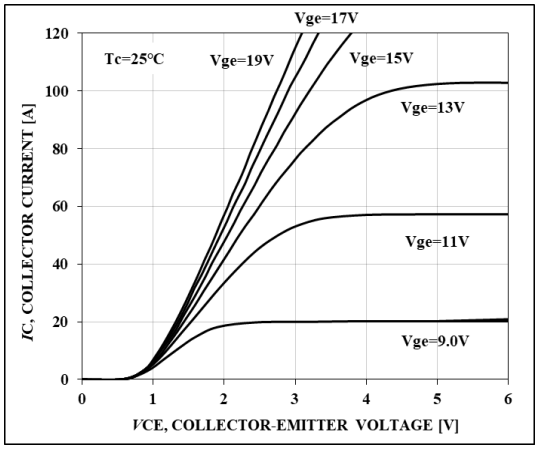


Figure 1. Output Characteristics

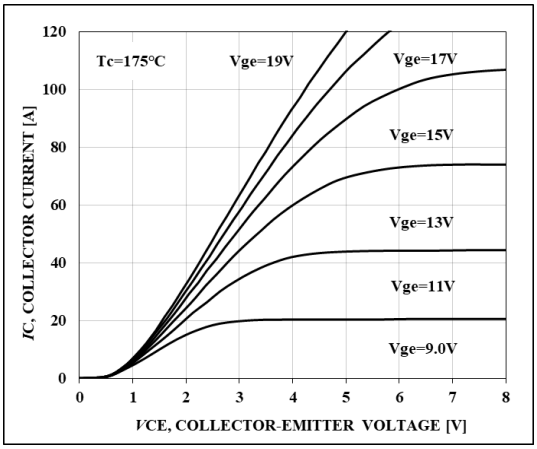


Figure 2. Output Characteristics

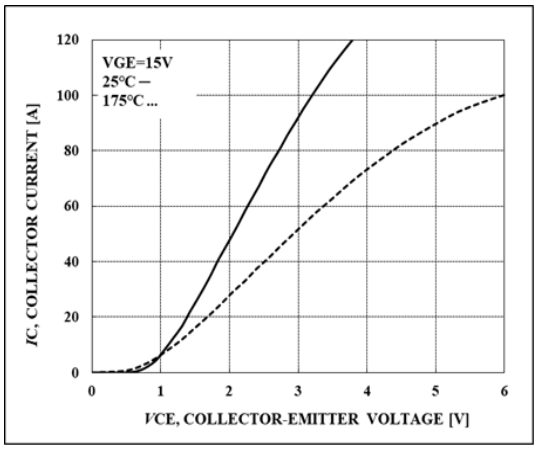


Figure 3. Saturation Voltage Characteristics

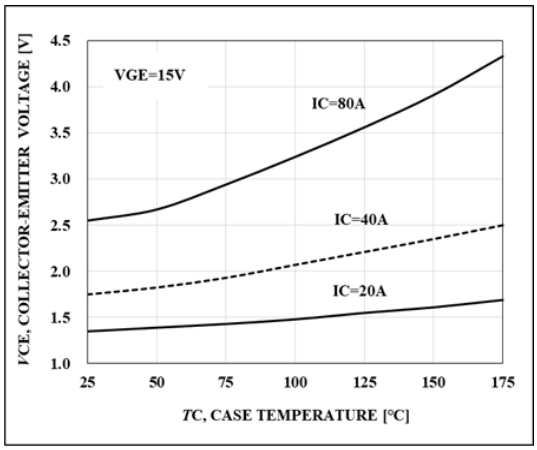


Figure 4. Saturation Voltage -T_C Characteristics

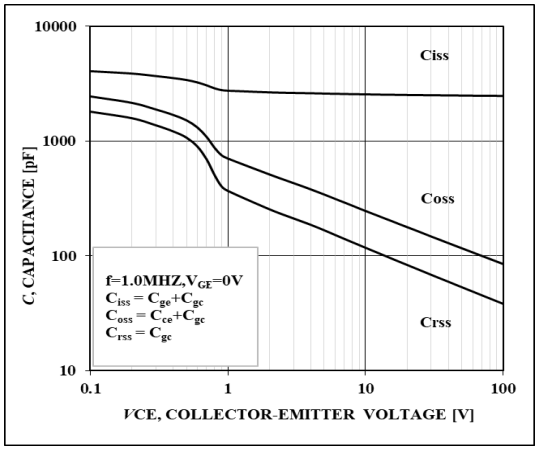


Figure 5. Capacitance Characteristics

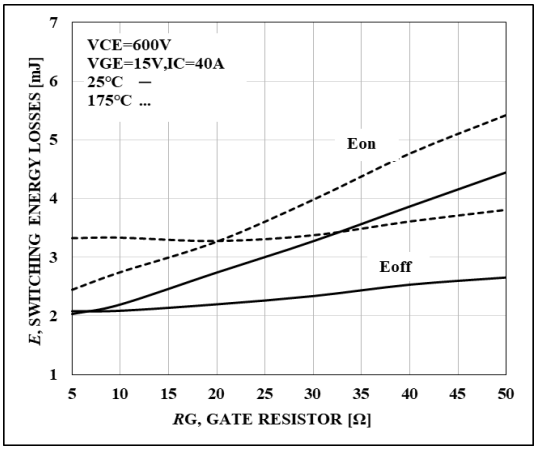


Figure 6. Switching Loss-R_G Characteristics

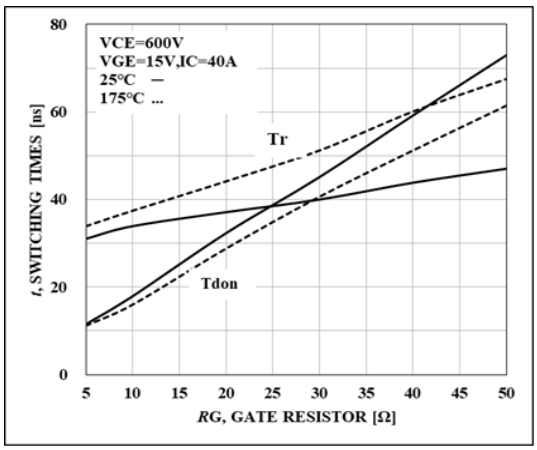


Figure 7. Switching Time-R_G Characteristics

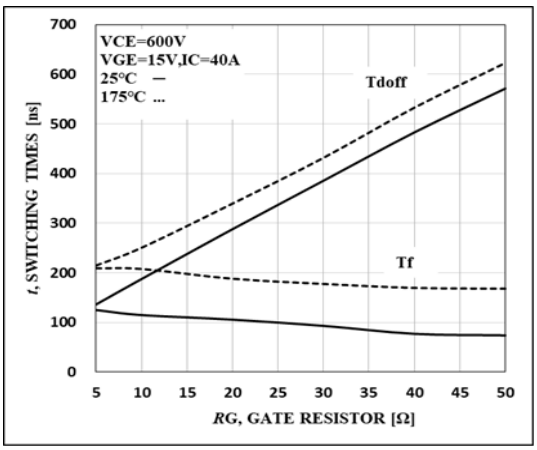


Figure 8. Switching Time-R_G Characteristics

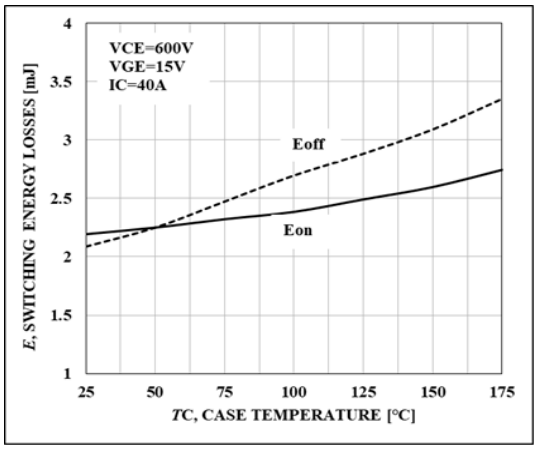


Figure 9. Switching Loss-Tc Characteristics

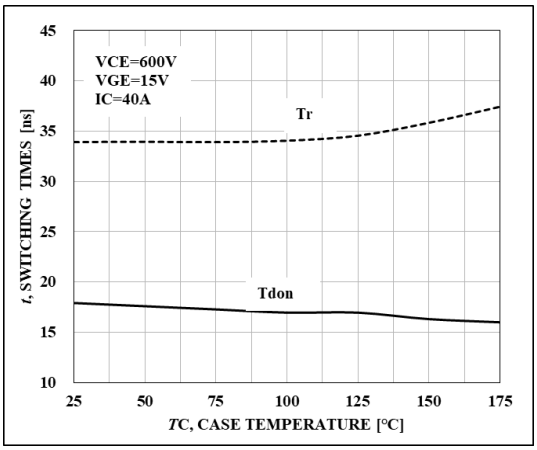


Figure 10. Switching Time-Tc Characteristics

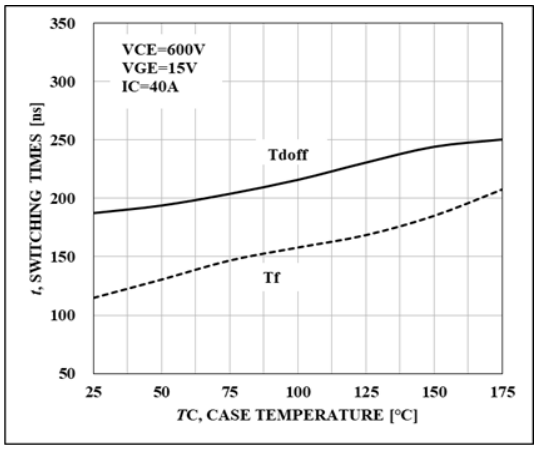


Figure 11. Switching Time-Tc Characteristics

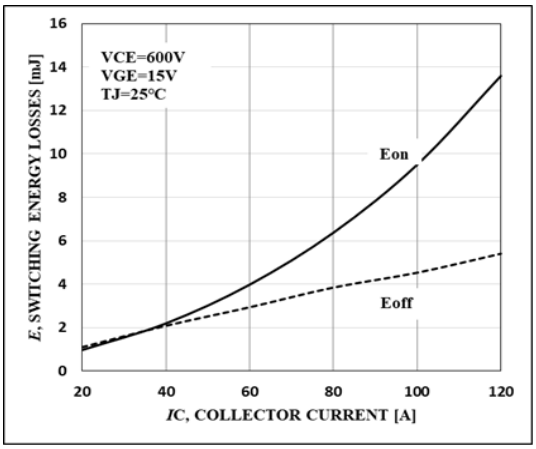


Figure 12. Switching Loss-I_C Characteristics

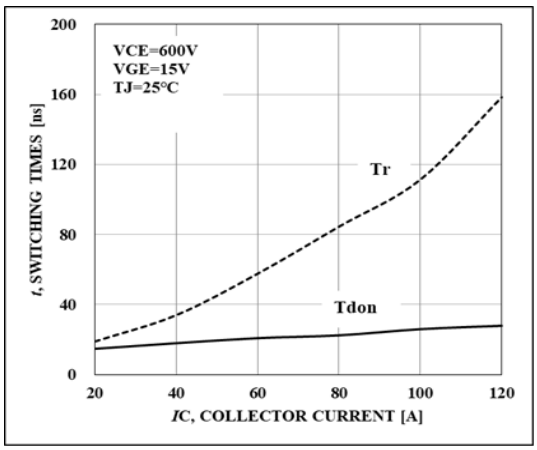


Figure 13. Switching Time-I_C Characteristics

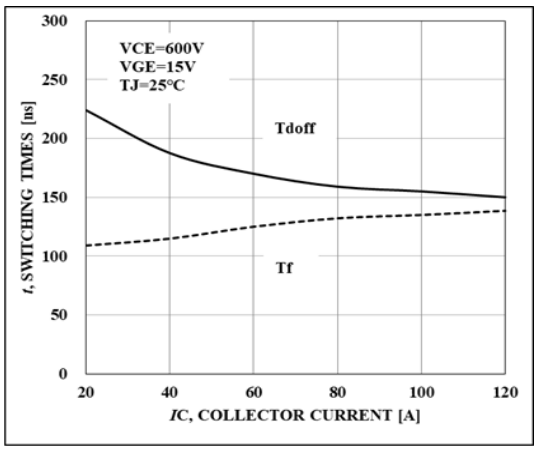


Figure 14. Switching Time-I_C Characteristics

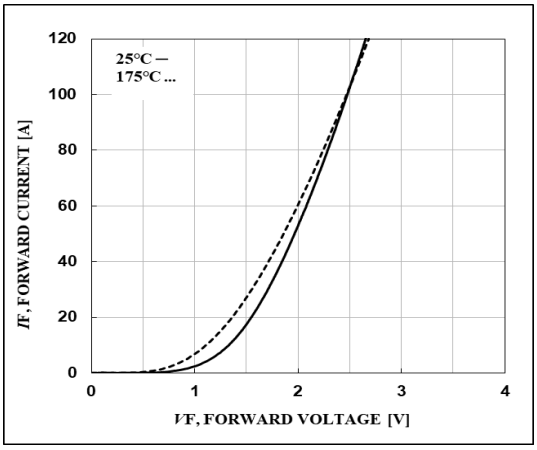


Figure 15. Diode Forward Characteristics

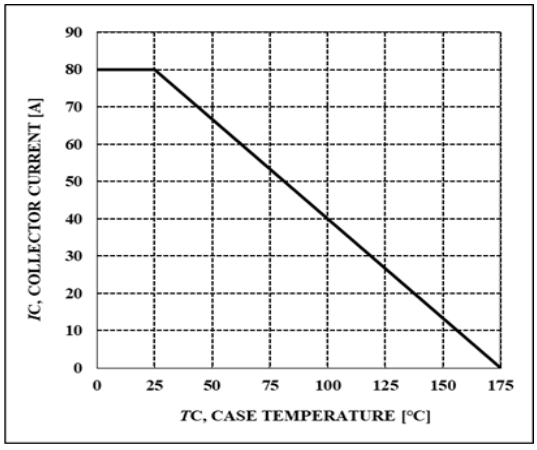


Figure 16. Collector Current-Tc Characteristics

(Tj ≤175℃)

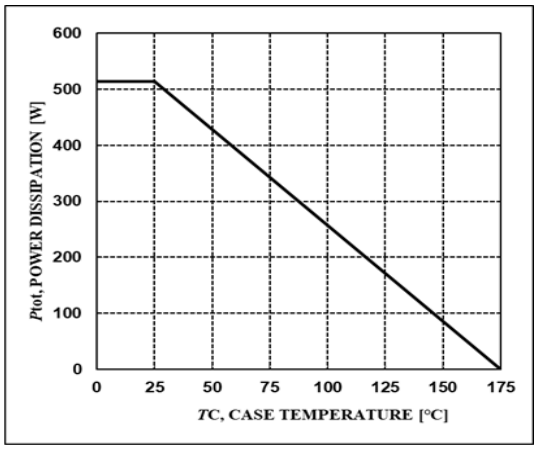


Figure 17. Power Dissipation-Tc Characteristics

(Tj ≤175℃)

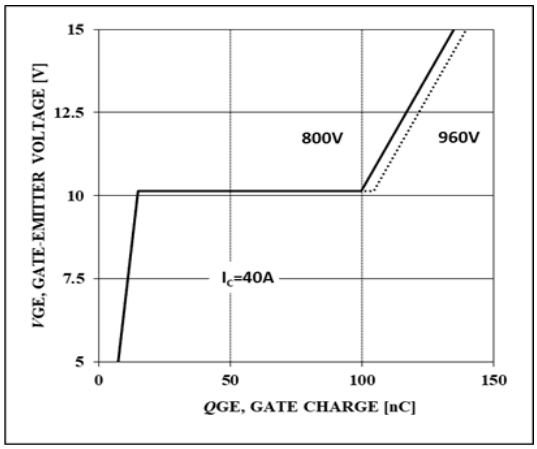


Figure 18. Gate Charge Characteristics

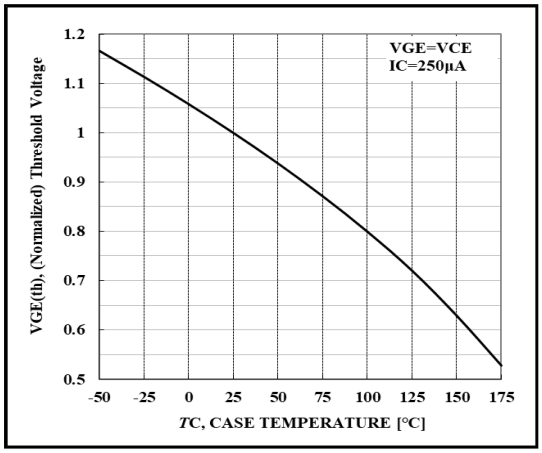


Figure 19. Threshold Voltage -Tc Characteristics

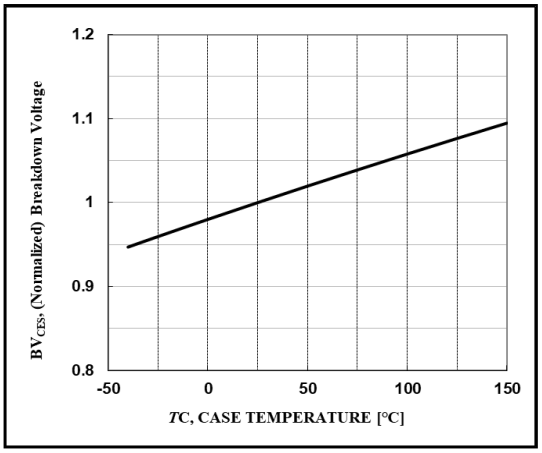


Figure 20. Breakdown Voltage-Tc Characteristics

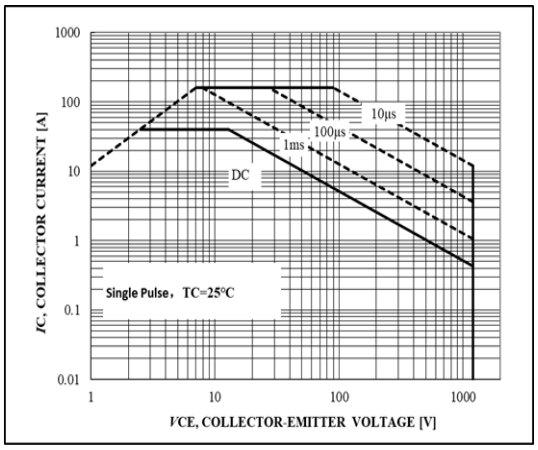


Figure 21. Forward Bias Safe Operating Area

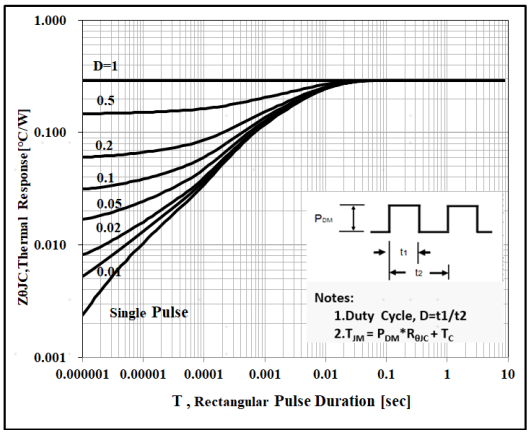
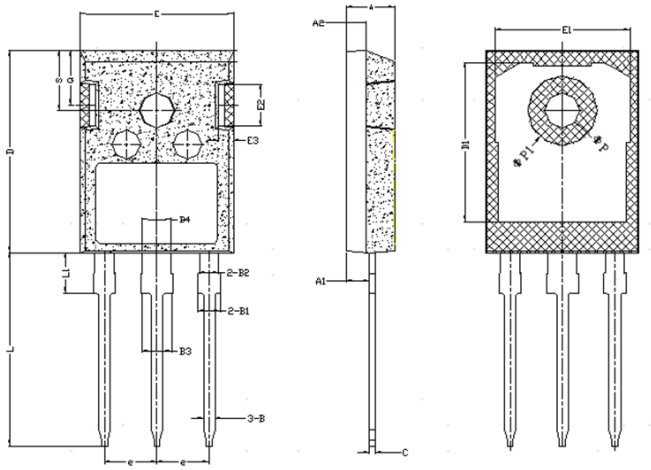


Figure 22. IGBT Transient Thermal Impedance

Package Information



项　目	规范(mm)	
	MIN	MAX
A	4.6	5.2
A1	2.2	2.6
A2	1.85	2.17
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
ΦP1	7.0	7.4
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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1. CRM reserves the right to change any product or information in this Specification at any time without prior notice.
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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.
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