

## 120A 650V Trenchstop Insulated Gate Bipolar Transistor

### 1 Description

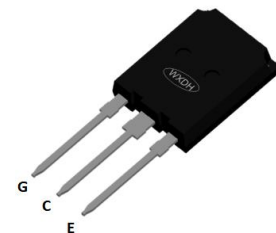
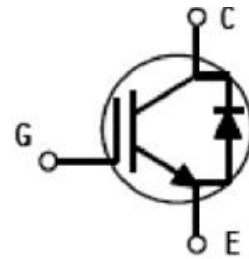
Using DongHai's proprietary Trench design and advance FS technology, the 650V FS IGBT offers superior and switching performances, high avalanche ruggedness easy parallel operation

### 2 Features

- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage:  $V_{CE(sat)}$ , typ = 1.6V @  $I_C = 120A$  and  $T_j = 25^\circ C$
- Extremely enhanced avalanche capability

### 3 Applications

- Welding
- UPS
- Three-level Inverter



Type	$V_{CE}$	$I_C$	$V_{cesat}, T_j=25^\circ C$	$T_{jmax}$	Package
DGCP120F65M2	650V	120A	1.6V	175 $^\circ C$	TO-247Plus-3L

### 4 Electrical Characteristics

#### 4.1 Absolute Maximum Ratings ( $T_j=25^\circ C$ , unless otherwise noted)

Parameter	Symbol	Value	Units
Collector-to-Emitter Voltage	$V_{CE}$	650	V
Gate-to-Emitter Voltage	$V_{GE}$	$\pm 30$	V
DC Collector current	$I_C$	$T_C=25^\circ C$	160
		$T_C=100^\circ C$	120
Pulsed Collector Current <sup>(1)</sup>	$I_{CM}$	360	A
Diode forward current	$I_F$	$T_C=25^\circ C$	160
		$T_C=100^\circ C$	120
Diode Pulsed Current	$I_{FM}$	360	A
Power Dissipation	$P_{tot}$	$T_C=25^\circ C$	500
		$T_C=100^\circ C$	250
Junction Temperature Range	$T_j$	-55 ~ 175	$^\circ C$
Storage Temperature Range	$T_{stg}$	-55 ~ 150	$^\circ C$
Soldering temperature	$T_L$	260	$^\circ C$

**4.2 Thermal Characteristics**

Parameter	Symbol	Rating	Units
IGBT Thermal Resistance,Junction to Case-sink	$R_{thJC}$	0.3	$^{\circ}C/W$
IGBT Thermal Resistance,Junction to Ambient	$R_{thJA}$	40	$^{\circ}C/W$
Diode Thermal Resistance,Junction to Case-sink	$R_{thJC}$	0.3	$^{\circ}C/W$

**4.3 Electrical Characteristics** ( $T_j=25^{\circ}C$ , unless otherwise noted)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
<b>Off Characteristics</b>						
Collector-to-Emitter Breakdown Voltage	$V_{CE}$	$I_C=1mA, V_{GE}=0V$	650	--	--	V
Collector-to-Emitter Leakage Current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V$	--	--	40	$\mu A$
Gate-to-Emitter Leakage Current	$I_{GES}$	$V_{GE}=\pm 30V, V_{CE}=0V$	--	--	$\pm 250$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=1mA$	4	5.3	6.5	V
Collector-emitter saturation voltage	$V_{CEsat}$	$V_{GE}=15V, I_C=120A, T_j=25^{\circ}C$	--	1.6	2.2	V
		$V_{GE}=15V, I_C=120A, T_j=175^{\circ}C$	--	2	--	V
Transconductance	$g_{fs}$	$V_{CE}=20V, I_C=120A$	--	171	--	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	--	10192	--	pF
Output Capacitance	$C_{oes}$		--	440	--	
Reverse Transfer Capacitance	$C_{res}$		--	114	--	
<b>Switching Characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{CE}=400V, I_C=120A,$ $R_g=5\Omega, V_{GE}=15V,$ 感性负载, $T_j=25^{\circ}C$	--	45	--	nS
Rise time	$t_r$		--	158	--	nS
Turn-off delay time	$t_{d(off)}$		--	166	--	nS
Fall time	$t_f$		--	139	--	nS
Turn-on energy	$E_{on}$		--	5.3	--	mJ
Turn-off energy	$E_{off}$		--	3.9	--	mJ
Total switching energy	$E_{ts}$		--	9.2	--	mJ
Turn-on delay time	$t_{d(on)}$	$V_{CE}=400V, I_C=120A,$ $R_g=5\Omega, V_{GE}=15V,$ 感性负载, $T_j=175^{\circ}C$	--	43	--	nS
Rise time	$t_r$		--	148	--	nS
Turn-off delay time	$t_{d(off)}$		--	187	--	nS
Fall time	$t_f$		--	162	--	nS
Turn-on energy	$E_{on}$		--	5.3	--	mJ
Turn-off energy	$E_{off}$		--	4.6	--	mJ
Total switching energy	$E_{ts}$		--	9.9	--	mJ
Gate charge	$Q_g$	$V_{CE}=400V, I_C=100A,$ $V_{GE}=15V$	--	300	--	nC

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
<b>Diode Characteristic</b>						
Diode forward voltage	$V_F$	$I_F=120A, T_j=25^\circ C$	--	1.8	2.4	V
		$I_F=120A, T_j=175^\circ C$	--	1.4	--	V
Diode reverse recovery time	$t_{rr}$	$I_F=120A, di/dt=100A/\mu S$	--	333	--	nS
Diode peak reverse recovery current	$I_{rrm}$		--	5.2	--	A
Diode reverse recovery charge	$Q_{rr}$		--	781	--	nC

Notes:

1. Pulse duration is limited by  $T_{j,max}$

### 5 Typical Characteristic Curves

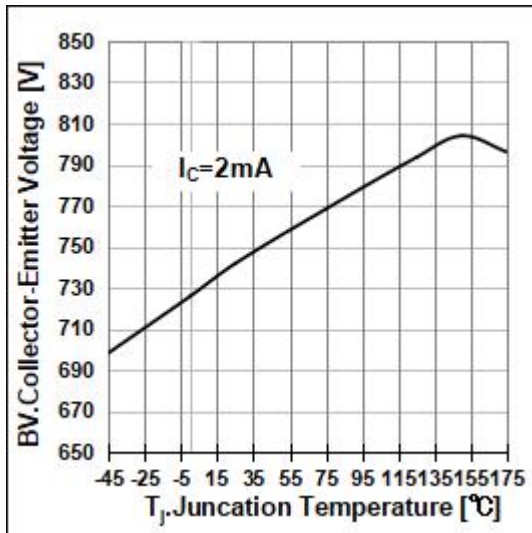


Fig1. Collector-Emitter Breakdown Voltage Temperature characteristic

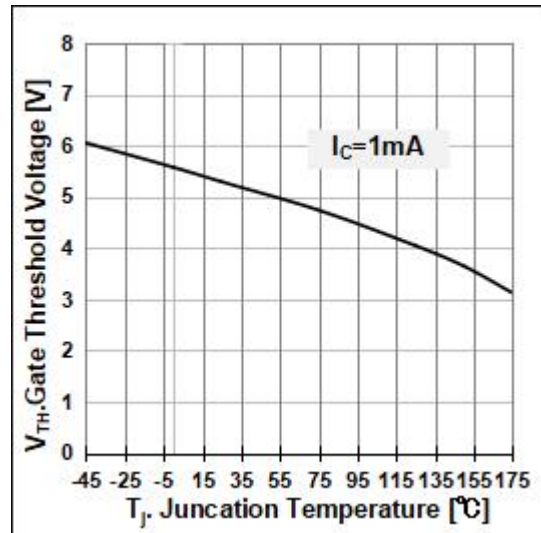


Fig2. Gate Threshold Voltage Temperature characteristic

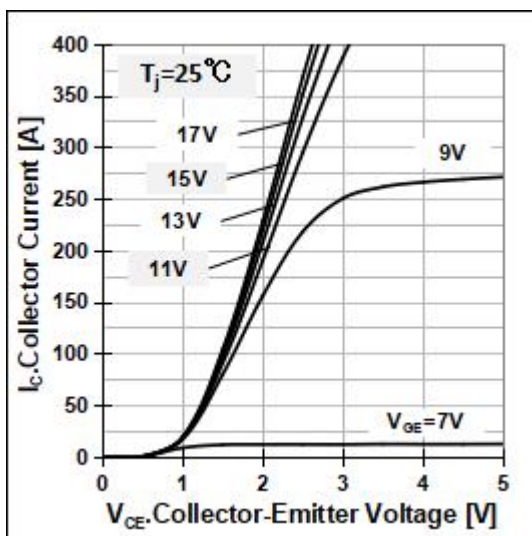


Fig3. Typical output characteristic

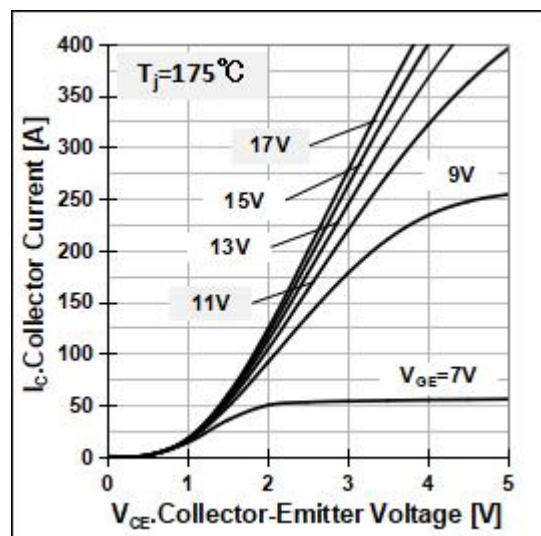


Fig4. Typical output characteristic

**5 Typical Characteristic Curves(Continue)**

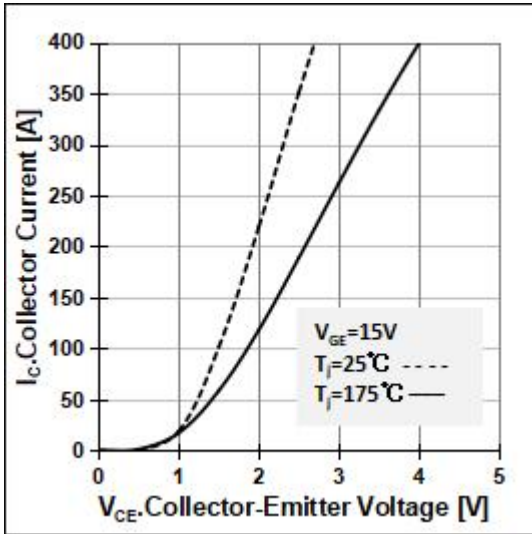


Fig5. Collector-Emitter saturation voltage Characteristic

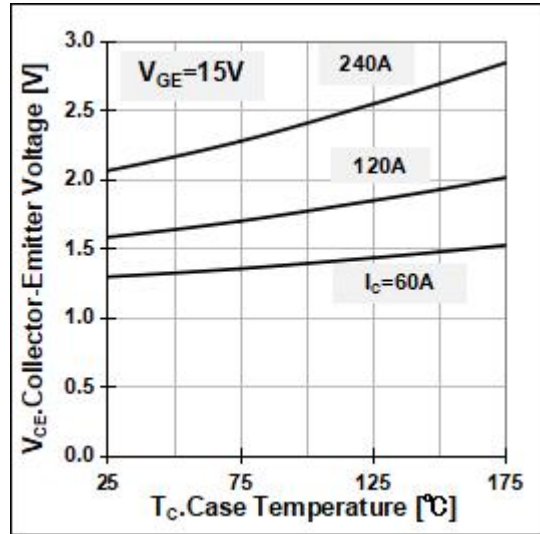


Fig6. Collector-Emitter saturation voltage Temperature Characteristic

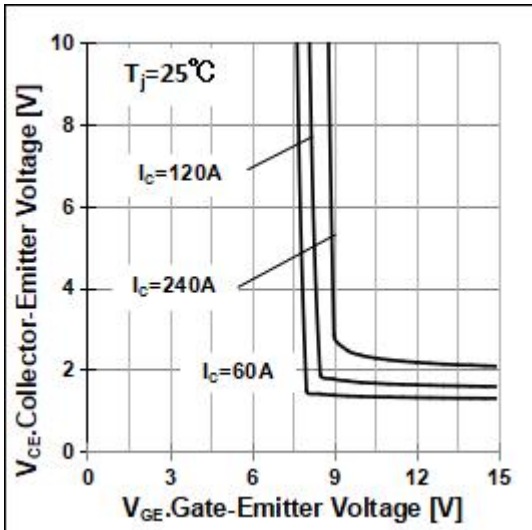


Fig7. Typical Transfer characteristic curve of Saturation Voltage vs Vge

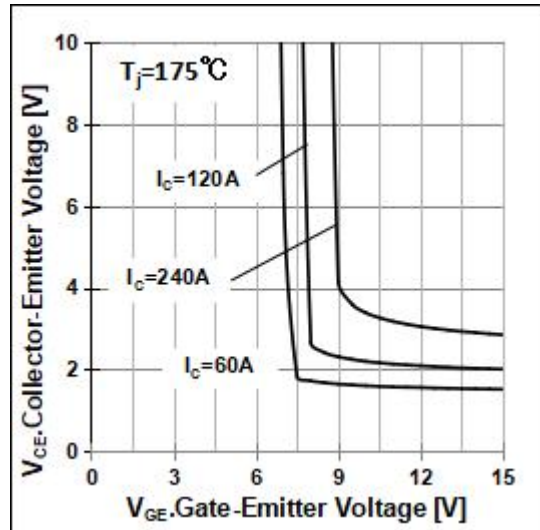


Fig8. Typical Transfer characteristic curve of Saturation Voltage vs Vge

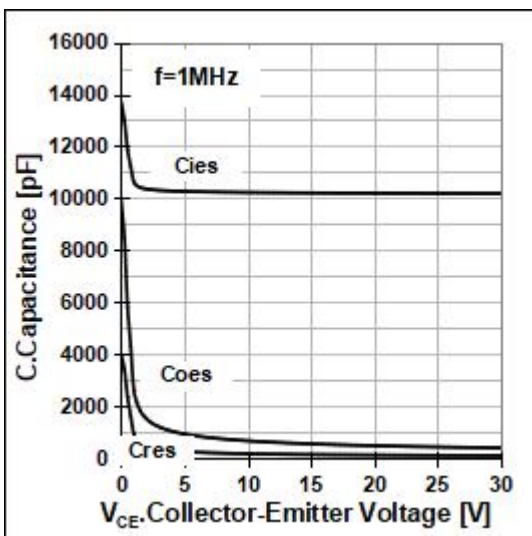


Fig9. Typical capacitance as a function of collector-emitter voltage

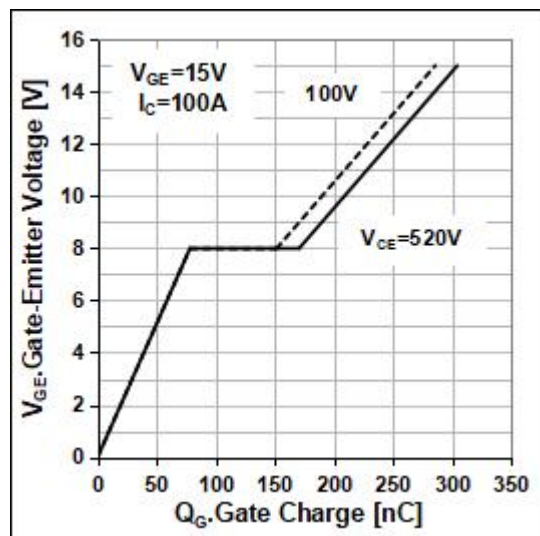


Fig10. Typical gate charge

5 Typical Characteristic Curves(Continue)

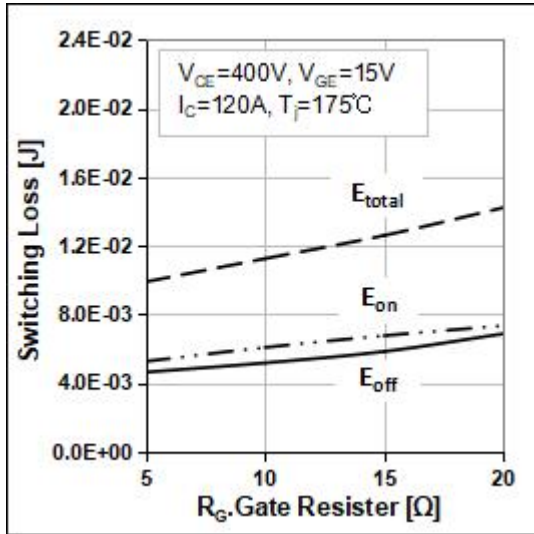


Fig11. Typical switching energy losses as a function of Gate resistor

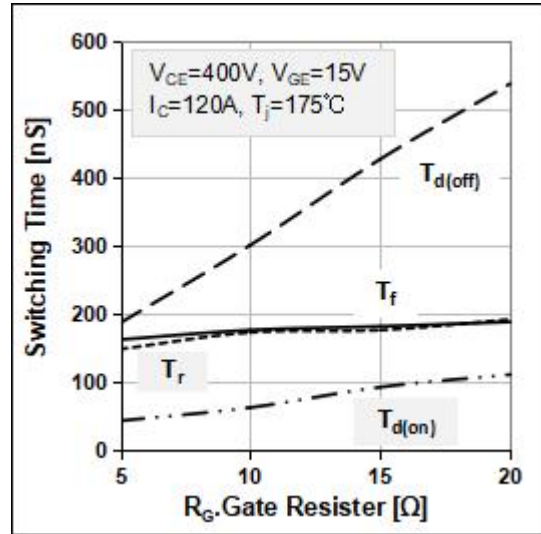


Fig12. Typical switching times as a function of Gate resistor

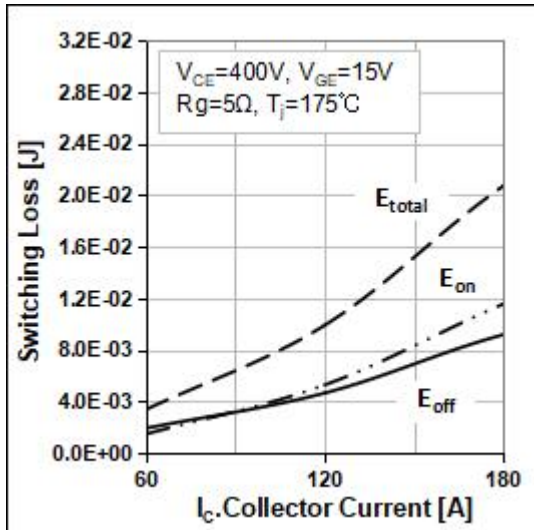


Fig13. Typical switching energy losses as a function of Collector Current

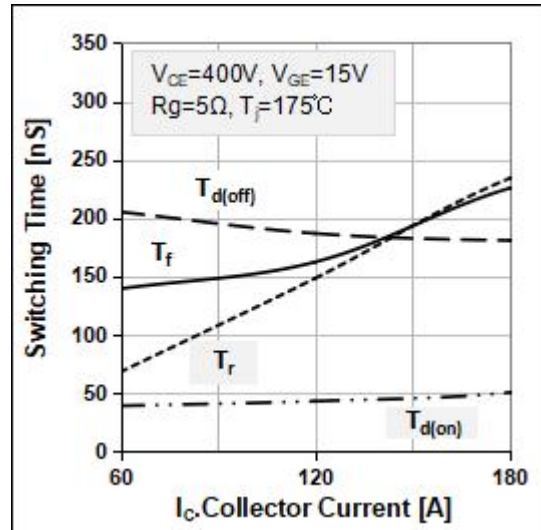


Fig14. Typical switching times as a function of Collector Current

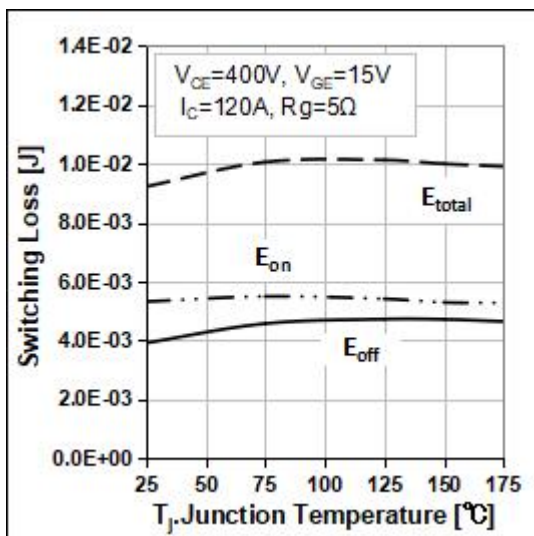


Fig15. Typical switching energy losses as a function of Junction temperature

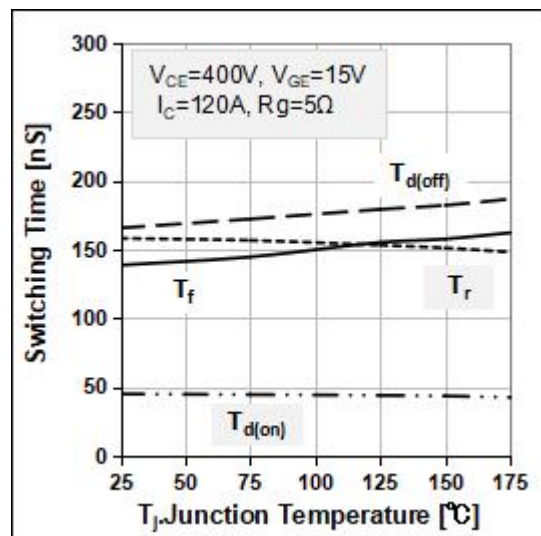


Fig16. Typical switching times as a function of Junction temperature



**5 Typical Characteristic Curves(Continue)**

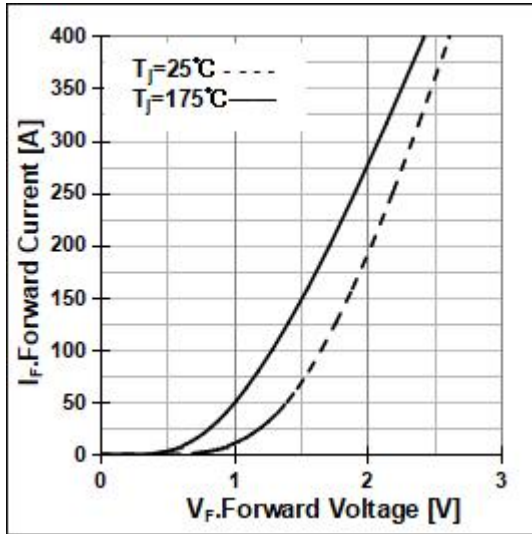


Fig17. Typical diode forward current as a function of forward voltage

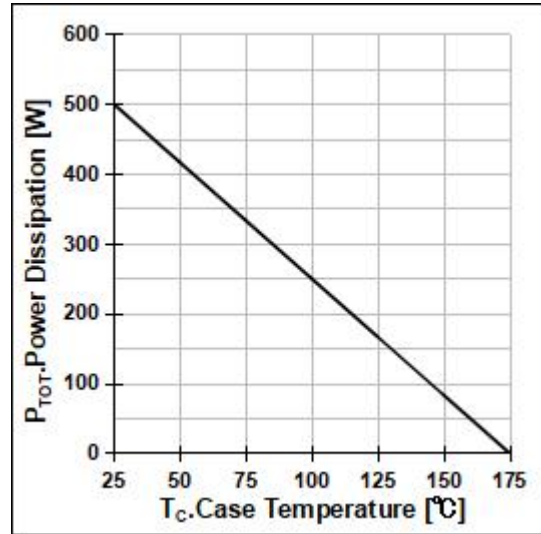


Fig18. Power dissipation temperature characteristic

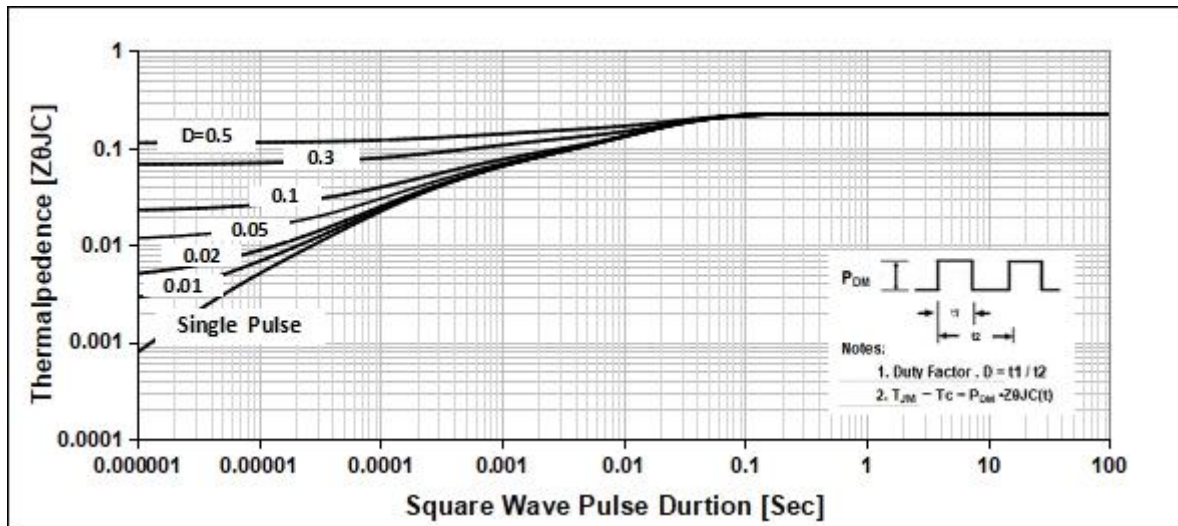
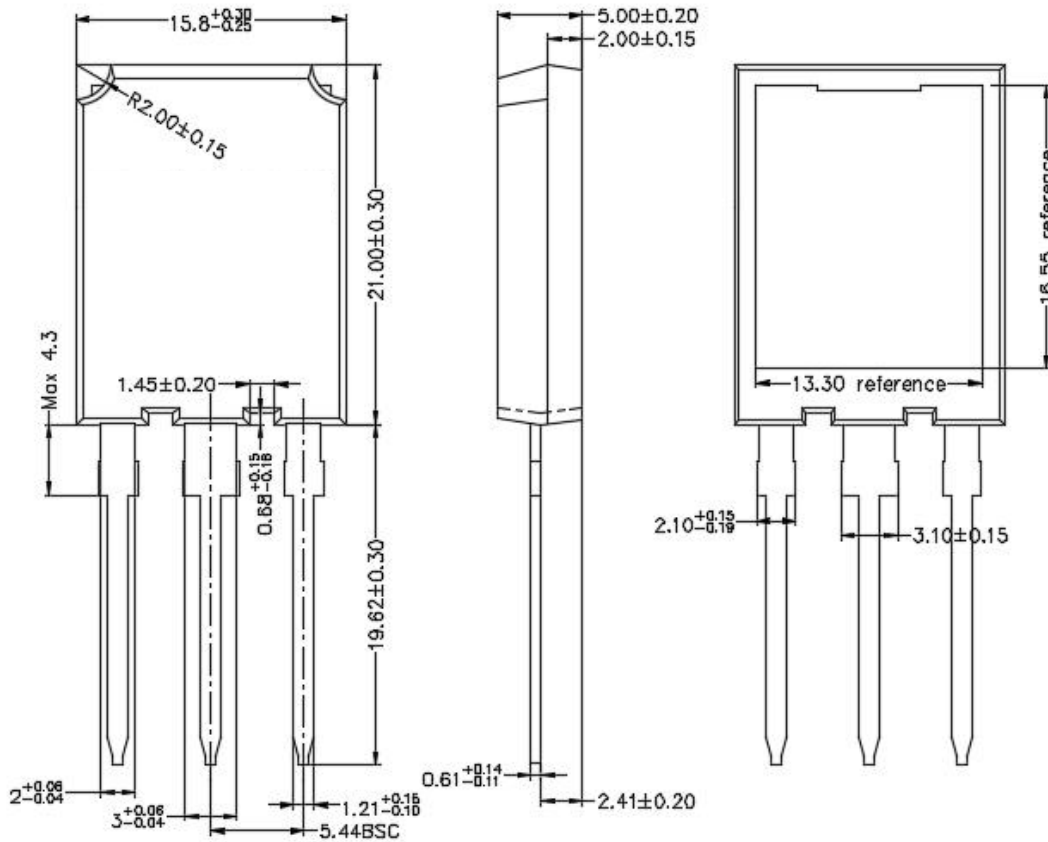


Fig19. IGBT transient thermal resistance

## 6 Dimensions (TO-247Plus-3L)

\*Dimensions in mm



## 7 Attentions

- Jiangsu Donghai Semiconductor CO.,LTD. reserves the right to change the specification without prior notice! The customer should obtain the latest version of the information before making the order and verify that the information is complete and up to date.
- It is the responsibility of the purchaser for any failure or failure of any semiconductor product under certain conditions. It is the responsibility of the purchaser to comply with safety standards and to take safety measures in the system design and machine manufacturing of Donghai products in order to avoid potential risk of failure. Injury or property damage.
- Product promotion is endless, our company will be dedicated to provide customers with better products.

## 8 Appendix

Revision history:

Date	REV.	Description	Page
2023.08.30	1.0	Original	