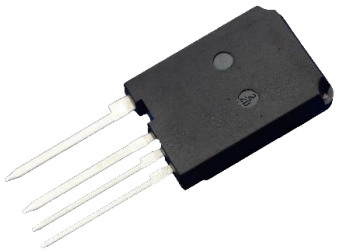
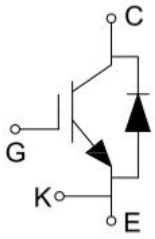
IGBT Discrete with Anti-Parallel Diode

V_{CES} =1200V， $I_{C\ nom}$ =120A / I_{CRM} =360A



TO-247PLUS-4L



Features：

- 1200V Trench /Field Stop type
- Low switching losses
- Vcesat has a positive temperature coefficient

Applications:

- Energy storage inverter
- Uninterruptible power supplies
- Solar inverters

IGBT

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	T_{vj}=25°C	V_{CES}	1200	V
Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	120	A
Repetitive peak collector current	t_P=1ms	I_{CRM}	360	A
Gate emitter voltage		V_{GE}	±20	V
Transient gate-emitter voltage	$t_p \leqslant 0.5\mu s$, D<0.001	V_{GE}	±25	V

Power dissipation	T_C=25℃ T_C=100℃	P_{tot}	1250 625	W
Temperature under switching conditions		$T_{vj\ op}$	-40…+175	℃
Storage temperature		T_{stg}	-40…+150	℃

Thermal Characteristics

Parameter	Conditions	Symbol	Value	Unit
IGBT thermal resistance, junction - case		$R_{th(j-C)}$	0.12	K/W
Diode thermal resistance, junction - case		$R_{th(j-C)}$	0.20	K/W

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Collector-Emitter saturation voltage	V_{GE}=15V, I_C=120A V_{GE}=15V, I_C=120A	T_{vj}=25°C T_{vj}=175°C	V_{CEsat}		1.70 2.30	2.10	V
Gate-Emitter threshold voltage	I_C=2.34mA, V_{GE}=V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.2	5.8	6.4	V
Transconductance	V_{CE}=20V， I_C=120A		G_{fs}		96		S
Input capacitance	f=100kHz, V_{CE}=25V, V_{GE}=0V	T_{vj}=25°C	C_{ies}		16.81		nF
Output capacitance			C_{oes}		0.41		nF
Reverse transfer capacitance			C_{res}		0.13		nF
Gate charge	I_C=120A, V_{GE}=15V, V_{CE}=960V	T_{vj}=25°C	Q_G		1.03		μC
Collector-emitter cut-off current	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25°C	I_{CES}			40	μA
Gate-emitter leakage current	V_{CE}=0V, V_{GE}=20V	T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(on)}$		235 175		ns
Rise time	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_r		137 139		ns

Turn-off delay time	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(off)}$		435 489		ns
Fall time	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_f		69 126		ns
Turn-on energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω di/dt=700A/us(T_{vj}=175°C) (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{on}		14.60 19.74		mJ
Turn-off energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15V, R_G=20Ω dv/dt=7500V/us(T_{vj}=175°C) (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{off}		4.41 6.74		mJ

Diode

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°C	V_{RRM}	1200	V
Continuous DC forward current	T_C=100°C, $T_{vj\ max}$=175°C	I_F	120	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	360	A

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F=120A, V_{GE}=0V I_F=120A, V_{GE}=0V	T_{vj}=25°C T_{vj}=175°C	V_F		1.75 1.96	2.2	V
Peak reverse recovery current	I_F=120A, -di$_F$/dt=700A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	I_{RM}		42 66		A
Reverse Recovered charge	I_F=120A, -di$_F$/dt=700A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	Q_{rr}		8.19 20.97		μC
Reverse Recovery Time	I_F=120A, -di$_F$/dt=700A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	t_{rr}		428 668		ns
Reverse recovered energy	I_F=120A, -di$_F$/dt=700A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	E_{rec}		2.84 8.11		mJ

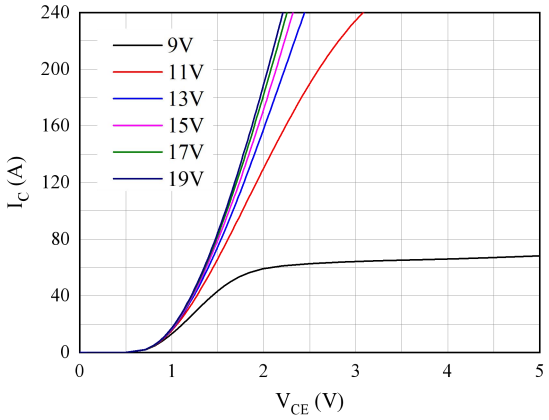


Fig 1. Typical output characteristics (T_{vj}=25℃)

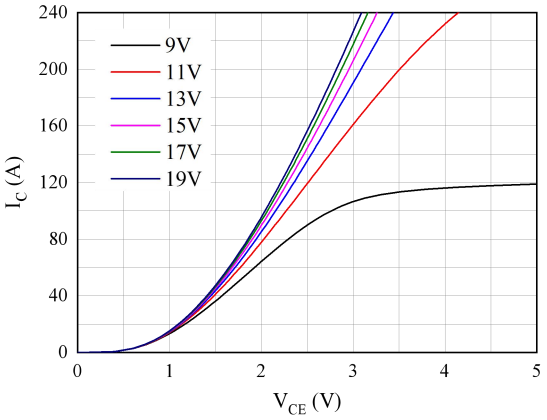


Fig 2. Typical output characteristics (T_{vj}=175℃)

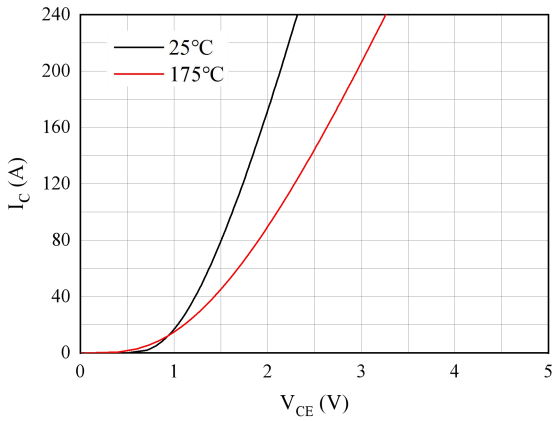


Fig 3. Typical output characteristics (V_{GE}=15V)

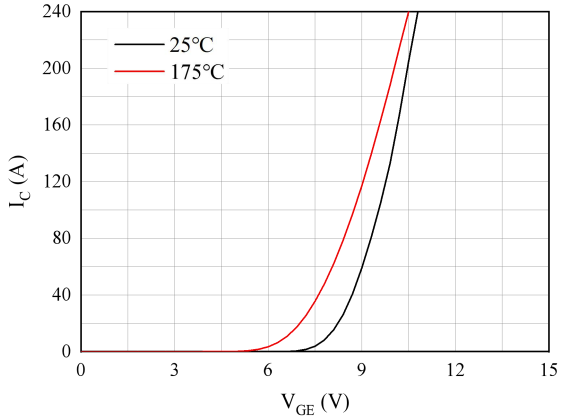


Fig 4. Typical transfer characteristic(V_{CE}=20V)

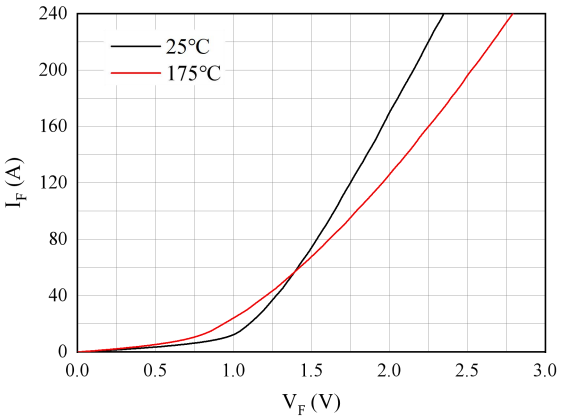


Fig 5. Forward characteristic of Diode

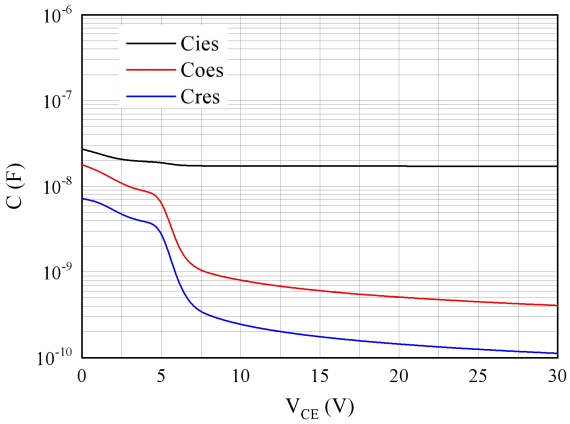


Fig 6. Capacitance characteristic

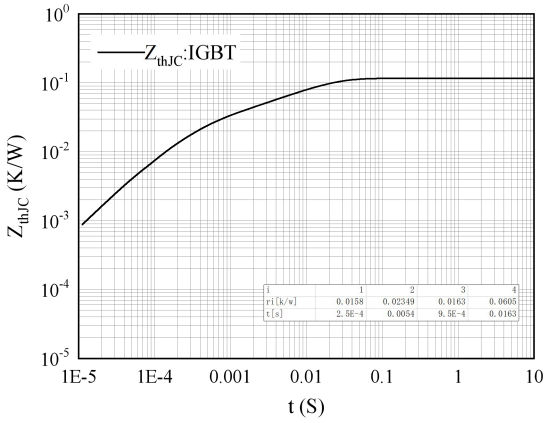


Fig 7. Transient thermal impedance IGBT, $Z_{thJC}=f(t)$

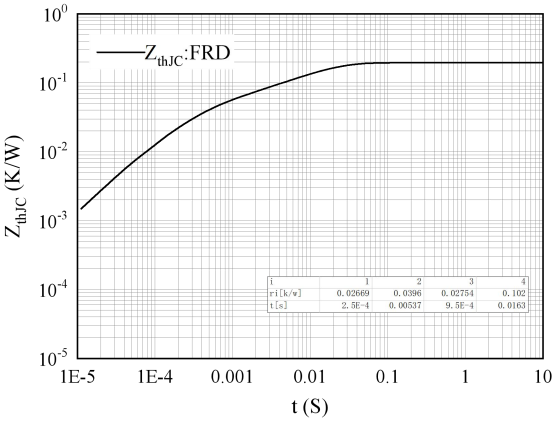


Fig 8. Transient thermal impedance FRD, $Z_{thJC}=f(t)$

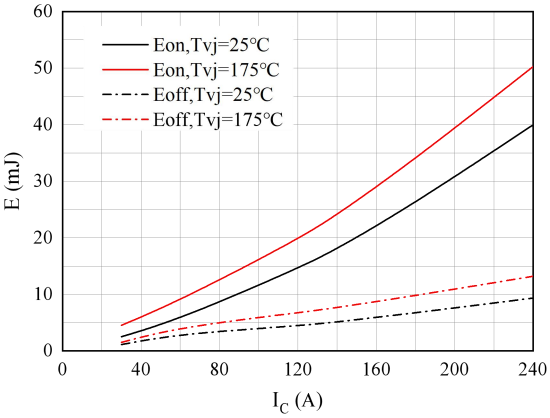


Fig 9. Switching losses of IGBT

$V_{GE}=\pm15V$, Rgon=20Ω, Rgoff=20Ω, $V_{CE}=600V$

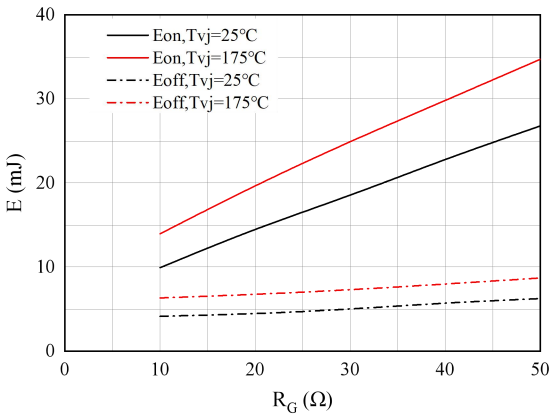


Fig 10. Switching losses of IGBT

$V_{GE}=\pm15V$, $I_C=120A$, $V_{CE}=600V$

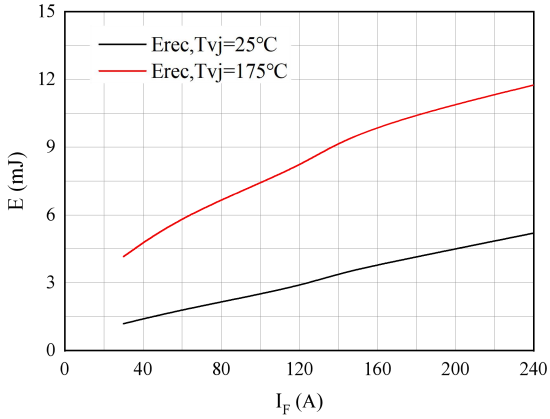


Fig 11. Switching losses of Diode

Rgon=20Ω, $V_{CE}=600V$

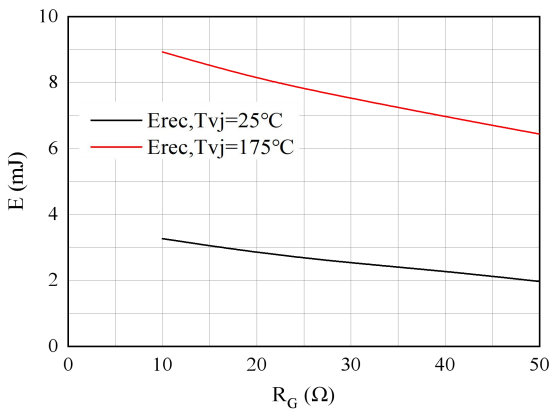
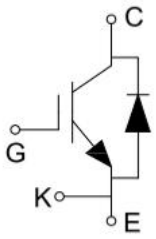


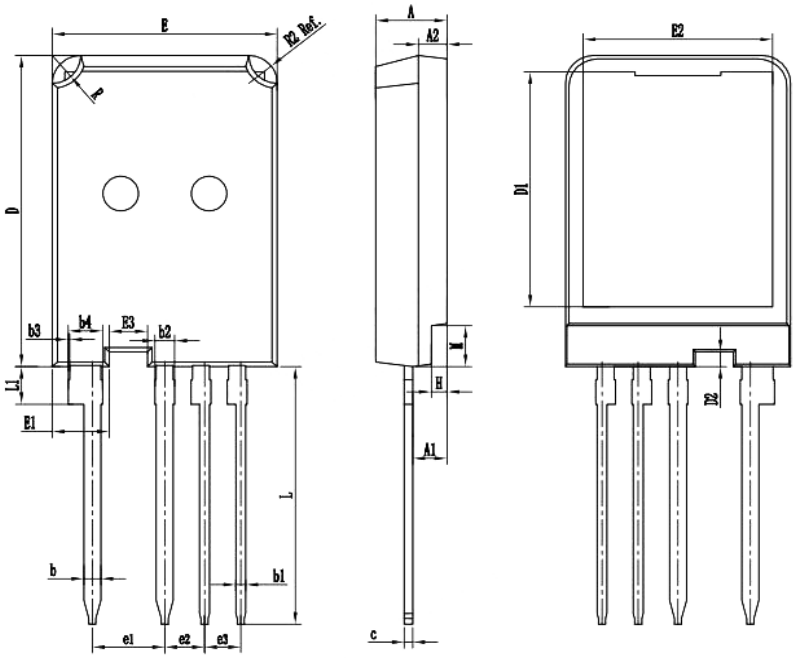
Fig 12. Switching losses of Diode

$I_F=120A$, $V_{CE}=600V$

Circuit diagram



Package outlines



Symbol	Dimensions In Millimeters	
	Min	Max
A	4.900	5.100
A1	2.310	2.510
A2	1.900	2.100
b	1.160	1.290
b1	0.650	0.790
b2	1.360	1.490
b3	0.000	0.200
b4	2.160	2.290
c	0.590	0.660
D	22.300	22.500
D1	16.650	17.250
D2	1.000	1.100
E	15.700	15.900
E1	3.900	4.100
E2	13.100	13.500
E3	2.580	2.780
e1	5.080 BSC	
e2	2.790 BSC	
e3	2.540 BSC	
H	1.000	1.200
L	18.460	18.660
L1	2.620	2.820
M	2.850	3.050
R	1.900	2.100