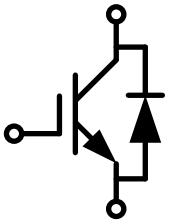
IGBT Discrete with Anti-Parallel Diode

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

TO-247 PLUS



Features：

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

Applications:

- Uninterruptible power supplies
- Solar inverter

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=1 ms	I_{CRM}	360	A
Gate emitter voltage	t_p ≤0.5μs, D<0.001	V_{GE}	±20 ±25	V
Power dissipation	T_C=25℃ T_C=100℃	P_{tot}	1010 505	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		$R_{th(j-C)}$	0.22	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 V_{GE}=15V, I_C=120A	T_{vj}=25°C T_{vj}=150°C T_{vj}=175°C	V_{CEsat}		1.83 2.42 2.53	2.2	V
Gate-Emitter threshold voltage	I_C=2.34mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.0	5.6	6.2	V
Transconductance	V_{CE}=20V， I_C=120A		G_{fs}		95		S
Input capacitance	f=100kHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		17.07		nF
Output capacitance			C_{oes}		0.40		nF
Reverse transfer capacitance			C_{res}		0.13		nF
Gate charge	I_C = 120 A, V_{GE} = 15 V, V_{CE} =960 V	T_{vj}=25°C	Q_G		1.06		μC
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			40	μA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(on)}$		29 30		ns
Rise time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_r		197 164		ns
Turn-off delay time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(off)}$		152 185		ns
Fall time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_f		70 136		ns

Turn-on energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω di/dt=600A/us(T_{vj}=175°C) (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{on}		17.49 26.06		mJ
Turn-off energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω dv/dt=8400V/us(T_{vj}=175°C) (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{off}		4.11 6.55		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	60	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	180	A

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Forward voltage	I_F=60A, V_{GE}=0V I_F=60A, V_{GE}=0V I_F=60A, V_{GE}=0V	T_{vj}=25°C T_{vj}=150°C T_{vj}=175°C	V_F		1.74 1.65 1.42	2.20	V
Peak reverse recovery current	I_F=60A, -di$_F$/dt=650A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	I_{RM}		46 70		A
Reverse Recovered charge	I_F=60A, -di$_F$/dt=650A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	Q_{rr}		5.75 20.35		μC
Reverse Recovery Time	I_F=60A, -di$_F$/dt=650A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	t_{rr}		253 654		ns
Reverse recovered energy	I_F=60A, -di$_F$/dt=650A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	E_{rec}		2.13 7.55		mJ

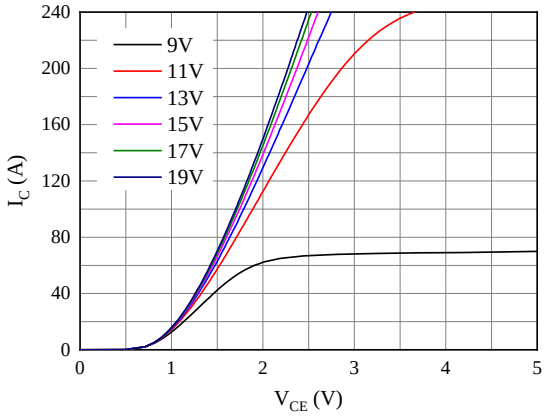


Fig 1. Typical output characteristics (T_{vj}=25℃)

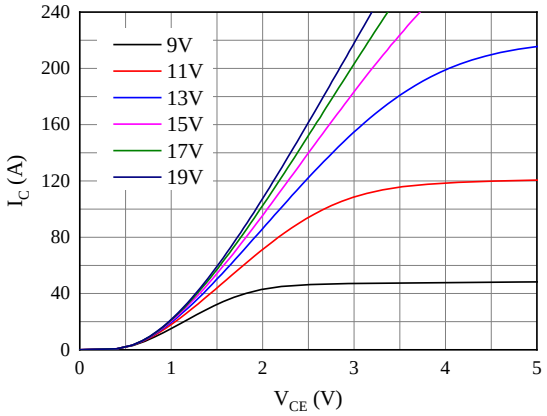


Fig 2. Typical output characteristics (T_{vj}=175℃)

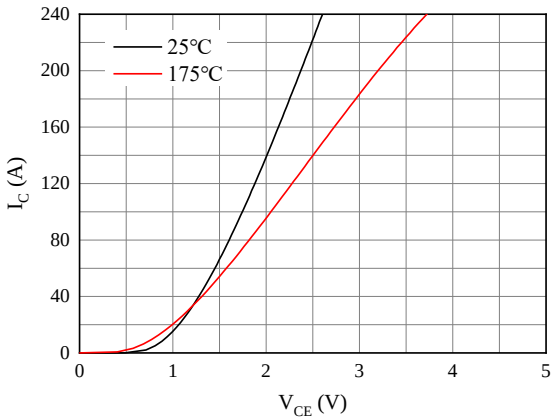


Fig 3. Typical output characteristics (V_{GE}=15V)

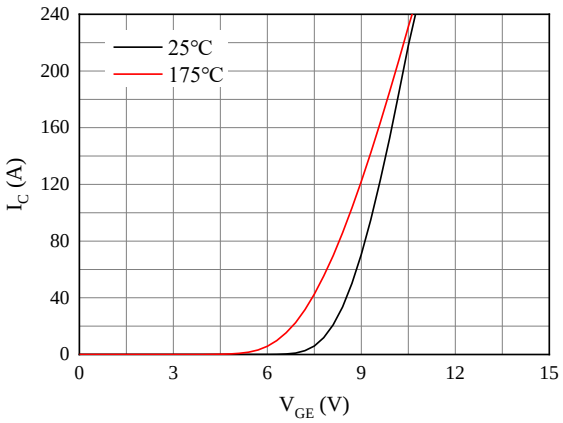


Fig 4. Typical transfer characteristic(V_{CE}=20V)

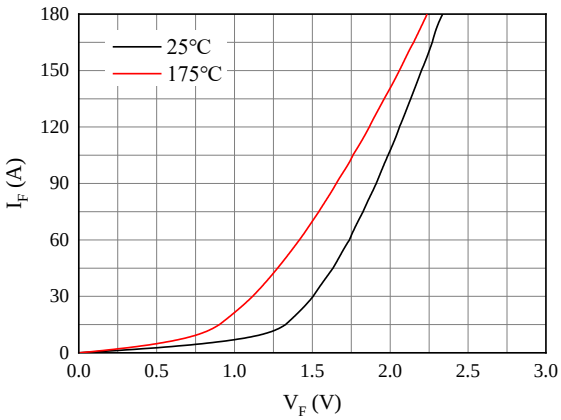


Fig 5. Forward characteristic of Diode

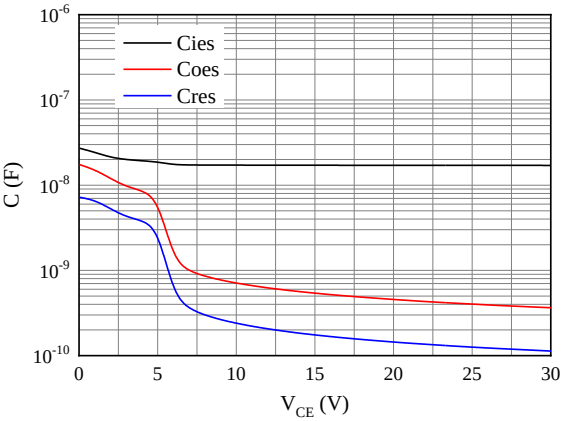


Fig 6. Capacitance characteristic

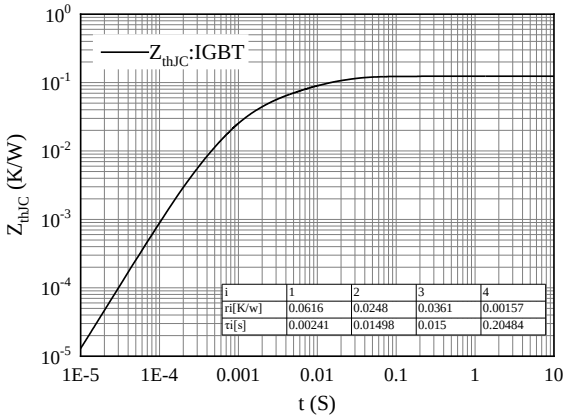


Fig 7. Transient thermal impedance IGBT, $Z_{thJC}=f(t)$

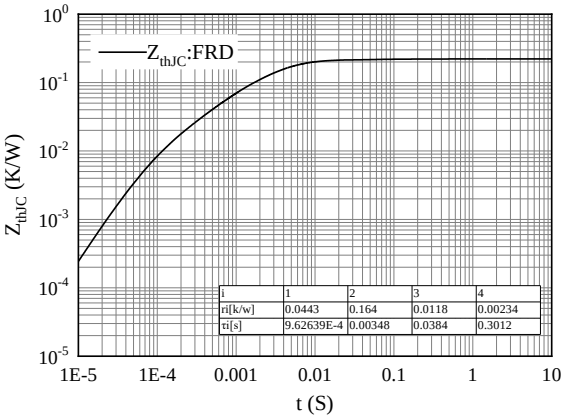


Fig 8. Transient thermal impedance FRD, $Z_{thJC}=f(t)$

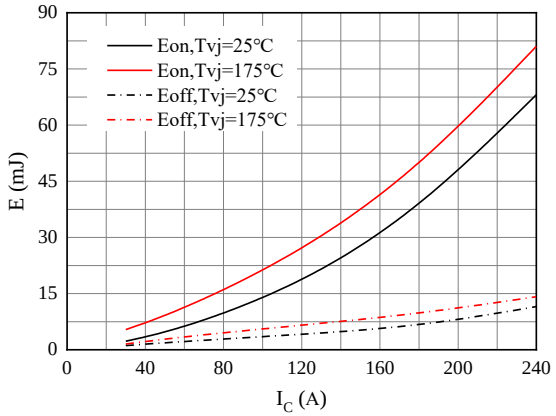


Fig 9. Switching losses of IGBT

$V_{GE}=\pm 15V$, Rgon=3.3Ω, Rgoff=3.3Ω, $V_{CE}=600V$

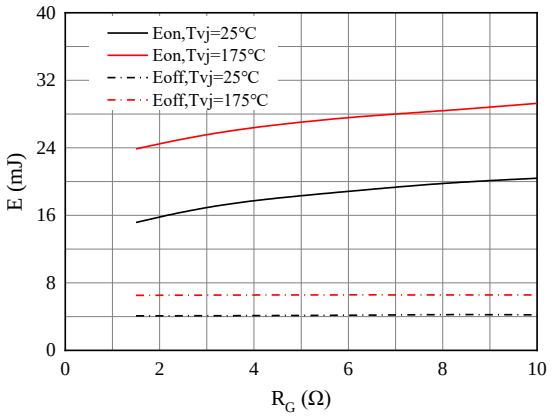


Fig 10. Switching losses of IGBT

$V_{GE}=\pm 15V$, $I_C=120A$, $V_{CE}=600V$

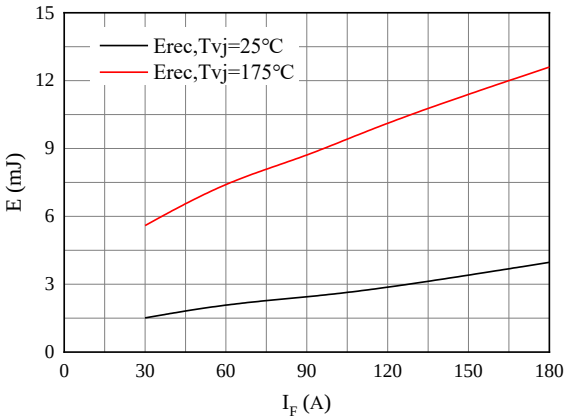


Fig 11. Switching losses of Diode

Rgon=3.3Ω, $V_{CE}=600V$

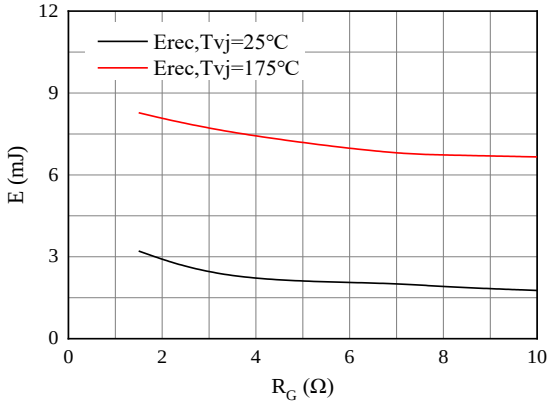
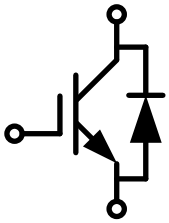


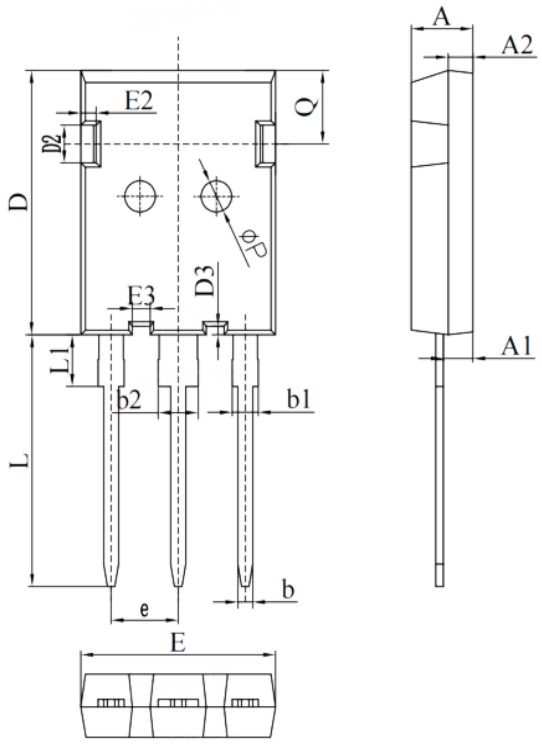
Fig 12. Switching losses of Diode

$I_F=60A$, $V_{CE}=600V$

Circuit diagram



Package outlines



symbol	Unit:mm		
	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
D	20.9	20.0	21.1
D1	16.25	16.55	16.85
D2	2.90	3.00	3.10
D3	0.58	0.68	0.78
E	15.7	15.8	15.9
E1	13.1	13.3	13.5
E2	1.14	1.24	1.34
E3	1.35	1.45	1.55
e	5.45BSC		
L	19.80	20.00	20.20
L1	3.90	4.10	4.30
Q	5.70	5.85	6.00
b	1.10	1.20	1.30
b1	1.95	2.10	2.25
b2	2.95	3.10	3.25
c	0.50	0.60	0.70