

IGBT Discrete with Anti-Parallel Diode

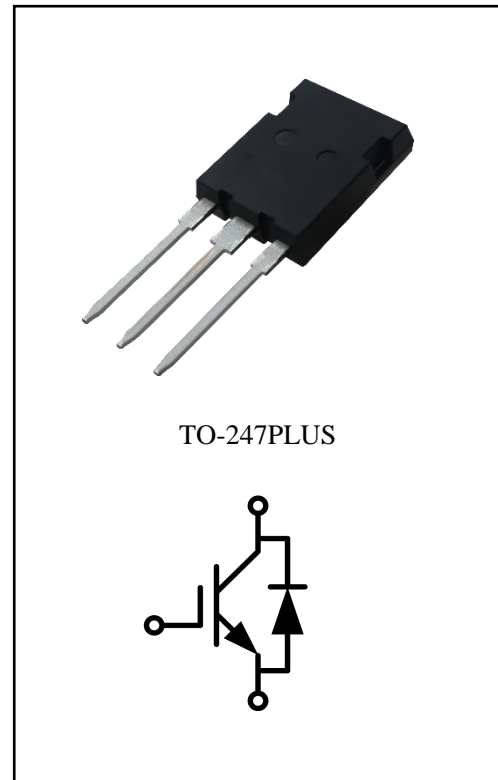
$V_{CES} = 1200V$, $I_{C\ nom} = 120A$ / $I_{CRM} = 360A$

Features :

- 1200V Trench /Field Stop type
- Low switching losses
- V_{cesat} has a positive temperature coefficient

Applications:

- frequency converter
- Servo motor
- Inverter



IGBT

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj} = 25^{\circ}C$	V_{CES}	1200	V
Continuous DC collector current	$T_C = 100^{\circ}C$, $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	120	A
Repetitive peak collector current	$t_p = 1\ ms$	I_{CRM}	360	A
Gate emitter voltage	$t_p \leq 0.5\ \mu s$, $D < 0.001$	V_{GE}	± 20 ± 25	V
Short-circuit withstand time	$V_{CC} = 800V$, $V_{GE} = 15\ V$, Allowed number of short circuits $< 1000\ A$, Time between short circuits $\geq 1.0\ s$, $T_{vj} = 150\ ^{\circ}C$	t_{SC}	8	μs

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

Thermal Characteristics

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

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
Collector-Emitter saturation voltage	$V_{\text{GE}}=15\text{V}$, $I_{\text{C}}=120\text{A}$ $V_{\text{GE}}=15\text{V}$, $I_{\text{C}}=120\text{A}$ $V_{\text{GE}}=15\text{V}$, $I_{\text{C}}=120\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=150^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	V_{CEsat}	1.68 2.21 2.30	2.08	V	
Gate-Emitter threshold voltage	$I_{\text{C}}=2.34\text{mA}$, $V_{\text{GE}}=V_{\text{CE}}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$V_{\text{GE(th)}}$	5.4	6.0	6.6	V
Transconductance	$V_{\text{CE}}=20\text{V}$, $I_{\text{C}}=120\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	G_{fs}		74		S
Input capacitance			C_{ies}		18.1		nF
Output capacitance	$f=100\text{kHz}$, $V_{\text{CE}}=25\text{V}$, $V_{\text{GE}}=0\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	C_{oes}		0.44		nF
Reverse transfer capacitance			C_{res}		0.12		nF
Gate charge	$I_{\text{C}}=120\text{A}$, $V_{\text{GE}}=15\text{V}$, $V_{\text{CE}}=960\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	Q_{G}		1.08		μC
Collector-emitter cut-off current	$V_{\text{CE}}=1200\text{V}$, $V_{\text{GE}}=0\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	I_{CES}			40	μA
Gate-emitter leakage current	$V_{\text{CE}}=0\text{V}$, $V_{\text{GE}}=20\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	I_{GES}			100	nA
Turn-on delay time	$I_{\text{C}}=120\text{A}$, $V_{\text{CE}}=600\text{V}$ $V_{\text{GE}}=\pm 15\text{V}$, $R_{\text{G}}=10\Omega$ (inductive load)	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	$t_{\text{d(on)}}$		130 108		ns
Rise time	$I_{\text{C}}=120\text{A}$, $V_{\text{CE}}=600\text{V}$ $V_{\text{GE}}=\pm 15\text{V}$, $R_{\text{G}}=10\Omega$ (inductive load)	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	t_{r}		270 260		ns

Turn-off delay time	$I_C=120A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_{d(off)}$		254 287		ns
Fall time	$I_C=120A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_f		105 182		ns
Turn-on energy loss per pulse	$I_C=120A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ $di/dt=370A/\mu s(T_{vj}=175^\circ C)$ / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{on}		22.40 29.16		mJ
Turn-off energy loss per pulse	$I_C=120A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ $dv/dt=8000V/\mu s(T_{vj}=175^\circ C)$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{off}		5.88 8.57		mJ

Diode

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^\circ C$	V_{RRM}	1200	V
Continuous DC forward current	$T_C=100^\circ C, T_{vj\ max}=175^\circ C$	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	$I_F=120A, V_{GE}=0V$ $I_F=120A, V_{GE}=0V$ $I_F=120A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	V_F		1.77 2.00 1.97	2.30 V
Peak reverse recovery current	$I_F=120A,$ $-di_F/dt=300A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	I_{RM}		24 42	A
Reverse Recovered charge	$I_F=120A,$ $-di_F/dt=300A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	Q_{rr}		6.62 18.00	μC
Reverse Recovery Time	$I_F=120A,$ $-di_F/dt=300A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_{rr}		482 790	ns
Reverse recovered energy	$I_F=120A,$ $-di_F/dt=300A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{rec}		2.04 6.48	mJ

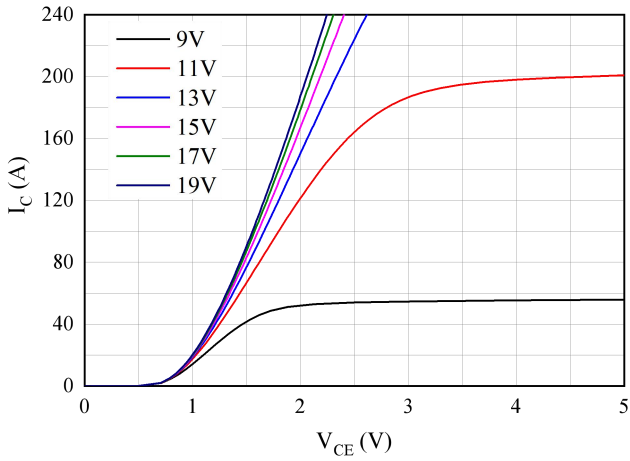


Fig 1. Typical output characteristics ($T_{vj}=25^{\circ}\text{C}$)

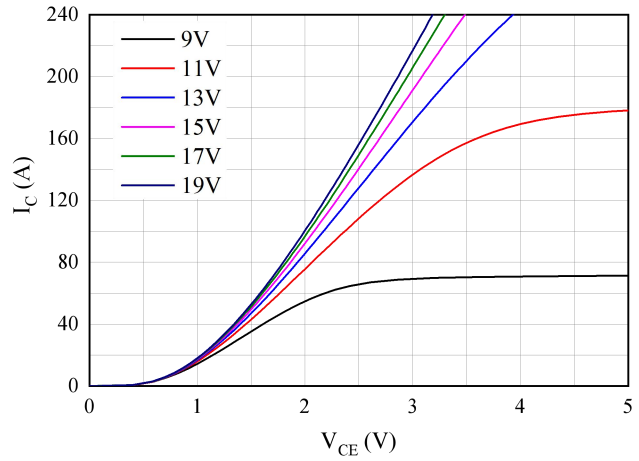


Fig 2. Typical output characteristics ($T_{vj}=175^{\circ}\text{C}$)

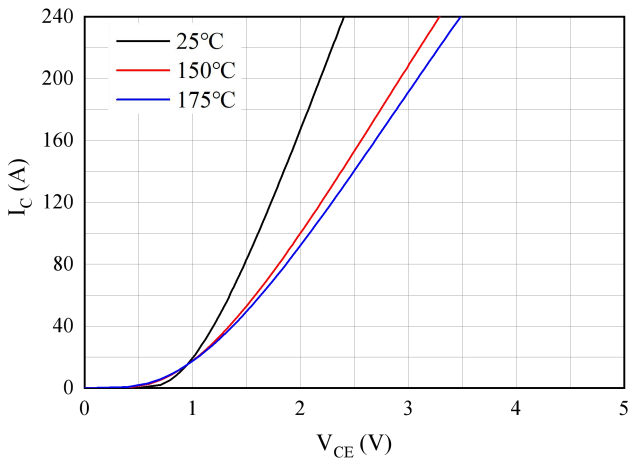


Fig 3. Typical output characteristics ($V_{GE}=15\text{V}$)

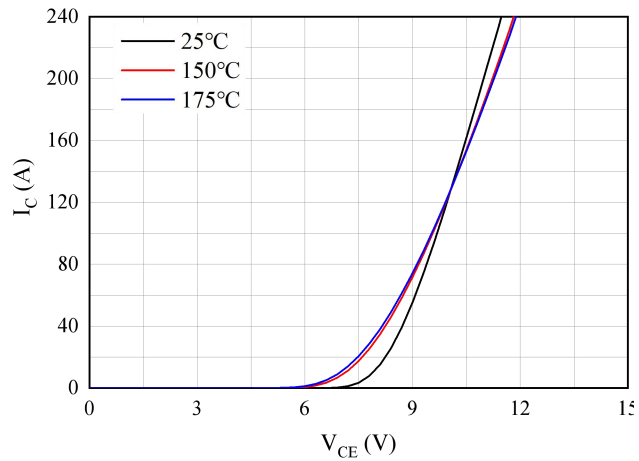


Fig 4. Typical transfer characteristics ($V_{CE}=20\text{V}$)

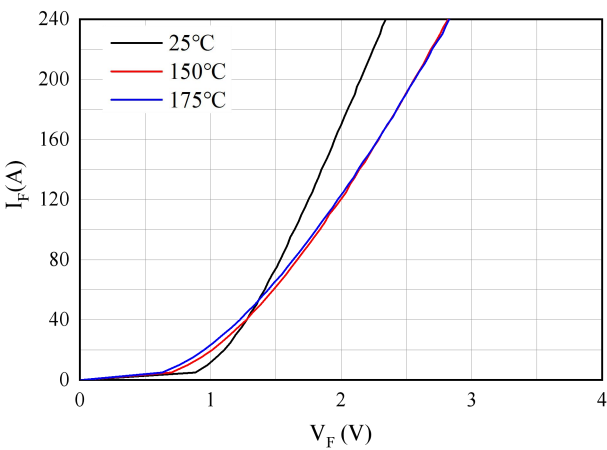


Fig 5. Forward characteristic of Diode

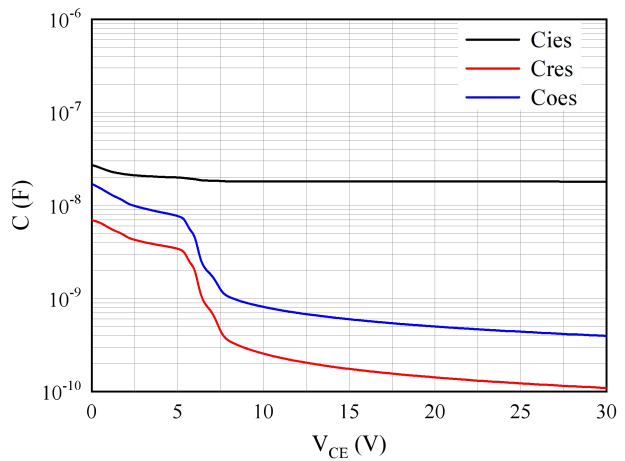


Fig 6. Capacitance characteristic

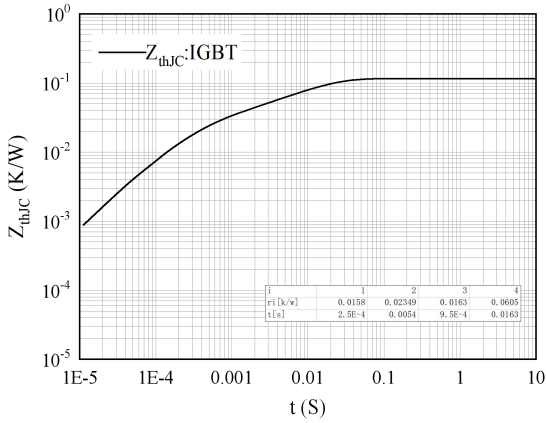


Fig 7. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

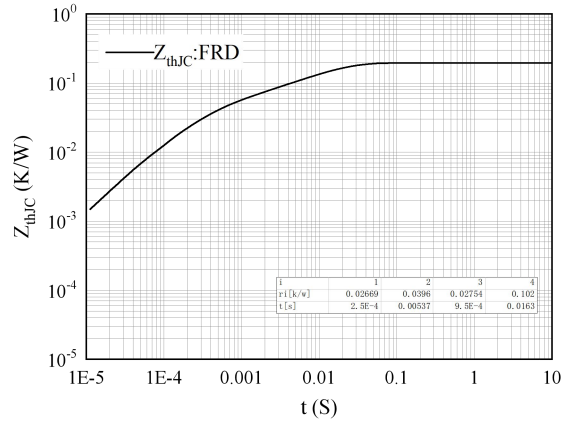


Fig 8. Transient thermal impedance FRD,
 $Z_{thJC}=f(t)$

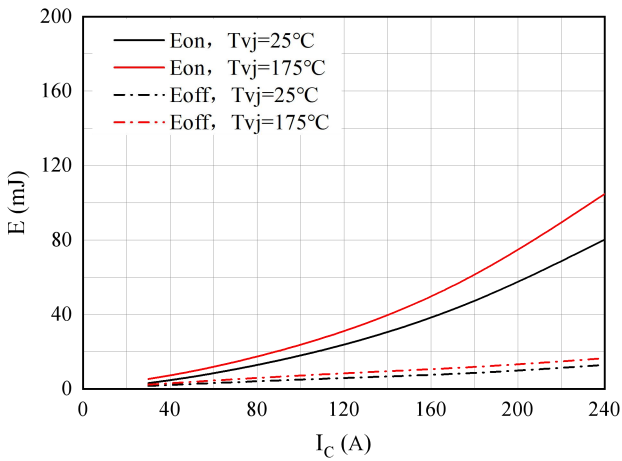


Fig 9. Switching losses of IGBT
 $V_{GE}=\pm 15V, R_{gon}=10\Omega, R_{goff}=10\Omega, V_{CE}=600V$

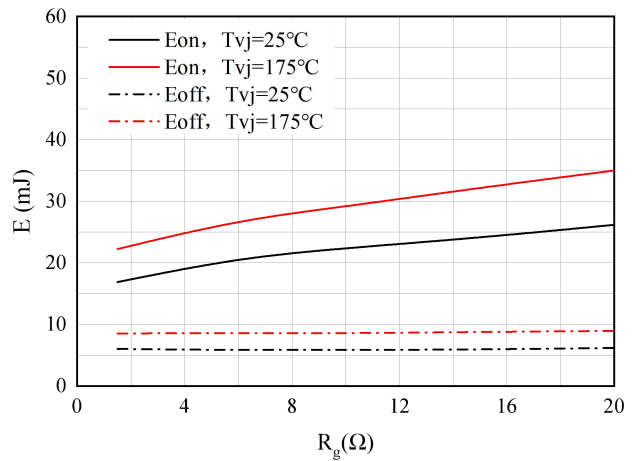


Fig 10. Switching losses of IGBT
 $V_{GE}=\pm 15V, I_C=120A, V_{CE}=600V$

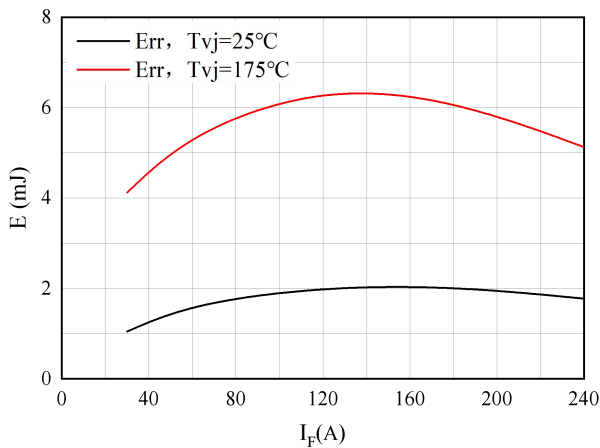


Fig 11. Switching losses of Diode
 $R_{gon}=10\Omega, V_{CE}=600V$

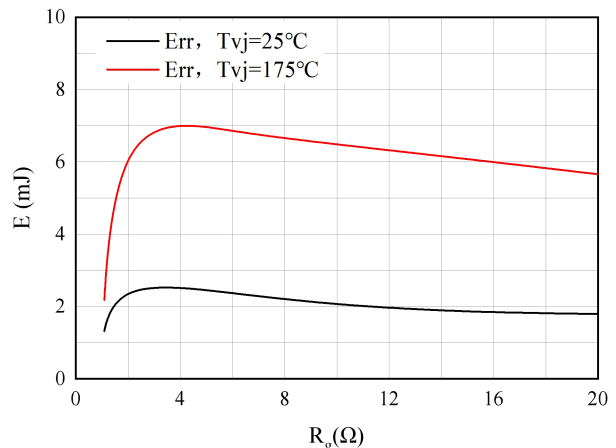
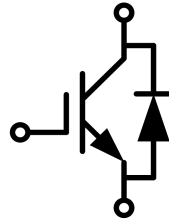
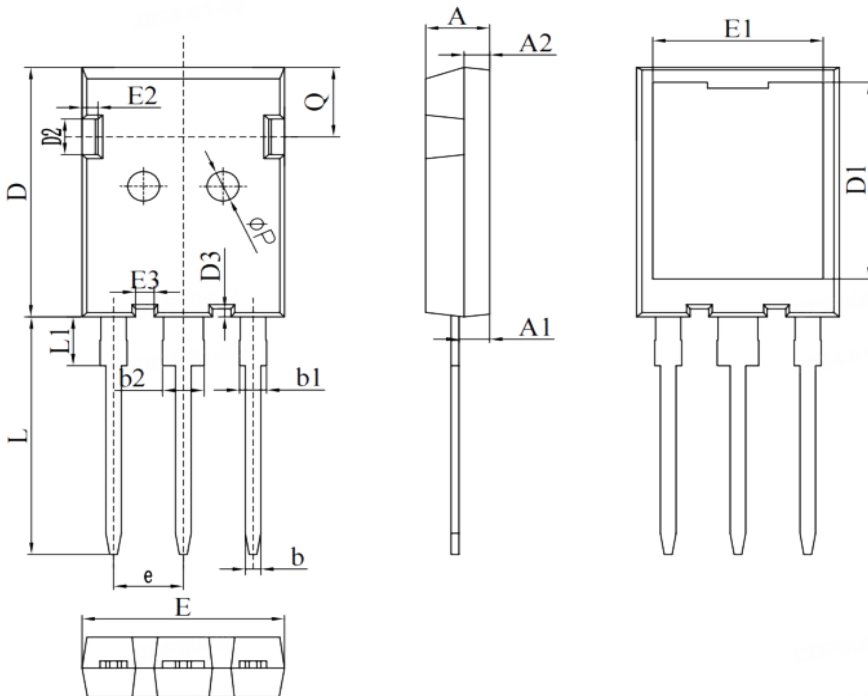


Fig 12. Switching losses of Diode
 $I_F=120A, V_{CE}=600V$

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