IGBT Discrete with Anti-Parallel Diode
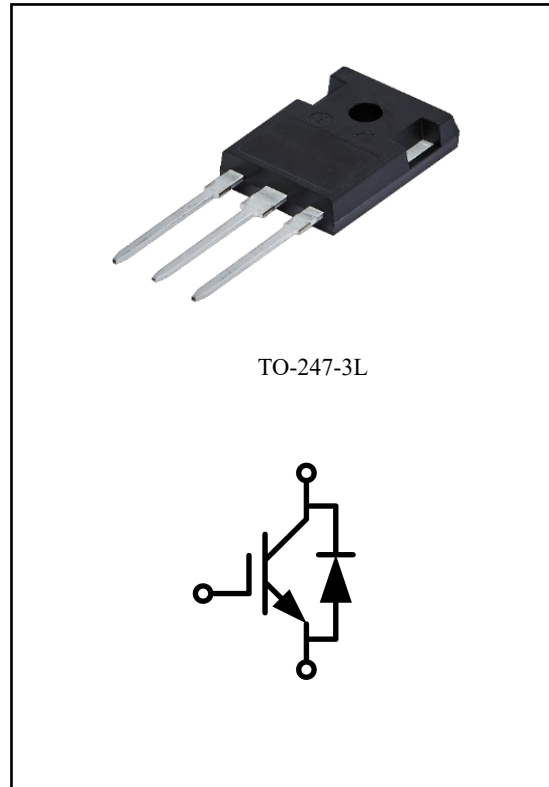
$V_{CES} = 1200V$，$I_{C\,nom} = 40A / I_{CRM} = 160A$

Feature:

- 1200V Trench /Field Stop type

- Low switching losses

- Vcesat hasA positive temperature coefficient

TO-247-3L

Applications:

- Charging station

- Uninterruptible power supplies

- 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=25°C, $T_{vj\,max}$=175°C T_C=100°C, $T_{vj\,max}$=175°C	$I_{C\,nom}$	80 40	A
Repetitive peak collector current	t_P=1 ms	I_{CRM}	160	A
Gate emitter voltage		V_{GE}	±20	V
Power dissipation	T_C=25℃ T_C=100℃	P_{tot}	575 290	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		$R_{th(j-C)}$	0.26	K/W
Diode thermal resistance, junction - case		$R_{th(j-C)}$	0.54	K/W

Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
Collector-Emitter saturation voltage	V_{GE}=15V, I_C=40A $\quad$ T_{vj}=25°C $\quad$ V_{GE}=15V, I_C=40A $\quad$ T_{vj}=175°C		V_{CEsat}		1.91 2.36	2.30	V
Gate-Emitter threshold voltage	I_C=1.5mA, V_{GE}= V_{CE} $\quad$ T_{vj}=25°C		$V_{GE(th)}$	4.5	5.1	5.7	
Transconductance	V_{CE}=20V，I_C=15A		G_{fs}		27		S
Input capacitance			C_{ies}		2.51		
Output capacitance	f=100KHz, V_{CE}=25 V, V_{GE}=0 V $\quad$ T_{vj}=25°C		C_{oes}		0.21		nF
Reverse transfer capacitance			C_{res}		0.11		
Gate charge	I_C = 40.0 A, V_{GE} = 15 V, V_{CE} = 960 V $\quad$ T_{vj}=25°C		Q_G		0.12		μC
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V $\quad$ T_{vj}=25°C		I_{CES}			250	μA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V $\quad$ T_{vj}=25°C		I_{GES}			600	nA
Turn-on delay time	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_{don}		17 16		ns
Rise time	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_r		71 68		
Turn-off delay time	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_{doff}		150 222		
Fall time	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_f		85 177		
Turn-on energy loss per pulse	I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{on}		3.48 5.74		mJ

| Turn-off energy loss per pulse | I_C=40A, V_{CE}=600 V V_{GE}=±15 V, R_G=12Ω (inductive load) | T_{vj}=25°C T_{vj}=175°C | E_{off} | | 1.47 2.54 | | |
| Temperature under switching conditions | | | $T_{vj\ op}$ | -40 | | 175 | °C |

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=25°C, $T_{vj\ max}$=175°C	I_F	40	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	80	A

Characteristic Values

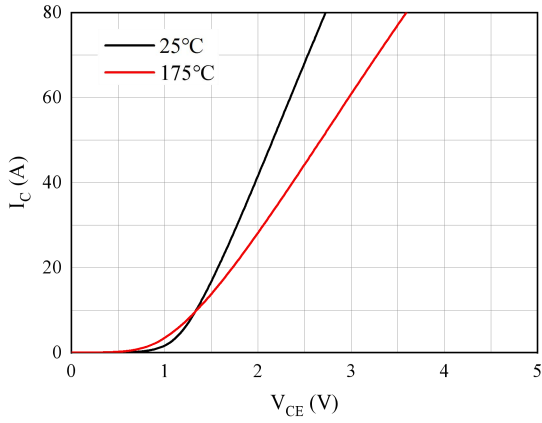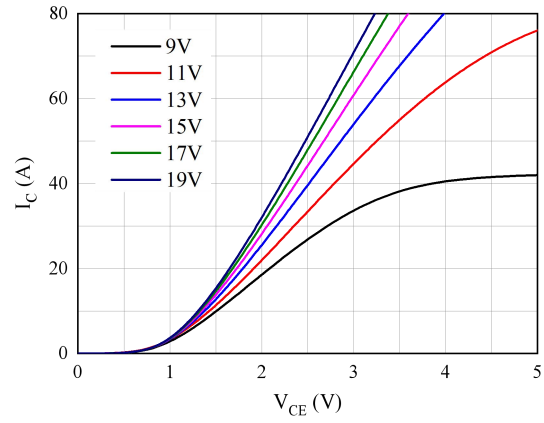| Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I_F=40A, V_{GE}=0V T_{vj}=25°C I_F=40A, V_{GE}=0V T_{vj}=175°C	V_F		2.00 1.74	2.50	V
Peak reverse recovery current	I_F=40A, di_F/dt=400A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V T_{vj}=25°C T_{vj}=175°C	I_{RM}		13 27		A
Reverse Recovered charge	I_F=40A, di_F/dt=400A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V T_{vj}=25°C T_{vj}=175°C	Q_{rr}		2.57 7.64		μC
Reverse Recovery Time	I_F=40A, di_F/dt=400A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V T_{vj}=25°C T_{vj}=175°C	t_{rr}		450 707		ns
Reverse recovered energy	I_F=40A, di_F/dt=400A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V T_{vj}=25°C T_{vj}=175°C	E_{rec}		1.04 3.08		mJ
Temperature under switching conditions		$T_{vj\ op}$	-40		175	°C

Fig1. Typical output characteristics (V_{GE}=15V)

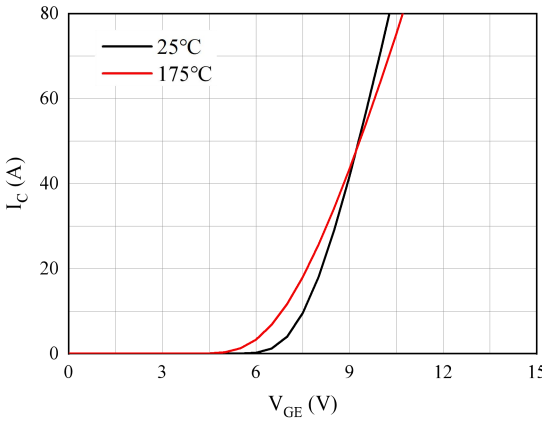Fig2. Typical output characteristics (T_{vj}=175℃)

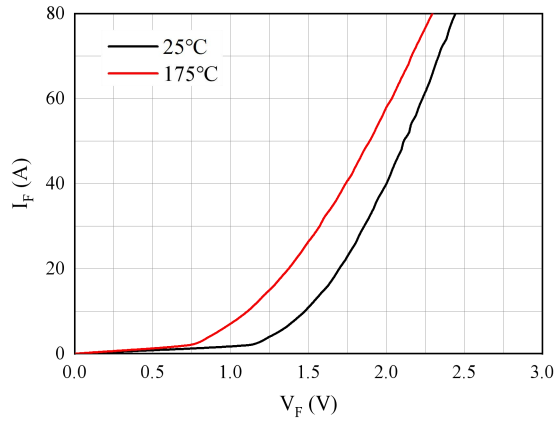Fig 3. Typical transfer characteristic(V_{CE}=20V)
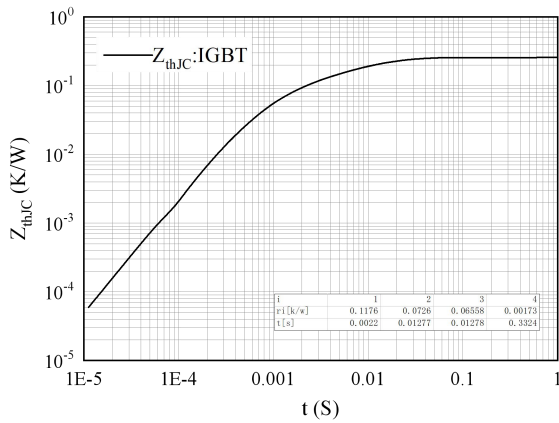
Fig 4. Forward characteristic of Diode

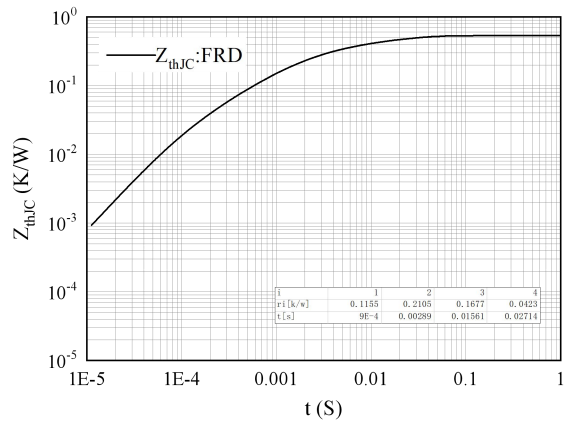Fig5. Transient thermal impedance IGBT,
Z_{thJC}=f(t)

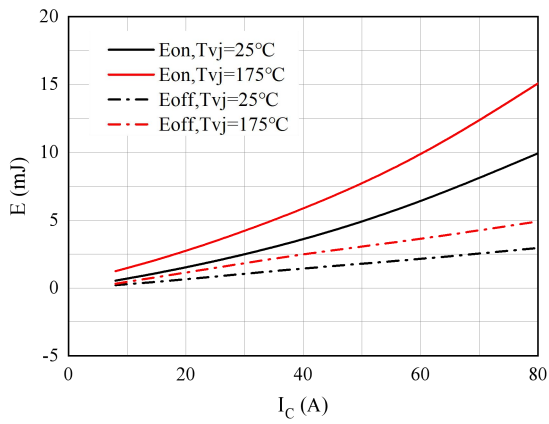Fig 6. Transient thermal impedance FRD,
Z_{thJC}=f(t)

Fig 7. Switching losses of IGBT

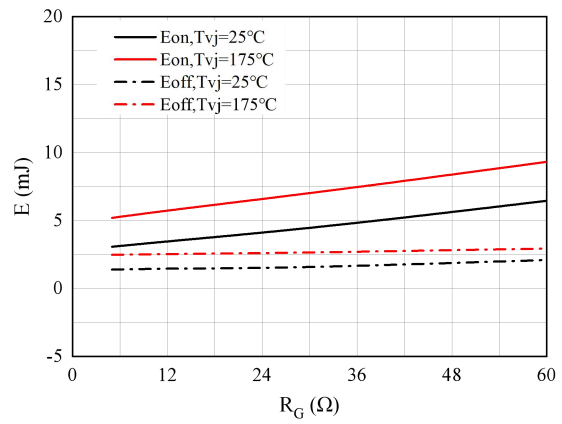VGE=±15V, RGon=12Ω, Rgoff=12Ω, VCE=600V

Fig 8. Switching losses of IGBT
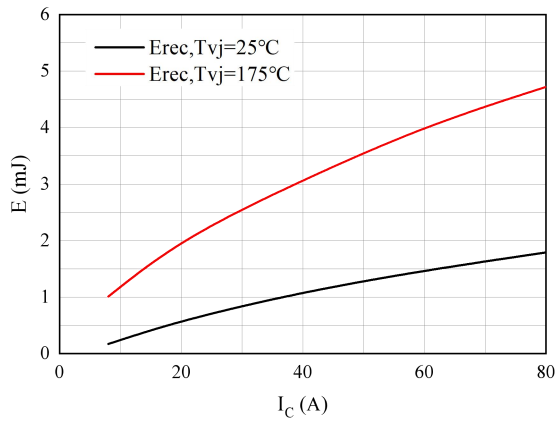
VGE=±15V, IC=40A, VCE=600V

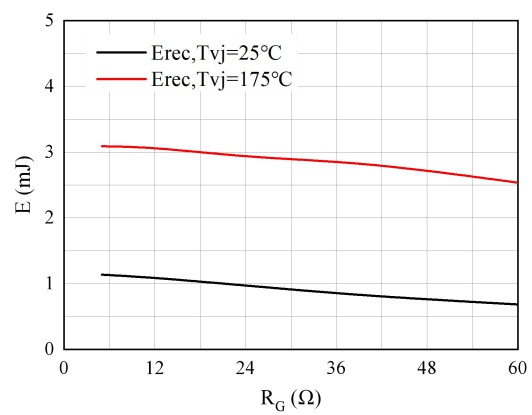Fig 9. Switching losses of Diode

Rgon=12Ω, VCE=600V

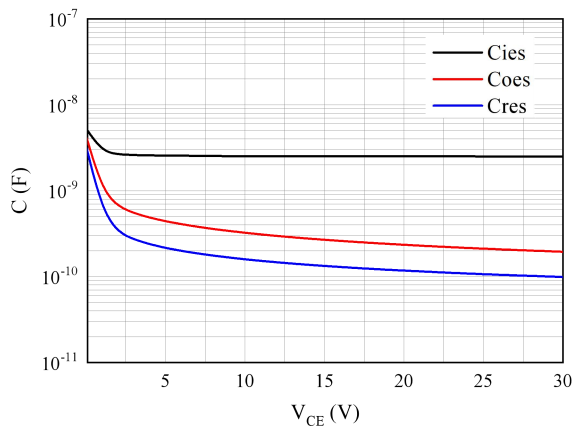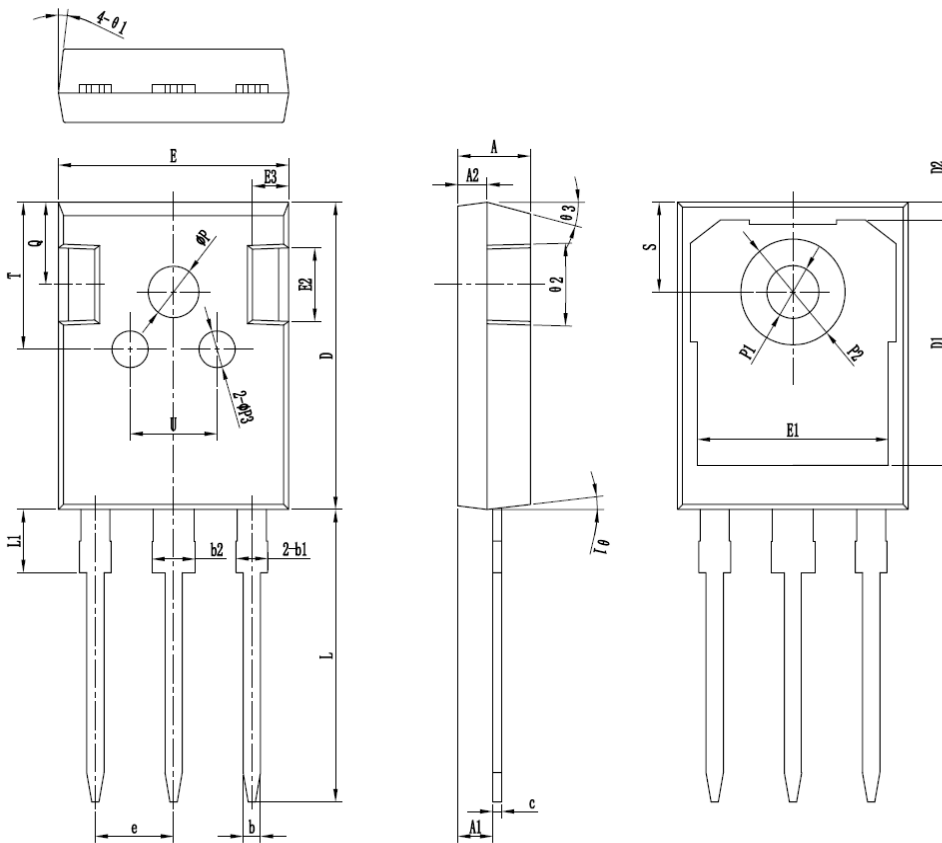Fig 10. Switching losses of Diode

IF=40A, VCE=600V

Fig 11. Capacitance characteristic

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
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.92	20.10
*L1	–	–	4.30
*φP	3.70	3.80	3.90
*φP1	3.50	3.60	3.70
φP2	7.00	7.20	7.40
φP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°