

IGBT Discrete with Anti-Parallel Diode

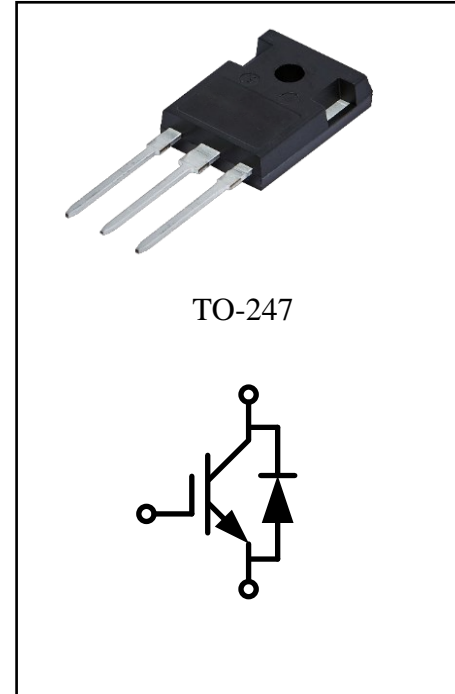
$V_{CES} = 700V$, $I_{C\ nom} = 60A$ / $I_{CRM} = 180A$

Features :

- 700V Trench /Field Stop type
- Low switching losses
- V_{cesat} has a positive temperature coefficient

Applications:

- Charging station
- Uninterruptible power supplies
- Inverters



IGBT

Maximum Ratings

| Parameter | Conditions | Symbol | Value | Unit |
|-----------------------------------|---|--------------|----------|------|
| Collector-Emitter voltage | $T_{vj} = 25^{\circ}C$ | V_{CES} | 700 | V |
| Continuous DC collector current | $T_C = 100^{\circ}C$, $T_{vj\ max} = 175^{\circ}C$ | $I_{C\ nom}$ | 60 | A |
| Repetitive peak collector current | $t_p = 1\ ms$ | I_{CRM} | 180 | A |
| Gate emitter voltage | | V_{GE} | ± 20 | V |
| Transient Gate-emitter voltage | $t_p \leq 10\ \mu s$, $D < 0.010$ | V_{GE} | ± 25 | V |

| | | | | |
|--|---|--------------------|------------|----|
| Power dissipation | T _C =25°C T _C =100°C | P _{tot} | 440 220 | W |
| Temperature under switching conditions | | T _{vj op} | -40...+175 | °C |
| Storage temperature | | T _{stg} | -40...+150 | °C |

Thermal Characteristics

| Parameter | Conditions | Symbol | Value | | | Unit |
|---|------------|----------------------|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| IGBT thermal resistance, junction - case | | R _{th(j-c)} | | 0.34 | | K/W |
| Diode thermal resistance, junction - case | | R _{th(j-c)} | | 0.49 | | K/W |

Characteristic Values

| Parameter | Conditions | Symbol | Value | | | Unit | |
|--------------------------------------|---|---|---------------------|----------------------|-----------|------|----|
| | | | Min. | Typ. | Max. | | |
| Collector-Emitter saturation voltage | V _{GE} =15V, I _C =60A V _{GE} =15V, I _C =60A V _{GE} =15V, I _C =60A | T _{vj} =25°C T _{vj} =150°C T _{vj} =175°C | | 1.47 1.81 1.86 | 1.90 | V | |
| Gate-Emitter threshold voltage | I _C =0.6mA, V _{GE} = V _{CE} | T _{vj} =25°C | V _{GE(th)} | 4.4 | 5.0 | 5.6 | V |
| Transconductance | V _{CE} =20V, I _C =60A | | G _{fs} | | 96 | | S |
| Input capacitance | f=100kHz, V _{CE} =25 V, V _{GE} =0 V | T _{vj} =25°C | C _{ies} | | 8039 | | pF |
| Output capacitance | | | C _{oes} | | 239 | | pF |
| Reverse transfer capacitance | | | C _{res} | | 136 | | pF |
| Gate charge | I _C = 60A, V _{GE} = 15 V, V _{CE} =560V | T _{vj} =25°C | Q _G | | 742 | | nC |
| Collector-emitter cut-off current | V _{CE} =700V, V _{GE} = 0 V | T _{vj} =25°C | I _{CES} | | | 1 | mA |
| Gate-emitter leakage current | V _{CE} =0 V, V _{GE} = 20 V | T _{vj} =25°C | I _{GES} | | | 200 | nA |
| Turn-on delay time | I _C =60A, V _{CE} =400V V _{GE} =±15 V, R _G =8Ω (inductive load) | T _{vj} =25°C T _{vj} =175°C | t _{d(on)} | | 36 30 | | ns |
| Rise time | I _C =60A, V _{CE} =400V V _{GE} =±15 V, R _G =8Ω (inductive load) | T _{vj} =25°C T _{vj} =175°C | t _r | | 112 97 | | ns |

| | | | | | | |
|--------------------------------|---|---|--------------|--------------|--|----|
| Turn-off delay time | $I_C=60A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ (inductive load) | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | $t_{d(off)}$ | 182 212 | | ns |
| Fall time | $I_C=60A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ (inductive load) | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | t_f | 49 78 | | ns |
| Turn-on energy loss per pulse | $I_C=60A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ $di/dt=600A/\mu s(T_{vj}=175^\circ C)$ (inductive load) | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | E_{on} | 2.76 3.53 | | mJ |
| Turn-off energy loss per pulse | $I_C=60A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ $dv/dt=10000V/\mu s(T_{vj}=175^\circ C)$ (inductive load) | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | E_{off} | 0.75 1.13 | | mJ |

Diode

Maximum Ratings

| Parameter | Conditions | Symbol | Value | Unit |
|---------------------------------|--|-----------|-------|------|
| Repetitive peak reverse voltage | $T_{vj}=25^\circ C$ | V_{RRM} | 700 | V |
| Continuous DC forward current | $T_C=100^\circ C, T_{vj\ max}=175^\circ C$ | 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 | $I_F=60A, V_{GE}=0V$ $I_F=60A, V_{GE}=0V$ $I_F=60A, V_{GE}=0V$ | $T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | V_F | 1.45 1.55 1.52 | 2.00 | V |
| Peak reverse recovery current | $I_F=60A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$ | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | I_{RM} | 18 30 | | A |
| Reverse Recovered charge | $I_F=60A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$ | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | Q_{rr} | 1.55 3.99 | | μC |
| Reverse Recovery Time | $I_F=60A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$ | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | t_{rr} | 142 210 | | ns |
| Reverse recovered energy | $I_F=60A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$ | $T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$ | E_{rec} | 0.38 0.97 | | mJ |

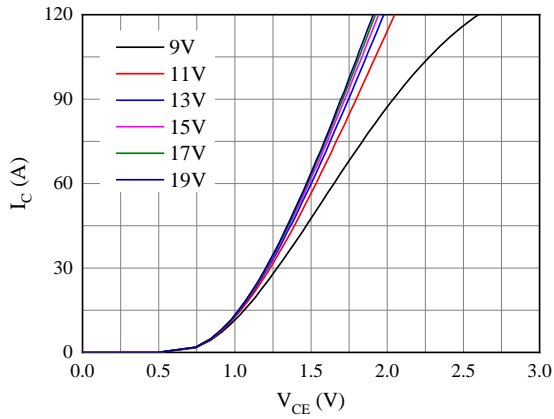


Fig 1. Typical output characteristics ($T_{vj}=25^{\circ}\text{C}$)

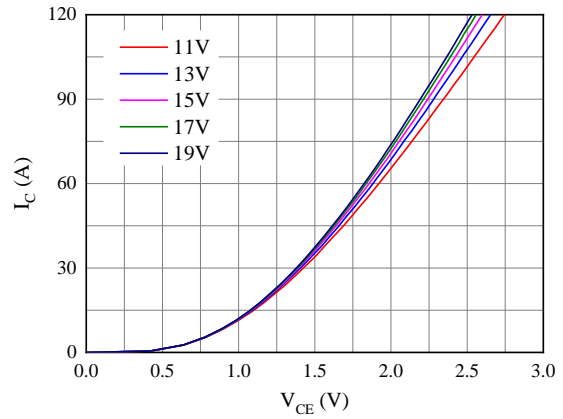


Fig 2. Typical output characteristics ($T_{vj}=175^{\circ}\text{C}$)

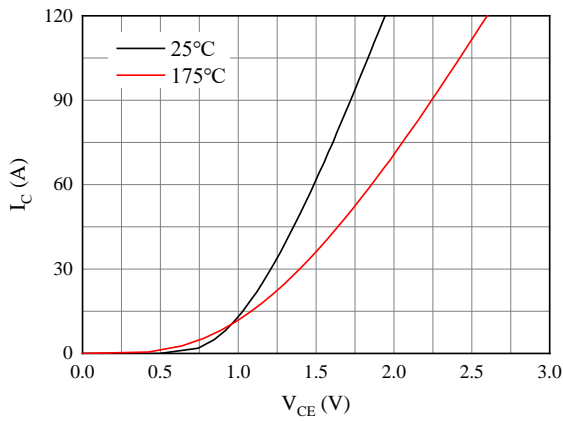


Fig 3. Typical output characteristics ($V_{GE}=15\text{V}$)

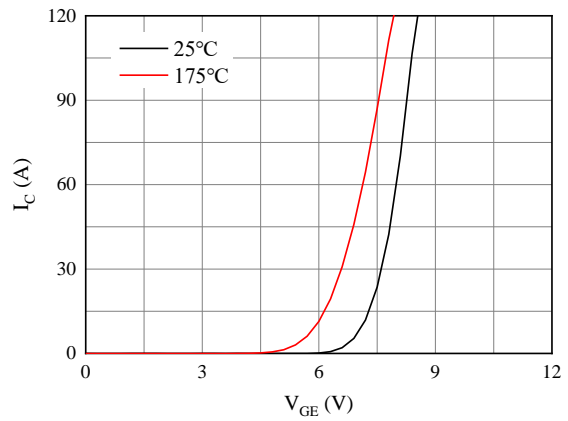


Fig 4. Typical transfer characteristic ($V_{CE}=20\text{V}$)

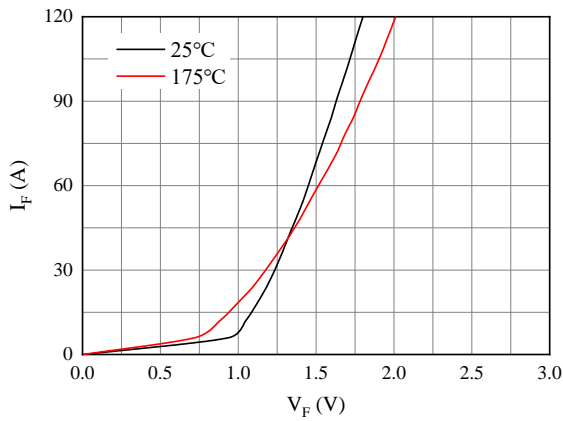


Fig 5. Forward characteristic of Diode

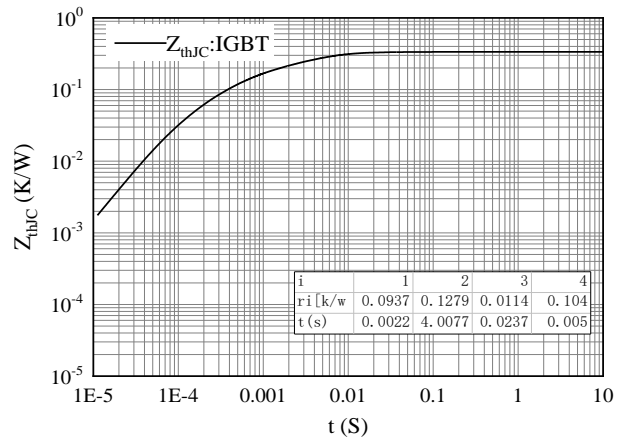


Fig 6. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

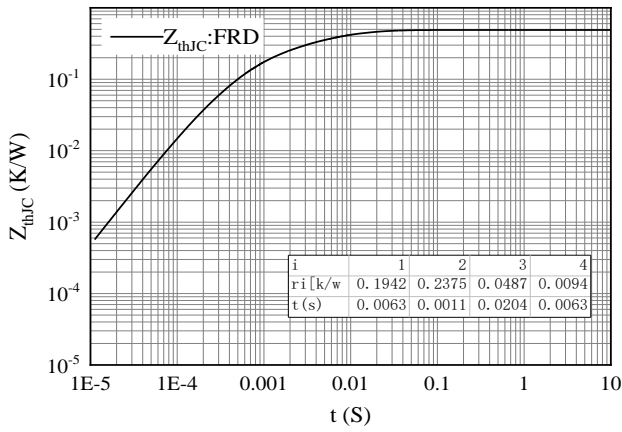


Fig 7. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

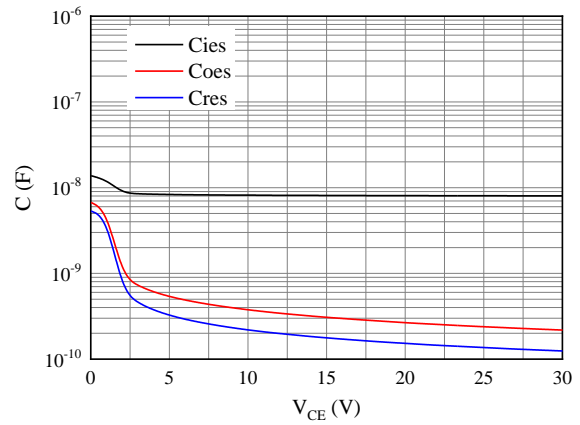


Fig 8. Capacitance characteristic

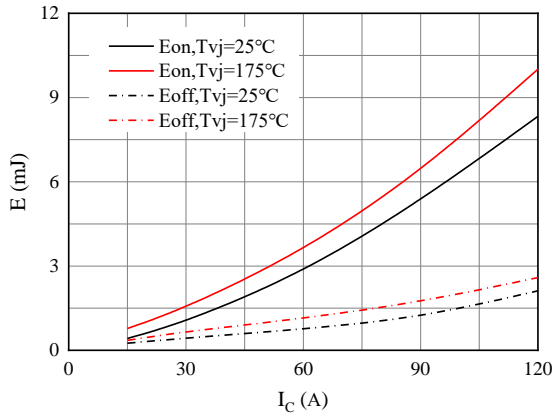


Fig 9. Switching losses of IGBT
 $V_{GE}=\pm 15V, R_{gon}=8\Omega, R_{goff}=8\Omega, V_{CE}=400V$

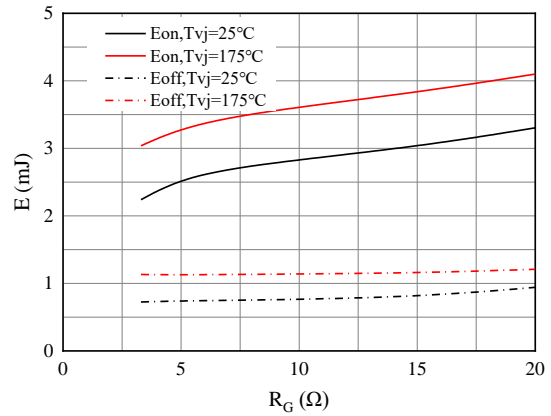


Fig 10. Switching losses of IGBT
 $V_{GE}=\pm 15V, I_C=60A, V_{CE}=400V$

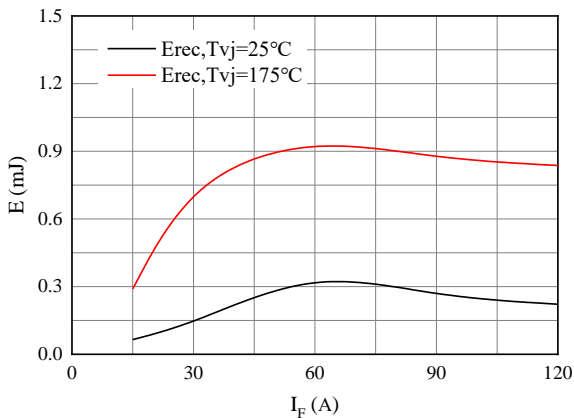


Fig 11. Switching losses of Diode
 $R_{gon}=8\Omega, V_{CE}=400V$

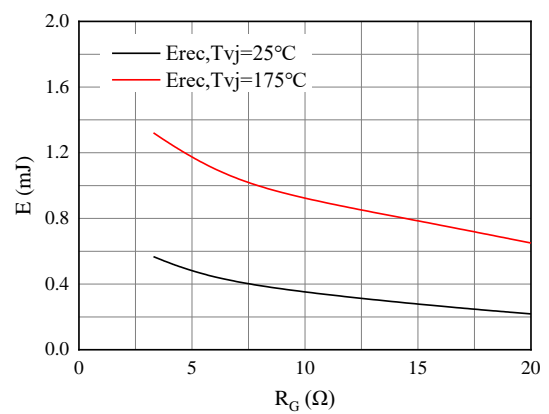
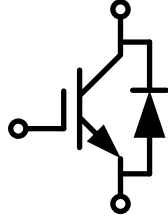
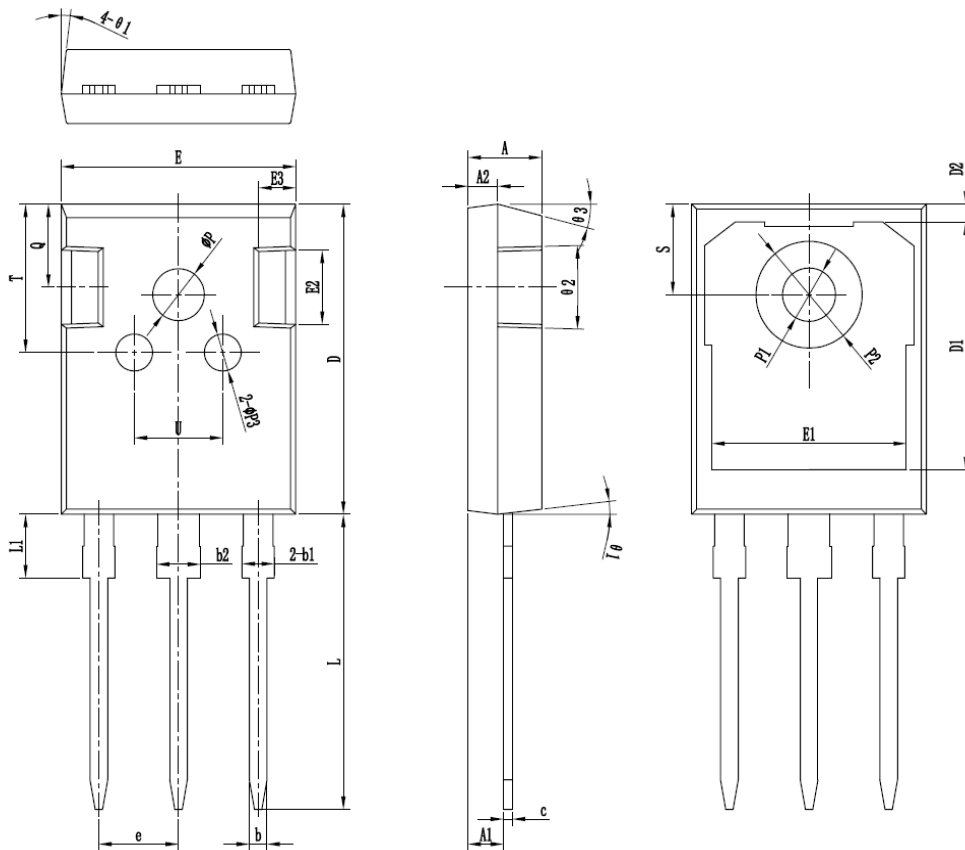


Fig 12. Switching losses of Diode
 $I_F=60A, V_{CE}=400V$

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 | 0.65 | 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 |
| *PP | 3.70 | 3.80 | 3.90 |
| *PP1 | 3.50 | 3.60 | 3.70 |
| *PP2 | 7.00 | 7.20 | 7.40 |
| *PP3 | 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 |
| Ø1 | 5° | 7° | 9° |
| Ø2 | 1° | 3° | 5° |
| Ø3 | 13° | 15° | 17° |