

Trench-FS Cool-Watt® II IGBT



- Applications
 - Inverter power supply
 - UPS
 - PV

- Features

- CoolWatt® II Trench-FS technology
- Low V_{CESAT}
- Low switching losses
- With anti-parallel fast recovery diode
- Positive temperature coefficient
- High reliability

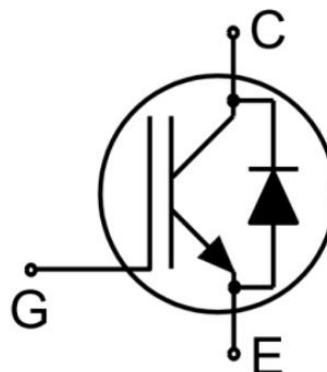
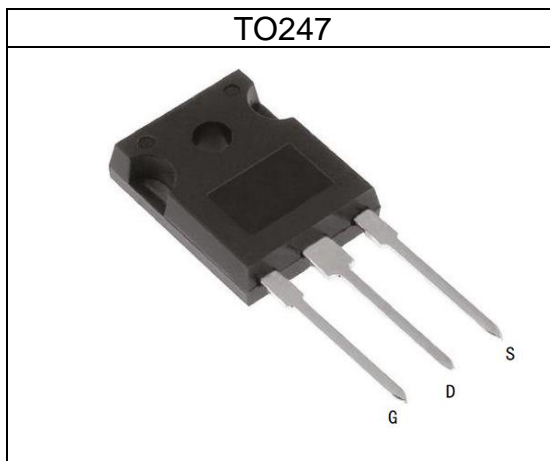


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|---------------|-------|------|
| V_{CES} | 650 | V |
| $V_{CE(sat)}$ | 1.3 | V |
| $V_{GE(th)}$ | 5.6 | V |
| $Q_{g,typ}$ | 142 | nC |
| I_{Cpuls} | 225 | A |

3. Packaging and Internal Circuit

| Part Name | Package | Marking |
|-----------|---------|----------|
| AGW75N65 | TO247 | AGW75N65 |



1 Maximum ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|-------------|--------|------|------|------------------|--|
| | | Min. | Typ. | Max. | | |
| Collector-emitter voltage | V_{CES} | 650 | - | - | V | $T_C=25^\circ\text{C}$ |
| DC collector current | I_C | | - | 150 | A | $T_C=25^\circ\text{C}$ |
| | | | - | 75 | A | $T_C=100^\circ\text{C}$ |
| Pulse collector current | I_{Cpuls} | - | - | 225 | A | $T_{vj} \leq 150^\circ\text{C}$ |
| Repetitive peak reverse voltage | V_{RRM} | 650 | - | | V | $T_C=25^\circ\text{C}$ |
| Diode continuous forward current | I_F | - | - | 150 | A | $T_C=25^\circ\text{C}$ |
| | | - | - | 75 | A | $T_C=100^\circ\text{C}$ |
| Diode pulse current | I_{Fpuls} | - | - | 225 | A | $T_{vj} \leq 150^\circ\text{C}$ |
| Gate-emitter voltage | V_{GE} | -20 | - | 20 | V | static; |
| | | -30 | - | 30 | V | Transient ($t_p \leq 10\mu\text{s}, D < 0.01$) |
| Power dissipation | P_{tot} | - | - | 469 | W | $T_C=25^\circ\text{C}$ |
| Storage temperature | T_{stg} | -50 | - | 150 | $^\circ\text{C}$ | |
| Operating junction temperature | T_j | -40 | - | 175 | $^\circ\text{C}$ | |
| Soldering Temperature Distance of 1.6mm from case for 10s | T_L | | | 260 | $^\circ\text{C}$ | |

2 Thermal characteristics

Table 3 Thermal characteristics

| Parameter | | Symbol | Values | | | Unit | Note / Test Condition |
|----------------------------------|-----------|-----------------|--------|------|------|------|-----------------------|
| | | | Min. | Typ. | Max. | | |
| IGBT thermal resistance junction | - case | $R_{thJC-IGBT}$ | - | - | 0.32 | K/W | - |
| FRD thermal resistance junction | - case | $R_{thJC-FRD}$ | - | - | 0.45 | K/W | - |
| Thermal resistance junction | - ambient | R_{thJA} | - | - | 40 | K/W | - |

3 Electrical characteristics

at $T_j=25^\circ\text{C}$, unless otherwise specified

Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--------------------------------------|---------------|--------|------|------|----------|--|
| | | Min. | Typ. | Max. | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | 650 | - | - | V | $V_{GE} = 0V, I_C=0.25mA, T_{vj}=25^\circ\text{C}$ |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | - | 1.3 | 2 | V | $V_{GE}=15V, I_C=30A, T_{vj}=25^\circ\text{C}$ |
| | | - | 1.85 | - | V | $V_{GE}=15V, I_C=30A, T_{vj}=150^\circ\text{C}$ |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | 5.1 | 5.6 | 6.1 | V | $V_{GE}= V_{CE}, I_C=1.5mA, T_{vj}=25^\circ\text{C}$ |
| Diode forward voltage | V_F | - | 1.35 | 1.85 | V | $V_{GE}= 0V, I_F=30A, T_{vj}=25^\circ\text{C}$ |
| | | - | 1.2 | - | V | $V_{GE}= 0V, I_F=30A, T_{vj}=150^\circ\text{C}$ |
| Zero collector voltage gate current | I_{GES} | - | - | 200 | nA | $V_{GE}=30V, V_{CE}=0V$ |
| Zero gate voltage collector current | I_{CES} | - | - | 0.2 | mA | $V_{CE} =650V, V_{GE}=0V, T_{vj}=25^\circ\text{C}$ |
| | | - | - | 1.0 | mA | $V_{CE} =650V, V_{GE}=0V, T_{vj}=150^\circ\text{C}$ |
| Integrated gate resistor | R_{Gin} | — | 0 | — | Ω | — |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{ies} | - | 3910 | - | pF | $V_{GE} = 0V, V_{CE}= 30V, f = 1MHz, T_{vj}=25^\circ\text{C}$ |
| Output capacitance | C_{oes} | - | 244 | - | pF | $V_{GE} = 0V, V_{CE}= 30V, f = 1MHz, T_{vj}=25^\circ\text{C}$ |
| Reverse transfer capacitance | C_{res} | - | 34.0 | - | pF | $V_{GE} = 0V, V_{CE}= 30V, f = 1MHz, T_{vj}=25^\circ\text{C}$ |
| Gate charge | Q_g | - | 142 | - | nC | $V_{GE}=0/15V, V_{cc}=400V, I_C=75A, T_{vj}=25^\circ\text{C}$ |
| Gate-emitter charge | Q_{ge} | - | 34.6 | - | nC | $V_{GE}=0/15V, V_{cc}=400V, I_C=75A, T_{vj}=25^\circ\text{C}$ |
| Gate-collector charge | Q_{gc} | - | 63.0 | - | nC | $V_{GE}=0/15V, V_{cc}=400V, I_C=75A, T_{vj}=25^\circ\text{C}$ |
| Gate-emitter plateau voltage | $V_{GE(pl)}$ | - | 9.65 | - | V | $I_C = 75A, V_{CE}=520V, V_{GE}=0/15V, T_{vj}=25^\circ\text{C}$ |

Table 6 Switching characteristics

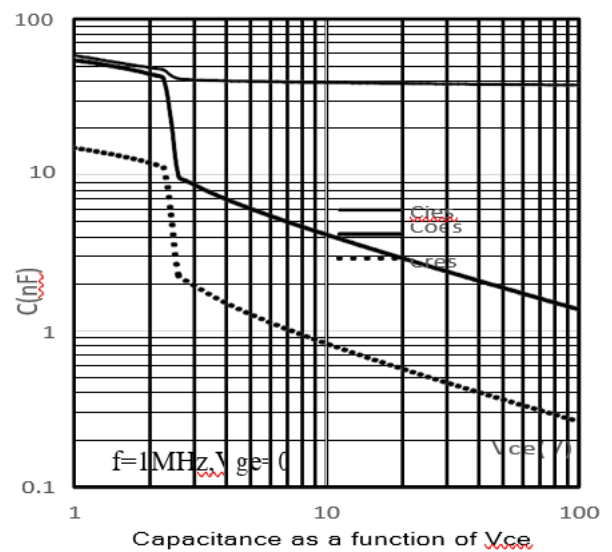
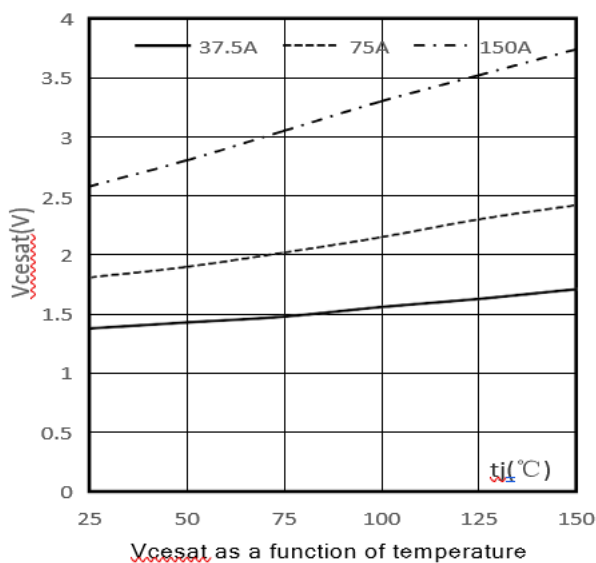
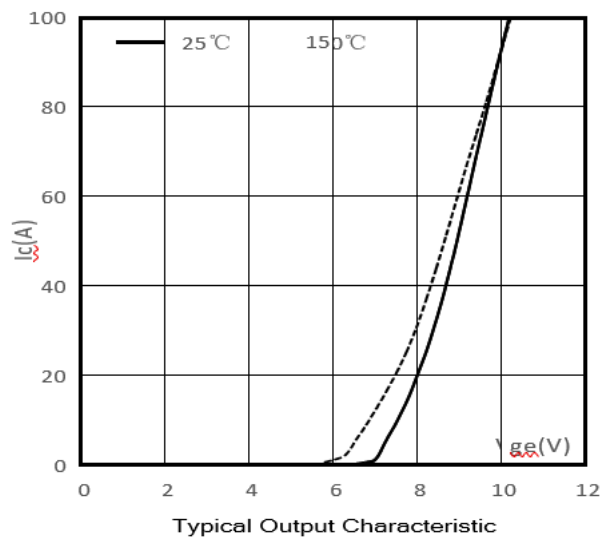
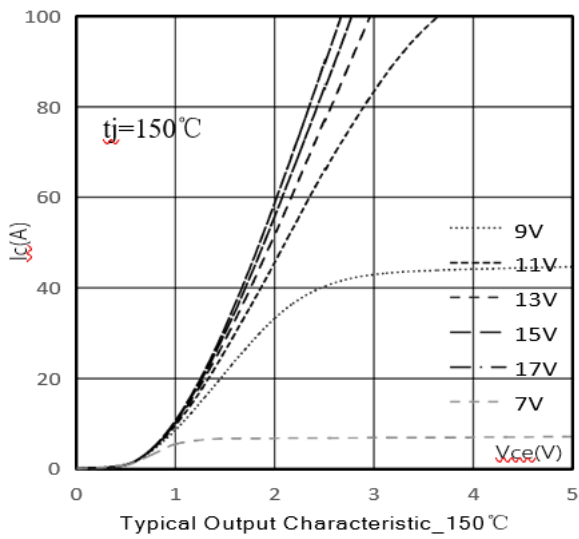
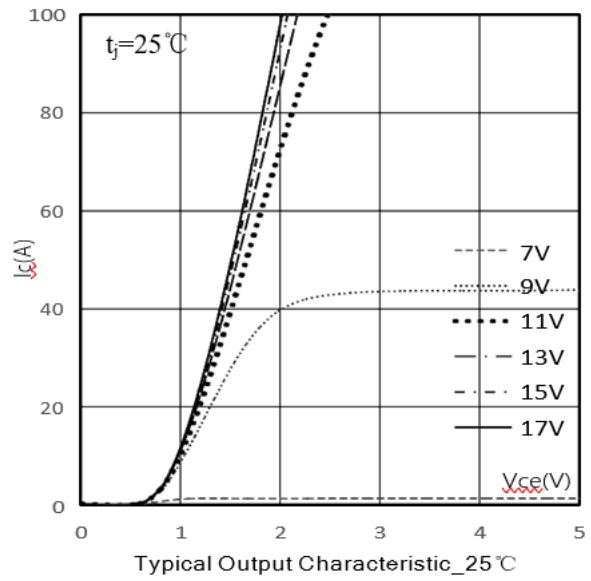
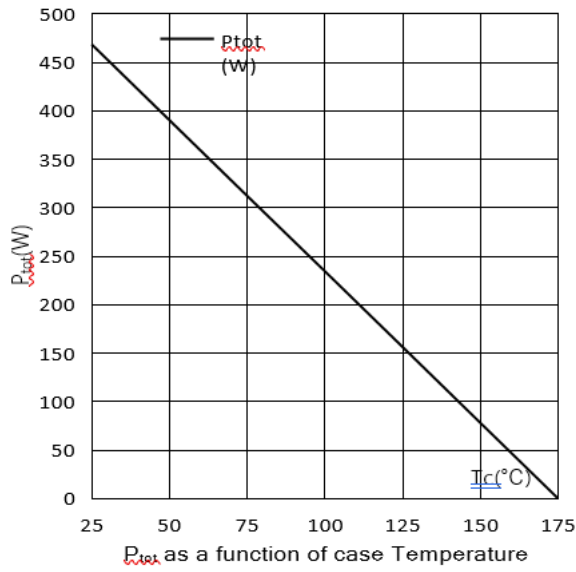
| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---------------------|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Turn-on delay time | $T_{d(on)}$ | — | 76.0 | — | ns | $V_{cc}=400V, I_c=75A,$ $R_{on}=10\ \Omega, R_{off}=10\ \Omega,$ $C_{ge}=0nF, V_{GE}=0/15V,$ $L_{load}=60\mu H, T_{vj}=25^\circ C$ |
| Rise time | T_r | — | 115 | — | ns | |
| Turn-off delay time | $T_{d(off)}$ | — | 196 | — | ns | |
| Fall time | t_f | — | 79.0 | — | ns | |
| Turn-on energy | E_{on} | — | 3.08 | — | mJ | |
| Turn-off energy | E_{off} | — | 2.22 | — | mJ | |
| Total switch energy | E_{total} | — | 5.30 | — | mJ | |

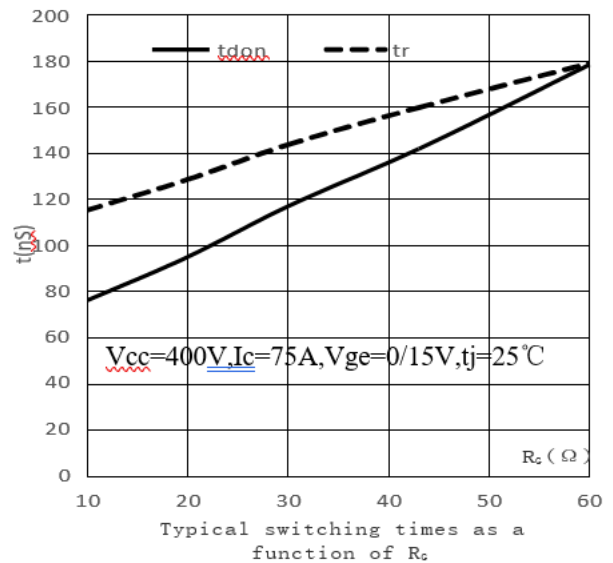
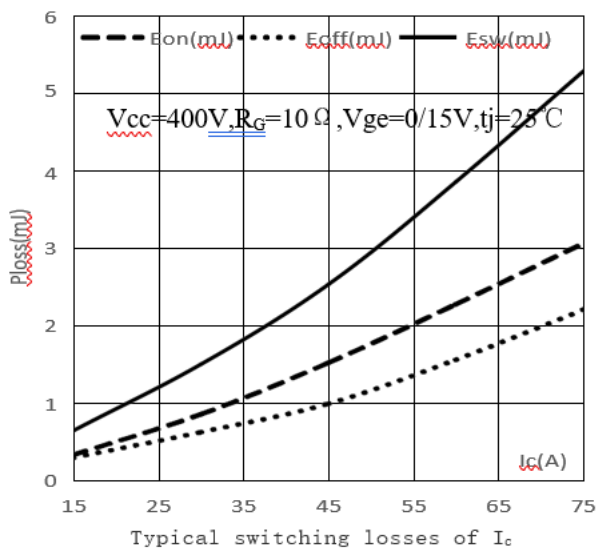
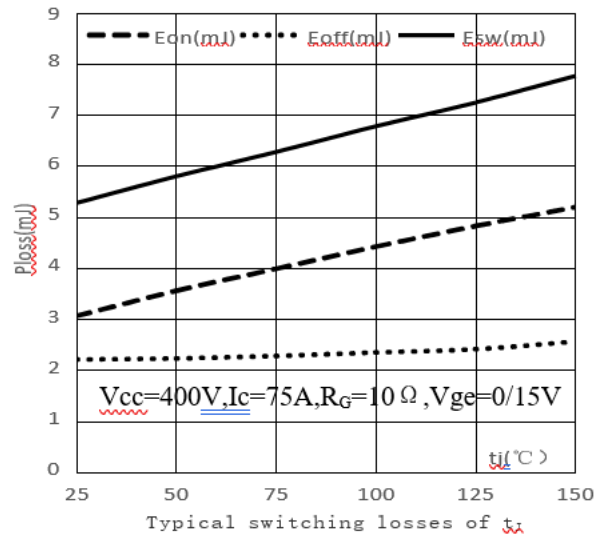
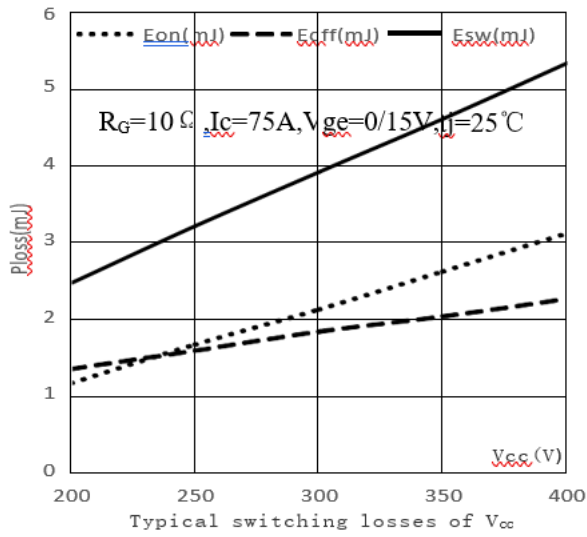
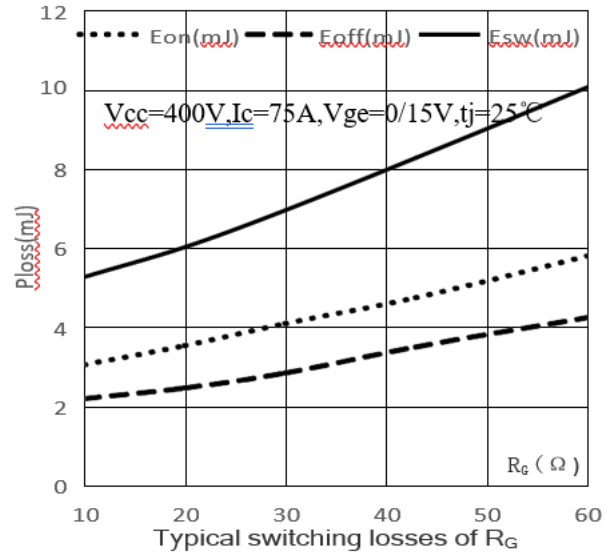
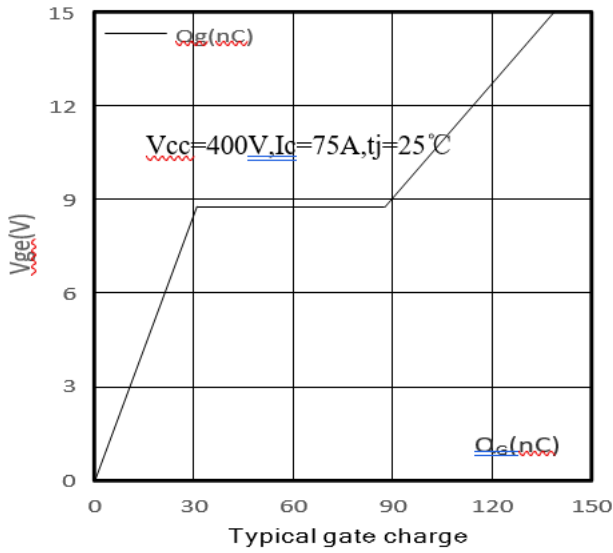
| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---------------------|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Turn-on delay time | $T_{d(on)}$ | — | 71.0 | — | ns | $V_{cc}=400V, I_c=75A,$ $R_{on}=10\ \Omega, R_{off}=10\ \Omega,$ $C_{ge}=0nF, V_{GE}=0/15V,$ $L_{load}=60\mu H, T_{vj}=150^\circ C$ |
| Rise time | T_r | — | 120 | — | ns | |
| Turn-off delay time | $T_{d(off)}$ | — | 211 | — | ns | |
| Fall time | t_f | — | 82.0 | — | ns | |
| Turn-on energy | E_{on} | — | 5.21 | — | mJ | |
| Turn-off energy | E_{off} | — | 2.57 | — | mJ | |
| Total switch energy | E_{total} | — | 7.78 | — | mJ | |

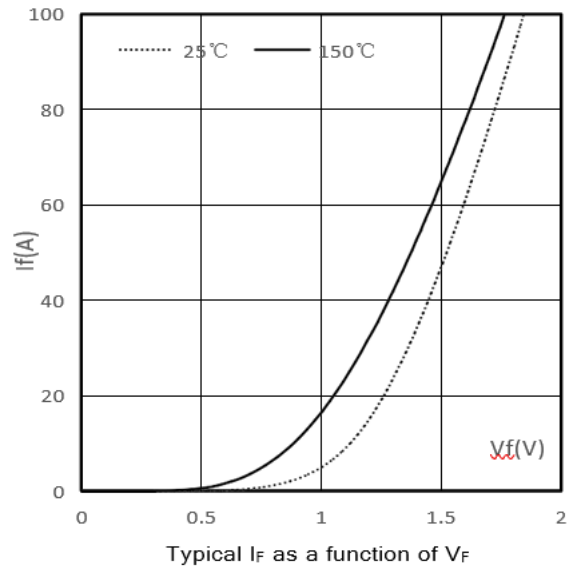
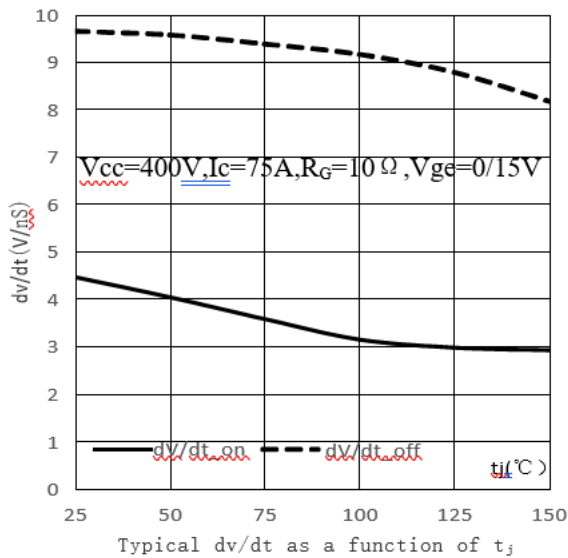
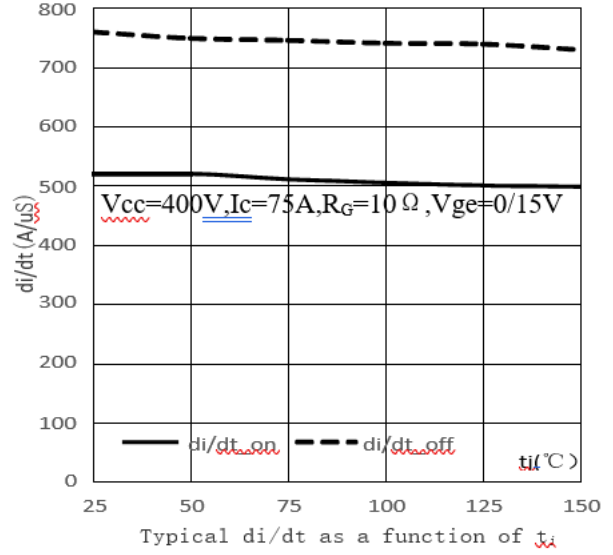
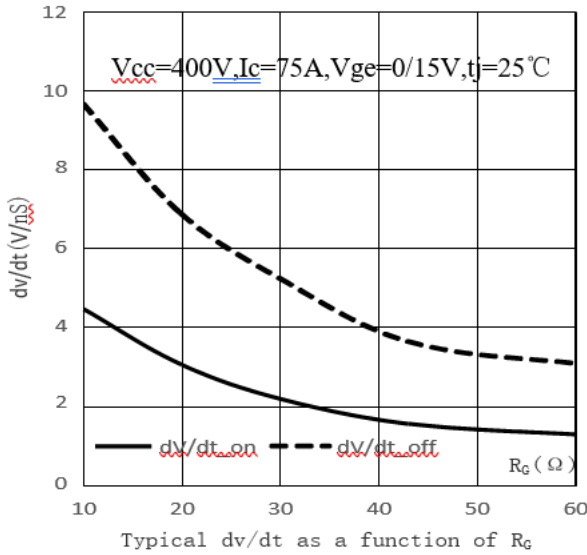
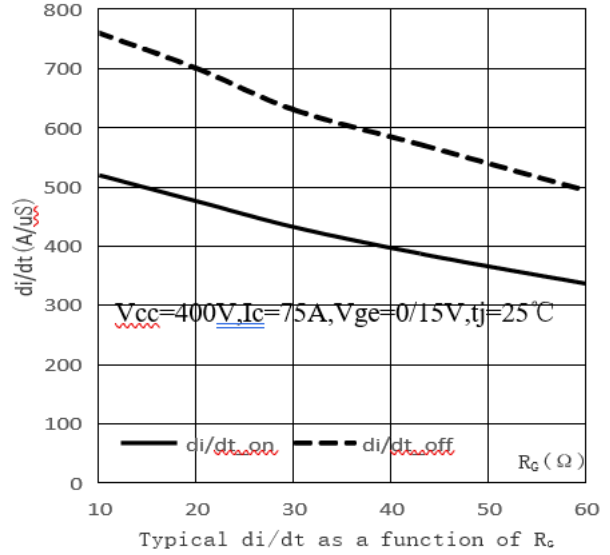
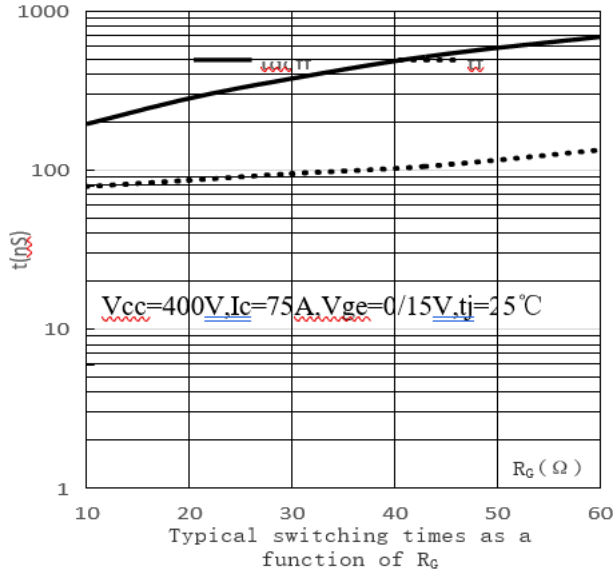
Table 7 Diode characteristics

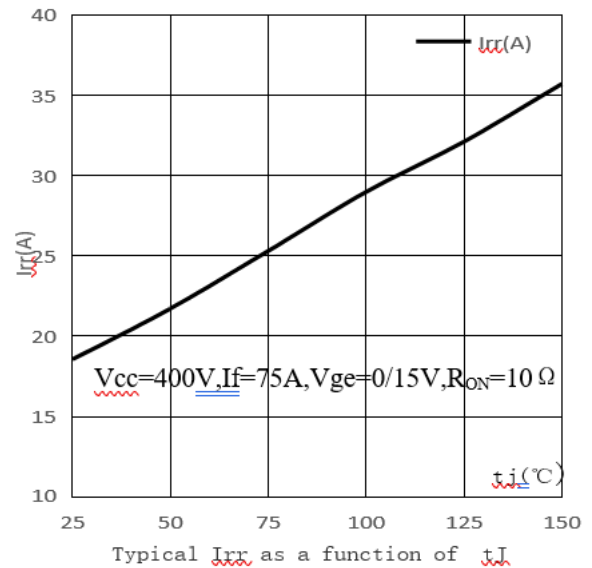
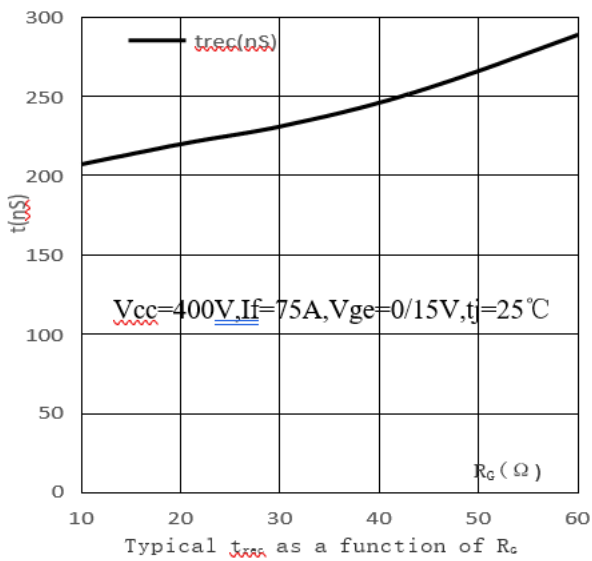
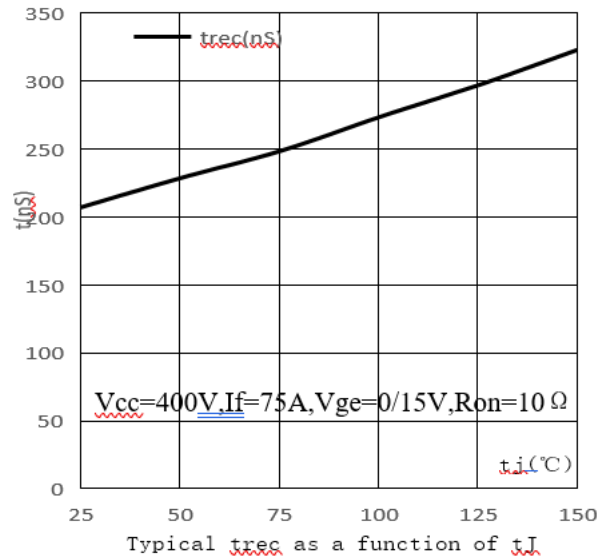
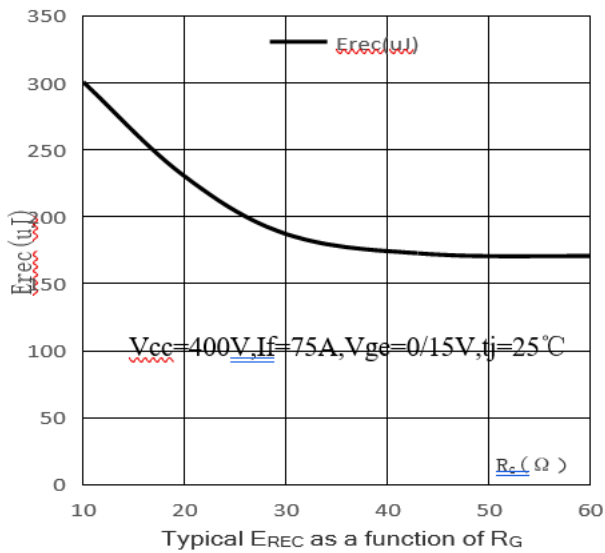
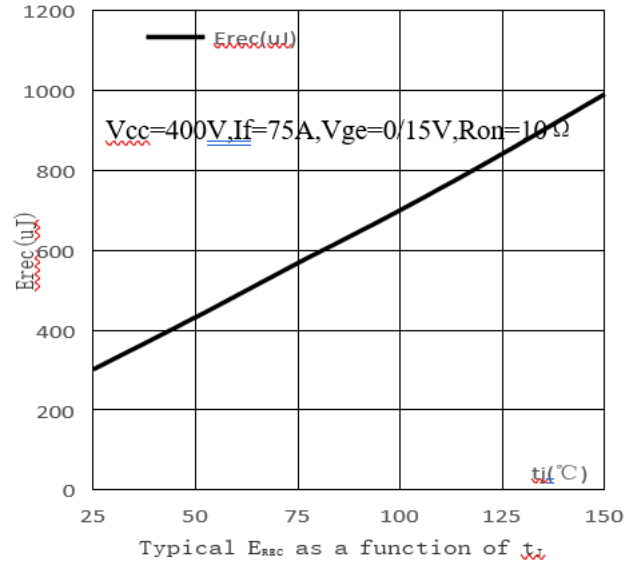
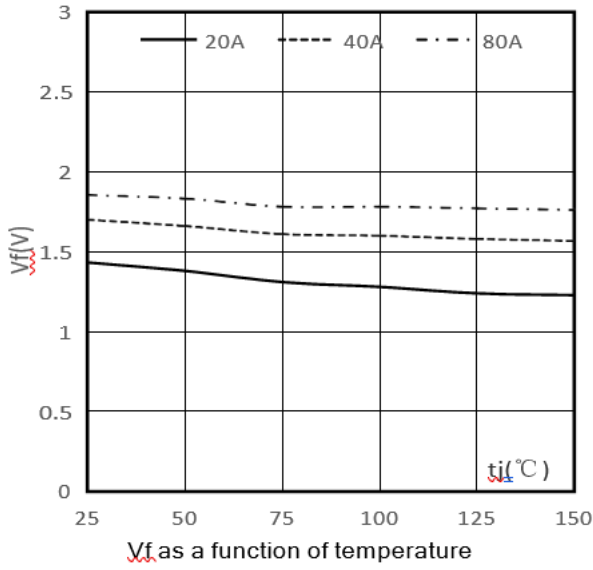
| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|----------------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Reverse recovery energy | Erec | — | 301 | — | uJ | I _F =75A, V _R =400V, V _{GE} =0/15V, R _{ON} =10 Ω, T _{vj} =25°C |
| Diode reverse recovery time | t _{rr} | — | 207 | — | nS | |
| Diode reverse recovery charge | Q _{rr} | — | 1355 | — | nC | |
| Diode peak reverse recovery current | I _{rrm} | — | 18.6 | — | A | |
| Diode peak rate of fall of reverse Recovery current during t _{rr} | d _{irr} /dt | — | 119 | — | A/uS | |
| Parameter | Symbol | Values | | | Unit | |
| | | Min. | Typ. | Max. | | |
| Reverse recovery energy | Erec | — | 991 | — | uJ | I _F =75A, V _R =400V, V _{GE} =0/15V, R _{ON} =10 Ω, T _{vj} =150°C |
| Diode reverse recovery time | t _{rr} | — | 323 | — | nS | |
| Diode reverse recovery charge | Q _{rr} | — | 4812 | — | nC | |
| Diode peak reverse recovery current | I _{rrm} | — | 34.7 | — | A | |
| Diode peak rate of fall of reverse Recovery current during t _{rr} | d _{irr} /dt | — | 184 | — | A/uS | |

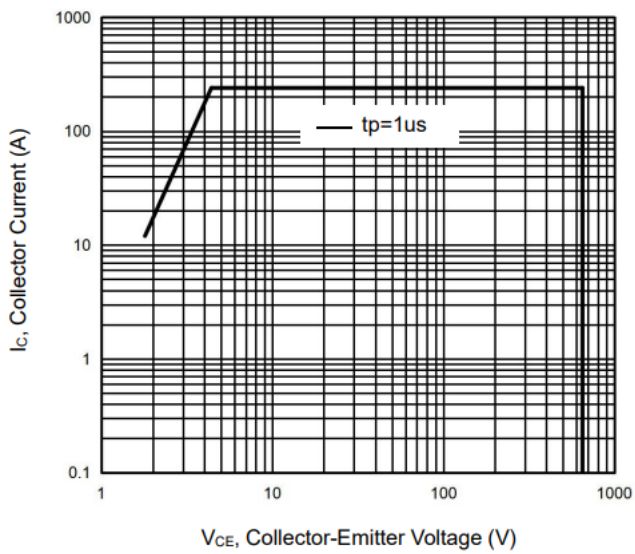
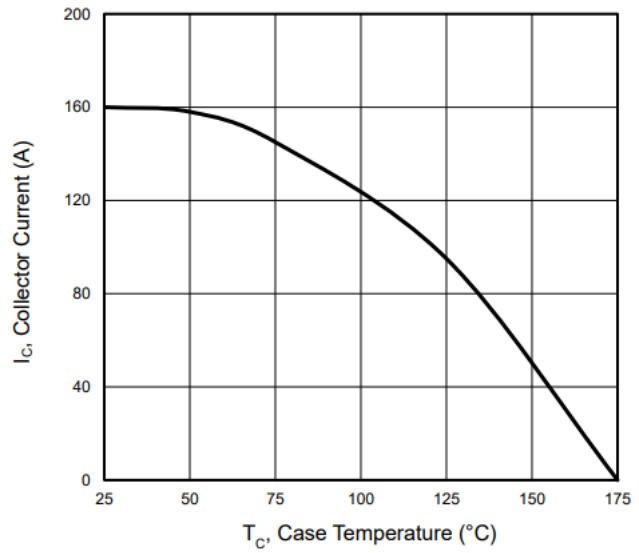
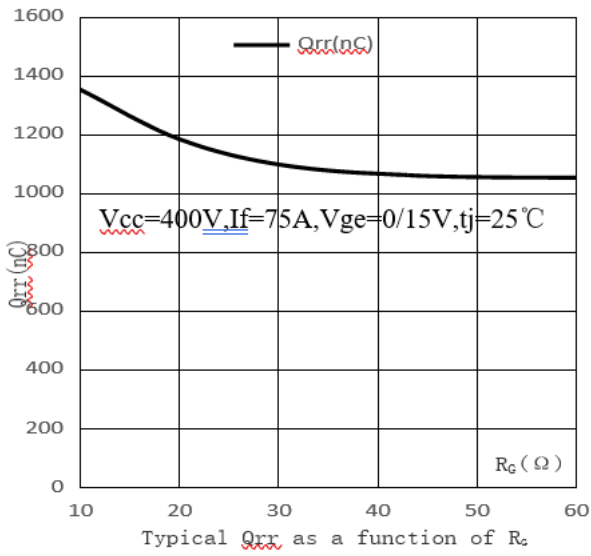
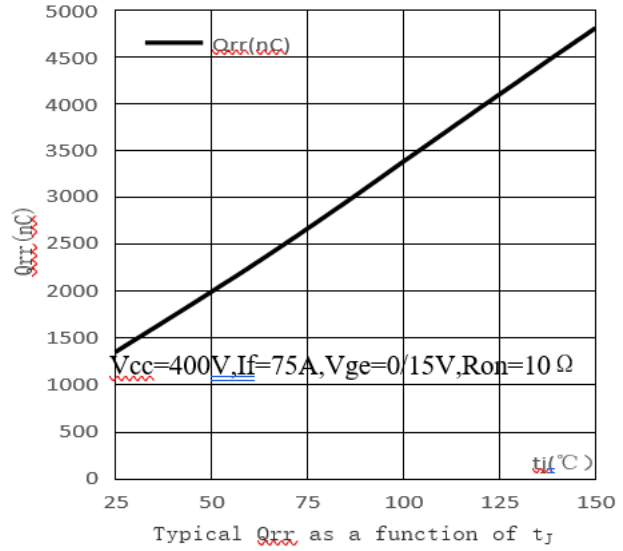
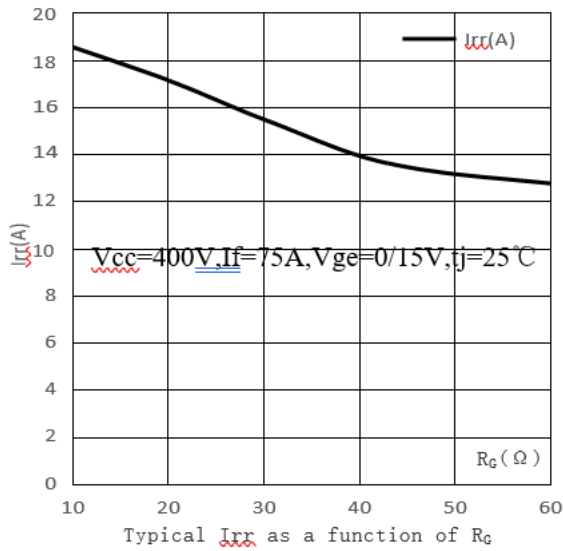
4 Electrical characteristics diagram





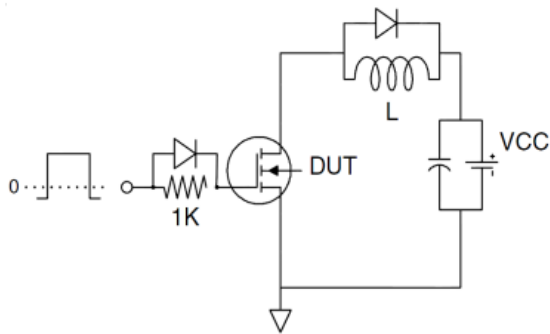




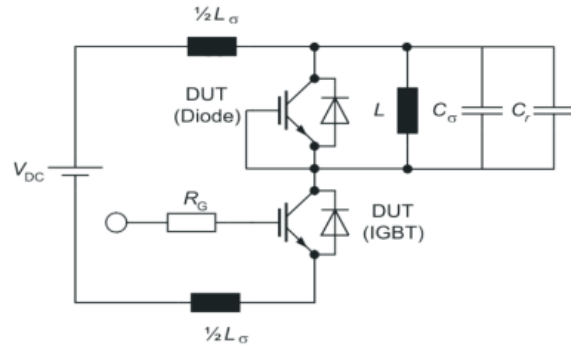


5 Test Circuits

1) Gate Charge Test Circuit

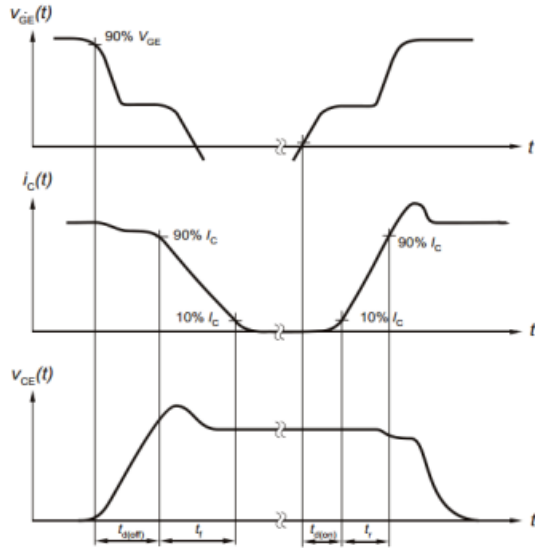


2) Switch Time Test Circuit

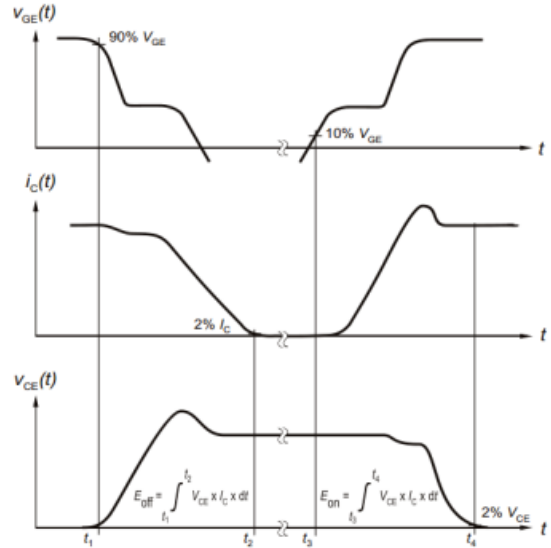


Switching characteristics

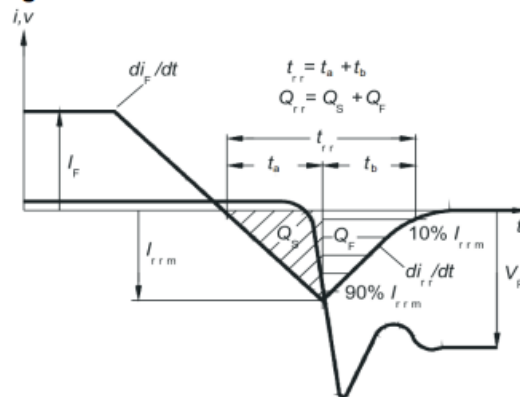
1) definition of switching times



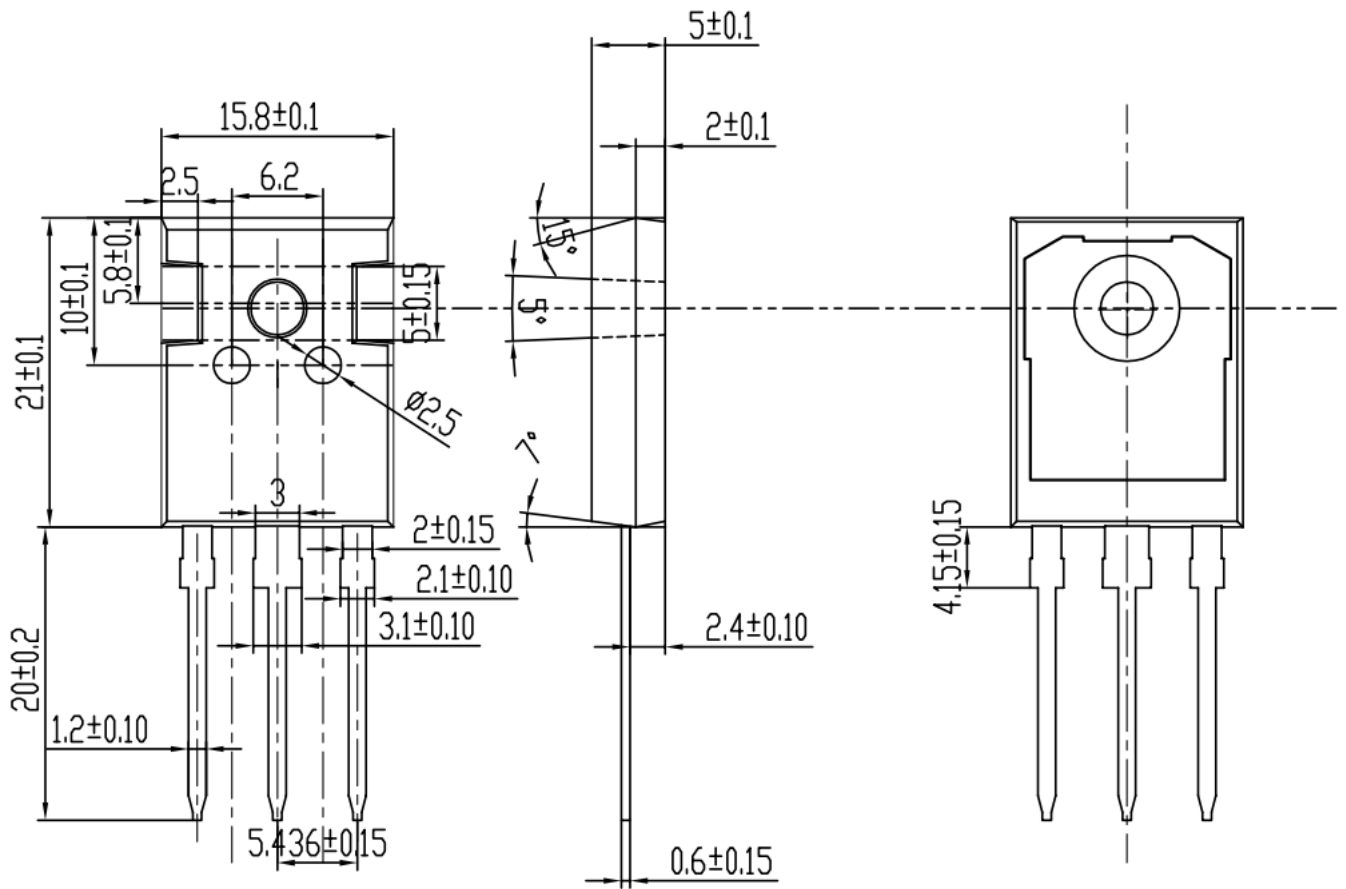
2) definition of switching losses



3) Definition of diode switching characteristics



6 Package Outlines



Outline PG-T0247(HT)

Revision History

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 1.0 | 2023-02-28 | Preliminary version |