

MOSFET Silicon N-Channel MOS

1. Applications

Soft Switching Boost PFC switch, Half bridge or Asymmetric half bridge or Series resonance half bridge and full bridge topologies.
Such as phase-shift-bridge(ZVS),LLC Application-Server Power, Telecom Power, EV Charging,Solar inverter.



2. Features

Low drain-source on-resistance: $R_{DS(ON)} = 1.24\Omega$ (typ.)
Easy to control Gate switching
Enhancement mode: $V_{th} = 2.5$ to 4.5 V

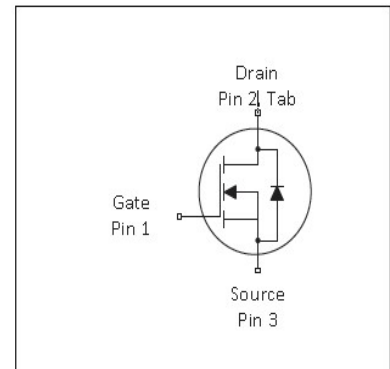
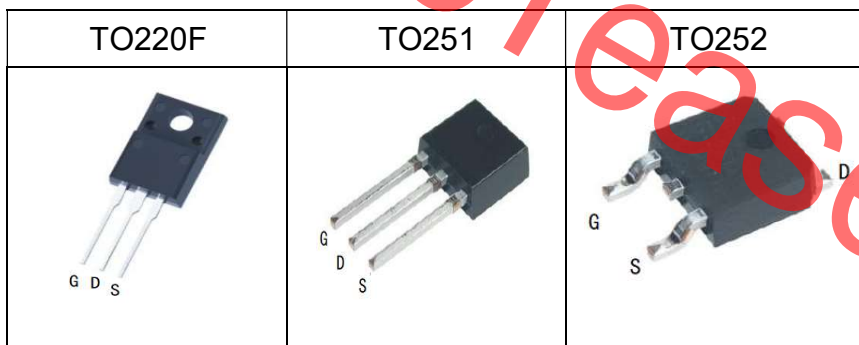


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|----------------------|-------|----------|
| $V_{DS} @ T_{j,max}$ | 700 | V |
| $R_{DS(on),max}$ | 1.4 | Ω |
| $Q_{g,typ}$ | 5.76 | nC |
| $I_{D,pulse}$ | 12 | A |

3. Packaging and Internal Circuit

| Part Name | Package | Marking |
|------------|---------|------------|
| ASA65R1K4E | TO220F | ASA65R1K4E |
| ASU65R1K4E | TO251 | ASU65R1K4E |
| ASD65R1K4E | TO252 | ASD65R1K4E |



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. | | |
| Continuous drain current ¹⁾ | I_D | | - | 4 | A | $T_C = 25^\circ\text{C}$ |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | - | - | 12 | A | $T_C = 25^\circ\text{C}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 125 | mJ | $T_C = 25^\circ\text{C}$, $V_{DD} = 50\text{V}$, $L = 10\text{mH}$, $R_G = 25\Omega$ |
| MOSFET dv/dt ruggedness | dv/dt | - | - | 50 | V/ns | $V_{DS} = 0 \dots 400\text{V}$ |
| Gate source voltage (static) | V_{GS} | -20 | - | 20 | V | static; |
| Gate source voltage (dynamic) | V_{GS} | -30 | - | 30 | V | AC ($f > 1\text{ Hz}$) |
| Power dissipation | P_{tot} | - | - | 28 | W | $T_C = 25^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 | - | 150 | $^\circ\text{C}$ | |
| Operating junction temperature | T_j | -55 | - | 150 | $^\circ\text{C}$ | |
| Reverse diode dv/dt ³⁾ | dv/dt | - | - | 15 | V/ns | $V_{DS} = 0 \dots 400\text{V}$, $I_{SD} \leq I_S$, $T_j = 25^\circ\text{C}$; see table 8 |

¹⁾ Limited by $T_{j,max}$. Maximum Duty Cycle $D = 0.50$

²⁾ Pulse width t_p limited by $T_{j,max}$

³⁾ Identical low side and high side switch with identical R_G

Not for release

2 Thermal characteristics

Table 3 Thermal characteristics (T0220 FullPAK)

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|------------|--------|------|------|------|----------------------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | R_{thJC} | - | - | 5.2 | °C/W | - |
| Thermal resistance, junction - ambient | R_{thJA} | - | - | 62.5 | °C/W | device on PCB, minimal footprint |

Thermal characteristics (T0251 and T0252)

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|------------|--------|------|------|------|----------------------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | R_{thJC} | - | - | 4.4 | °C/W | - |
| Thermal resistance, junction - ambient | R_{thJA} | - | - | 62 | °C/W | device on PCB, minimal footprint |

Not for release

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. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 655 | - | - | V | $V_{GS}=0\text{V}$, $I_D=10\text{mA}$ |
| Gate threshold voltage | $V_{(GS)th}$ | 2.5 | | 4.5 | V | $V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | - | 100 | nA | $V_{DS}=650\text{V}$, $V_{GS}=0\text{V}$, $T_j=25^{\circ}\text{C}$ |
| Gate-source leakage current | I_{GSS} | - | - | 100 | nA | $V_{GS}=30\text{V}$, $V_{DS}=0\text{V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 1.24 | 1.4 | Ω | $V_{GS}=10\text{V}$, $I_D=2\text{A}$, $T_j=25^{\circ}\text{C}$ |
| Gate resistance | R_G | - | 13.4 | - | Ω | $f=1\text{MHz}$, open drain |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 238 | - | pF | $V_{GS}=0\text{V}$, $V_{DS}=50\text{V}$, $f=10\text{kHz}$ |
| Output capacitance | C_{oss} | - | 25 | - | pF | $V_{GS}=0\text{V}$, $V_{DS}=50\text{V}$, $f=10\text{kHz}$ |
| Reverse transfer capacitance | C_{rss} | | 4.2 | | pF | $V_{GS}=0\text{V}$, $V_{DS}=50\text{V}$, $f=10\text{kHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 5.2 | - | ns | $V_{DD}=400\text{V}$, $V_{GS}=13\text{V}$, $I_D=1.2\text{A}$, $R_G=10\Omega$; see table 9 |
| Rise time | t_r | - | 22 | - | ns | $V_{DD}=400\text{V}$, $V_{GS}=13\text{V}$, $I_D=1.2\text{A}$, $R_G=10\Omega$; see table 9 |
| Turn-off delay time | $t_{d(off)}$ | - | 30.4 | - | ns | $V_{DD}=400\text{V}$, $V_{GS}=13\text{V}$, $I_D=1.2\text{A}$, $R_G=10\Omega$; see table 9 |
| Fall time | t_f | - | 25.2 | - | ns | $V_{DD}=400\text{V}$, $V_{GS}=13\text{V}$, $I_D=1.2\text{A}$, $R_G=10\Omega$; see table 9 |

Table 6 Gate charge characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|-----------------------|---------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | | 0.4 | - | nC | $V_{DD}=400\text{V}$, $I_D=1.2\text{A}$, $V_{GS}=0$ to 10V |
| Gate to drain charge | Q_{gd} | - | 1.5 | - | nC | $V_{DD}=400\text{V}$, $I_D=1.2\text{A}$, $V_{GS}=0$ to 10V |
| Gate charge total | Q_g | - | 5.76 | - | nC | $V_{DD}=400\text{V}$, $I_D=1.2\text{A}$, $V_{GS}=0$ to 10V |
| Gate plateau voltage | $V_{plateau}$ | - | 4.2 | - | V | $V_{DD}=400\text{V}$, $I_D=1.2\text{A}$, $V_{GS}=0$ to 10V |

Table 7 Reverse diode characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|-------------------------------|-----------|--------|-------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Diode forward voltage | V_{SD} | - | 0.79 | - | V | $V_{GS}=0V, I_F=1A, T_j=25^{\circ}C$ |
| Reverse recovery time | t_{rr} | - | 158 | - | ns | $V_R=400V, I_F=49.6A, di_F/dt=100A/\mu s$; see table 8 |
| Reverse recovery charge | Q_{rr} | - | 0.412 | - | uC | $V_R=400V, I_F=49.6A, di_F/dt=100A/\mu s$; see table 8 |
| Peak reverse recovery current | I_{rrm} | - | 5.92 | - | A | $V_R=400V, I_F=49.6A, di_F/dt=100A/\mu s$; see table 8 |

release

4 Electrical characteristics diagram

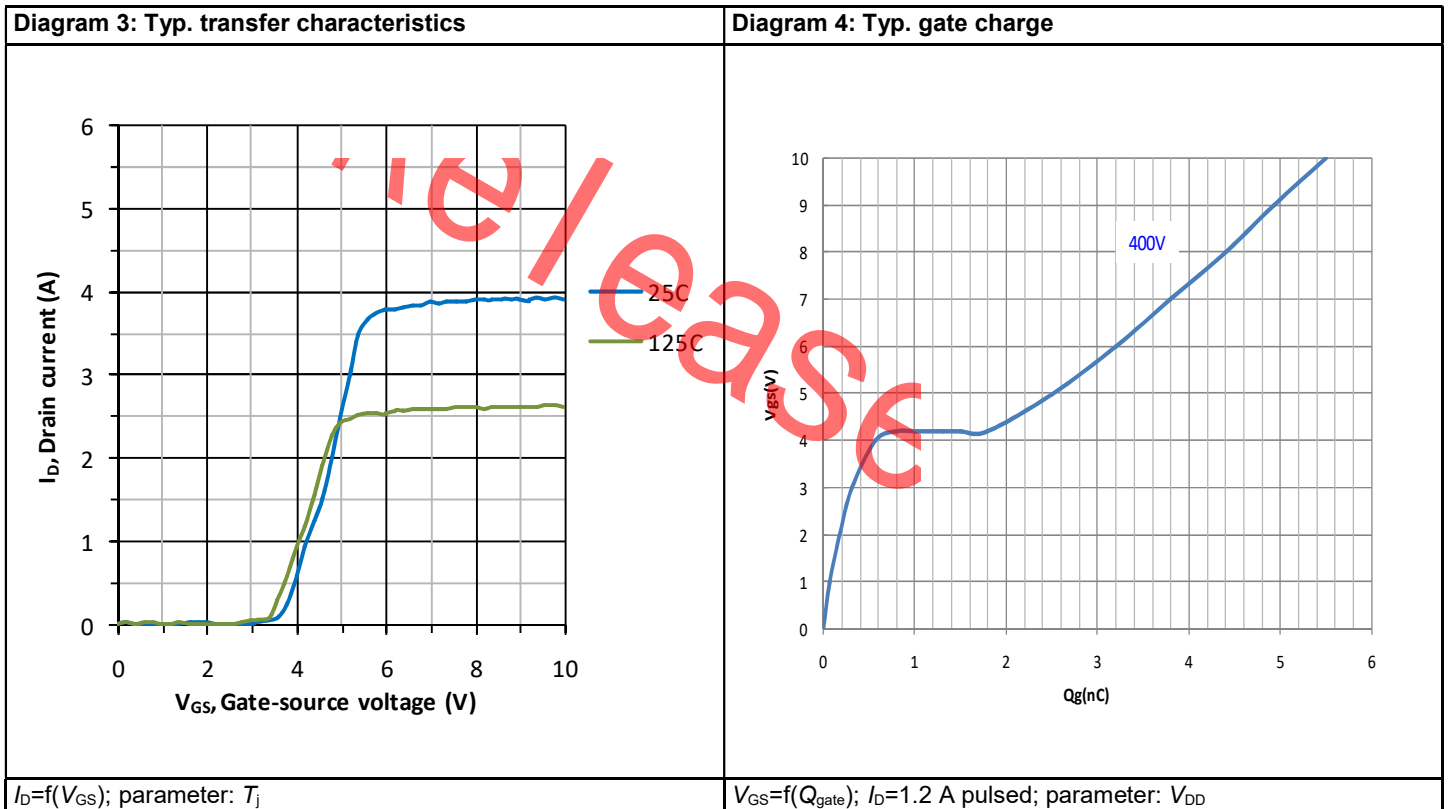
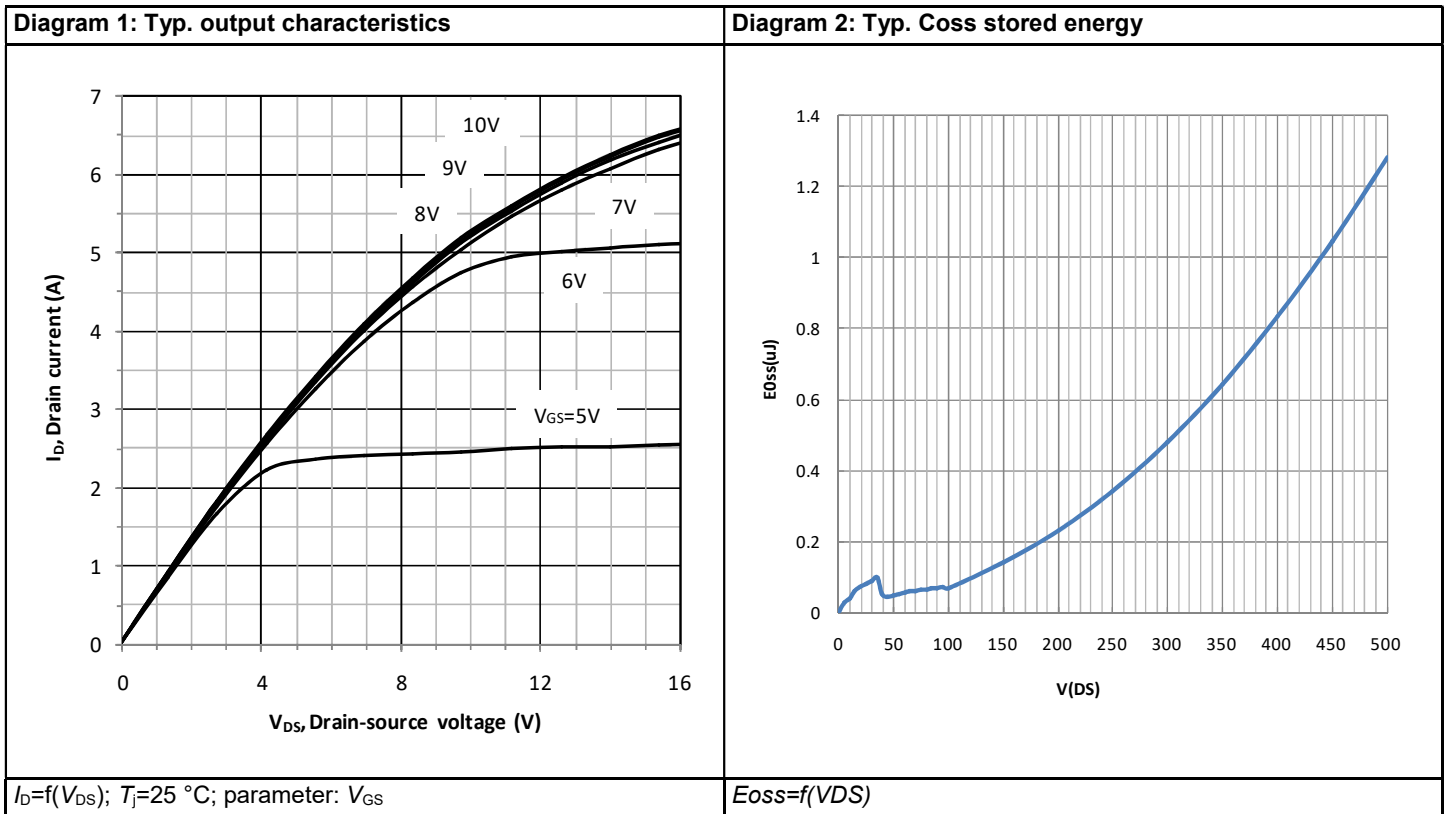
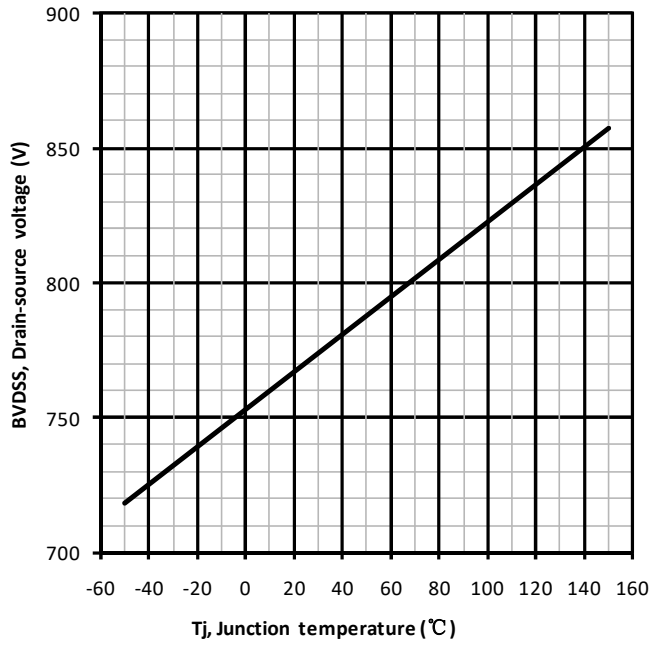
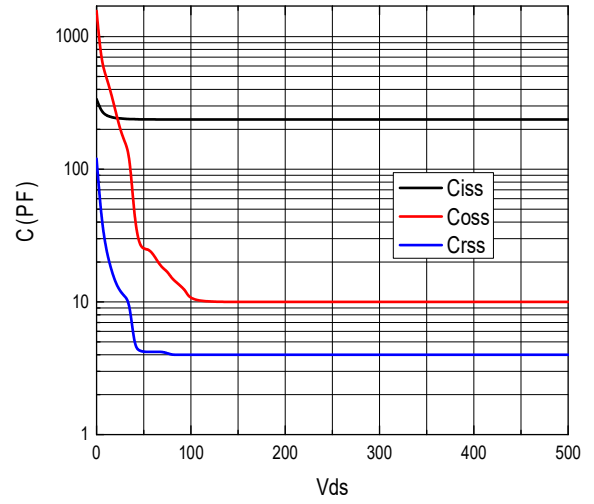


Diagram 5: Drain-source breakdown voltage



$V_{BR(DSS)}=f(T_j); I_D=10\text{ mA}$

Diagram 6: Typ. capacitances



$C=f(V_{DS}); V_{GS}=0\text{ V}; f=10\text{ kHz}$

release

5 Test Circuits

Table 8 Diode characteristics

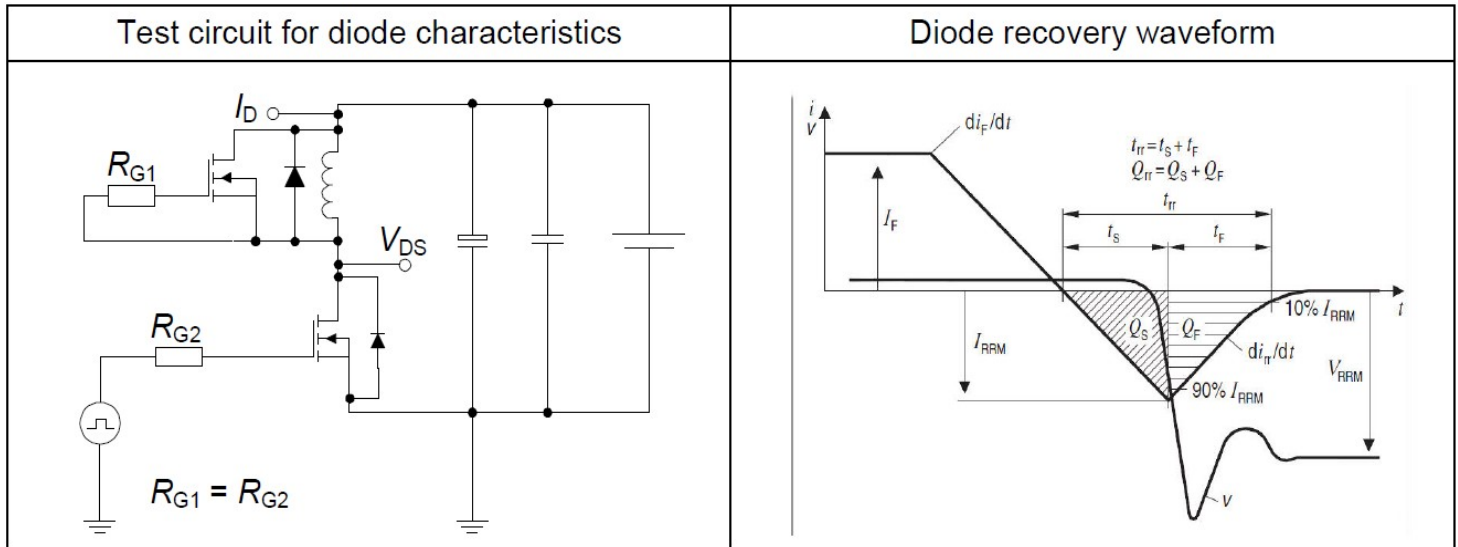


Table 9 Switching times

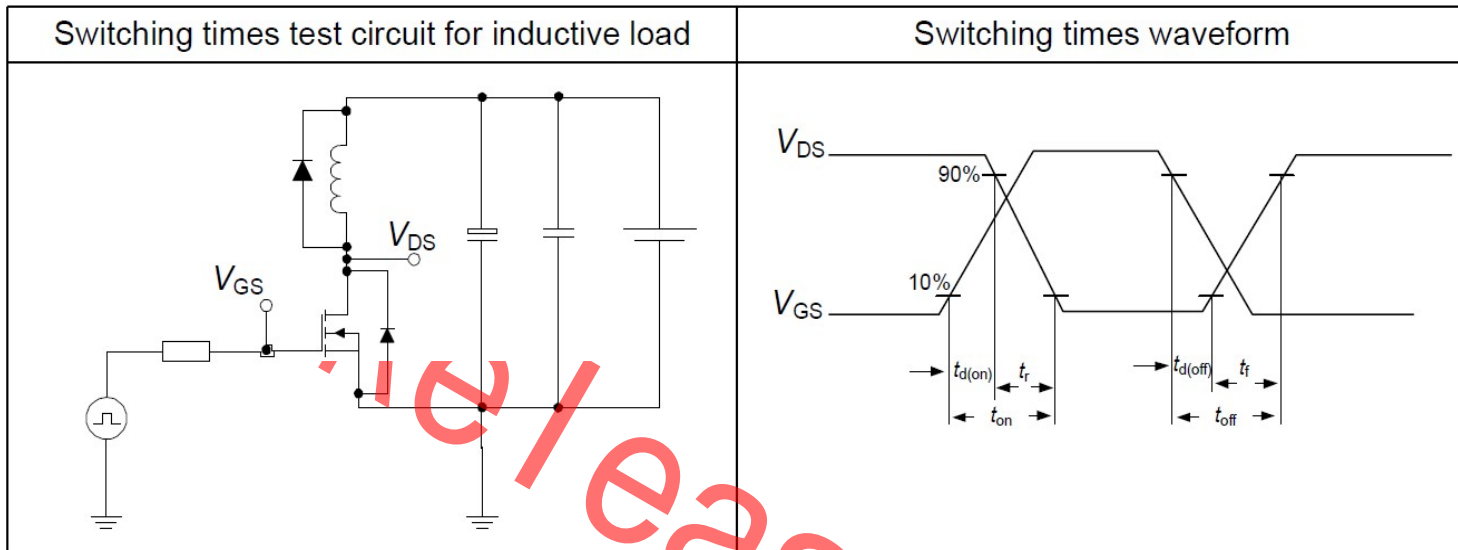
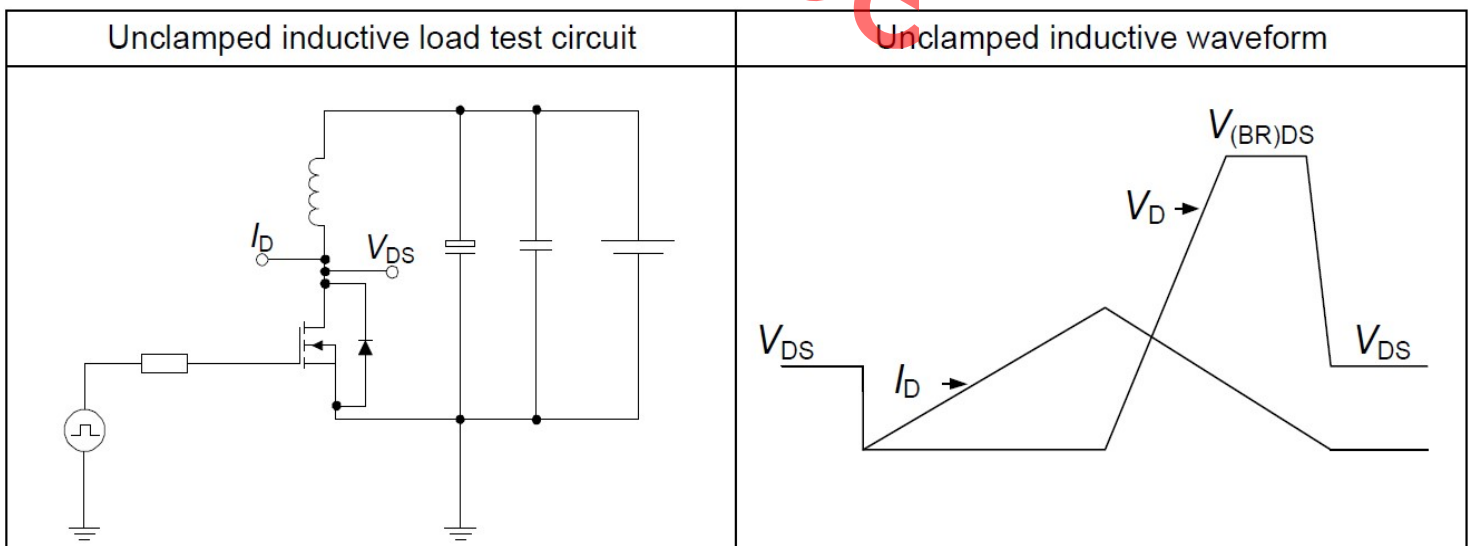


Table 10 Unclamped inductive load



6 Package Outlines

TO-220F

单位: mm

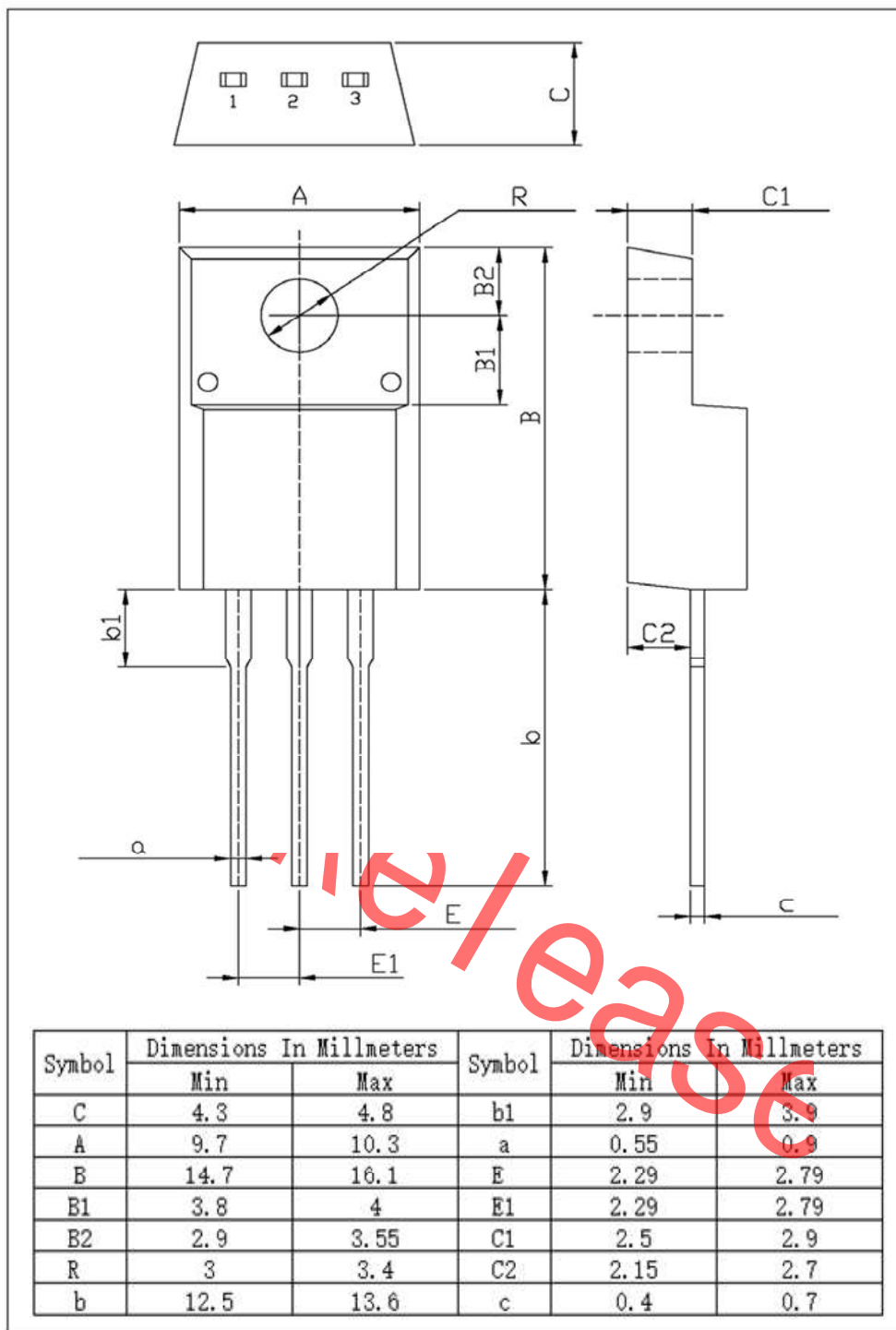
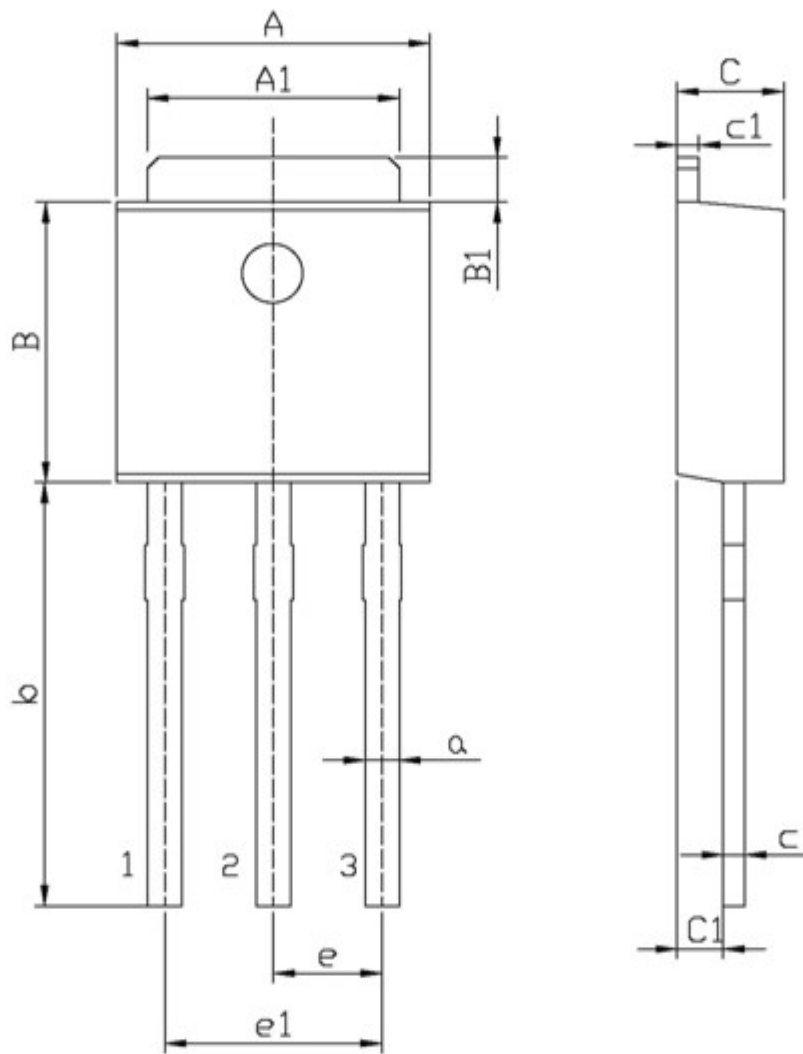


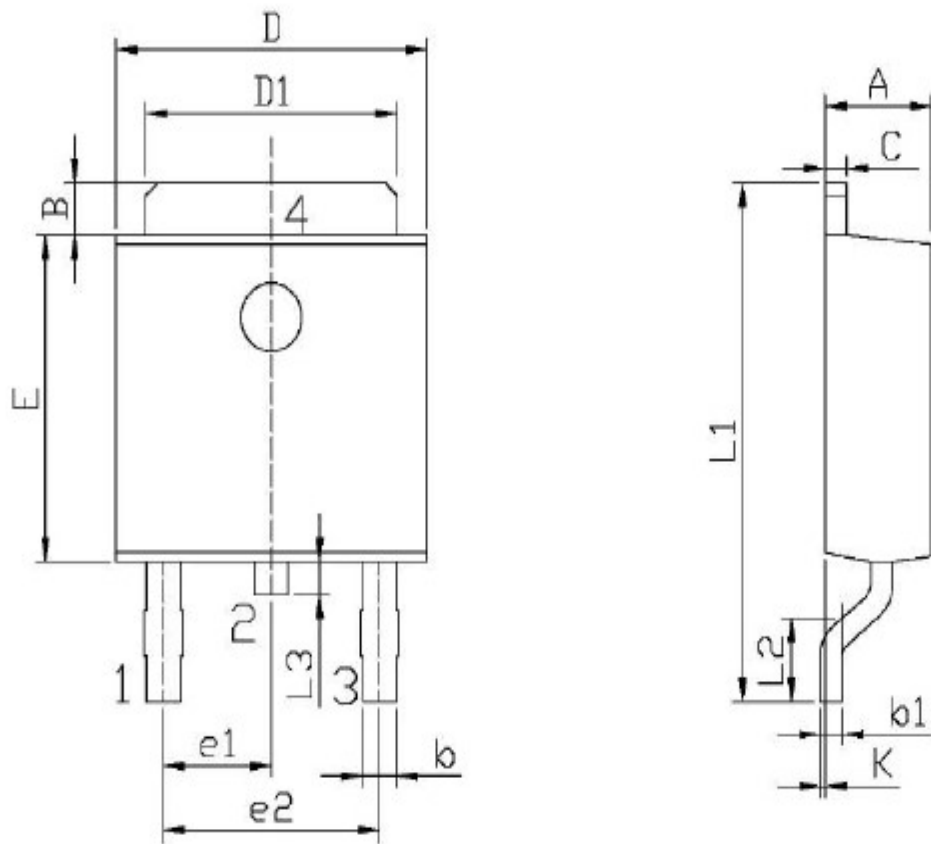
Figure1: Outline PG-TO220F



单位: mm

| Symbol | Dimensions In Millimeters | | Symbol | Dimensions In Millimeters | |
|--------|---------------------------|------|--------|---------------------------|------|
| | Min | Max | | Min | Max |
| A | 6.45 | 6.75 | a | 0.50 | 0.70 |
| A1 | 5.10 | 5.50 | b | 9.00 | 9.40 |
| B | 5.95 | 6.25 | c | 0.45 | 0.55 |
| B1 | 0.95 | 1.25 | c1 | 0.45 | 0.55 |
| C | 2.20 | 2.40 | e | 2.24 | 2.34 |
| C1 | 0.95 | 1.15 | e1 | 4.43 | 4.73 |

Figure2: Outline PG-T0251



单位: mm

| Symbol | Dimensions In Millimeters | | Symbol | Dimensions In Millimeters | |
|--------|---------------------------|------|--------|---------------------------|------|
| | Min | Max | | Min | Max |
| A | 2.20 | 2.40 | E | 5.95 | 6.25 |
| B | 0.95 | 1.25 | e1 | 2.24 | 2.34 |
| b | 0.50 | 0.70 | e2 | 4.43 | 4.73 |
| b1 | 0.45 | 0.55 | L1 | 9.45 | 9.95 |
| C | 0.45 | 0.55 | L2 | 1.25 | 1.75 |
| D | 6.45 | 6.75 | L3 | 0.60 | 0.90 |
| D1 | 5.10 | 5.50 | K | 0.00 | 0.10 |

Figure3: Outline PG-T0252

Revision History

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 1.0 | 2020-07-15 | Preliminary version |

Pre-release