

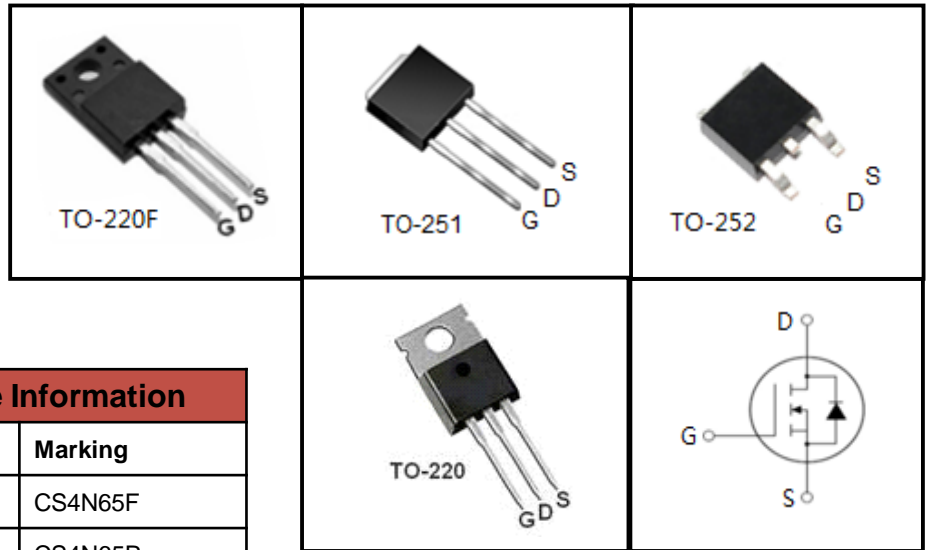
650V N-Channel MOSFET

FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information

| Device | Package | Marking |
|---------|---------|---------|
| CS4N65F | TO-220F | CS4N65F |
| CS4N65P | TO-220 | CS4N65P |
| CS4N65U | TO-251 | CS4N65U |
| CS4N65D | TO-252 | CS4N65D |

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted

| Parameter | Symbol | Value | | | | Unit |
|--|----------------|----------|--------|--------|--------|------------------|
| | | TO-220F | TO-220 | TO-251 | TO-252 | |
| Drain-Source Voltage ($V_{GS} = 0V$) | V_{DSS} | 650 | | | | V |
| Continuous Drain Current | I_D | 4 | | | | A |
| Pulsed Drain Current (note1) | I_{DM} | 16 | | | | A |
| Gate-Source Voltage | V_{GSS} | ± 20 | | | | V |
| Single Pulse Avalanche Energy (note2) | E_{AS} | 76 | | | | mJ |
| Avalanche Current (note1) | I_{AS} | 4 | | | | A |
| Repetitive Avalanche Energy (note1) | E_{AR} | 45 | | | | mJ |
| Power Dissipation ($T_C = 25^\circ\text{C}$) | P_D | 20 | 25 | | | W |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55~+150 | | | | $^\circ\text{C}$ |

Thermal Resistance

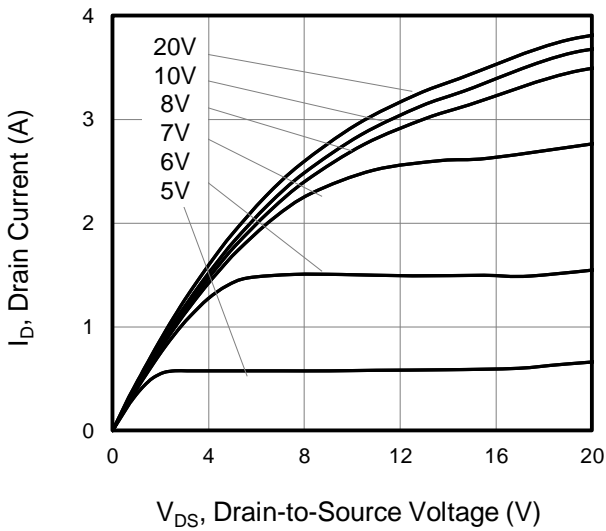
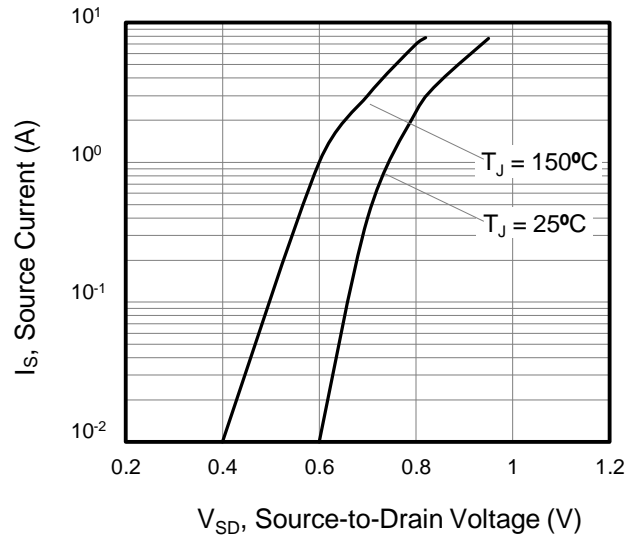
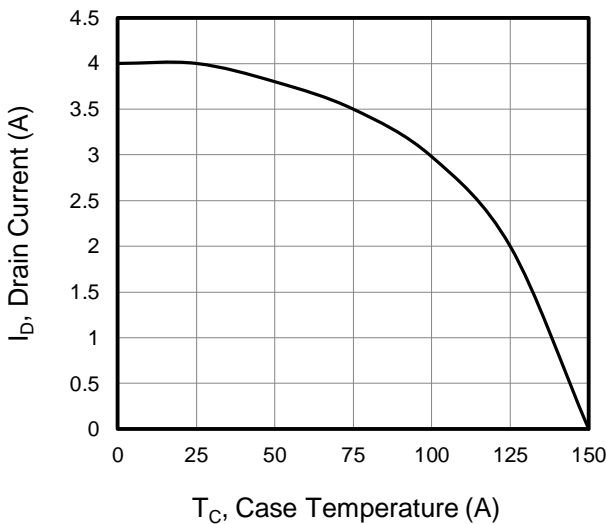
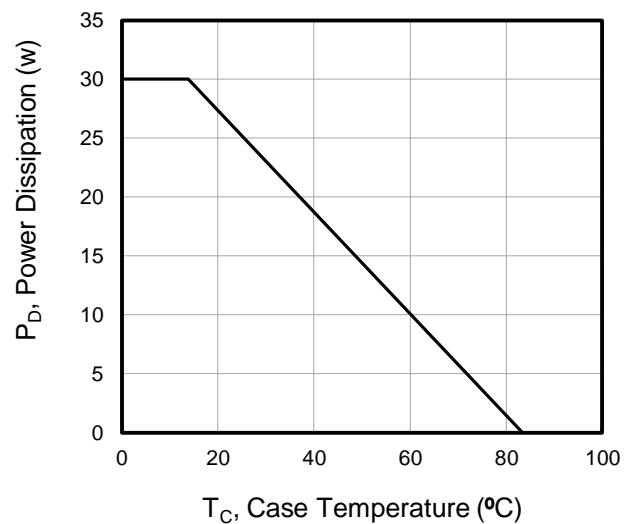
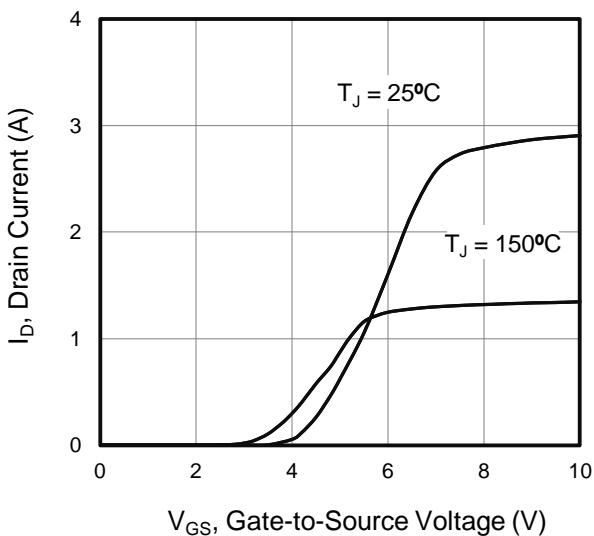
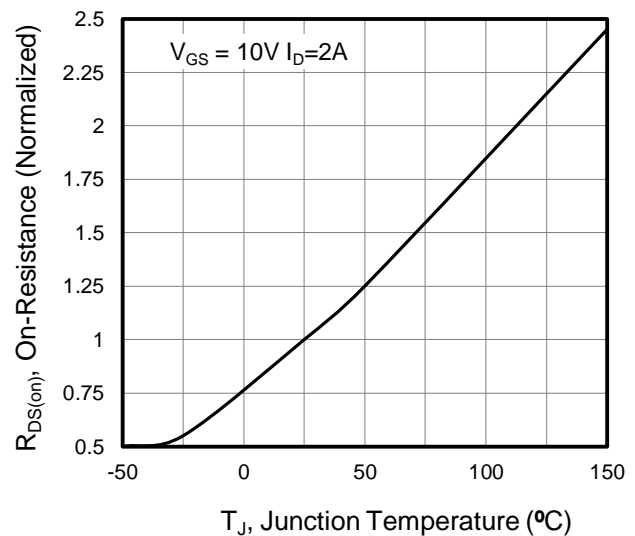
| Parameter | Symbol | Value | | | | Unit |
|---|------------|---------|--------|--------|--------|------|
| | | TO-220F | TO-251 | TO-252 | TO-220 | |
| Thermal Resistance, Junction-to-Case | R_{thJC} | 6.25 | 5 | | | K/W |
| Thermal Resistance, Junction-to-Ambient | R_{thJA} | 62.5 | 60 | | | |

| Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted | | | | | | |
|--|---------------|--|-------|------|-----------|----------|
| Parameter | Symbol | Test Conditions | Value | | | Unit |
| | | | Min. | Typ. | Max. | |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$ | 650 | -- | -- | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$ | -- | -- | 1 | μA |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 20V$ | -- | -- | ± 100 | nA |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 3.0 | -- | 4.0 | V |
| Drain-Source On-Resistance (Note3) | $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 2A$ | -- | 2 | 2.4 | Ω |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$ | -- | 545 | -- | pF |
| Output Capacitance | C_{oss} | | -- | 53 | -- | |
| Reverse Transfer Capacitance | C_{rss} | | -- | 4.5 | -- | |
| Total Gate Charge | Q_g | $V_{DD} = 520V, I_D = 4A,$ $V_{GS} = 10V$ | -- | 15 | -- | nC |
| Gate-Source Charge | Q_{gs} | | -- | 3 | -- | |
| Gate-Drain Charge | Q_{gd} | | -- | 7 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD} = 250V, I_D = 4A,$ $R_G = 25\Omega$ | -- | 36 | -- | ns |
| Turn-on Rise Time | t_r | | -- | 13 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 80 | -- | |
| Turn-off Fall Time | t_f | | -- | 24 | -- | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Body Diode Current | I_S | $T_C = 25^\circ\text{C}$ | -- | -- | 4 | A |
| Pulsed Diode Forward Current | I_{SM} | | -- | -- | 16 | |
| Body Diode Voltage | V_{SD} | $T_J = 25^\circ\text{C}, I_{SD} = 2.0A, V_{GS} = 0V$ | -- | -- | 1.4 | V |
| Reverse Recovery Time | t_{rr} | $V_{GS} = 0V, I_S = 4A,$ $di_F/dt = 100A/\mu s$ | -- | 550 | -- | ns |
| Reverse Recovery Charge | Q_{rr} | | -- | 1.38 | -- | μC |

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 10.0\text{mH}, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 1\%$

Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics ($T_J = 25^\circ\text{C}$)

Figure 2. Body Diode Forward Voltage

Figure 3. Drain Current vs. Temperature

Figure 4. Power Dissipation vs. Temperature

Figure 5. Transfer Characteristics

Figure 6. On-Resistance vs. Temperature


Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

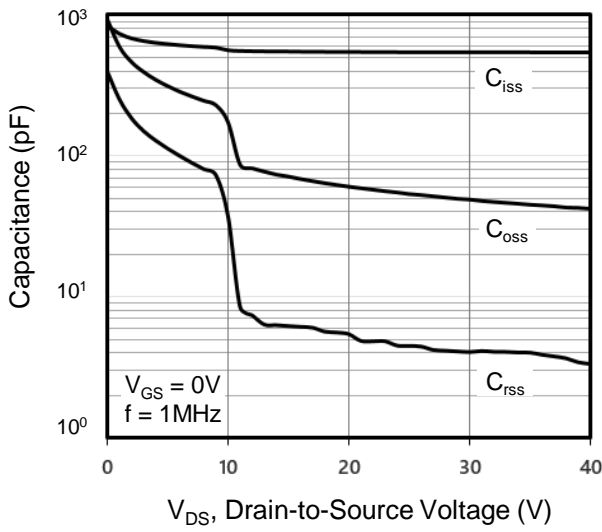
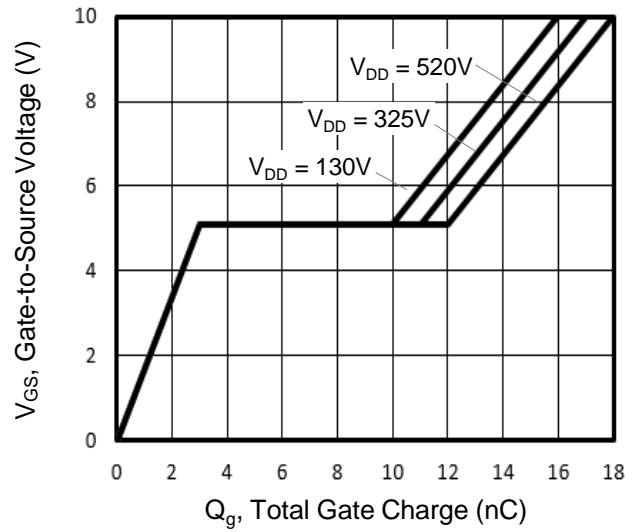
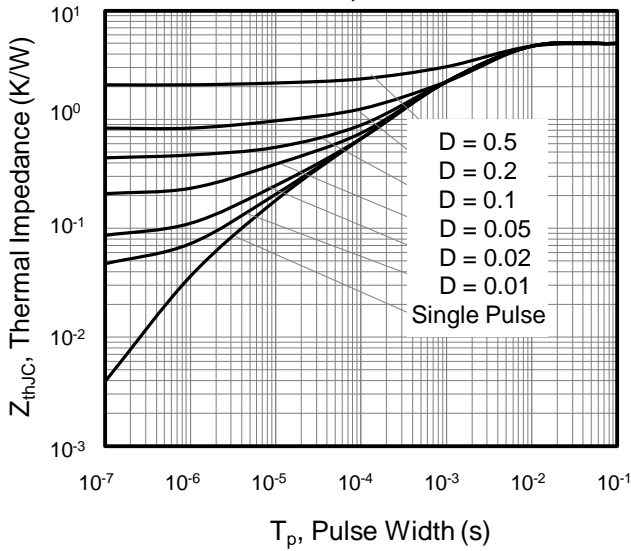
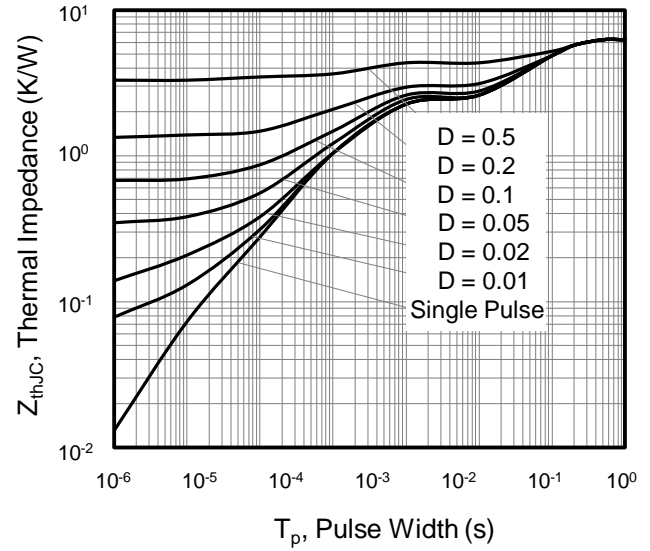
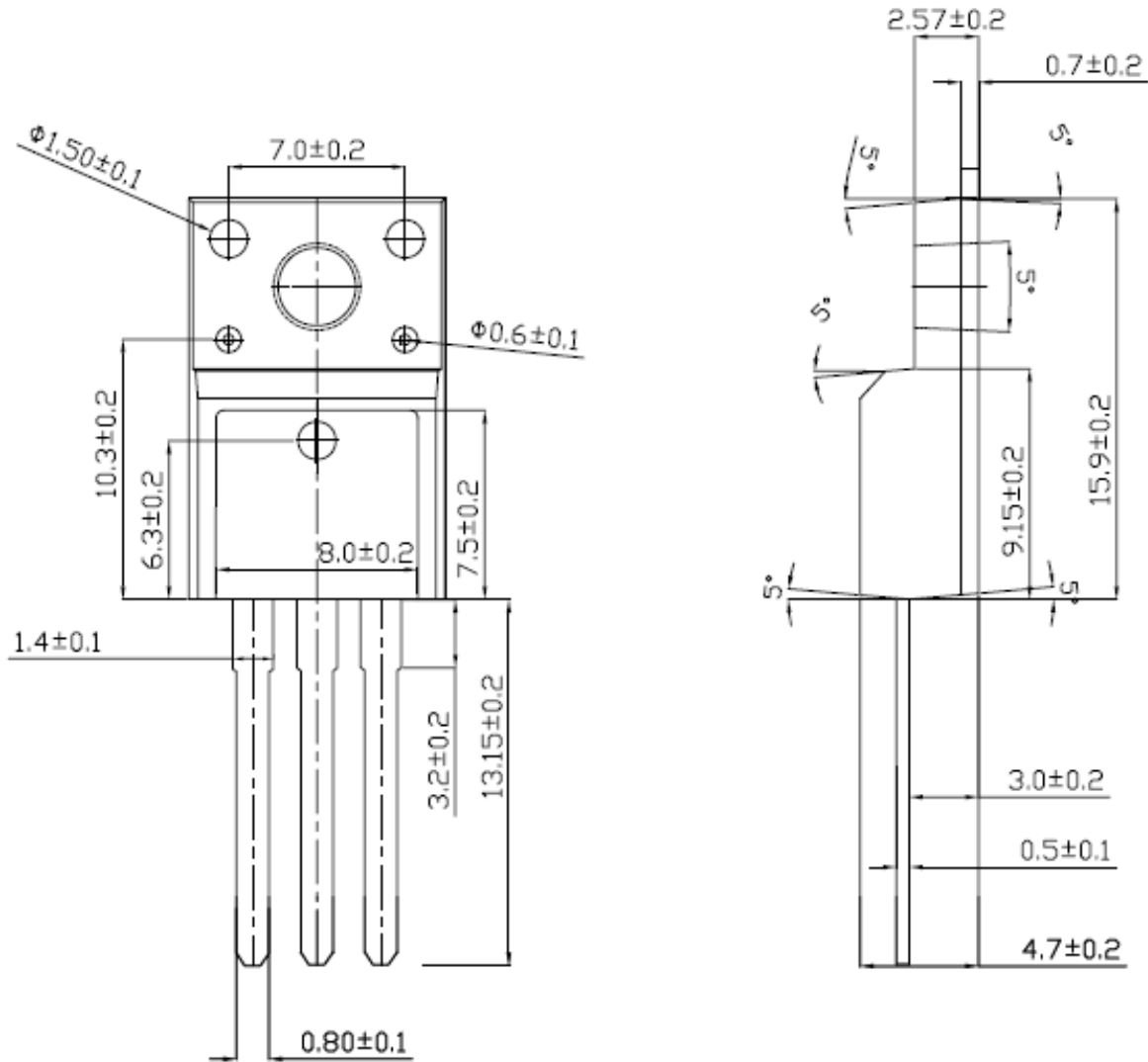
Figure 7. Capacitance

Figure 8. Gate Charge

Figure 9. Transient Thermal Impedance TO-251, TO-252

Figure 10. Transient Thermal Impedance TO-220F


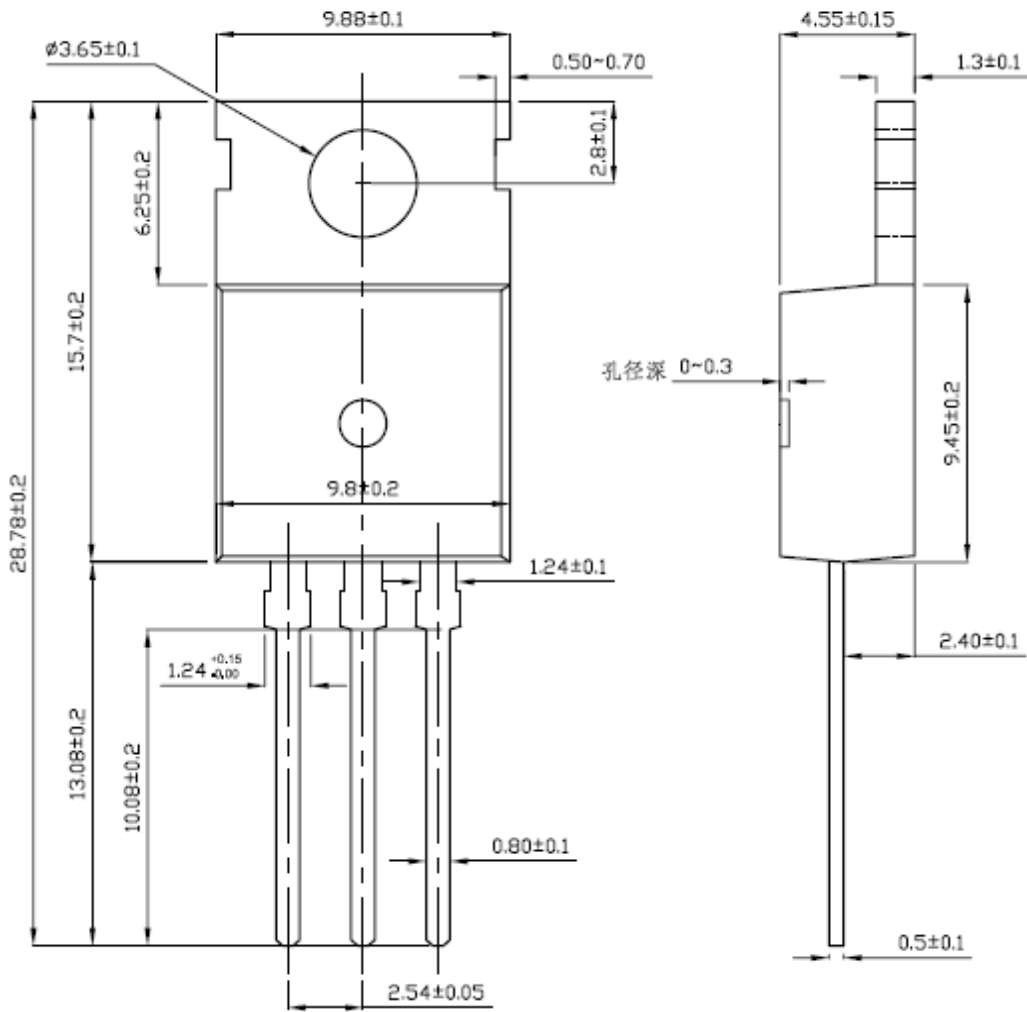
Figure A: Gate Charge Test Circuit and Waveform

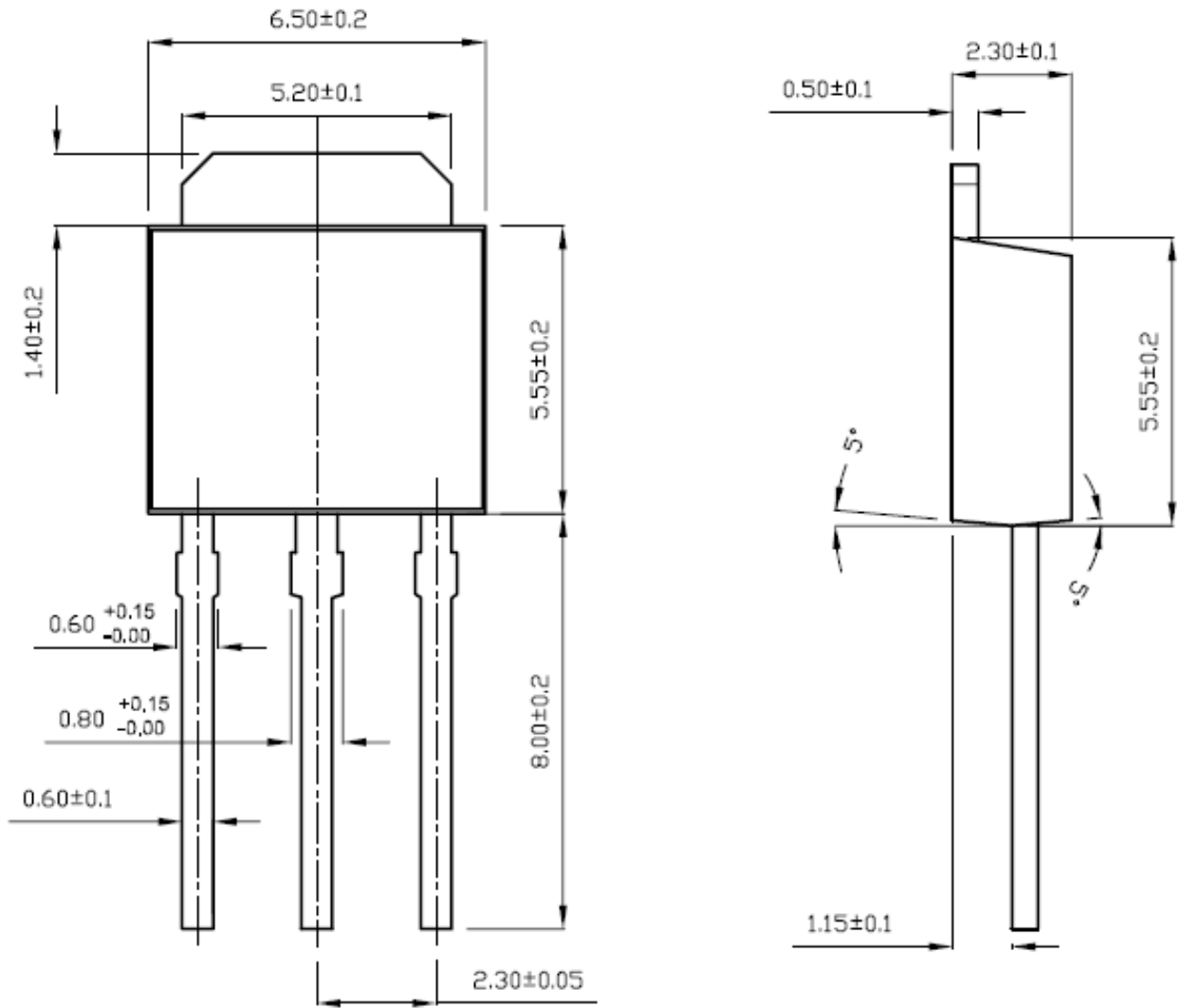
Figure B: Resistive Switching Test Circuit and Waveform

Figure C: Unclamped Inductive Switching Test Circuit and Waveform

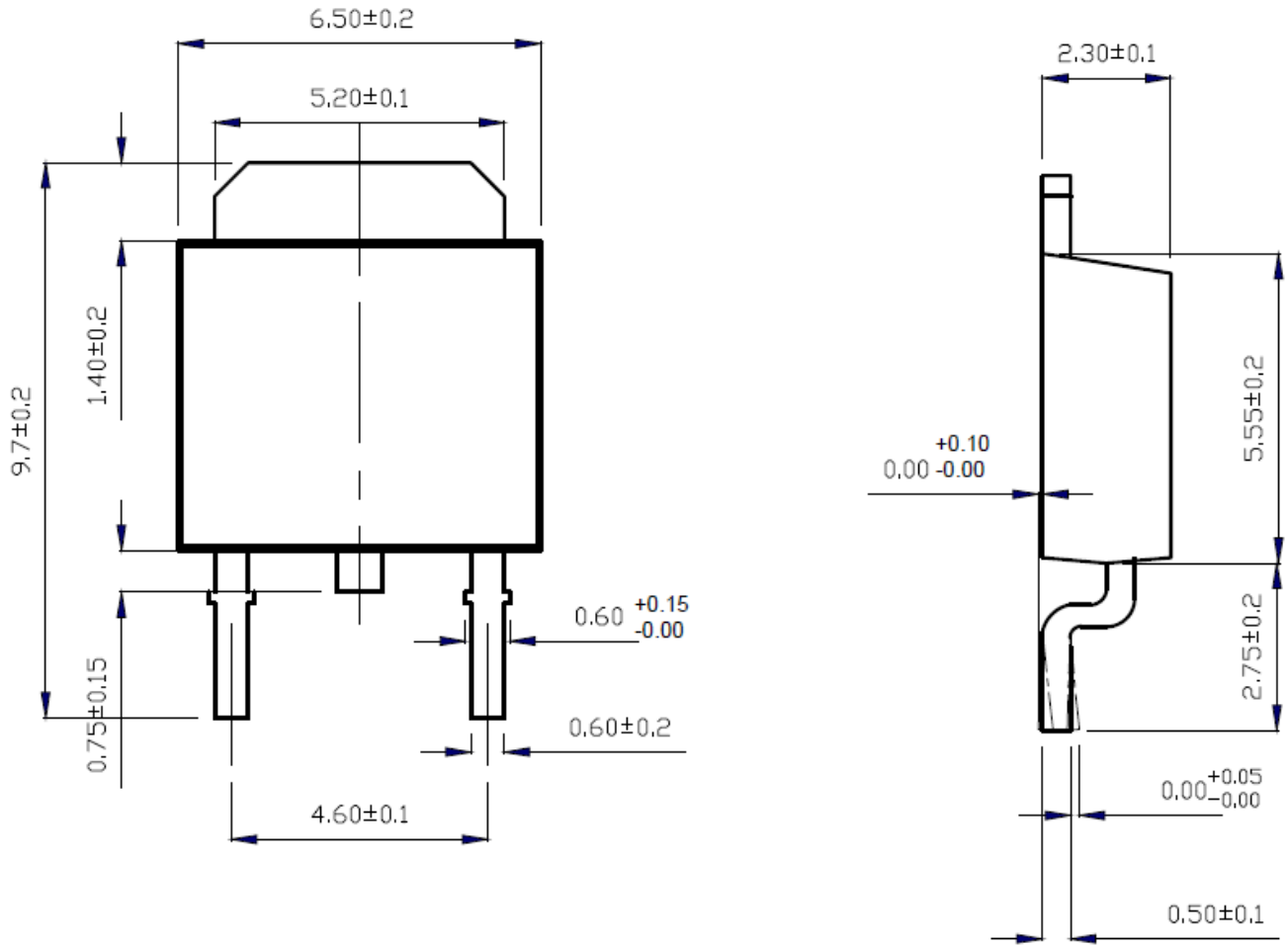

TO-220F


TO-220



TO-251


TO-252



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