

General Description

These N-channel enhancement mode power mosfets used advanced trench technology design, provided excellent $R_{DS(on)}$ and low gate charge. Which accords with the RoHS standard.

Features

- Fast switching
- Low reverse transfer capacitances
- Low gate charge and Low on-resistance
- 100% avalanche tested

Mechanical Data

- Case: TO-220, ITO-220, TO-263, TO-262, TO-251, TO-252 Package

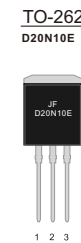
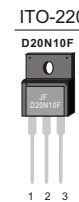
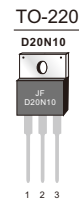
Application

- Power switching applications
- Inverter management system
- Electric tools
- DC-DC converters

Ordering Information

| Part No. | Package Type | Package | Quantity(box) |
|----------|--------------|-------------|---------------|
| D20N10 | TO-220 | Tube | 1000 |
| D20N10F | ITO-220 | Tube | 1000 |
| D20N10D | TO-263 | Tape & Reel | 800 |
| D20N10E | TO-262 | Tube | 1000 |
| D20N10N | TO-251 | Tube | 1000 |
| D20N10M | TO-252 | Tape & Reel | 2500 |

| Product Summary | | | |
|-----------------|--------------------------------|-----------|-------------|
| V_{DS} | $R_{DS(on)}$ (m Ω) Typ | I_D (A) | Q_g (Typ) |
| 100V | 25 @ 10V 20A | 20 | 14.1nc |



Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

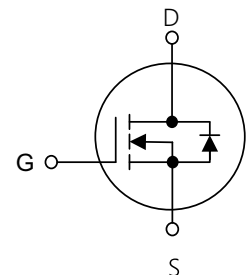


Table1 Absolute Maximum Ratings ($T_c=25^\circ\text{C}$, unless otherwise specified)

| Parameter | Symbol | D20N10/D20N10D/D20N10E D20N10M/D20N10N | D20N20F | Unit |
|--|-------------------------|---|---------|------------------|
| Drain-Source Voltage | V_{DS} | 100 | | V |
| Gate-Source Voltage | V_{GS} | ± 20 | | V |
| Continuous Drain Current | $T_c=25^\circ\text{C}$ | 20 | 20 * | A |
| | $T_c=100^\circ\text{C}$ | 16 | 16 * | |
| Pulsed Drain Current (Note 1) | I_{DM} | 80 | | A |
| Single Pulse Avalanche Energy(Note 2) | E_{AS} | 64 | | mJ |
| Avalanche Current(Note 2) | I_{AR} | 16 | | A |
| Power Dissipation $T_c=25^\circ\text{C}$ | P_D | 45 | 20 | W |
| Operating Junction and Storage Temperature | T_J/T_{STG} | -55~+175 | | $^\circ\text{C}$ |

※ limited by maximum junction temperature

Table 2. Thermal Characteristics

| Parameter | Symbol | D20N10/D20N10D/ D20N10M/D20N10N D20N10E | D20N10F | Unit |
|--|-----------------|---|---------|-----------------------------|
| Thermal resistance Junction to Ambient | $R_{\theta JA}$ | 75 | 75 | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance Junction to Case | $R_{\theta JC}$ | 3.33 | 7.5 | $^{\circ}\text{C}/\text{W}$ |

Table 3. Electrical Characteristics (Tc=25°C, unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--|--------------|---|-----|------|------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 100 | - | - | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS}=100V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate- Source Leakage Current | Forward | I_{GSS} | - | - | 100 | nA |
| | Reverse | | | | -100 | nA |
| On Characteristics(Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.0 | 1.6 | 1.5 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=20A$ | - | 25 | 30 | m Ω |
| Dynamic Characteristics(Note 4) | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=50V, V_{GS}=0V, f=1\text{MHz}$ | - | 967 | - | pF |
| Output Capacitance | C_{OSS} | | - | 105 | - | pF |
| Reverse Transfer Capacitance | C_{RSS} | | - | 17 | - | pF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}=50V, I_D=13A$ $V_{GS}=10V, R_{GEN}=1.6\Omega,$ | - | 7.8 | - | ns |
| Turn-On Rise Time | t_r | | - | 24.5 | - | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 10.6 | - | ns |
| Turn-Off Fall Time | t_f | | - | 25 | - | ns |
| Total Gate Charge | Q_G | $V_{DD}=50V, I_D=13A,$ $V_{GS}=10V$ | - | 14.1 | - | nC |
| Gate-Source Charge | Q_{GS} | | - | 6.35 | - | nC |
| Gate-Drain Charge | Q_{GD} | | - | 1.72 | - | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_S=20A$ | - | - | 1.2 | V |
| Maximum Continuous Drain-Source Diode Forward Current | I_S | | - | - | 20 | A |
| Reverse Recovery Time | t_{rr} | $V_{GS}=0V, I_F=20A$ $di_F/dt=100A/\mu s(\text{Note 1})$ | - | 33 | - | ns |
| Reverse Recovery Charge | Q_{RR} | | - | 29 | - | nC |

Notes: 1 Repetitive Rating:Pulse width limited by maximum junction temperature

2 L=0.5mH, I_D=16A, V_{DD}=80V, V_{GATE}=20V, Starting T_J=25°C

3 Pulse Test: Pulse width ≤300μs, Duty cycle ≤2%

4 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Figure 1. Output Characteristics

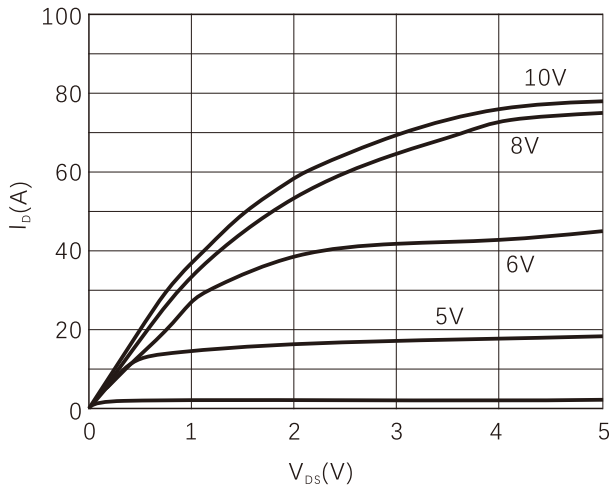


Figure 2. Transfer Characteristics

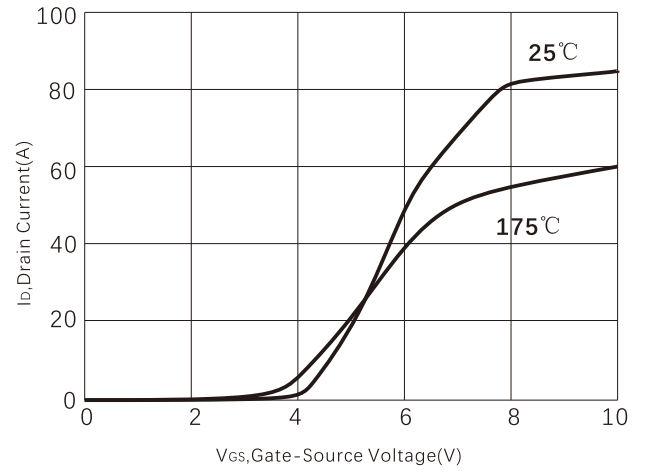


Figure 3. $R_{DS(ON)}$ vs Drain Current

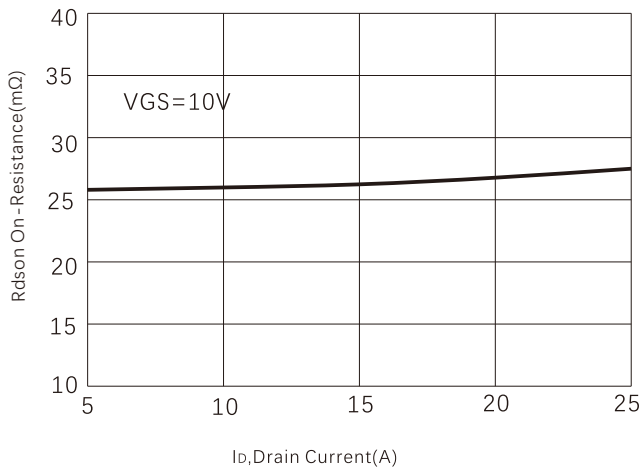


Figure 4. Capacitance

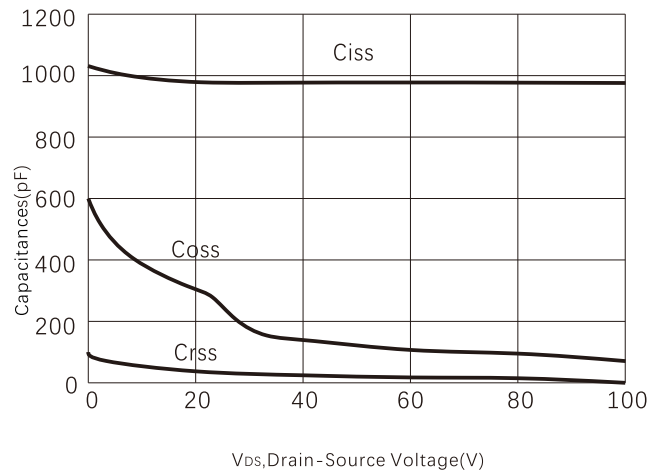


Figure 5. Gate charge

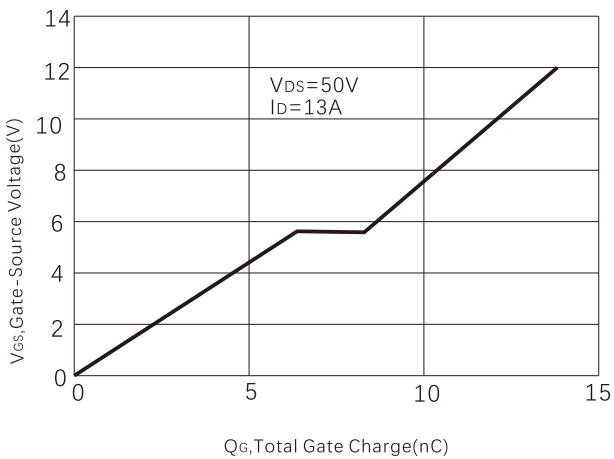


Figure 6. Drain Current

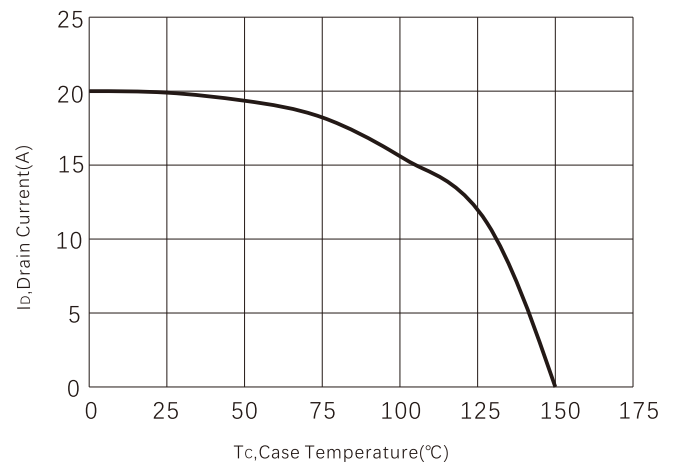


Figure 7. $R_{DS(ON)}$ vs Junction Temperature

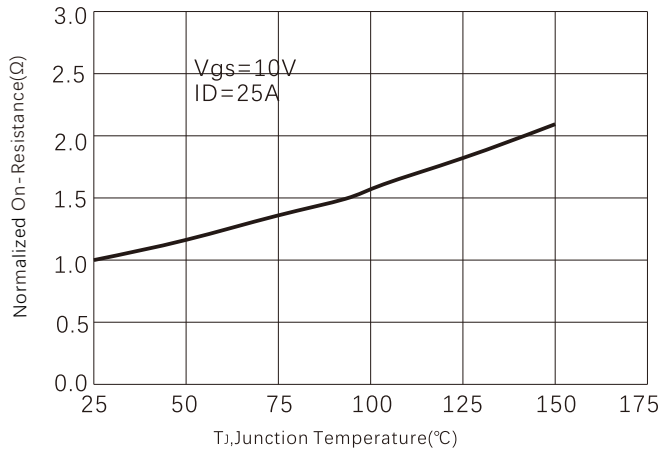


Figure 8. Power dissipation

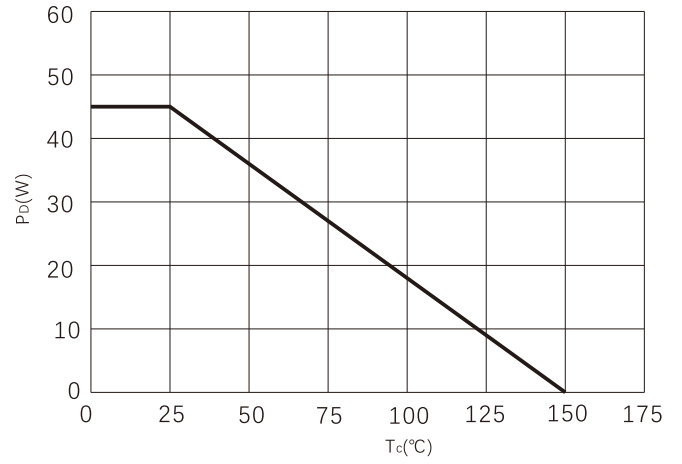
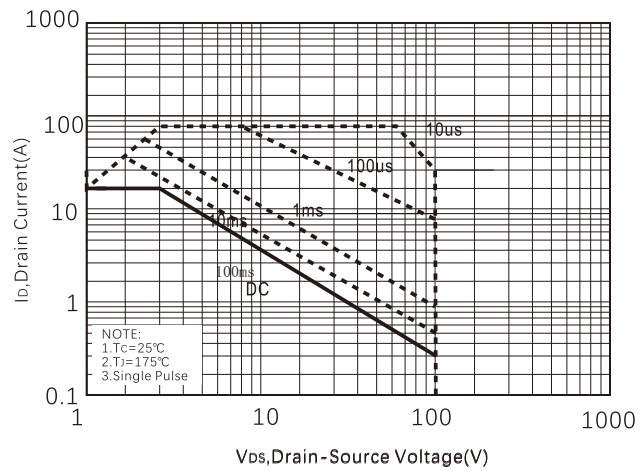
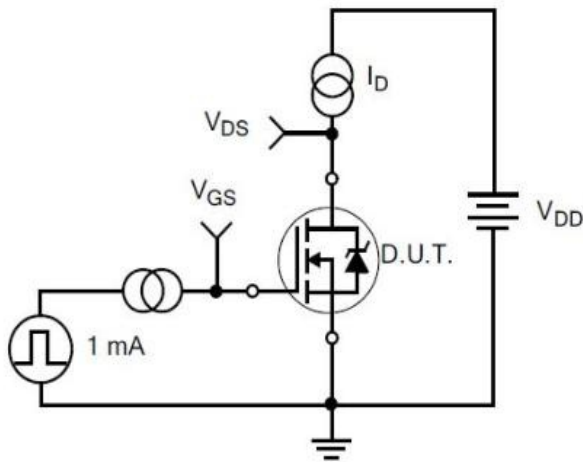


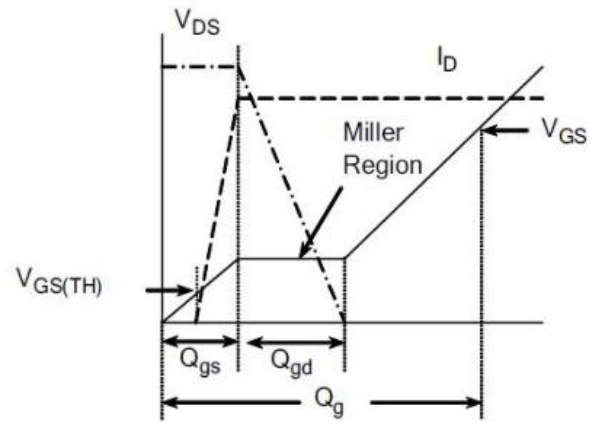
Figure 9. Safe operating area



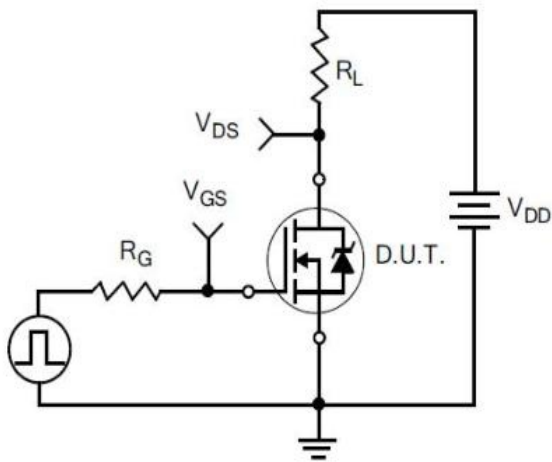
Typical Test Circuit



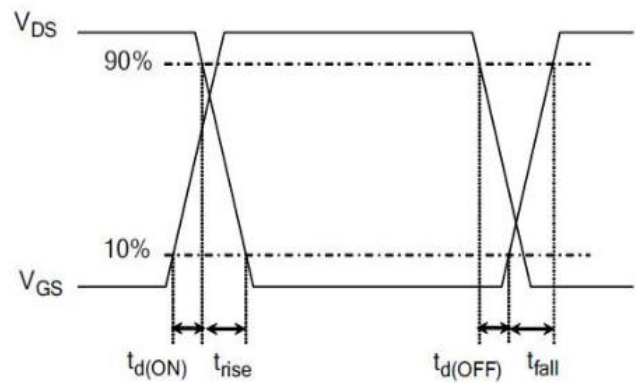
1) Gate Charge Test Circuit



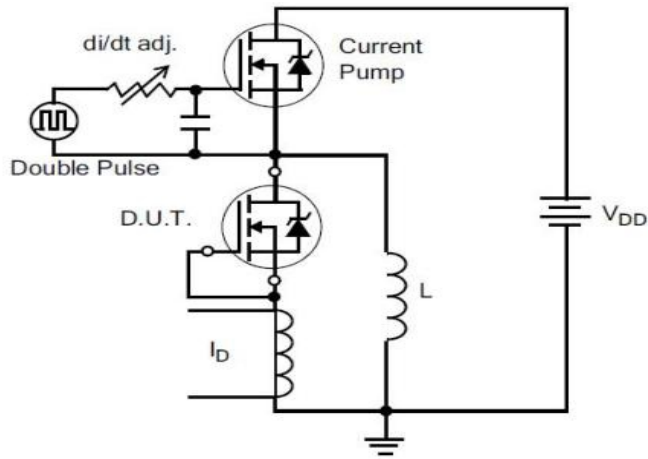
2) Gate Charge Waveform



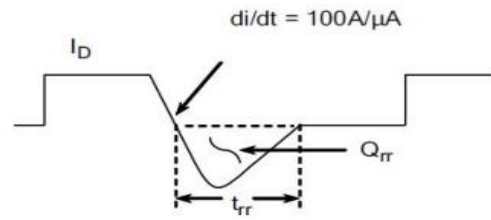
3) Resistive Switching Test Circuit



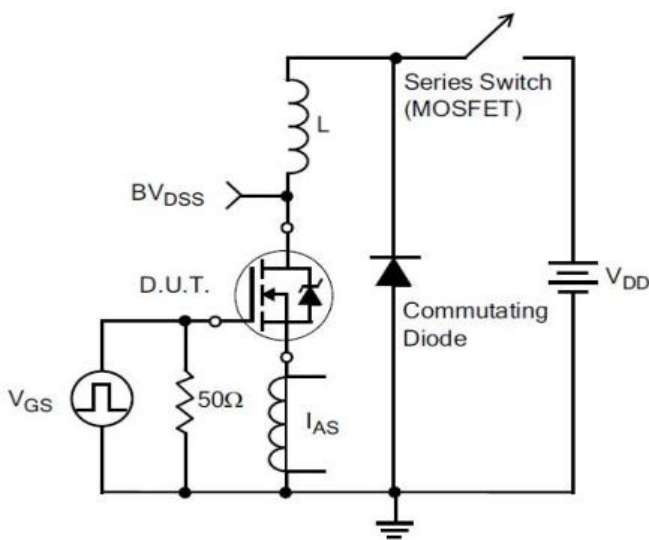
4) Resistive Switching Waveforms



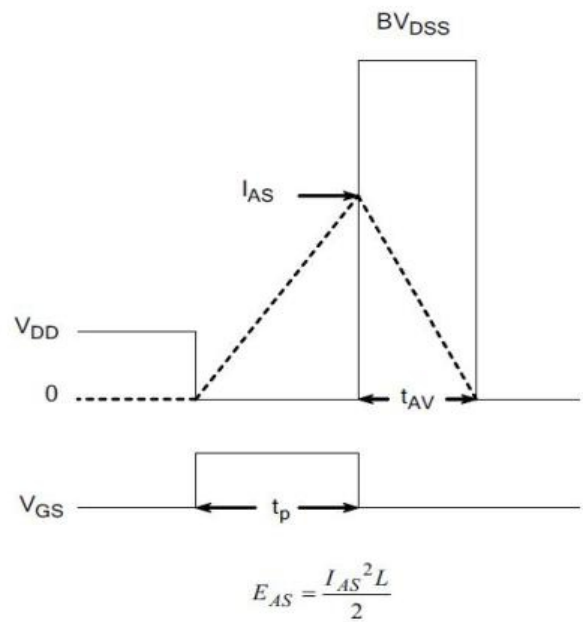
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



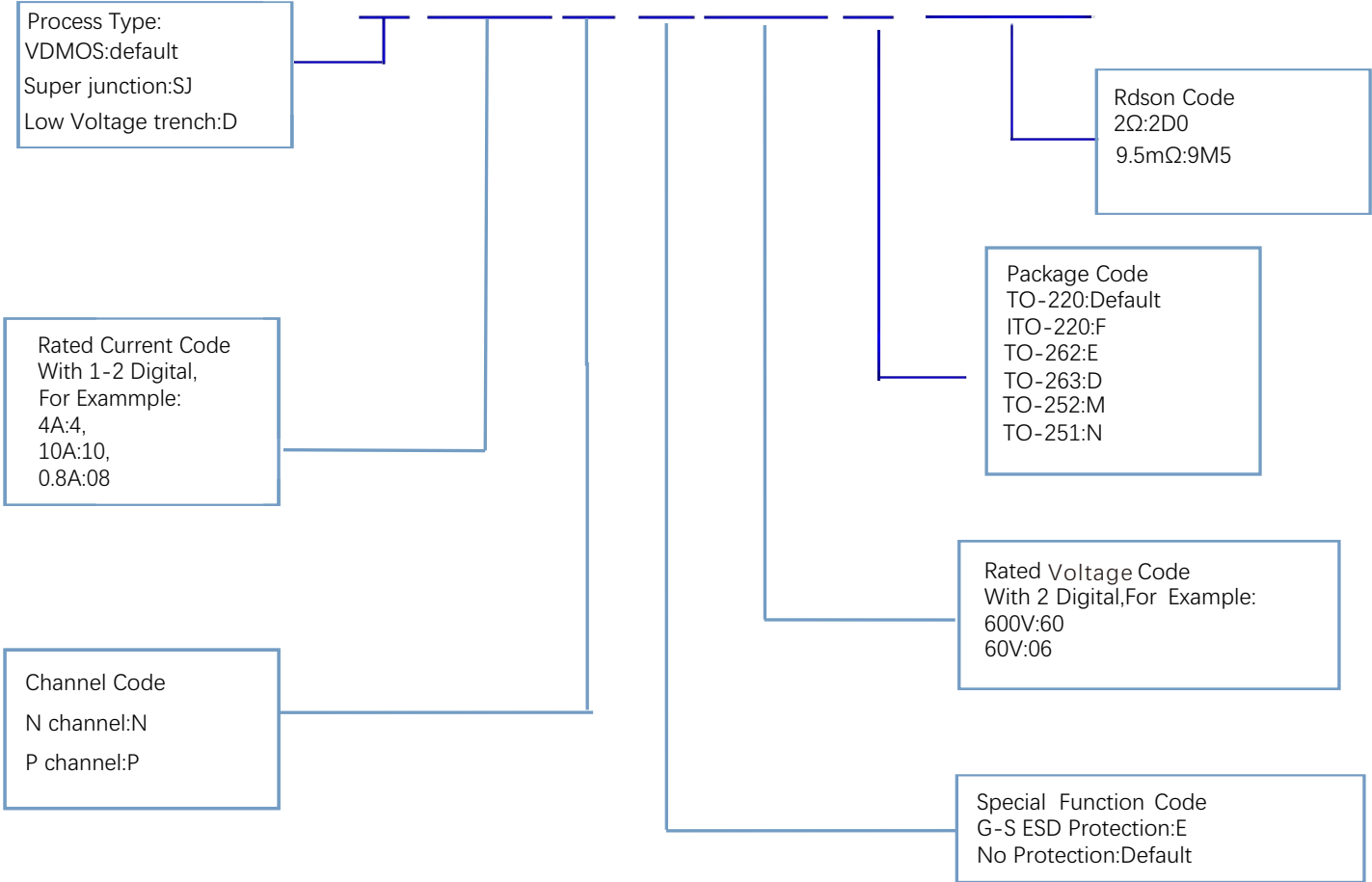
7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

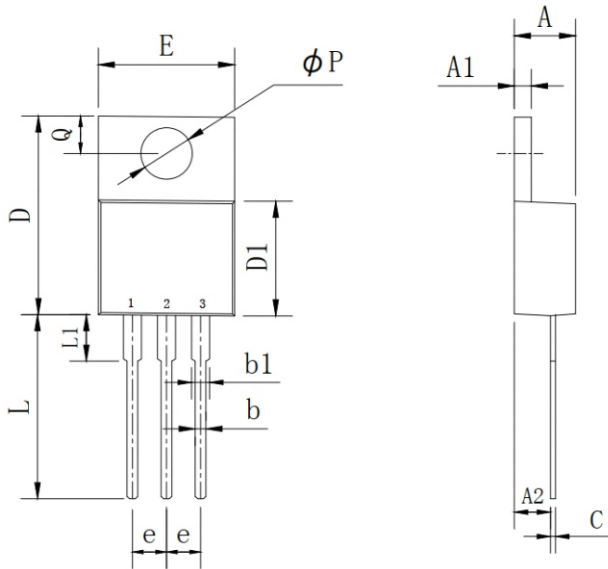
Product Names Rules

X X X N E X X X-X X X



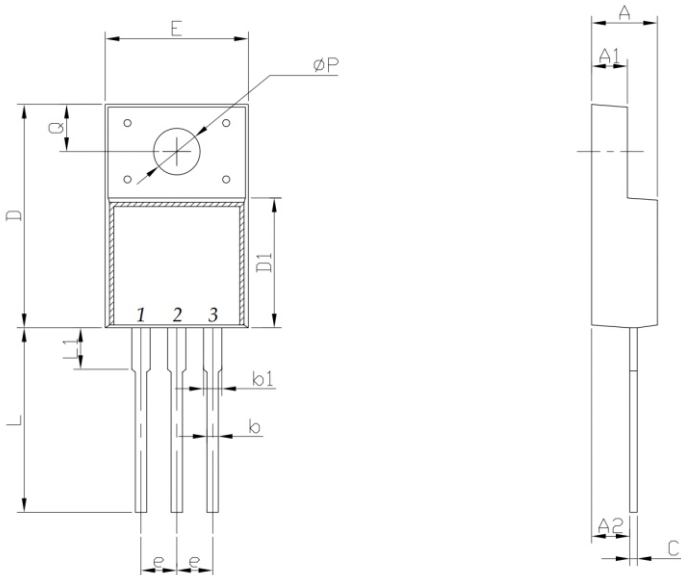
Dimensions

TO-220 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.25 | 4.87 | 0.167 | 0.192 |
| A1 | 1.07 | 1.47 | 0.042 | 0.058 |
| A2 | 2.03 | 2.92 | 0.080 | 0.115 |
| b | 0.51 | 1.11 | 0.020 | 0.044 |
| b1 | 0.97 | 1.6 | 0.038 | 0.063 |
| C | 0.3 | 0.7 | 0.012 | 0.028 |
| D | 14.6 | 15.9 | 0.575 | 0.626 |
| D1 | 8.04 | 9.3 | 0.317 | 0.366 |
| E | 9.57 | 10.57 | 0.377 | 0.416 |
| e | 2.34 | 2.74 | 0.092 | 0.108 |
| L | 12.58 | 14.3 | 0.495 | 0.563 |
| L1 | 2.8 | 4.2 | 0.110 | 0.165 |
| P | 3.4 | 4.14 | 0.134 | 0.163 |
| Q | 2.45 | 3 | 0.096 | 0.118 |

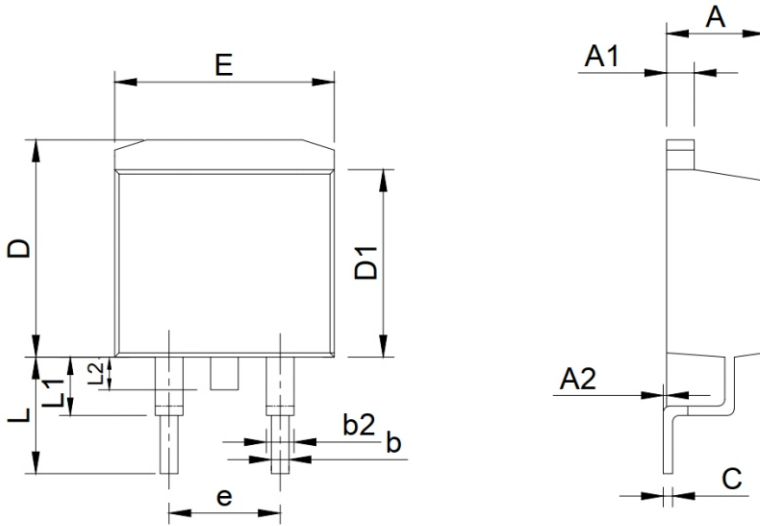
ITO-220 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.24 | 4.9 | 0.167 | 0.193 |
| A1 | 2.3 | 2.92 | 0.091 | 0.115 |
| A2 | 2.61 | 2.81 | 0.103 | 0.111 |
| b | 0.3 | 1 | 0.012 | 0.039 |
| b1 | 0.9 | 1.55 | 0.035 | 0.061 |
| C | 0.3 | 0.7 | 0.012 | 0.028 |
| D | 14.5 | 16.36 | 0.571 | 0.644 |
| D1 | 8.8 | 9.41 | 0.346 | 0.370 |
| E | 9.5 | 10.5 | 0.374 | 0.413 |
| e | 2.3 | 2.75 | 0.091 | 0.108 |
| L | 12.6 | 14 | 0.496 | 0.551 |
| L1 | 2.45 | 4.3 | 0.096 | 0.169 |
| P | 2.9 | 3.8 | 0.114 | 0.150 |
| Q | 2.5 | 3.55 | 0.098 | 0.140 |

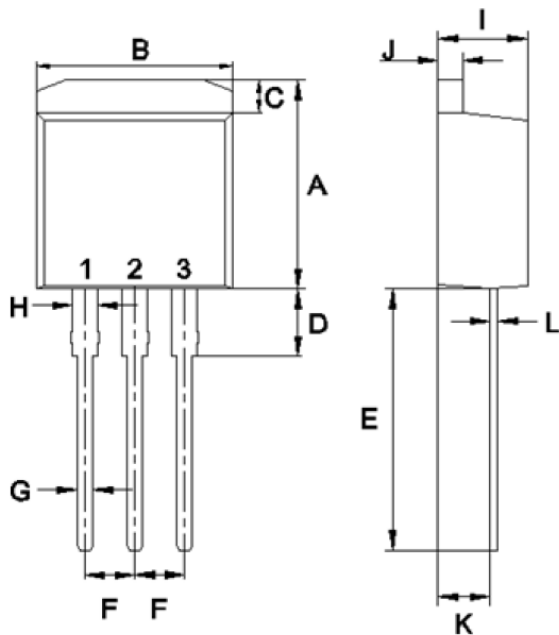
Dimensions

TO-263 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.25 | 4.87 | 0.167 | 0.192 |
| A1 | 1.07 | 1.47 | 0.042 | 0.058 |
| A2 | 0 | 0.25 | 0.000 | 0.010 |
| b | 0.61 | 1.01 | 0.024 | 0.040 |
| b1 | 1.2 | 1.34 | 0.047 | 0.053 |
| C | 0.3 | 0.6 | 0.012 | 0.024 |
| D | 9.48 | 10.84 | 0.373 | 0.427 |
| D1 | 8.49 | 9.3 | 0.334 | 0.366 |
| E | 9.7 | 10.31 | 0.382 | 0.406 |
| e | 4.88 | 5.28 | 0.192 | 0.208 |
| L | 4.46 | 5.85 | 0.176 | 0.230 |
| L1 | 1.33 | 2.33 | 0.052 | 0.092 |
| L2 | 0 | 2.2 | 0.000 | 0.087 |

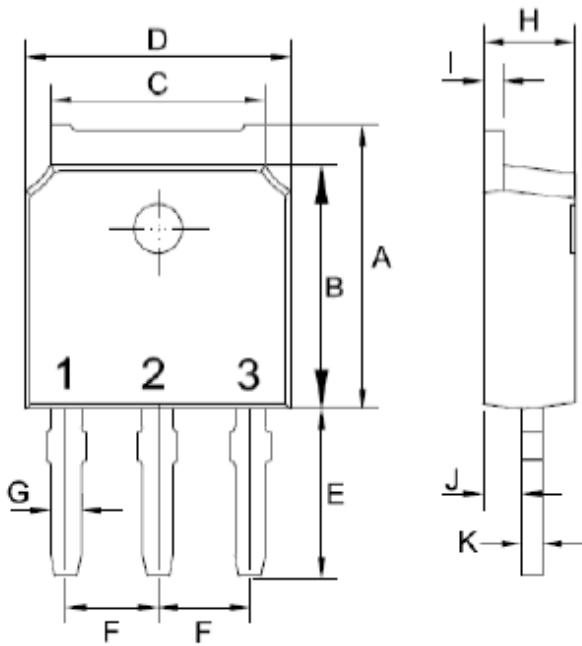
TO-262 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 10.14 | 11.14 | 0.399 | 0.439 |
| B | 9.57 | 10.57 | 0.377 | 0.416 |
| C | 1.15 | 1.84 | 0.045 | 0.072 |
| D | 2.95 | 3.95 | 0.116 | 0.156 |
| E | 12.25 | 13.75 | 0.482 | 0.541 |
| F | 2.34 | 2.74 | 0.092 | 0.108 |
| G | 0.51 | 1.11 | 0.020 | 0.044 |
| H | 0.97 | 1.57 | 0.038 | 0.062 |
| I | 4.25 | 4.87 | 0.167 | 0.192 |
| J | 1.07 | 1.47 | 0.042 | 0.058 |
| K | 2.03 | 2.92 | 0.080 | 0.115 |
| L | 0.3 | 0.6 | 0.012 | 0.024 |

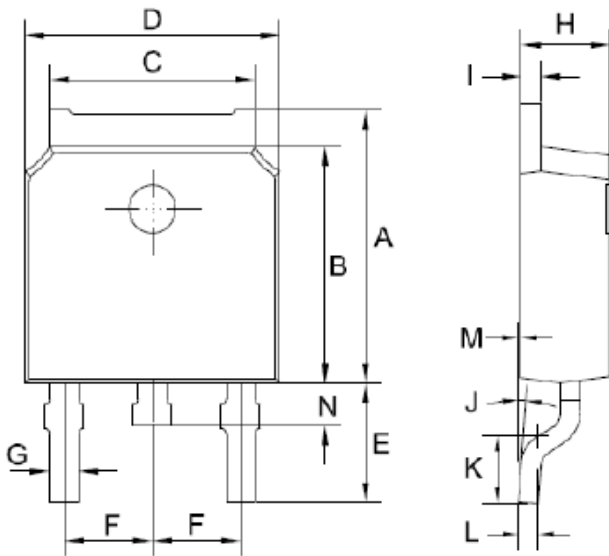
Dimensions

TO-251 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 6.85 | 7.25 | 0.270 | 0.285 |
| B | 5.8 | 6.3 | 0.228 | 0.248 |
| C | 5 | 5.53 | 0.197 | 0.218 |
| D | 6.3 | 6.8 | 0.248 | 0.268 |
| E | 3.5 | 4.35 | 0.138 | 0.171 |
| F | 2.19 | 2.39 | 0.086 | 0.094 |
| G | 0.45 | 0.85 | 0.018 | 0.033 |
| H | 2.2 | 2.4 | 0.087 | 0.094 |
| I | 0.41 | 0.61 | 0.016 | 0.024 |
| J | 0.71 | 1.31 | 0.028 | 0.052 |
| K | 0.41 | 0.61 | 0.016 | 0.024 |

TO-252 PACKAGE OUTLINE DIMENSIONS



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|------|----------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 6.85 | 7.25 | 0.270 | 0.285 |
| B | 5.8 | 6.3 | 0.228 | 0.248 |
| C | 5 | 5.53 | 0.197 | 0.218 |
| D | 6.3 | 6.8 | 0.248 | 0.268 |
| E | 2.6 | 3.3 | 0.102 | 0.130 |
| F | 2.19 | 2.39 | 0.086 | 0.094 |
| G | 0.45 | 0.85 | 0.018 | 0.033 |
| H | 2.2 | 2.4 | 0.087 | 0.094 |
| I | 0.41 | 0.61 | 0.016 | 0.024 |
| J | 0° | 8° | 0° | 8° |
| K | 1.45 | 1.85 | 0.057 | 0.073 |
| L | 0.41 | 0.61 | 0.016 | 0.024 |
| M | 0 | 0.12 | 0.000 | 0.005 |
| N | 0.6 | 1 | 0.024 | 0.039 |

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