

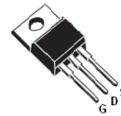
## 550V N-Channel Super Junction power MOSFET

### DESCRIPTION

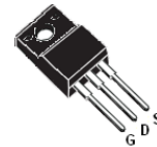
SJ MOSFET is an advanced technology for high voltage power MOSFETs, designed according to the super junction principle by Xinyuan semiconductor. The offered devices provide all benefits of a fast switching and low on resistance, making it especially suitable for applications which require more efficient, more compact, LED Lighting, High Performance Adapter etc.

|              |     |            |
|--------------|-----|------------|
| $V_{DS}$     | 550 | V          |
| $R_{DS(ON)}$ | 140 | m $\Omega$ |
| $I_D$        | 25  | A          |

TO-220



TO-220F



TO-247

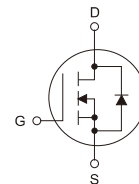


### Features

- Extremely low losses due to very low  $R_{dson} * Q_g$
- Superior Avalanche Rugged Technology
- Fast switching capability
- 100% Avalanche Tested
- Pb-free lead plating; ROHS compliant

### APPLICATIONS

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- High Performance Adapter
- LED Lighting Power



### ORDERING INFORMATION

| Temperature Range | Package |         | Orderable Device | Package Qty. |
|-------------------|---------|---------|------------------|--------------|
| -55°C ~ +125°C    | TO-220  | Pb-Free | CWS55R140AC      | 50 PCS/Tube  |
|                   | TO-220F |         | CWS55R140AF      | 50 PCS/Tube  |
|                   | TO-247  |         | CWS55R140AZ      | 30 PCS/Tube  |



**ABSOLUTE MAXIMUM RATINGS**(T<sub>J</sub>=25°C, unless otherwise noted)

| Parameter  | Symbol                            | Value                                    | Unit |
|--|-----------------------------------|--|------|
| Drain-Source Voltage (V <sub>GS</sub> =0V)                 | V <sub>DSS</sub>                  | 550                                      | V    |
| Gate-Source Voltage (V <sub>DS</sub> =0V, static)          | V <sub>GS</sub>                   | ±30                                      | V    |
| Continuous Drain Current (T <sub>C</sub> =25 °C)(Note 1)   | I <sub>D(DC)</sub>                | 25                                       | A    |
| Continuous Drain Current (T <sub>C</sub> =100 °C) (Note 1) | I <sub>D(DC)</sub>                | 15.5                                     | A    |
| Pulsed Drain Current (Note 2)                              | I <sub>DM</sub>                   | 75                                       | A    |
| MOSFET dv/dt ruggedness, V <sub>DS</sub> ≤480 V            | dv/dt                             | 50                                       | V/nS |
| Single Pulsed Avalanche Energy (Note 3)                    | E <sub>AS</sub>                   | 515                                      | mJ   |
| Avalanche Energy, Repetitive (Note 1)                      | E <sub>AR</sub>                   | 0.8                                      | mJ   |
| Avalanche Current, Repetitive (Note 1)                     | I <sub>AR</sub>                   | 3.8                                      | A    |
| Maximum Power Dissipation (T <sub>C</sub> =25 °C)          | P <sub>D</sub>                    | TO-220: 96<br>TO-220F: 33<br>TO-247: 130 | W    |
| Operating, Storage Temperature Range                       | T <sub>J</sub> , T <sub>STG</sub> | -55~150                                  | °C   |

**THERMAL CHARACTERISTICS**

| Parameter                               | Symbol            | Min. | Typ. | Max.   | Units |
|---|-------------------|------|------|--|-------|
| Thermal Resistance, Junction-to-Case    | R <sub>thJC</sub> | -    | -    | TO-220: 1.3<br>TO-220F: 3.75<br>TO-247: 0.96 | °C /W |
| Thermal Resistance, Junction-to-Ambient | R <sub>thJA</sub> | -    | -    | TO-220: 62<br>TO-220F: 80<br>TO-247: 57      | °C /W |

**ELECTRICAL CHARACTERISTICS**(T<sub>J</sub> = 25°C, unless otherwise noted)

| Parameter                        | Symbol              | Test Conditions  | Min. | TYP. | Max. | Unit |
|----------------------------------|---------------------|--|------|------|------|------|
| Drain-Source Breakdown Voltage   | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA               | 550  | -    | -    | V    |
| Zero Gate Voltage Drain Current  | I <sub>DSS</sub>    | V <sub>DS</sub> =550V, V <sub>GS</sub> =0V               | -    | -    | 1    | μA   |
| Gate-Source Leakage Current      | I <sub>GSS</sub>    | V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V               | -    | -    | ±100 | nA   |
| Gate Threshold Voltage           | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA | 2.5  | 3.0  | 3.5  | V    |
| Drain-Source On-state Resistance | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =12A                | -    | 0.11 | 0.14 | Ω    |
| Gate Resistance                  | R <sub>g</sub>      | F=1MHZ,<br>open drain                                    | -    | 5.4  | -    | Ω    |



## Dynamic Characteristics

( $T_j = 25^\circ\text{C}$ , unless otherwise noted)

| Parameter                    | Symbol       | Test Conditions  | Min. | Typ. | Max. | Units |
|------------------------------|--------------|--|------|------|------|-------|
| Input capacitance            | $C_{iss}$    | $V_{DS}=100\text{V}, V_{GS}=0\text{V},$<br>$f=1\text{MHz}$                 | -    | 1525 | -    | pF    |
| Output capacitance           | $C_{oss}$    |  | -    | 71   | -    |       |
| Reverse transfer capacitance | $C_{riss}$   |  | -    | 1.1  | -    |       |
| Turn-on delay Time           | $t_{d(on)}$  | $V_{DD}=420\text{V}, I_D=24\text{A}$<br>$R_G=6.8\Omega, V_{GS}=10\text{V}$ | -    | 20.2 | -    | ns    |
| Rise time                    | $t_r$        |  | -    | 17.5 |      |       |
| Turn-off delay time          | $t_{d(off)}$ |  | -    | 64   |      |       |
| Fall time                    | $t_f$        |  | -    | 17   |      |       |

## Gate charge characteristics

( $T_j = 25^\circ\text{C}$ , unless otherwise noted)

| Parameter             | Symbol        | Test Conditions  | Min. | Typ. | Max. | Units |
|-----------------------|---------------|--|------|------|------|-------|
| Gate to Source Charge | $Q_{gs}$      | $V_{DD}=420\text{V}, I_D=24\text{A}$<br>$V_{GS}=0$ to $10\text{V}$ | -    | 7.1  | -    | nC    |
| Gate to Drain Charge  | $Q_{gd}$      |  | -    | 12.8 | -    |       |
| Gate Charge Total     | $Q_g$         |  | -    | 34   | -    |       |
| Gate Plateau Voltage  | $V_{plateau}$ |  | -    | 6.4  | -    | V     |

## Reverse diode characteristics

( $T_j = 25^\circ\text{C}$ , unless otherwise noted)

| Parameter                     | Symbol    | Test Conditions  | Min. | Typ. | Max. | Units         |
|-------------------------------|-----------|--|------|------|------|---------------|
| Body Diode Forward Voltage    | $V_{SD}$  | $V_{GS}=0\text{V}, I_{SD}=24\text{A}$                                  | -    | 0.9  | -    | V             |
| Reverse Recovery Time         | $t_{rr}$  | $V_R=420\text{V}, I_F=24\text{A}$<br>$di_F/dt=100\text{A}/\mu\text{s}$ | -    | 340  | -    | nS            |
| Reverse Recovery Charge       | $Q_{rr}$  |  | -    | 5.6  | -    | $\mu\text{C}$ |
| Peak Reverse Recovery Current | $I_{rrm}$ |  | -    | 27.6 | -    | A             |

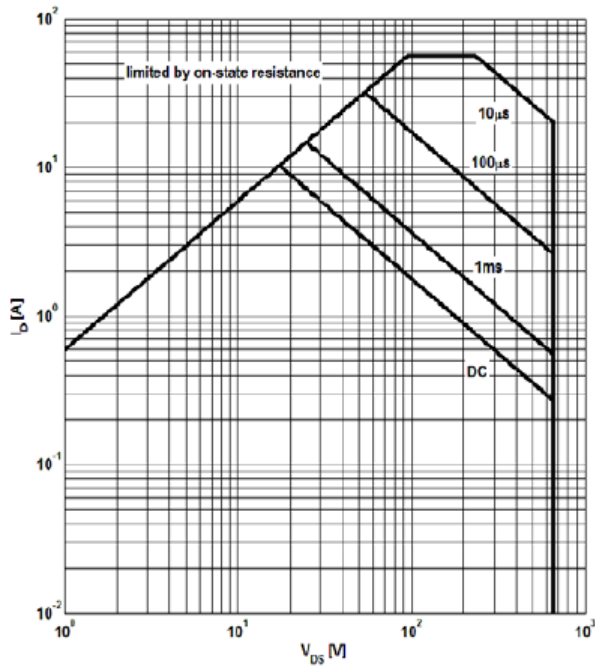
### Notes:

- Limited by maximum junction temperature;
- Pulse width limited by maximum junction temperature;
- $I_{AS} = 12\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_j = 25^\circ\text{C}$ .



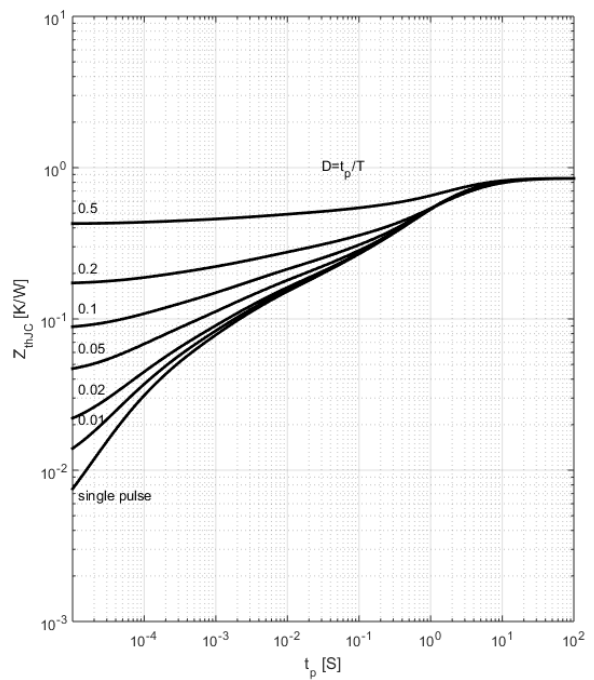
## Electrical Characteristics Diagrams

Figure 1. Safe operating area



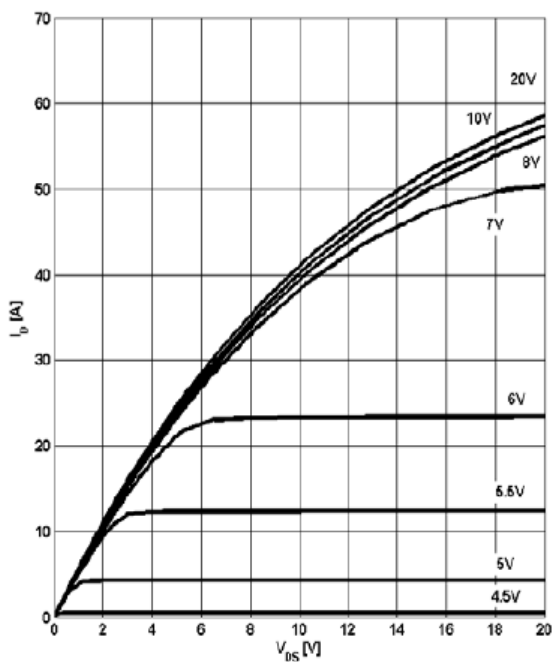
$I_D=f(V_{DS})$ ;  $T_c=25\text{ }^\circ\text{C}$ ; parameter  $t_p$

Figure 2. Transient thermal impedance



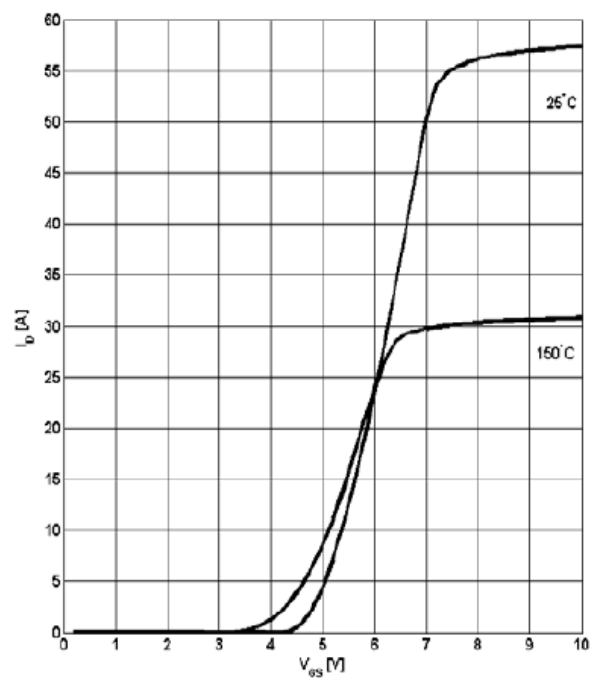
$Z_{(thJC)}=f(t_p)$ ; parameter:  $D=t_p/T$

Figure3. Typ. output characteristics



$I_D=f(V_{DS})$ ;  $T_j=25\text{ }^\circ\text{C}$ ; parameter:  $V_{GS}$

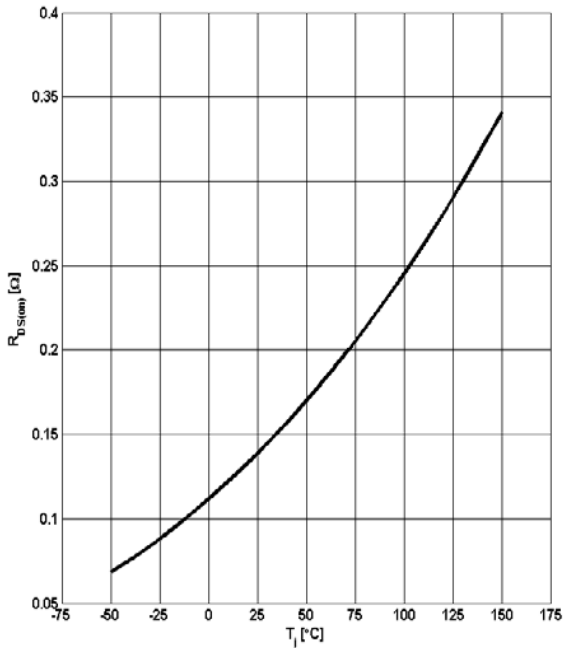
Figure 4. Typ. transfer characteristics



$I_D=f(V_{GS})$ ;  $V_{DS}=20\text{V}$

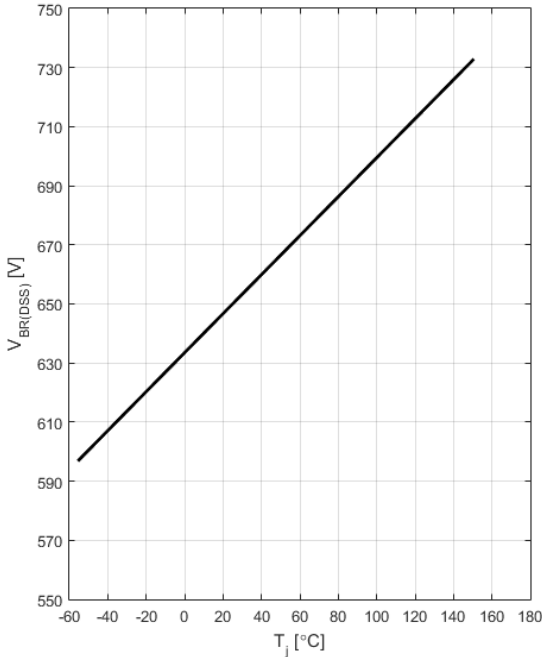


**Figure 5. Drain-source on-state resistance**



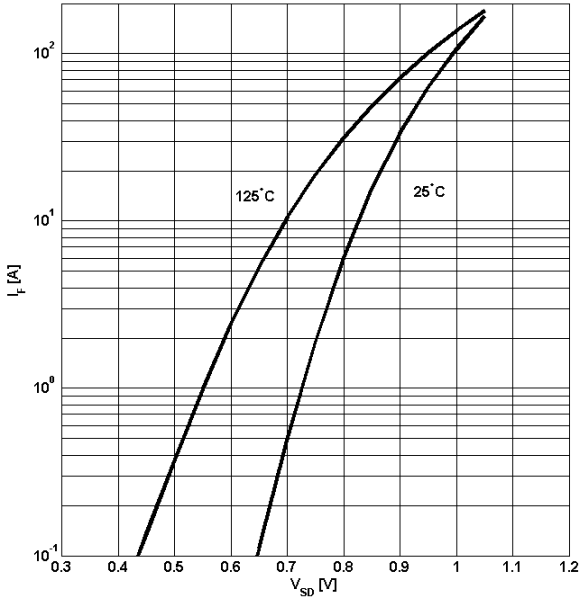
$R_{DS(ON)}=f(T_j); I_D=12A; V_{GS}=10V$

**Figure6. Drain-source breakdown voltage**



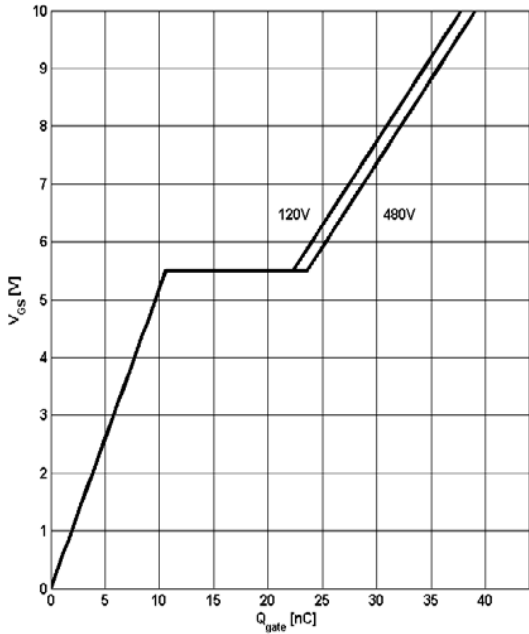
$V_{BR(DSS)}=f(T_j); I_D=250\mu A$

**Figure7. Forward characteristics of reverse diode**



$I_F=f(V_{SD}); \text{parameter: } T_j$

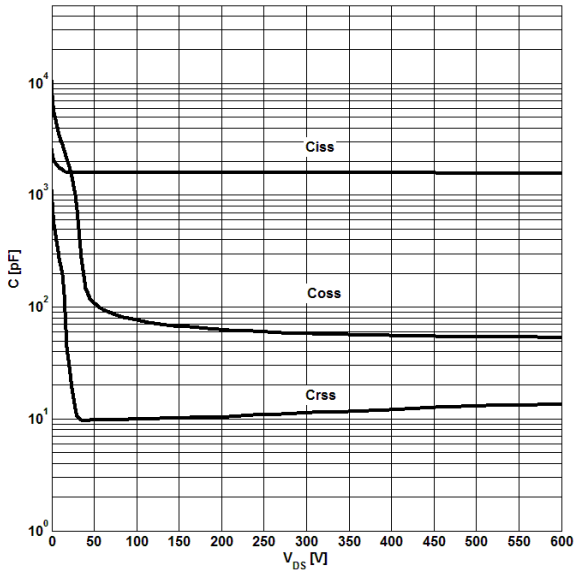
**Figure 8. Typ. gate charge**



$V_{GS}=f(Q_{gate}), I_D=12A \text{ pulsed}$

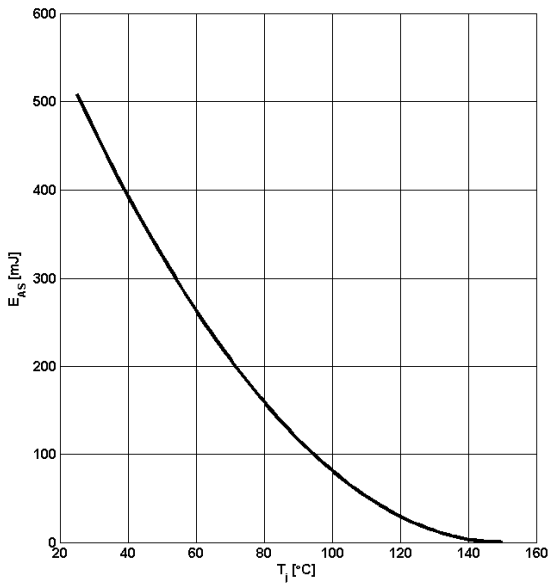


**Figure 9: Typ. capacitances**



**C=f(V<sub>DS</sub>); V<sub>GS</sub>=0; f=1MHz**

**Figure 10: Avalanche energy**

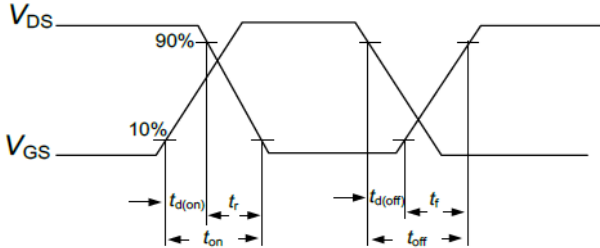
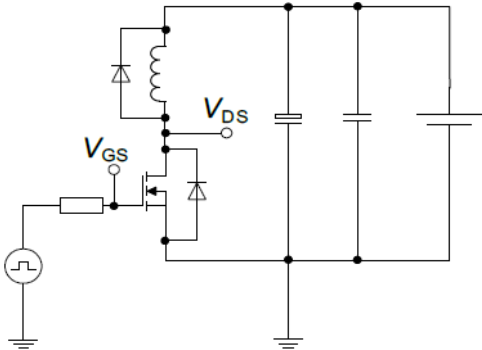


**E<sub>AS</sub>=f(T<sub>j</sub>); I<sub>D</sub>=10A; V<sub>DD</sub>=50V**

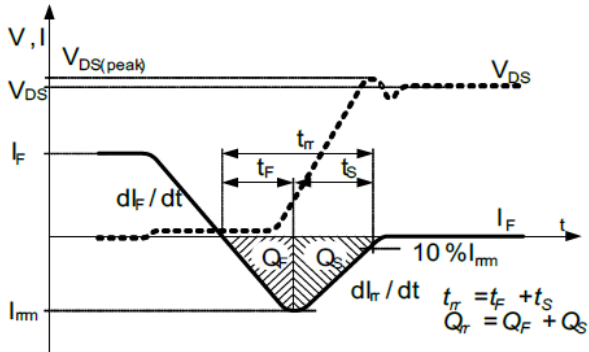
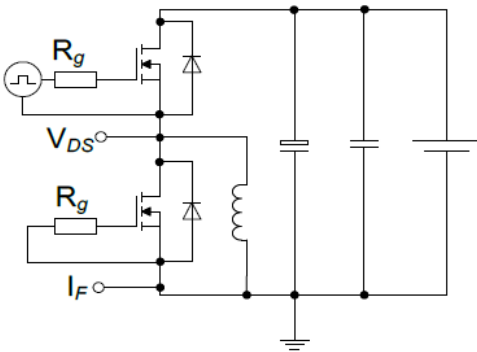


## Test Circuits

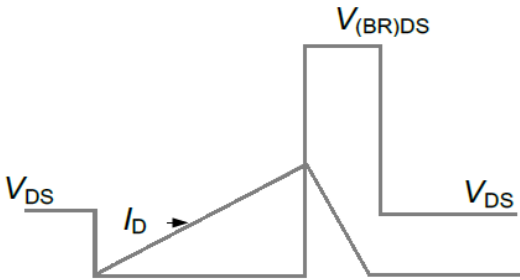
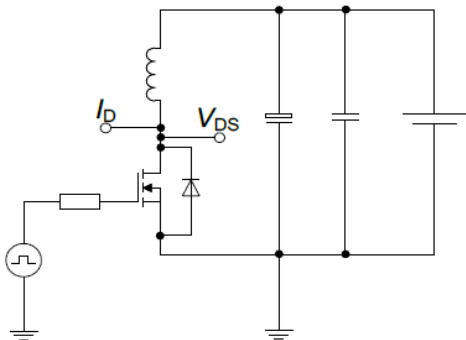
### Switch time test circuit



### Reverse diode characteristics test circuit and waveform

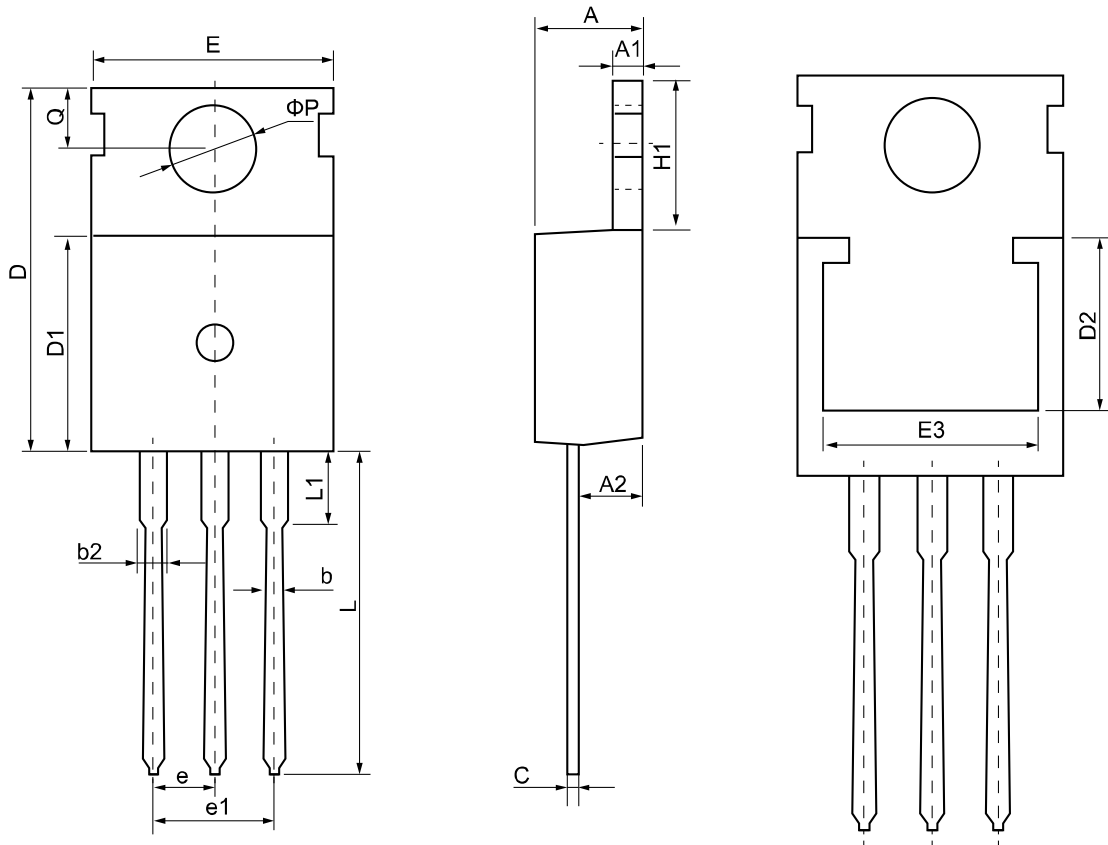


### Unclaimed inductive switching test circuit & waveform



## PHYSICAL DIMENSIONS

TO-220

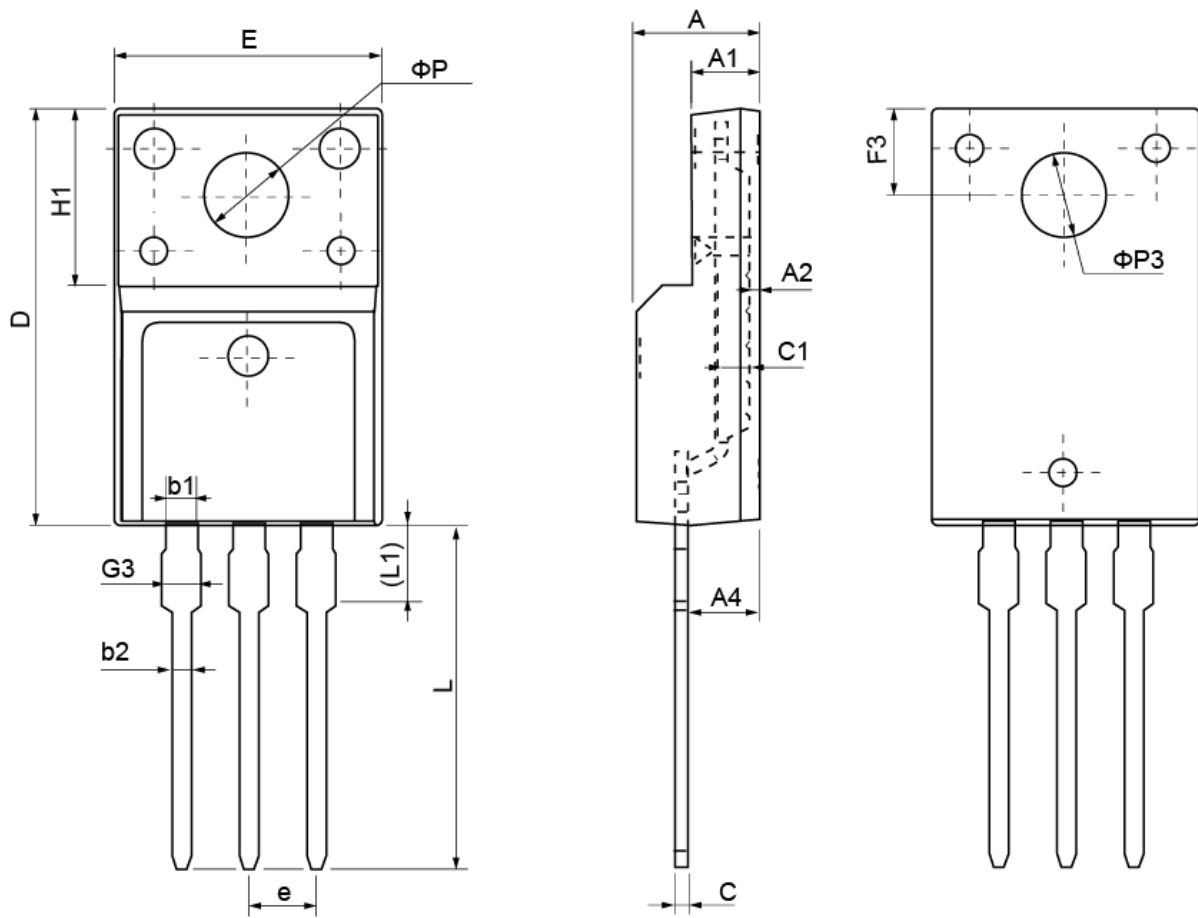


| Symbol | Dimension (mm) |       |       | Symbol | Dimension (mm) |       |       |
|--------|----------------|-------|-------|--------|----------------|-------|-------|
|        | Min            | Nom   | Max   |        | Min            | Nom   | Max   |
| A      | 4.37           | 4.57  | 4.77  | E      | 9.80           | 10.00 | 10.20 |
| A1     | 1.25           | 1.30  | 1.45  | E3     | 7.00           | -     | -     |
| A2     | 2.20           | 2.40  | 2.60  | e      | 2.54(BSC)      |       |       |
| b      | 0.70           | 0.80  | 0.95  | e1     | 5.08(BSC)      |       |       |
| b2     | 1.17           | 1.27  | 1.47  | H1     | 6.30           | 6.50  | 6.80  |
| c      | 0.40           | 0.50  | 0.65  | L      | 12.75          | 13.50 | 13.80 |
| D      | 15.30          | 15.60 | 15.90 | L1     | -              | 3.10  | 3.40  |
| D1     | 8.90           | 9.10  | 9.30  | ΦP     | 3.40           | 3.60  | 3.80  |
| D2     | 5.50           | -     | -     | Q      | 2.60           | 2.80  | 3.00  |





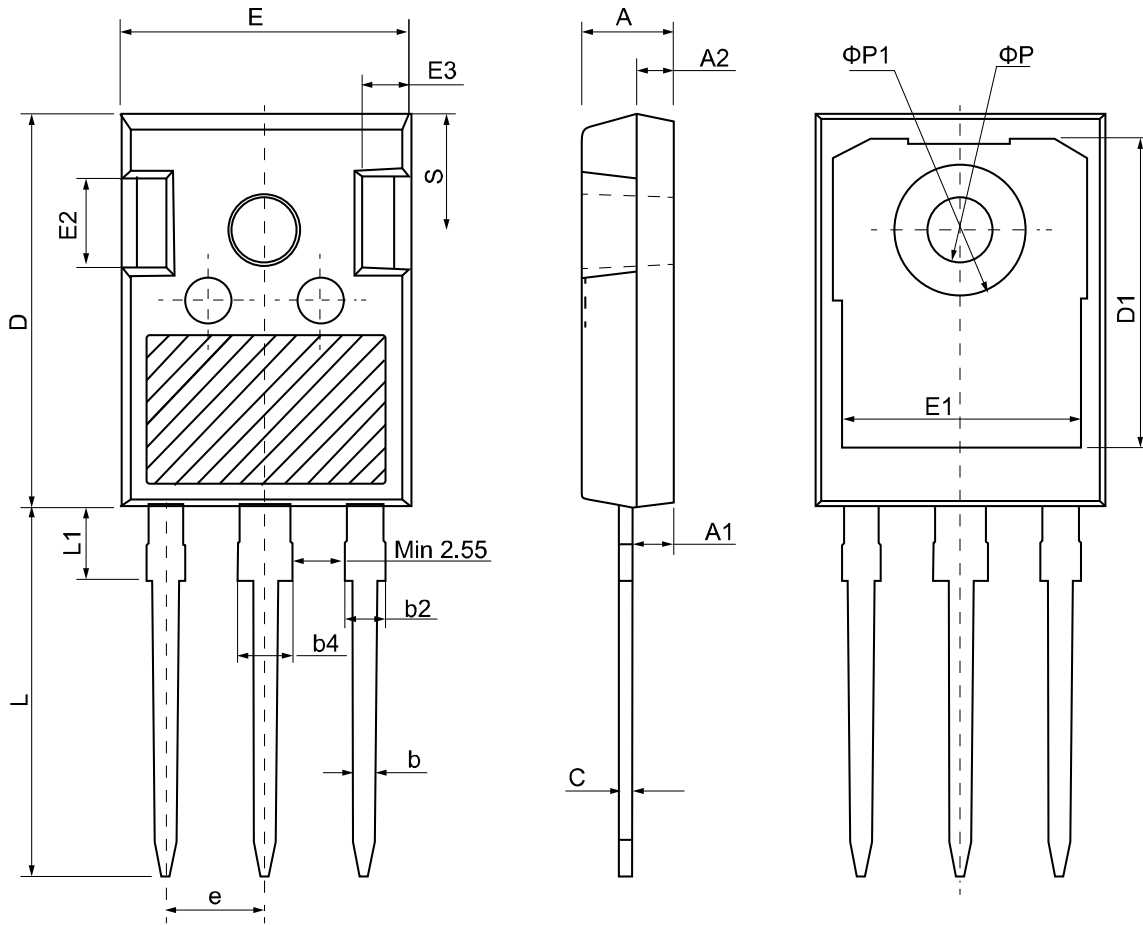
## TO-220F



| Symbol | Dimension (mm) |       |       | Symbol    | Dimension (mm) |       |       |
|--------|----------------|-------|-------|-----------|----------------|-------|-------|
|        | Min            | Nom   | Max   |           | Min            | Nom   | Max   |
| E      | 9.96           | 10.16 | 10.36 | e         | 2.54(BSC)      |       |       |
| A      | 4.50           | 4.70  | 4.90  | L         | 12.68          | 12.98 | 13.28 |
| A1     | 2.34           | 2.54  | 2.74  | L1        | 2.93           | 3.03  | 3.13  |
| A2     | 0.30           | 0.45  | 0.60  | $\Phi P$  | 3.03           | 3.18  | 3.38  |
| A4     | 2.56           | 2.76  | 2.96  | $\Phi P3$ | 3.15           | 3.45  | 3.65  |
| c      | 0.40           | 0.50  | 0.65  | F3        | 3.15           | 3.30  | 3.45  |
| c1     | 1.20           | 1.30  | 1.35  | G3        | 1.25           | 1.35  | 1.55  |
| D      | 15.57          | 15.87 | 16.17 | b1        | 1.18           | 1.28  | 1.43  |
| H1     | 6.70(REF)      |       |       | b2        | 0.70           | 0.80  | 0.95  |



## TO-247



| Symbol | Dimension (mm) |       |       | Symbol | Dimension (mm) |       |       |
|--------|----------------|-------|-------|--------|----------------|-------|-------|
|        | Min            | Nom   | Max   |        | Min            | Nom   | Max   |
| A      | 4.80           | 5.00  | 5.20  | E1     | 13.00          | 13.30 | 13.60 |
| A1     | 2.21           | 2.41  | 2.59  | E2     | 4.80           | 5.00  | 5.20  |
| A2     | 1.85           | 2.00  | 2.15  | E3     | 2.30           | 2.50  | 2.70  |
| b      | 1.11           | 1.21  | 1.36  | e      | 5.44(BSC)      |       |       |
| b2     | 1.91           | 2.01  | 2.21  | L      | 19.82          | 19.92 | 20.22 |
| b4     | 2.91           | 3.01  | 3.21  | L1     | -              | -     | 4.30  |
| c      | 0.51           | 0.61  | 0.75  | ΦP     | 3.40           | 3.60  | 3.80  |
| D      | 20.80          | 21.00 | 21.30 | ΦP1    | -              | -     | 7.30  |
| D1     | 16.25          | 16.55 | 16.85 | S      | 6.15(BSC)      |       |       |
| E      | 15.50          | 15.80 | 16.10 | -      | -              | -     | -     |

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