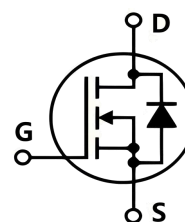
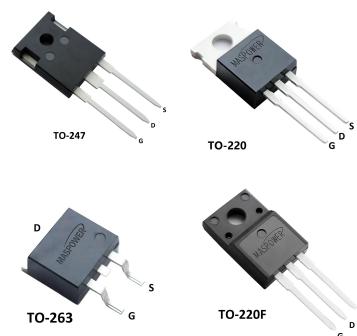


### Features

- 100% avalanche tested
- Avalanche ruggedness
- Very low intrinsic capacitances
- High speed switching
- Very low on-resistance

### Applications

- Welder
- UPS
- PV Inverter
- Switching applications



### Electrical ratings

| Absolute maximum ratings                                                   |           |            |                    |
|----------------------------------------------------------------------------|-----------|------------|--------------------|
| Parameter                                                                  | Symbol    | Value      | Unit               |
| Drain-source voltage ( $V_{GS} = 0$ )                                      | $V_{DSS}$ | 1200       | V                  |
| Transient Gate-source voltage                                              | $V_{GSM}$ | $\pm 30$   |                    |
| Gate- source voltage(DC)                                                   | $V_{GSS}$ | $\pm 20$   |                    |
| Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$           | $I_D$     | 8          | A                  |
| Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$          |           | 5.5        |                    |
| Drain current (pulsed)<br>(pulse width limited by $T_J$ max)               | $I_{DM}$  | 24         |                    |
| Peak Diode Recovery $dv/dt$                                                | $dv/dt$   | 5          | V/ns               |
| Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$<br>(TO-247,TO-263) | $P_{TOT}$ | 320        | W                  |
| Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$ (TO-220)           | $P_{TOT}$ | 250        | W                  |
| Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$ (TO-220F)          | $P_{TOT}$ | 67         | W                  |
| Operating junction temperature                                             | $T_J$     | -55 to 150 | $^{\circ}\text{C}$ |
| Storage temperature                                                        | $T_{stg}$ |            |                    |
| Maximum lead temperature for soldering<br>purpose                          | $T_J$     | 300        |                    |

| Thermal data |        |                   |        |         |      |
|--------------|--------|-------------------|--------|---------|------|
| Parameter    | Symbol | Value             |        |         | Unit |
|              |        | TO-247/<br>TO-263 | TO-220 | TO-220F |      |

|                                         |                |      |      |      |               |
|-----------------------------------------|----------------|------|------|------|---------------|
| Thermal resistance junction-case max    | $R_{thj-case}$ | 0.39 | 0.5  | 1.84 | $^{\circ}C/W$ |
| Thermal resistance junction-ambient max | $R_{thj-amb}$  | 50   | 62.5 | 62.5 |               |

| Avalanche characteristics                                                                          |          |           |      |
|----------------------------------------------------------------------------------------------------|----------|-----------|------|
| Parameter                                                                                          | Symbol   | Max value | Unit |
| Avalanche current, repetitive or not-repetitive<br>(pulse width limited by $T_J$ max)              | $I_{AR}$ | 8         | A    |
| Single pulse avalanche energy<br>(starting $T_J = 25^{\circ}C$ , $I_D = I_{AR}$ , $V_{DD} = 50$ V) | $E_{AS}$ | 83        | mJ   |

**Electrical Characteristics ( $T_{vj} = 25^{\circ}C$  unless otherwise specified)**

| On /off states                                   |               |                                                                                     |      |      |           |          |
|--------------------------------------------------|---------------|-------------------------------------------------------------------------------------|------|------|-----------|----------|
| Parameter                                        | Symbol        | Test conditions                                                                     | Min  | Type | Max       | Unit     |
| Drain-source breakdown voltage                   | $V_{(BR)DSS}$ | $I_D = 1$ mA, $V_{GS} = 0$                                                          | 1200 | -    | -         | V        |
| Zero gate voltage drain current ( $V_{GS} = 0$ ) | $I_{DSS}$     | $V_{DS} = \text{Max rating}$<br>$V_{DS} = \text{Max rating}$ , $T_C = 125^{\circ}C$ | -    | -    | 10        | $\mu A$  |
| Gate-body leakage current ( $V_{DS} = 0$ )       | $I_{GSS}$     | $V_{GS} = \pm 20$ V                                                                 | -    | -    | $\pm 100$ | nA       |
| Gate threshold voltage                           | $V_{GS(th)}$  | $V_{DS} = V_{GS}$ , $I_D = 250$ $\mu A$                                             | 3.0  | -    | 5.5       | V        |
| Static drain-source on resistance                | $R_{DS(on)}$  | $V_{GS} = 10$ V, $I_D = 1$ A                                                        | -    | 2.6  | 3.4       | $\Omega$ |

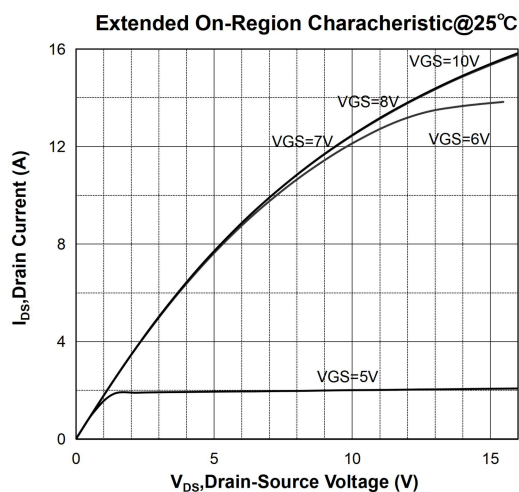
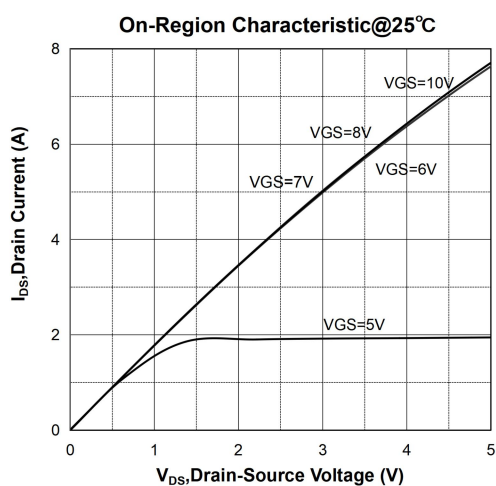
| Dynamic                      |           |                                                                      |     |      |     |          |
|------------------------------|-----------|----------------------------------------------------------------------|-----|------|-----|----------|
| Parameter                    | Symbol    | Test conditions                                                      | Min | Type | Max | Unit     |
| Forward transconductance     | $g_{fs}$  | $V_{DS} = 30$ V, $I_D = 2$ (note 4)                                  | -   | 4.2  | -   | S        |
| Input capacitance            | $C_{iss}$ | $V_{DS} = 25$ V, $f = 1$ MHz, $V_{GS} = 0$                           | -   | 833  | -   | pF       |
| Output capacitance           | $C_{oss}$ |                                                                      | -   | 150  | -   |          |
| Reverse transfer capacitance | $C_{rss}$ |                                                                      | -   | 98   | -   |          |
| Gate input resistance        | $R_g$     | $f = 1$ MHz Gate DC Bias = 0<br>Test signal level = 20 mV open drain | -   | 2.61 | -   | $\Omega$ |
| Total gate charge            | $Q_g$     | $V_{DD} = 960$ V, $I_D = 4$ A<br>$V_{GS} = 10$ V<br>(note 4,5)       | -   | 39   | -   | nC       |
| Gate-source charge           | $Q_{gs}$  |                                                                      | -   | 6    | -   |          |
| Gate-drain charge            | $Q_{gd}$  |                                                                      | -   | 25   | -   |          |

| Switching times                  |                     |                                                                                                 |     |      |     |      |
|----------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Parameter                        | Symbol              | Test conditions                                                                                 | Min | Type | Max | Unit |
| Turn-on delay time               | t <sub>d(on)</sub>  | V <sub>DD</sub> = 600 V, I <sub>D</sub> = 4 A,<br>R <sub>G</sub> = 25 Ω, V <sub>GS</sub> = 10 V | -   | 29   | -   | ns   |
| Rise time                        | t <sub>r</sub>      |                                                                                                 | -   | 55   | -   |      |
| Turn-off-delay time              | t <sub>d(off)</sub> |                                                                                                 | -   | 94   | -   |      |
| Fall time                        | t <sub>f</sub>      |                                                                                                 | -   | 88   | -   |      |
| Source drain diode               |                     |                                                                                                 |     |      |     |      |
| Parameter                        | Symbol              | Test conditions                                                                                 | Min | Type | Max | Unit |
| Source-drain current             | I <sub>SD</sub>     |                                                                                                 | -   | 8    | -   | A    |
| Source-drain current<br>(pulsed) | I <sub>SDM</sub>    |                                                                                                 | -   | 22   | -   |      |
| Forward on voltage               | V <sub>SD</sub>     | I <sub>SD</sub> = 1A, V <sub>GS</sub> = 0                                                       | -   | -    | 1.2 | V    |
| Reverse recovery time            | t <sub>rr</sub>     | I <sub>SD</sub> = 4A, di/dt= 100A/μs<br>T <sub>J</sub> =25°C(note 4)                            | -   | 595  | -   | nS   |
| Reverse recovery charge          | Q <sub>rr</sub>     |                                                                                                 | -   | 4.9  | -   | μC   |

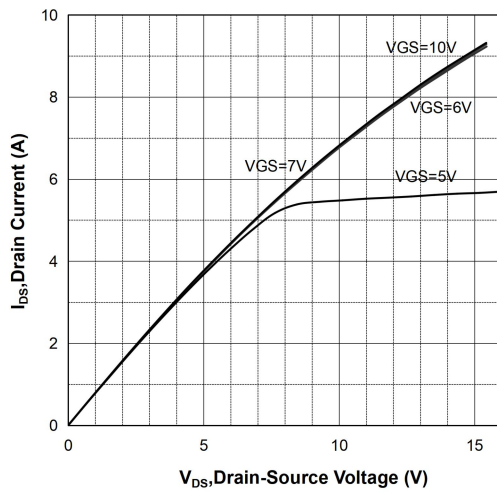
### Order information

| Ordering Code | Silkscreen | Package |
|---------------|------------|---------|
| MS8N120FC     | MS8N120FC  | TO-247  |
| MS8N120FT     | MS8N120FT  | TO-220  |
| MS8N120FE     | MS8N120FE  | TO-263  |
| MS8N120FS     | MS8N120FS  | TO-220F |

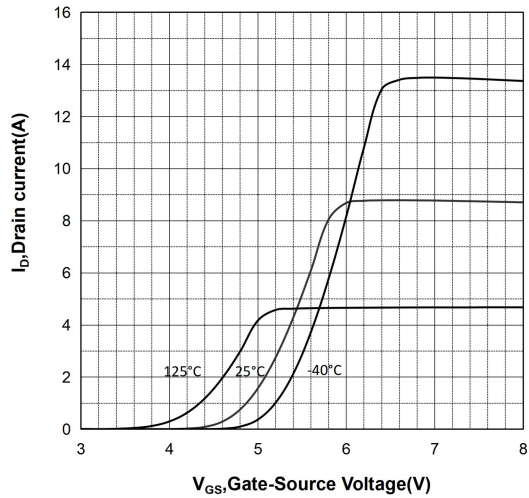
### Electrical characteristics



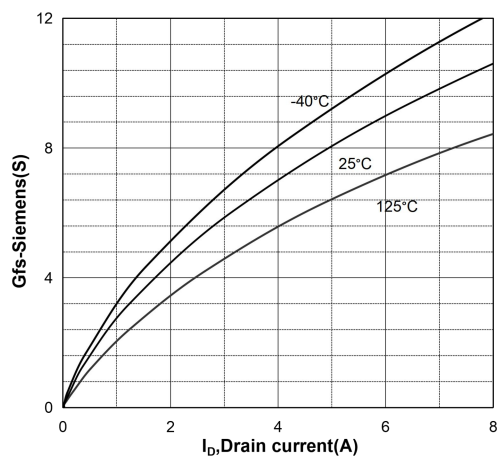
On-Region Characteristic@125°C



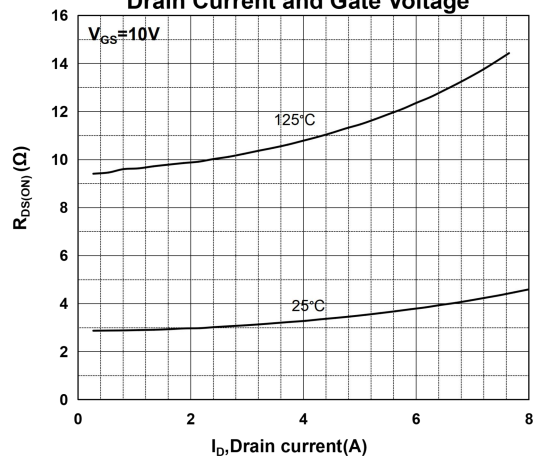
Transfer Characteristics



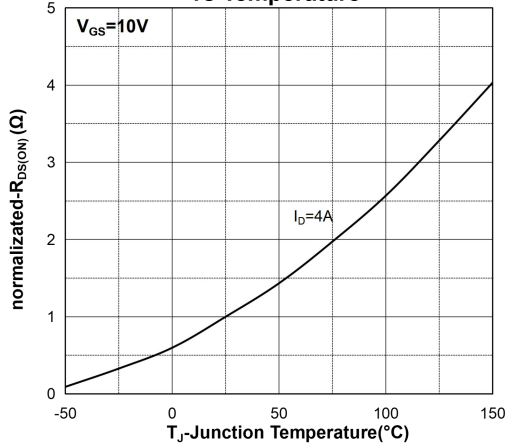
Transconductance



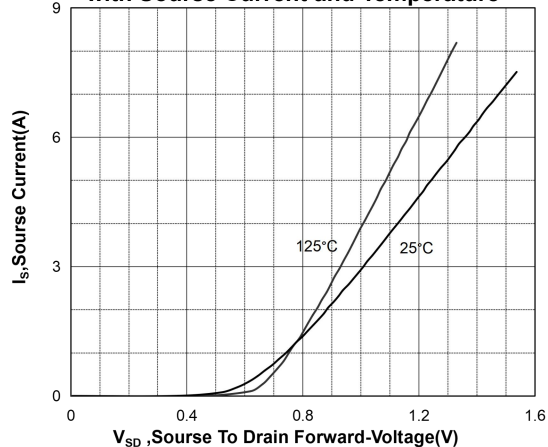
On-Resistance Variation vs Drain Current and Gate Voltage

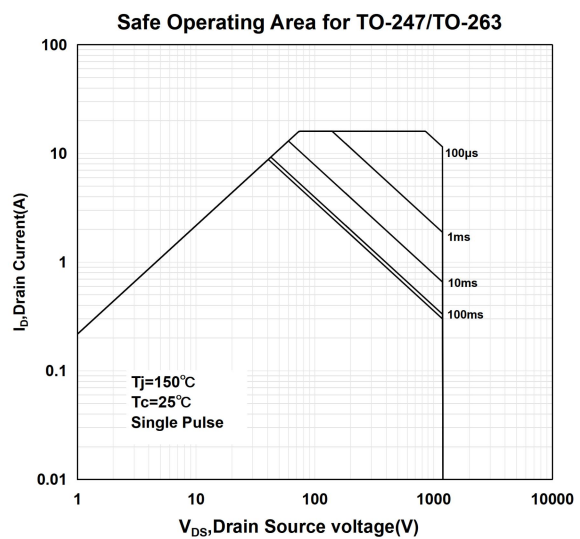
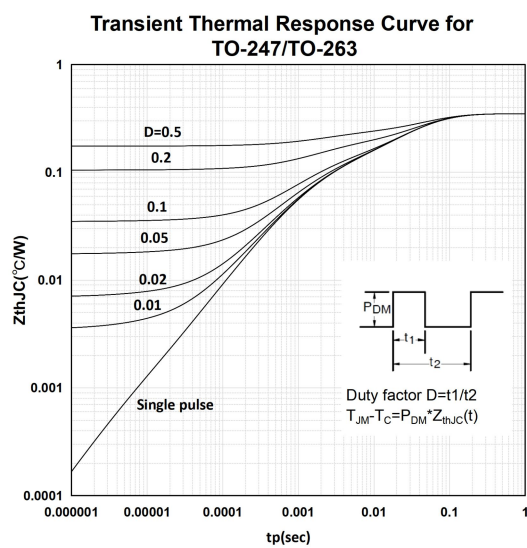
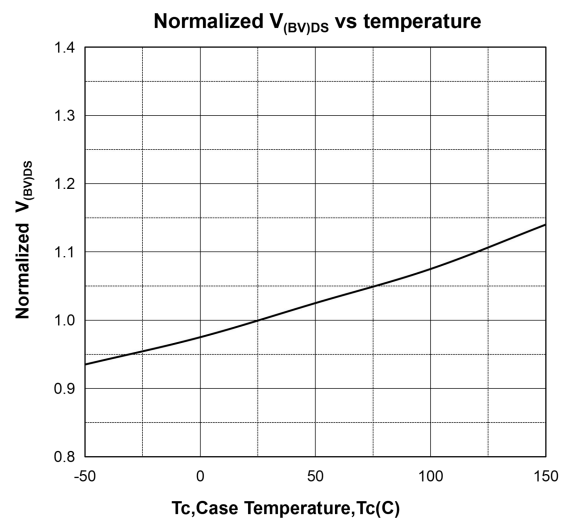
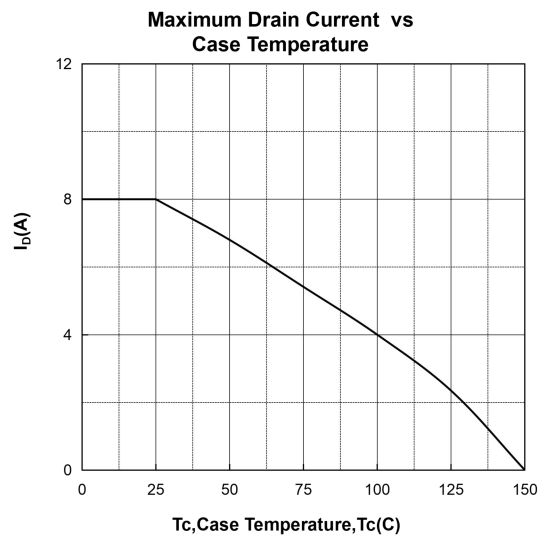
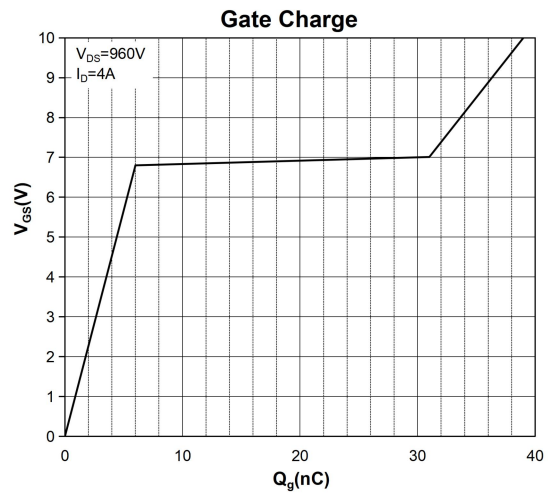
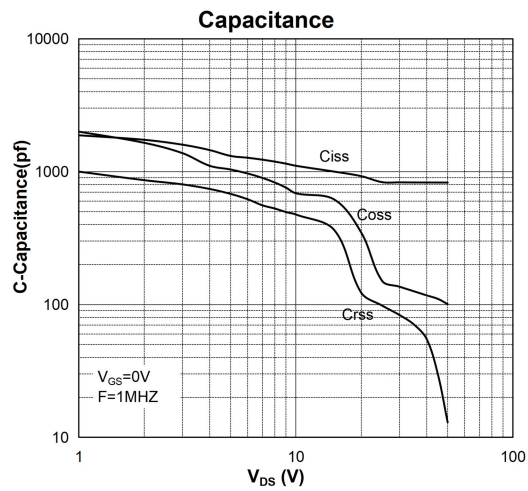


Normalized On-Resistance Variation vs Temperature

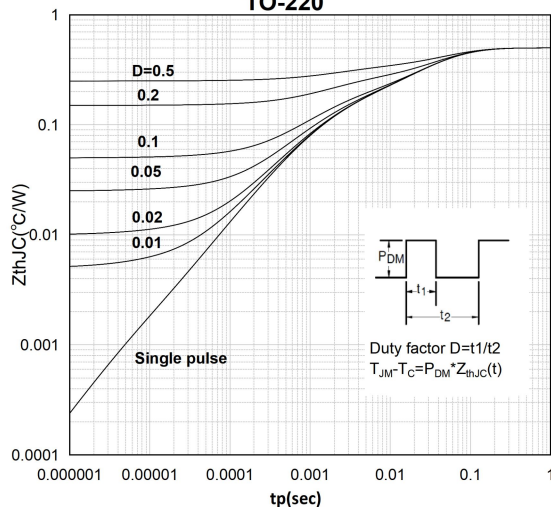


Body Diode Forward Voltage Variation with Source Current and Temperature

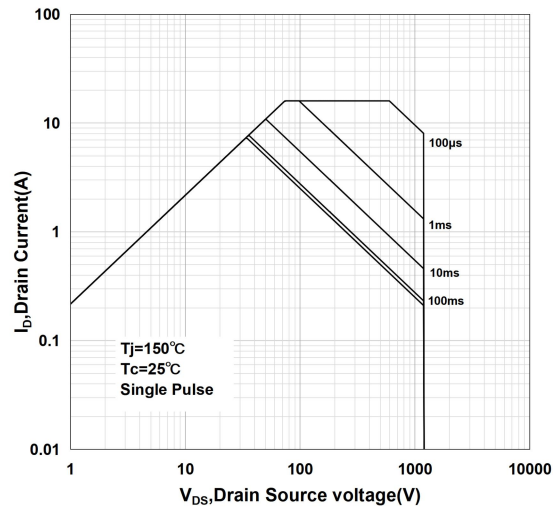




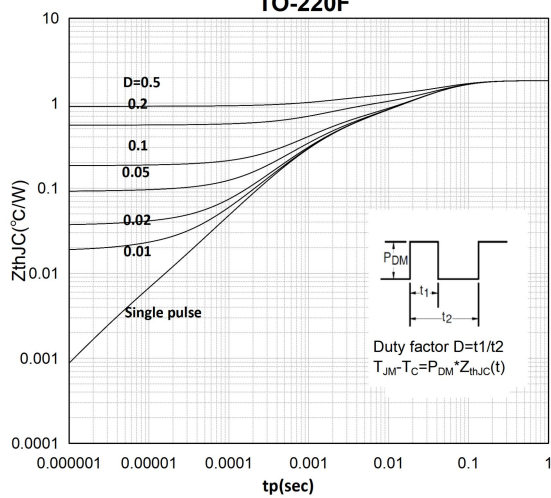
**Transient Thermal Response Curve for TO-220**



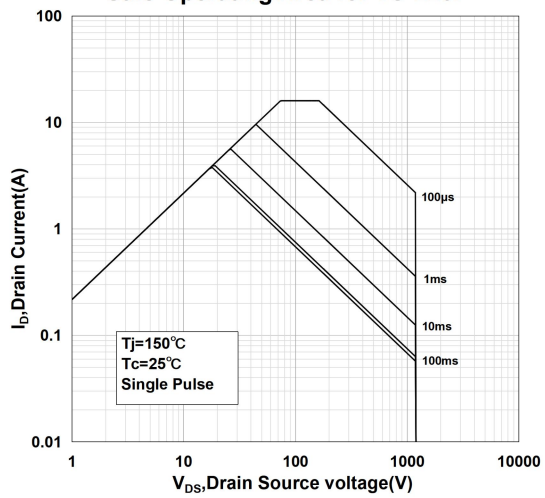
**Safe Operating Area for TO-220**



**Transient Thermal Response Curve for TO-220F**

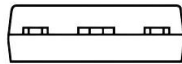
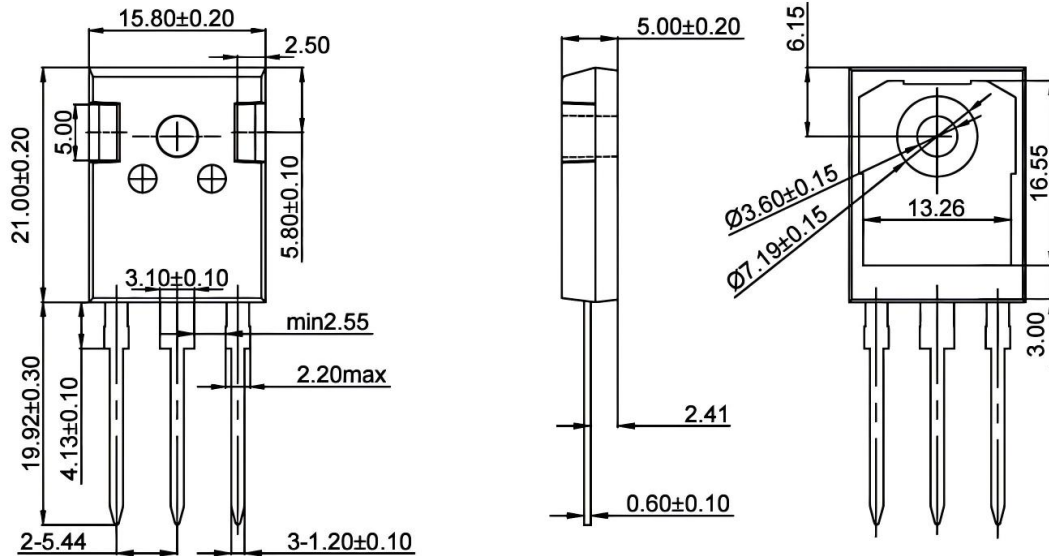


**Safe Operating Area for TO-220F**



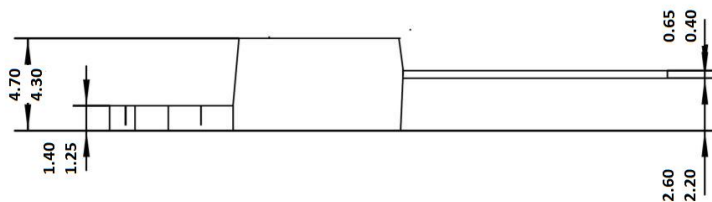


### Package outline dimension



NOTES: 1. surface roughness  $R_a = 1.14 \pm 0.20 \mu\text{m}$   
 2. Unmarked tolerance  $\pm 0.15$   
 3. unit: mm

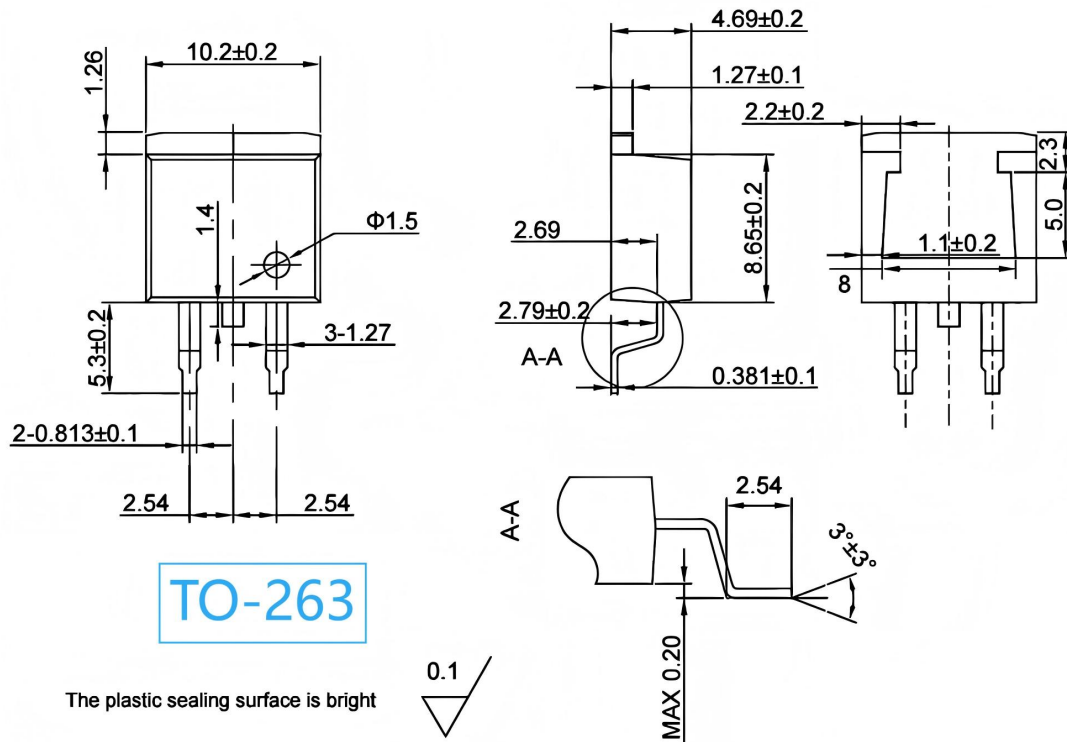
**TO-247**



Unit: mm

**TO-220**





**Notes:**

1. Unmarked tolerance  $\pm 0.15\text{mm}$ ; unmarked R  $< 0.15\text{mm}$
2. The resin body is not allowed to have defects, shrinkage holes, cracks, bubbles and other harmful defects
3. The drawing indicates that the leg has reinforcement
4. Unit : mm

