

## / Descriptions

TO-220            N  
N-CHANNEL MOSFET in a TO-220 Plastic Package.

## / Features

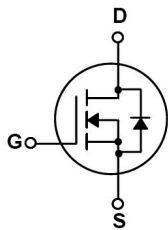
Ultra Low On-Resistance, fast switching, HF Product.

## / Applications

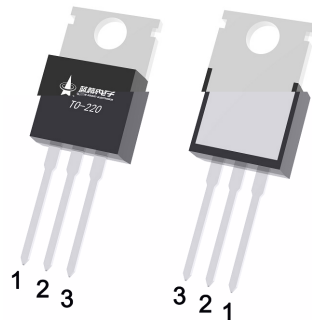
PFC

These devices are well suited for high efficient switched mode power supplies    Active power factor correction, electronic lamp ballast based on half bridge topology.

## / Equivalent Circuit



## / Pinning



PIN1   G            PIN 2   4   D            PIN 3   S

## / Marking

See Marking Instructions.

/ Absolute Maximum Ratings( $T_a=25^\circ\text{C}$ )

| Parameter                              |              | Symbol                                 | Rating     | Unit |
|----------------------------------------|--------------|----------------------------------------|------------|------|
| Drain-Source Voltage                   |              | V <sub>DSS</sub>                       | 40         | V    |
| Drain Current                          |              | I <sub>D</sub> (T <sub>c</sub> =25 °C) | 220        | A    |
| Pulsed Drain Current                   |              | I <sub>DM</sub>                        | 800        | A    |
| Gate-Source Voltage                    |              | V <sub>GS</sub>                        | ±20        | V    |
| Single Pulsed Avalanche Energy L=0.5mH |              | E <sub>AS</sub>                        | 482        | mJ   |
| Avalanche Current                      |              | I <sub>AS</sub>                        | 35         | A    |
| Total Power Dissipation                |              | P <sub>D</sub> (T <sub>c</sub> =25 °C) | 187        | W    |
| Junction and Storage Temperature Range |              | T <sub>J</sub> ,T <sub>STG</sub>       | -55 to 150 |      |
| Thermal Resistance-Junction to Ambient | t ≤ 10s      | R <sub>θJA</sub>                       | 15         | /W   |
|                                        | Steady-State |                                        | 60         |      |
| Thermal Resistance-Junction to Case    | Steady-State | R <sub>θJC</sub>                       | 0.67       |      |

/ Electrical Characteristics( $T_a=25^\circ\text{C}$ )

| Parameter                         | Symbol       | Test Conditions                                        | Min | Typ   | Max       | Unit          |
|-----------------------------------|--------------|--------------------------------------------------------|-----|-------|-----------|---------------|
| Drain-Source Breakdown Voltage    | $BV_{DS}$    | $V_{GS}=0\text{V}$ $I_D=250\mu\text{A}$                | 40  | 44    |           | V             |
| Zero Gate Voltage Drain Current   | $I_{DSS}$    | $V_{DS}=40\text{V}$ $V_{GS}=0\text{V}$                 |     |       | 1         | $\mu\text{A}$ |
| Gate-Body Leakage Current Forward | $I_{GSS}$    | $V_{GS}=\pm 20\text{V}$ $V_{DS}=0\text{V}$             |     |       | $\pm 100$ | nA            |
| Gate Threshold Voltage            | $V_{GS(th)}$ | $V_{DS}=V_{GS}$ $I_D=250\mu\text{A}$                   | 1   | 1.6   | 3         | V             |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}$ $I_D=20\text{A}$                   |     | 1.6   | 2         | m $\Omega$    |
|                                   |              | $V_{GS}=4.5\text{V}$ $I_D=10\text{A}$                  |     | 2.1   | 4         |               |
| Forward On Voltage                | $V_{SD}$     | $V_{GS}=0\text{V}$ $I_S=1\text{A}$                     |     |       | 1.2       | V             |
| Input Capacitance                 | $C_{iss}$    | $V_{DS}=25\text{V}$ $V_{GS}=0\text{V}$ $f=1\text{MHz}$ |     | 11000 |           | pF            |
| Output Capacitance                | $C_{oss}$    |                                                        |     | 840   |           |               |
| Reverse Transfer Capacitance      | $C_{rss}$    |                                                        |     | 650   |           |               |

/ Electrical Characteristics(Ta=25 )

| Parameter           | Symbol             | Test Conditions                                                            | Min | Typ  | Max | Unit     |
|---------------------|--------------------|----------------------------------------------------------------------------|-----|------|-----|----------|
| Gate resistance     | $R_g$              | $f=1\text{MHz}$                                                            |     | 1.45 |     | $\Omega$ |
| Total Gate Charge   | $Q_g(10\text{V})$  | $V_{GS}=10\text{V}$ $V_{DS}=20\text{V}$<br>$I_D=20\text{A}$                |     | 68   |     | nC       |
| Total Gate Charge   | $Q_g(4.5\text{V})$ |                                                                            |     | 28   |     |          |
| Gate Source Charge  | $Q_{gs}$           |                                                                            |     | 16.5 |     |          |
| Gate Drain Charge   | $Q_{gd}$           |                                                                            |     | 4.5  |     |          |
| Turn-On Delay Time  | $t_{d(on)}$        | $V_{GS}=10\text{V}$ $V_{DS}=20\text{V}$<br>$R_L=1\Omega$ $R_{GEN}=3\Omega$ |     | 12.5 |     | ns       |
| Turn-On Rise Time   | $t_r$              |                                                                            |     | 9.5  |     |          |
| Turn-Off Delay Time | $t_{d(off)}$       |                                                                            |     | 57.5 |     |          |
| Turn-Off Fall Time  | $t_f$              |                                                                            |     | 10.5 |     |          |

/ Electrical Characteristic Curve

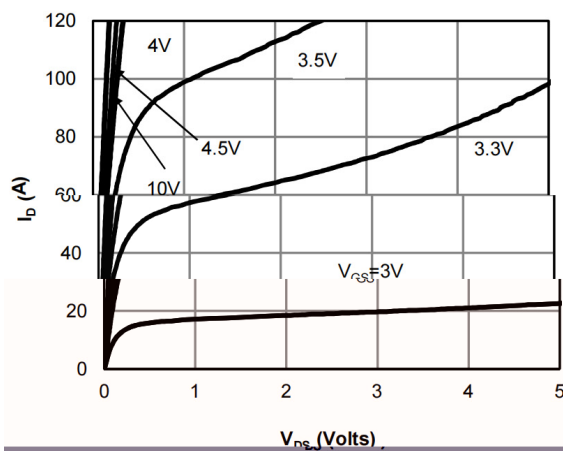


Figure 1: Drain Current vs. Drain-Source Voltage

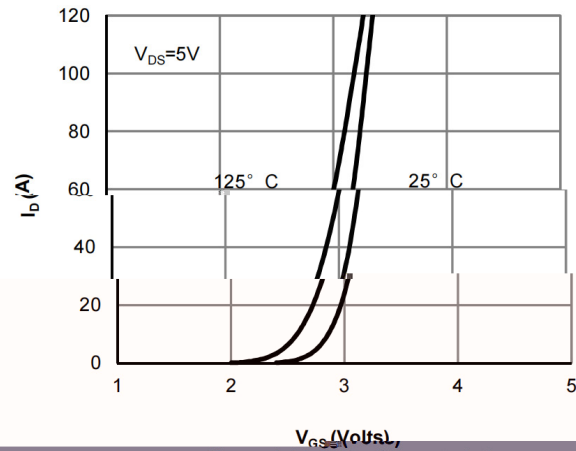


Figure 2: Drain Current vs. Gate-Source Voltage

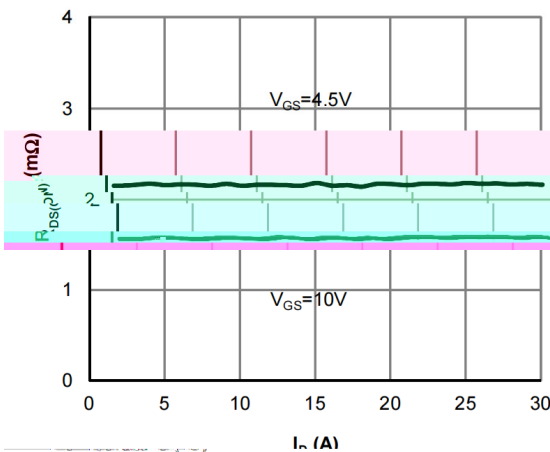


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

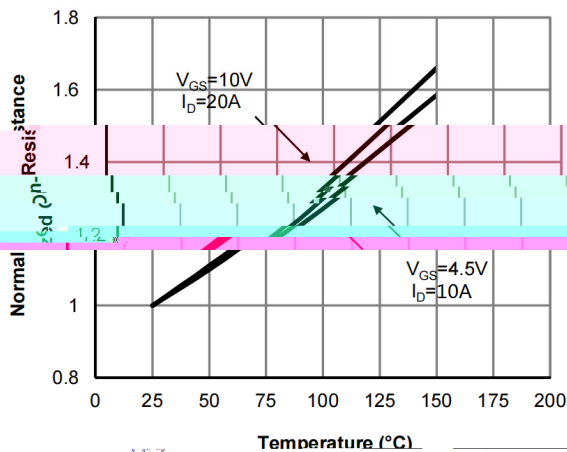


Figure 4: On-Resistance vs. Junction Temperature

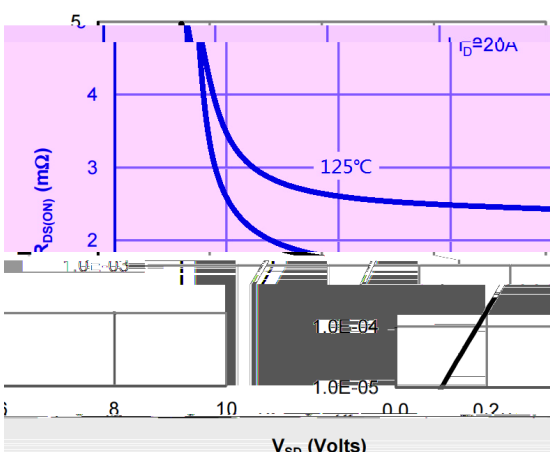


Figure 5: On-Resistance vs. Gate-Source Voltage

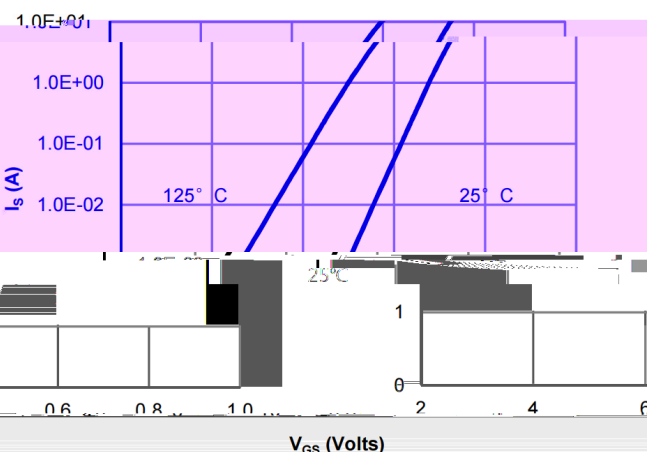
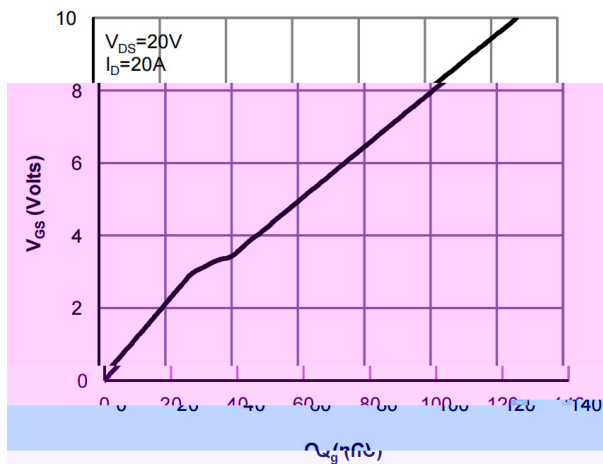
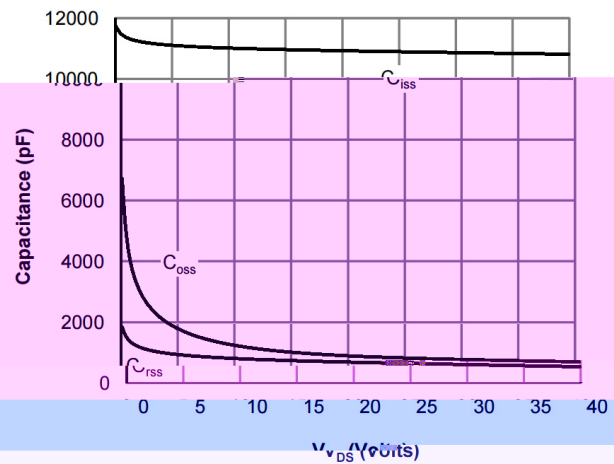


Figure 6: Body Diode Characteristics

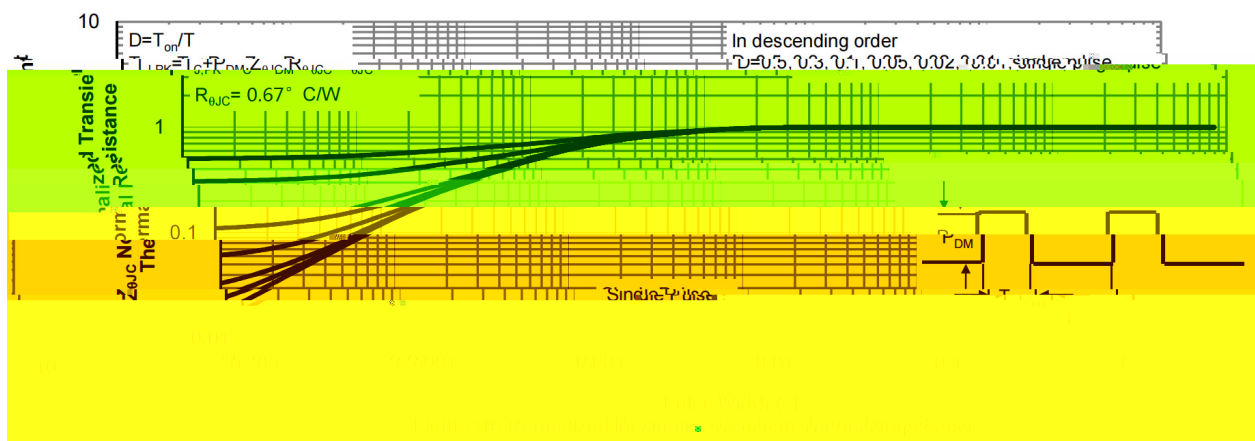
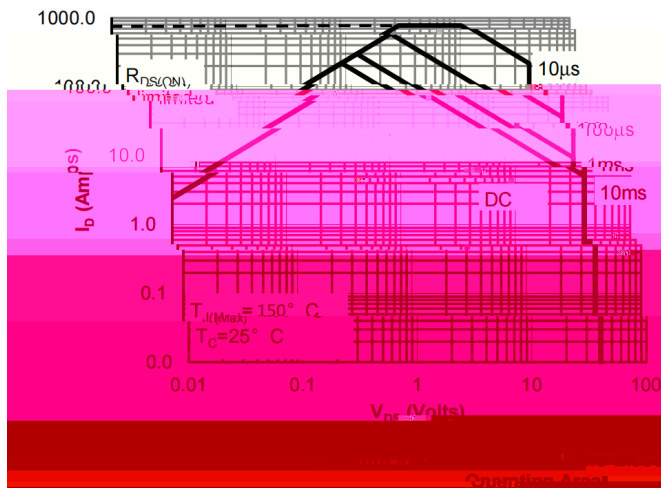
## / Electrical Characteristic Curve



### Figure 7: Gate Charge Characteristics



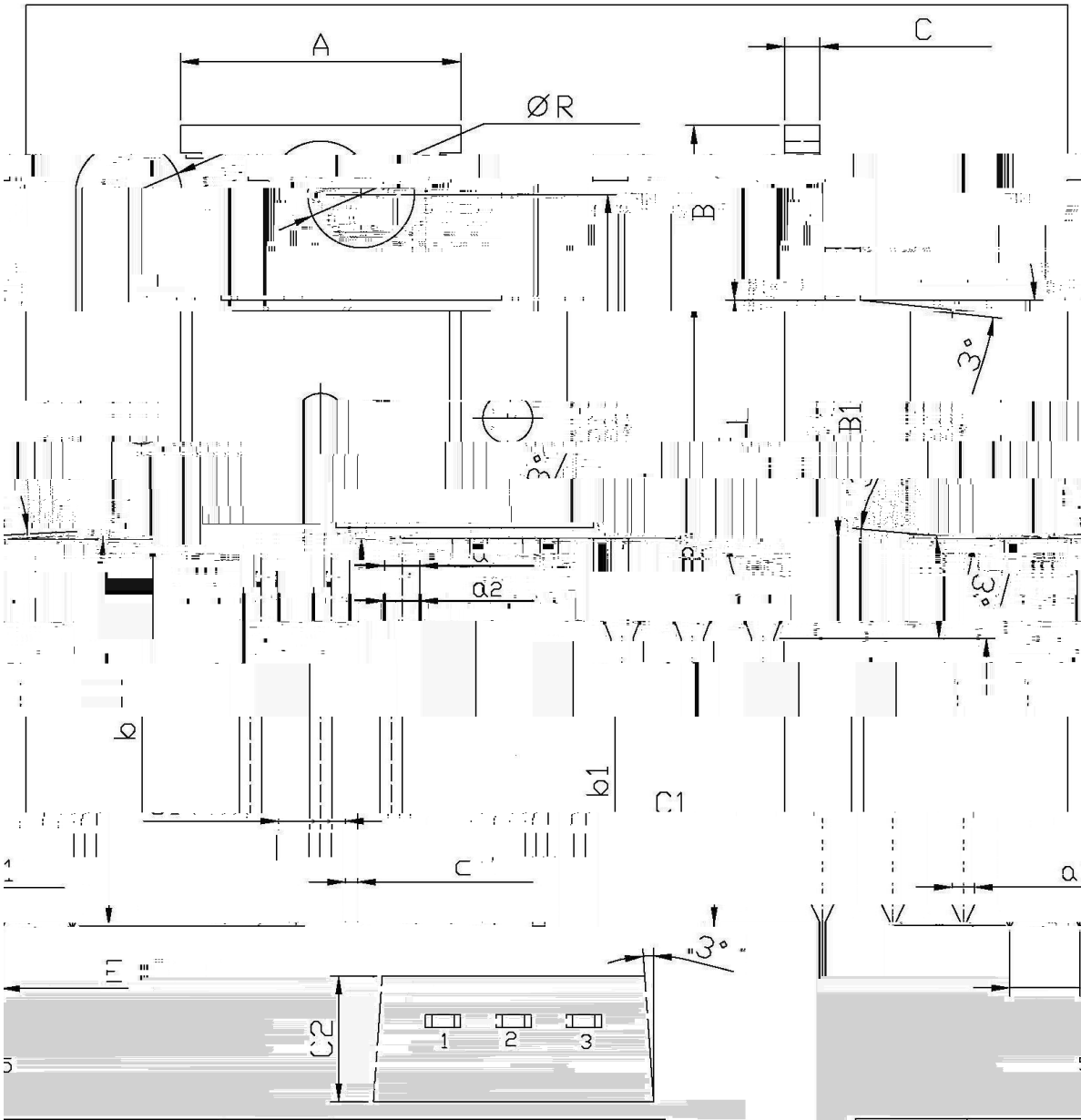
### Figure 8: Capacitance Characteristics



/ Package Dimensions

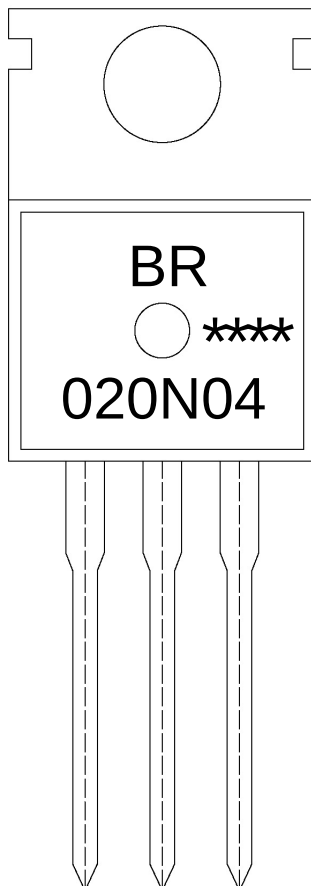
T0-220

单位: mm



| Dimensions In Millimeters |     |     | Dimensions In Millimeters |      |      |
|---------------------------|-----|-----|---------------------------|------|------|
| Symbol                    | Min | Max | Symbol                    | Min  | Max  |
| C                         | 1.2 | 1.4 | A                         | 9.8  | 10.2 |
| B                         | 6.3 | 6.7 | R                         | 3.56 | 3.64 |
| B1                        | 9.0 | 9.4 | C1                        | 15.7 | 16.1 |
| C1                        | 2.2 | 2.6 | b                         | 12.6 | 13.6 |

/ Marking Instructions



BR

020N04

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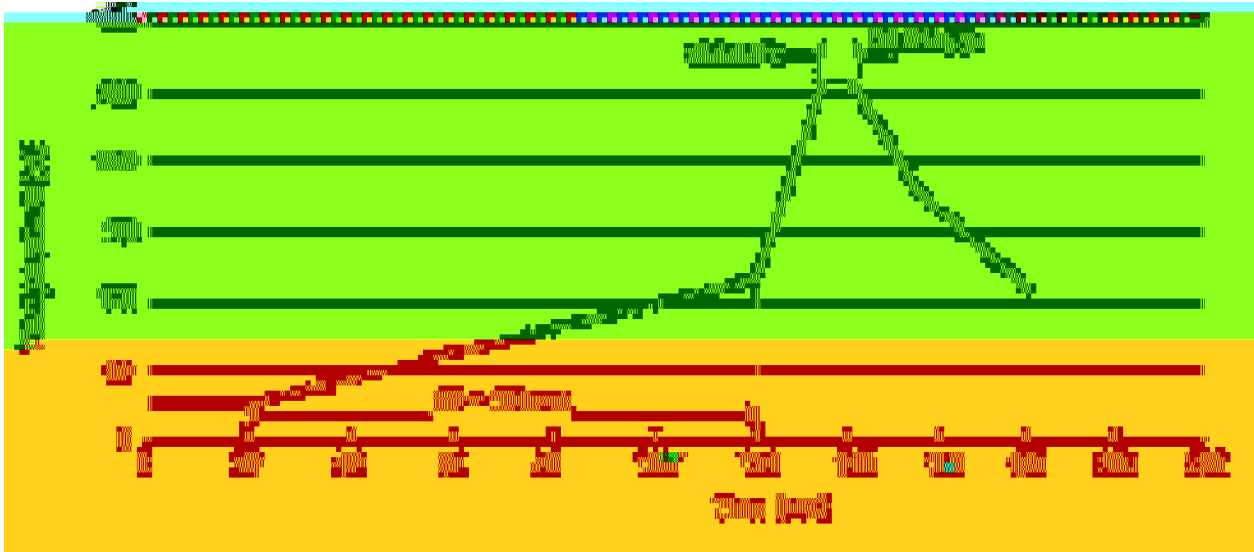
Note:

BR: Company Code

020N04: Product Type

\*\*\*\*: Lot No. Code, code change with Lot No

( ) / Temperature Profile for Dip Soldering(Pb-Free)



Note:

- 1

25 150

60 90sec;

25
- 2

255±5

5±0.5sec;

25
- 3

2 10

/sec.

25
- 1.Preheating:25~150

, Time:60~90sec.
- 2.Peak Temp.:255±5

, Duration:5±0.5sec.
3. Cooling Speed: 2~10

/sec.

/ Resistance to Soldering Heat Test Conditions

270±5                      10±1 sec.                      Temp.:270±5                      Time:10±1 sec

/ Packaging SPEC.

/ BULK

| Package Type | Units     |                |                 |                       |                 | Dimension (unit mm <sup>3</sup> ) |             |             |
|--------------|-----------|----------------|-----------------|-----------------------|-----------------|-----------------------------------|-------------|-------------|
|              | Units/Bag | Bags/Inner Box | Units/Inner Box | Inner Boxes/Outer Box | Units/Outer Box | Bag                               | Inner Box   | Outer Box   |
| TO-220/F     | 200       | 10             | 2,000           | 5                     | 10,000          | 135×190                           | 237×172×102 | 560×245×195 |

/ TUBE(unit mm