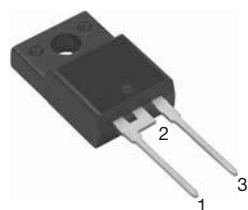
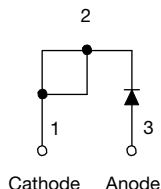




## Fast Soft Recovery Rectifier Diode, 10 A



TO-220 FULL-PAK



## FEATURES

- Glass passivated pellet chip junction
- 150 °C max. operation junction temperature
- Designed and qualified according to JEDEC®-JESD 47
- Fully isolated package ( $V_{INS} = 2500 V_{RMS}$ )
- UL E78996 approved
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

## PRODUCT SUMMARY

|                 |                |
|-----------------|----------------|
| Package         | TO-220FP       |
| $I_{F(AV)}$     | 10 A           |
| $V_R$           | 1000 V, 1200 V |
| $V_F$ at $I_F$  | 1.33 V         |
| $I_{FSM}$       | 140 A          |
| $t_{rr}$        | 80 ns          |
| $T_J$ max.      | 150 °C         |
| Diode variation | Single die     |
| Snap factor     | 0.6            |

## APPLICATIONS

These devices are intended for use in output rectification and freewheeling in inverters, choppers and converters as well as in input rectification where severe restrictions on conducted EMI should be met.

## DESCRIPTION

The VS-10ETF1..FP... fast soft recovery rectifier series has been optimized for combined short reverse recovery time and low forward voltage drop.

The glass passivation ensures stable reliable operation in the most severe temperature and power cycling conditions.

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS     | VALUES       | UNITS |
|-------------|---------------------|--------------|-------|
| $V_{RRM}$   |                     | 1000 to 1200 | V     |
| $I_{F(AV)}$ | Sinusoidal waveform | 10           | A     |
| $I_{FSM}$   |                     | 140          |       |
| $t_{rr}$    | 1 A, 100 A/ $\mu$ s | 80           | ns    |
| $V_F$       | 10 A, $T_J = 25$ °C | 1.33         | V     |
| $T_J$       |                     | -40 to +150  | °C    |

## VOLTAGE RATINGS

| PART NUMBER                      | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$<br>AT 150 °C<br>mA |
|----------------------------------|-----------------------------------------------|--------------------------------------------------------------|------------------------------|
| VS-10ETF10FPPbF, VS-10ETF10FP-M3 | 1000                                          | 1100                                                         | 4                            |
| VS-10ETF12FPPbF, VS-10ETF12FP-M3 | 1200                                          | 1300                                                         |                              |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                           | SYMBOL        | TEST CONDITIONS                               | VALUES | UNITS                     |
|-----------------------------------------------------|---------------|-----------------------------------------------|--------|---------------------------|
| Maximum average forward current                     | $I_{F(AV)}$   | $T_C = 95$ °C, 180° conduction half sine wave | 10     | A                         |
| Maximum peak one cycle non-repetitive surge current | $I_{FSM}$     | 10 ms sine pulse, rated $V_{RRM}$ applied     | 115    |                           |
|                                                     |               | 10 ms sine pulse, no voltage reapplied        | 140    |                           |
| Maximum $I^2t$ for fusing                           | $I^2t$        | 10 ms sine pulse, rated $V_{RRM}$ applied     | 66     | A <sup>2</sup> s          |
|                                                     |               | 10 ms sine pulse, no voltage reapplied        | 94     |                           |
| Maximum $I^2\sqrt{t}$ for fusing                    | $I^2\sqrt{t}$ | $t = 0.1$ to 10 ms, no voltage reapplied      | 940    | A <sup>2</sup> $\sqrt{s}$ |



## ELECTRICAL SPECIFICATIONS

| PARAMETER                       | SYMBOL      | TEST CONDITIONS                          |                               | VALUES | UNITS      |
|---------------------------------|-------------|------------------------------------------|-------------------------------|--------|------------|
| Maximum forward voltage drop    | $V_{FM}$    | 10 A, $T_J = 25\text{ }^{\circ}\text{C}$ |                               | 1.33   | V          |
| Forward slope resistance        | $r_t$       | $T_J = 150\text{ }^{\circ}\text{C}$      |                               | 22.9   | m $\Omega$ |
| Threshold voltage               | $V_{F(TO)}$ |                                          |                               | 0.96   | V          |
| Maximum reverse leakage current | $I_{RM}$    | $T_J = 25\text{ }^{\circ}\text{C}$       | $V_R = \text{Rated } V_{RRM}$ | 0.1    | mA         |
|                                 |             | $T_J = 150\text{ }^{\circ}\text{C}$      |                               | 4      |            |

## RECOVERY CHARACTERISTICS

| PARAMETER                | SYMBOL   | TEST CONDITIONS                                                       | VALUES | UNITS         |  |
|--------------------------|----------|-----------------------------------------------------------------------|--------|---------------|--|
| Reverse recovery time    | $t_{rr}$ | $I_F$ at 10 A <sub>pk</sub><br>25 A/ $\mu$ s<br>25 $^{\circ}\text{C}$ | 310    | ns            |  |
| Reverse recovery current | $I_{rr}$ |                                                                       | 4.7    | A             |  |
| Reverse recovery charge  | $Q_{rr}$ |                                                                       | 1.05   | $\mu\text{C}$ |  |
| Snap factor              | S        |                                                                       | 0.6    |               |  |

## THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER                                      | SYMBOL                            | TEST CONDITIONS                       | VALUES                 | UNITS                  |
|------------------------------------------------|-----------------------------------|---------------------------------------|------------------------|------------------------|
| Maximum junction and storage temperature range | T <sub>J</sub> , T <sub>Stg</sub> |                                       | -40 to +150            | °C                     |
| Maximum thermal resistance junction to case    | R <sub>thJC</sub>                 | DC operation                          | 2.5                    | °C/W                   |
| Maximum thermal resistance junction to ambient | R <sub>thJA</sub>                 |                                       | 62                     |                        |
| Typical thermal resistance, case to heatsink   | R <sub>thCS</sub>                 | Mounting surface, smooth, and greased | 0.5                    |                        |
| Approximate weight                             |                                   |                                       | 2                      | g                      |
|                                                |                                   |                                       | 0.07                   | oz.                    |
| Mounting torque                                | minimum                           |                                       | 6 (5)                  | kgf · cm<br>(lbf · in) |
|                                                | maximum                           |                                       | 12 (10)                |                        |
| Marking device                                 |                                   | Case style TO-220 FULL-PAK            | 10ETF10FP<br>10ETF12FP |                        |

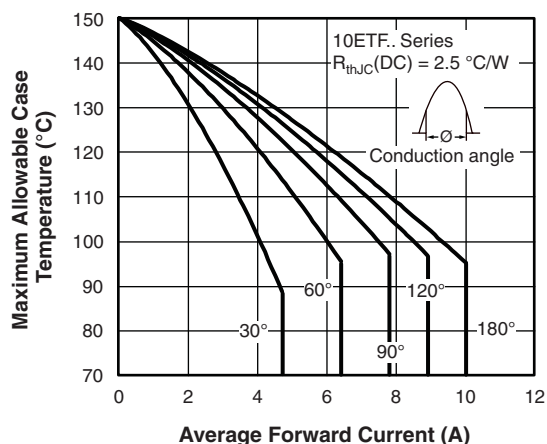


Fig. 1 - Current Rating Characteristics

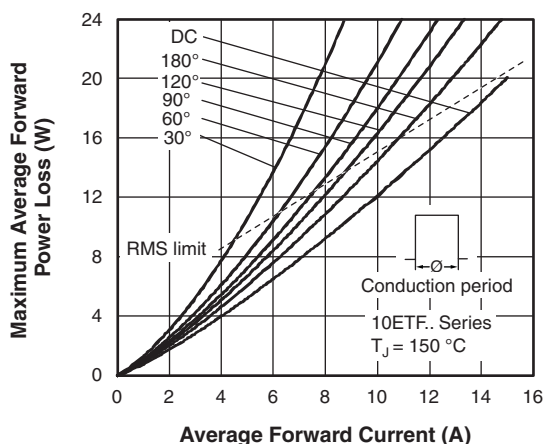


Fig. 4 - Forward Power Loss Characteristics

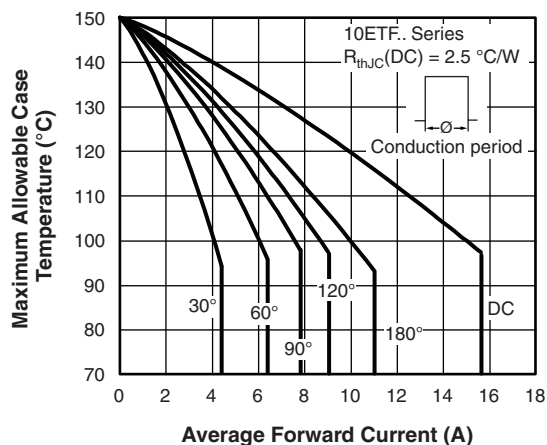


Fig. 2 - Current Rating Characteristics

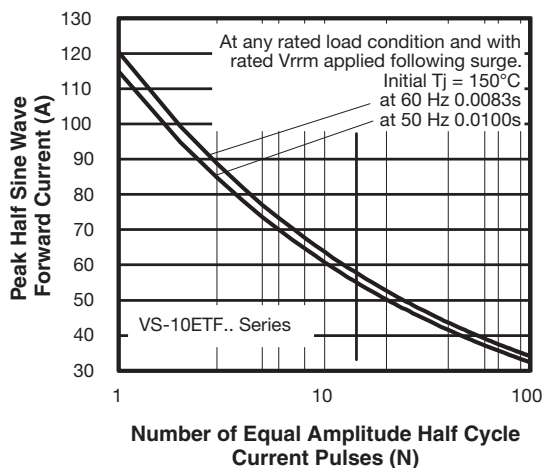


Fig. 5 - Maximum Non-Repetitive Surge Current

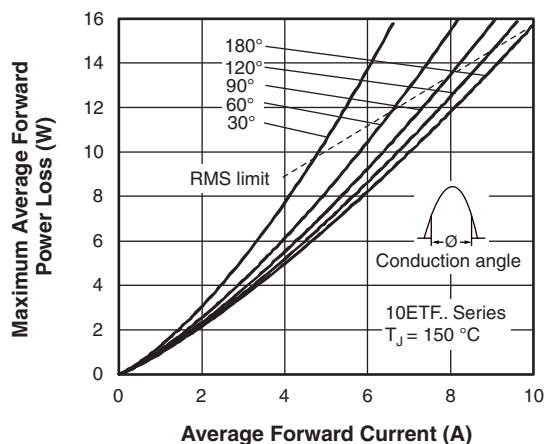


Fig. 3 - Forward Power Loss Characteristics

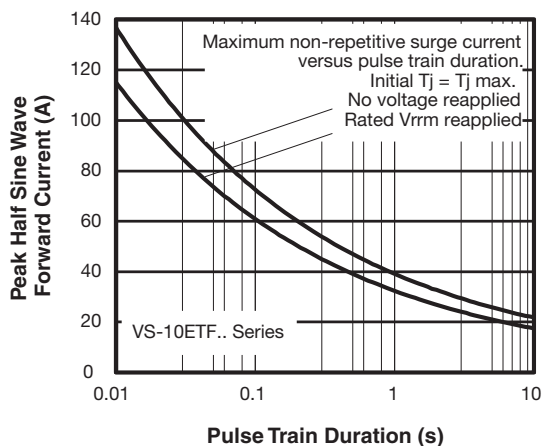


Fig. 6 - Maximum Non-Repetitive Surge Current

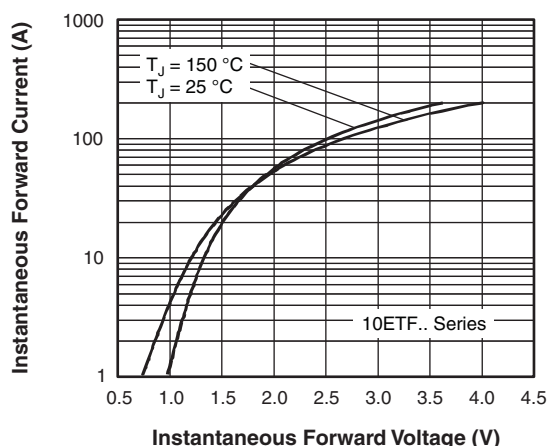


Fig. 7 - Forward Voltage Drop Characteristics

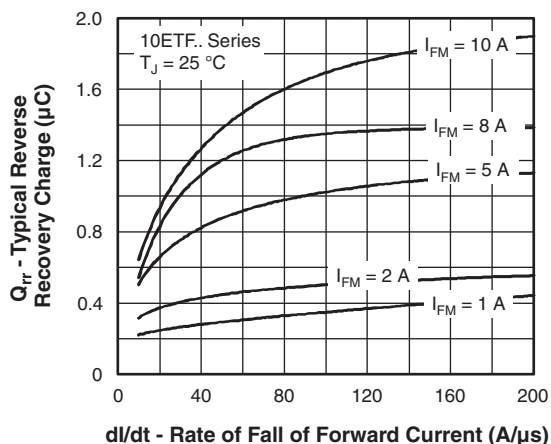


Fig. 10 - Recovery Charge Characteristics,  $T_J = 25\text{ °C}$

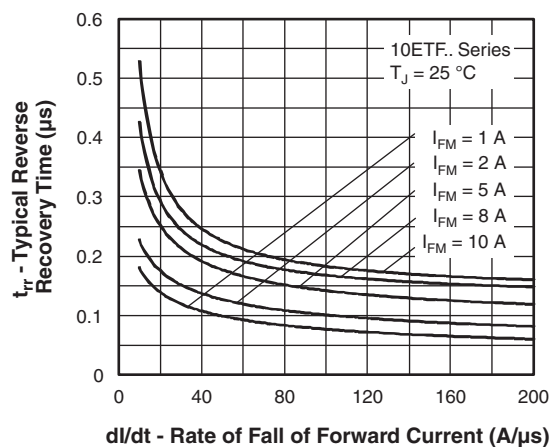


Fig. 8 - Recovery Time Characteristics,  $T_J = 25\text{ °C}$

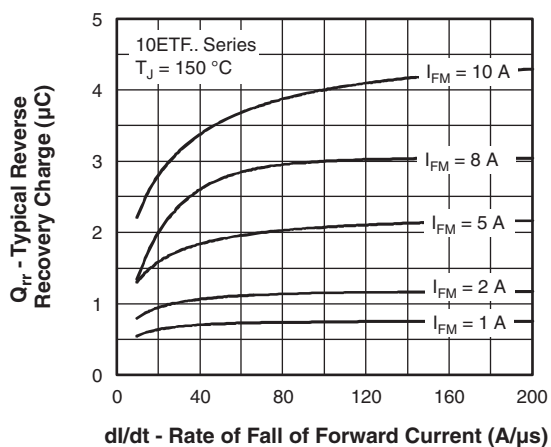


Fig. 11 - Recovery Charge Characteristics,  $T_J = 150\text{ °C}$

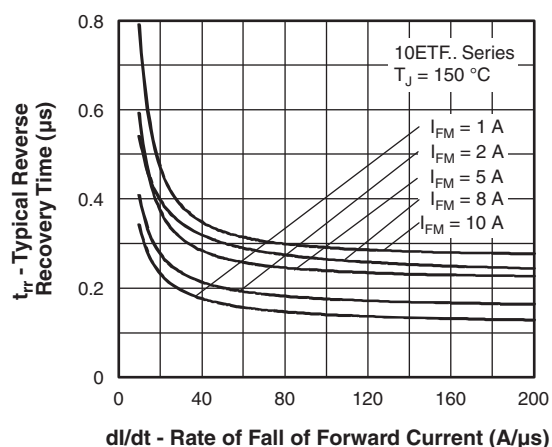


Fig. 9 - Recovery Time Characteristics,  $T_J = 150\text{ °C}$

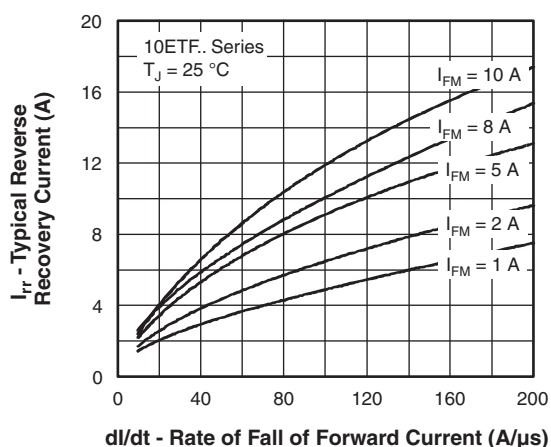


Fig. 12 - Recovery Current Characteristics,  $T_J = 25\text{ °C}$

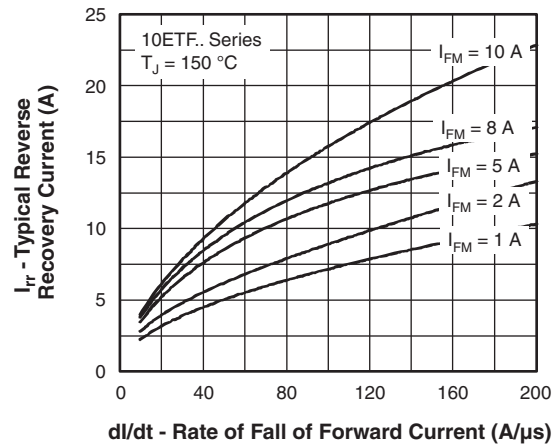


Fig. 13 - Recovery Current Characteristics, T<sub>J</sub> = 150 °C

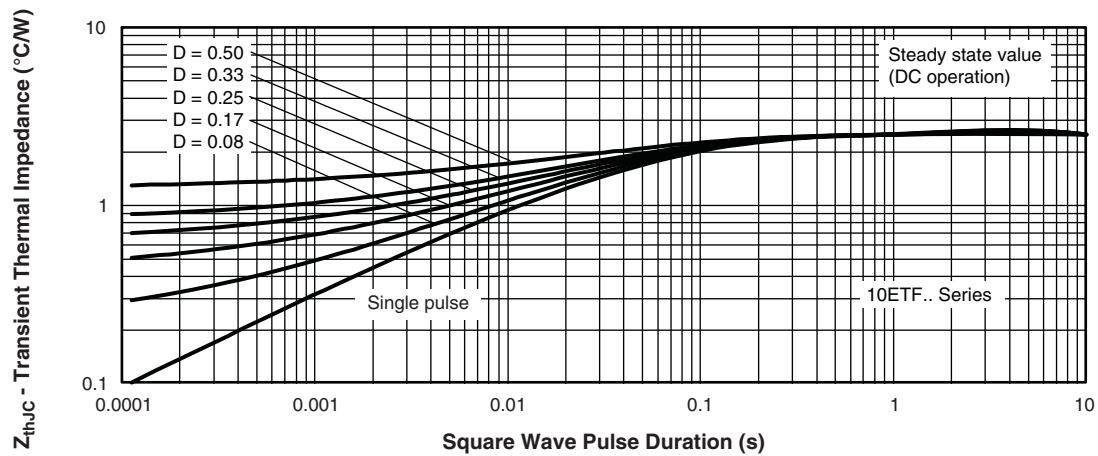


Fig. 14 - Thermal Impedance Z<sub>thJC</sub> Characteristics



## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |    |    |     |
|-------------|-----|----|---|---|---|----|----|-----|
| Device code | VS- | 10 | E | T | F | 12 | FP | PbF |
|             | ①   | ②  | ③ | ④ | ⑤ | ⑥  | ⑦  | ⑧   |

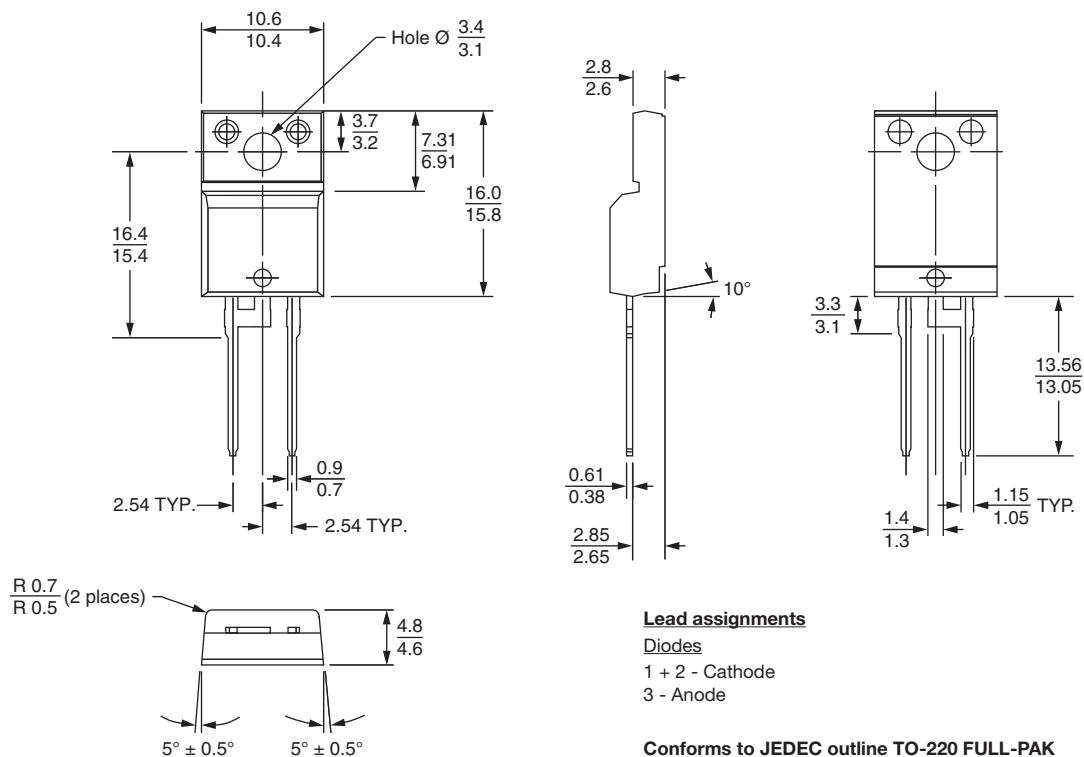
- 1** - Vishay Semiconductors product
- 2** - Current rating (10 = 10 A)
- 3** - Circuit configuration:  
E = single diode
- 4** - Package:  
T = TO-220
- 5** - Type of silicon:  
F = fast soft recovery rectifier
- 6** - Voltage code x 100 =  $V_{RRM}$  ————  
02 = 200 V  
04 = 400 V  
06 = 600 V
- 7** - FULL-PAK
- 8** - Environmental digit:
  - PbF = lead (Pb)-free and RoHS-compliant
  - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) |                  |                        |                          |
|--------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-10ETF10FPPbF                | 50               | 1000                   | Antistatic plastic tubes |
| VS-10ETF10FP-M3                | 50               | 1000                   | Antistatic plastic tubes |
| VS-10ETF12FPPbF                | 50               | 1000                   | Antistatic plastic tubes |
| VS-10ETF12FP-M3                | 50               | 1000                   | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |               |                                                                        |
|----------------------------|---------------|------------------------------------------------------------------------|
| Dimensions                 |               | <a href="http://www.vishay.com/doc?95005">www.vishay.com/doc?95005</a> |
| Part marking information   | TO-220 FP PbF | <a href="http://www.vishay.com/doc?95009">www.vishay.com/doc?95009</a> |
|                            | TO-220 FP -M3 | <a href="http://www.vishay.com/doc?95440">www.vishay.com/doc?95440</a> |



**DIMENSIONS** in millimeters



#### Lead assignments

##### Diodes

1 + 2 - Cathode  
3 - Anode

Conforms to JEDEC outline TO-220 FULL-PAK



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