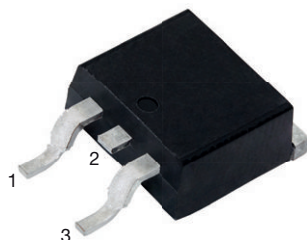
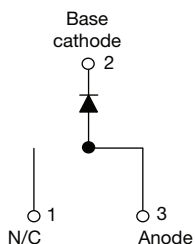


## High Performance Schottky Rectifier, 6 A


D<sup>2</sup>PAK (TO-263AB)


### FEATURES

- 175 °C T<sub>J</sub> operation
- High frequency operation
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### PRIMARY CHARACTERISTICS

|                                  |                               |
|----------------------------------|-------------------------------|
| I <sub>F(AV)</sub>               | 6 A                           |
| V <sub>R</sub>                   | 35 V, 40 V, 45 V              |
| V <sub>F</sub> at I <sub>F</sub> | 0.53 V                        |
| I <sub>RM</sub>                  | 7 mA at 125 °C                |
| T <sub>J</sub> max.              | 175 °C                        |
| E <sub>AS</sub>                  | 8 mJ                          |
| Package                          | D <sup>2</sup> PAK (TO-263AB) |
| Circuit configuration            | Single                        |

### DESCRIPTION

The VS-6TQ... Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                             | VALUES      | UNITS |
|--------------------|---------------------------------------------|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform                        | 6           | A     |
| V <sub>RRM</sub>   | Range                                       | 35 to 45    | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 µs sine                  | 690         | A     |
| V <sub>F</sub>     | 6 A <sub>pk</sub> , T <sub>J</sub> = 125 °C | 0.53        | V     |
| T <sub>J</sub>     | Range                                       | -55 to +175 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-6TQ035S-M3 | VS-6TQ040S-M3 | VS-6TQ045S-M3 | UNITS |
|--------------------------------------|------------------|---------------|---------------|---------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | 35            | 40            | 45            | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |               |               |               |       |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                            | SYMBOL             | TEST CONDITIONS                                                                                                                        | VALUES | UNITS |
|----------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current<br>See fig. 5                        | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 164 °C, rectangular waveform                                                                       | 6      | A     |
| Maximum peak one cycle<br>non-repetitive surge current<br>See fig. 7 | I <sub>FSM</sub>   | 5 µs sine or 3 µs rect. pulse                                                                                                          | 690    |       |
|                                                                      |                    | 10 ms sine or 6 ms rect. pulse                                                                                                         | 140    |       |
| Non-repetitive avalanche energy                                      | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 1.20 A, L = 11.10 mH                                                                         | 8      | mJ    |
| Repetitive avalanche current                                         | I <sub>AR</sub>    | Current decaying linearly to zero in 1 µs<br>Frequency limited by T <sub>J</sub> maximum V <sub>A</sub> = 1.5 x V <sub>R</sub> typical | 1.20   | A     |



## ELECTRICAL SPECIFICATIONS

| PARAMETER                                     | SYMBOL         | TEST CONDITIONS                                                                            | VALUES | UNITS      |
|-----------------------------------------------|----------------|--------------------------------------------------------------------------------------------|--------|------------|
| Maximum forward voltage drop<br>See fig. 1    | $V_{FM}^{(1)}$ | 6 A                                                                                        | 0.60   | V          |
|                                               |                | 12 A                                                                                       | 0.73   |            |
|                                               |                | 6 A                                                                                        | 0.53   |            |
|                                               |                | 12 A                                                                                       | 0.64   |            |
| Maximum reverse leakage current<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                         | 0.8    | mA         |
|                                               |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        | 7      |            |
| Threshold voltage                             | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$                                                                | 0.35   | V          |
| Forward slope resistance                      | $r_t$          |                                                                                            | 18.23  | m $\Omega$ |
| Maximum junction capacitance                  | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$ | 400    | pF         |
| Typical series inductance                     | $L_S$          | Measured lead to lead 5 mm from package body                                               | 8.0    | nH         |
| Maximum voltage rate of change                | dV/dt          | Rated $V_R$                                                                                | 10 000 | V/ $\mu$ s |

### Note

<sup>(1)</sup> Pulse width < 300  $\mu$ s, duty cycle < 2 %

## THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER                                      | SYMBOL         | TEST CONDITIONS                          | VALUES     | UNITS                  |
|------------------------------------------------|----------------|------------------------------------------|------------|------------------------|
| Maximum junction and storage temperature range | $T_J, T_{Stg}$ |                                          | -55 to 175 | $^{\circ}\text{C}$     |
| Maximum thermal resistance, junction to case   | $R_{thJC}$     | DC operation<br>See fig. 4               | 2.2        | $^{\circ}\text{C/W}$   |
| Typical thermal resistance, case to heatsink   | $R_{thCS}$     | Mounting surface, smooth, and greased    | 0.50       |                        |
| Approximate weight                             |                |                                          | 2          | g                      |
|                                                |                |                                          | 0.07       | oz.                    |
| Mounting torque                                | minimum        |                                          | 6 (5)      | kgf · cm<br>(lbf · in) |
|                                                | maximum        |                                          | 12 (10)    |                        |
| Marking device                                 |                | Case style D <sup>2</sup> PAK (TO-263AB) | 6TQ035S    |                        |
|                                                |                |                                          | 6TQ040S    |                        |
|                                                |                |                                          | 6TQ045S    |                        |

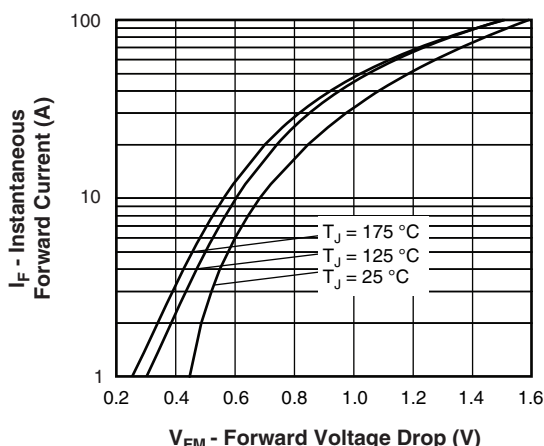


Fig. 1 - Maximum Forward Voltage Drop Characteristics

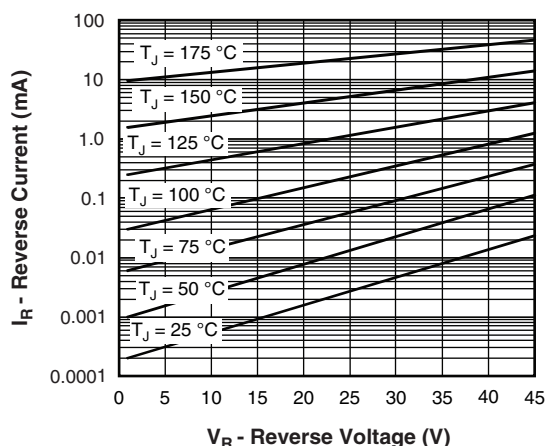


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

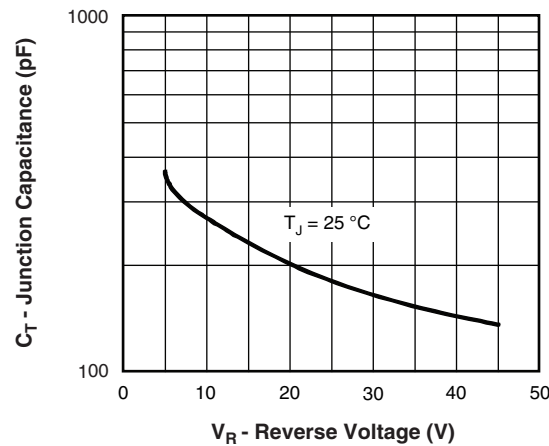


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

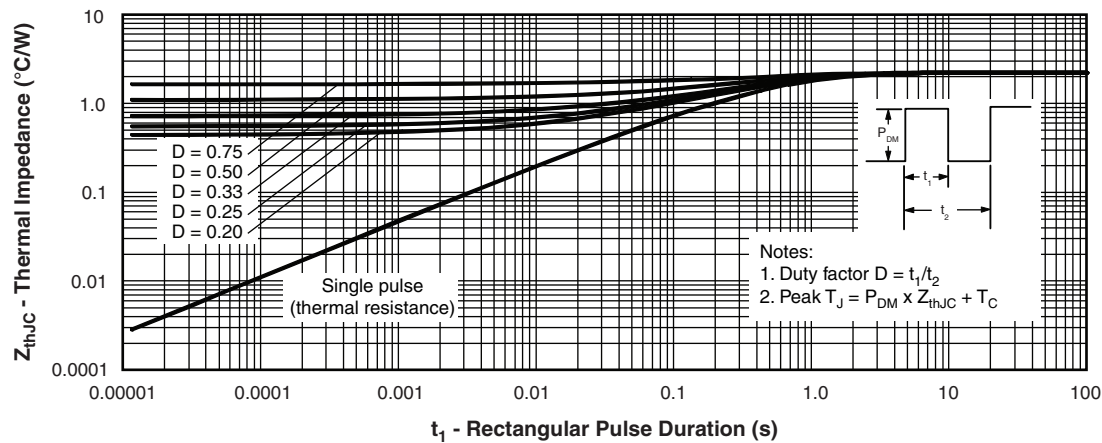


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

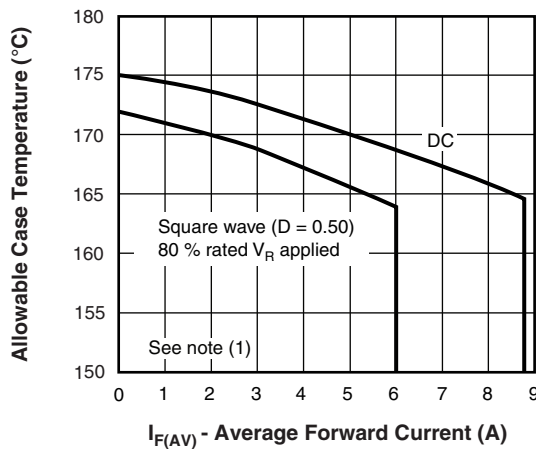


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

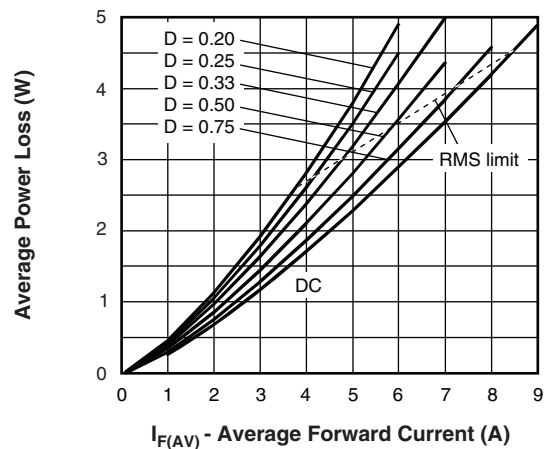


Fig. 6 - Forward Power Loss Characteristics

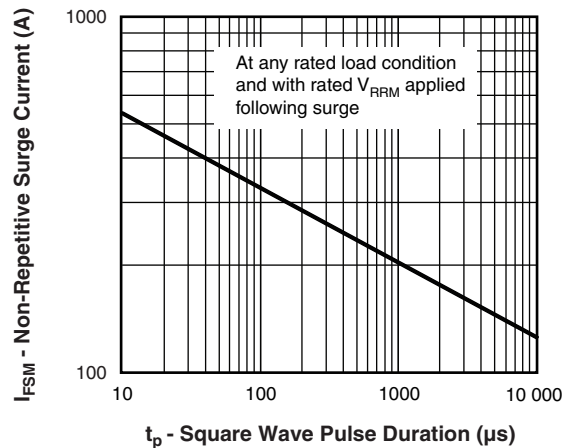


Fig. 7 - Maximum Non-Repetitive Surge Current

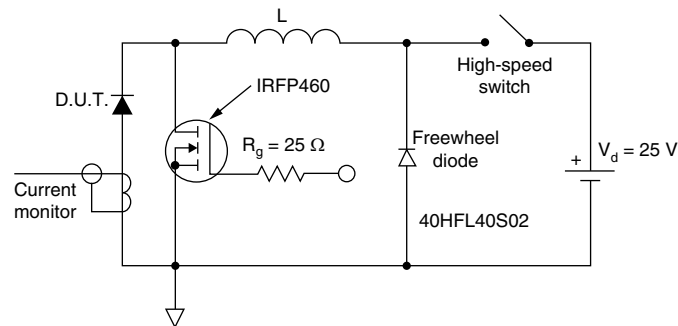


Fig. 8 - Unclamped Inductive Test Circuit

## Note

- <sup>(1)</sup> Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\%$  rated  $V_R$



## ORDERING INFORMATION TABLE

| Device code | VS-                                                                                                                                                        | 6 | T | Q | 045 | S | TRL | -M3 |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|---|-----|-----|
|             | 1                                                                                                                                                          | 2 | 3 | 4 | 5   | 6 | 7   | 8   |
| 1           | Vishay Semiconductors product                                                                                                                              |   |   |   |     |   |     |     |
| 2           | Current rating (6 A)                                                                                                                                       |   |   |   |     |   |     |     |
| 3           | Package: T = TO-220                                                                                                                                        |   |   |   |     |   |     |     |
| 4           | Schottky "Q" series                                                                                                                                        |   |   |   |     |   |     |     |
| 5           | Voltage ratings                                                                                                                                            |   |   |   |     |   |     |     |
| 6           | S = D <sup>2</sup> PAK (TO-263AB)                                                                                                                          |   |   |   |     |   |     |     |
| 7           | <ul style="list-style-type: none"><li>• None = tube</li><li>• TRL = tape and reel (left oriented)</li><li>• TRR = tape and reel (right oriented)</li></ul> |   |   |   |     |   |     |     |
| 8           | -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free                                                                                         |   |   |   |     |   |     |     |

|            |
|------------|
| 035 = 35 V |
| 040 = 40 V |
| 045 = 45 V |

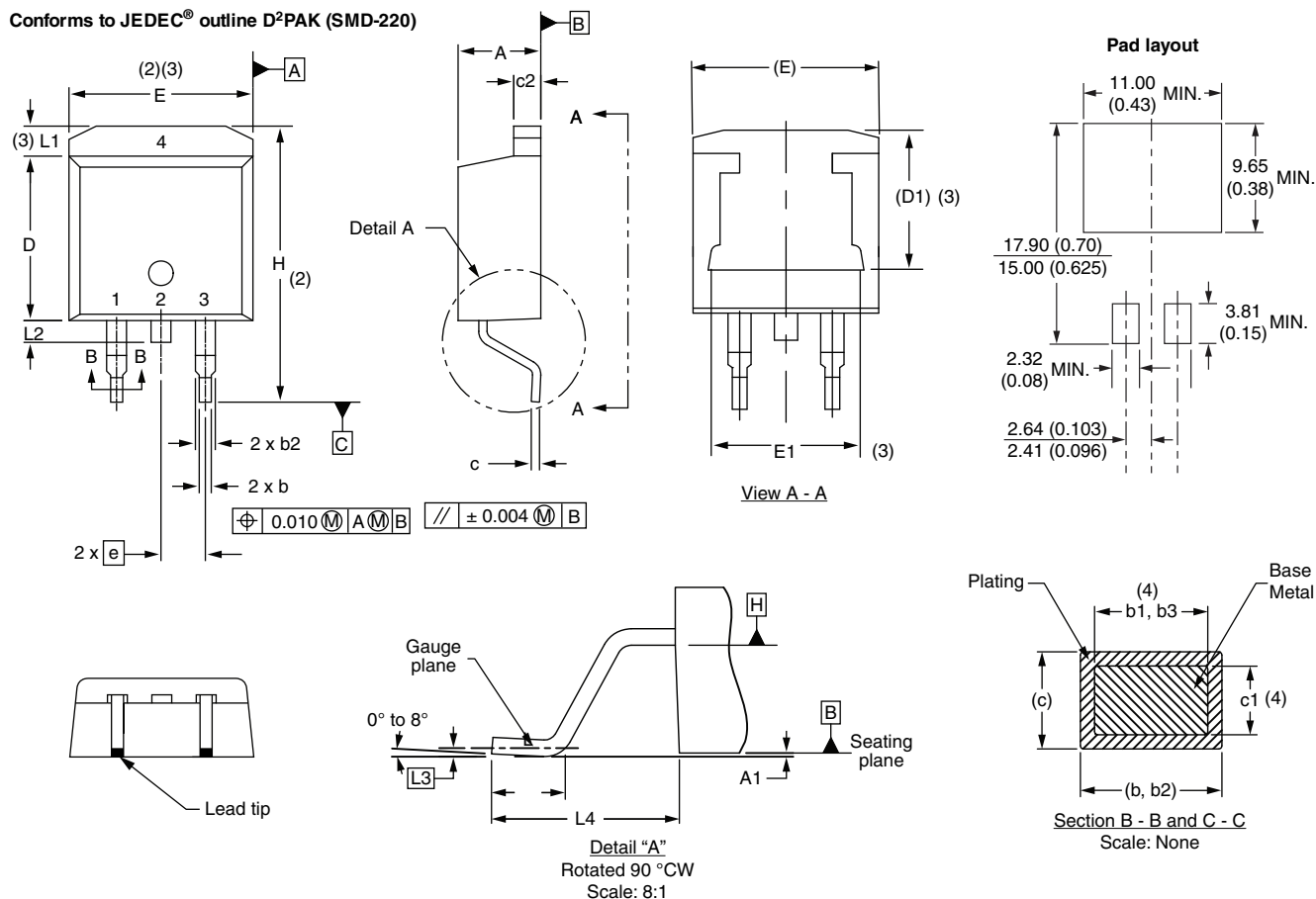
| ORDERING INFORMATION |               |                                    |
|----------------------|---------------|------------------------------------|
| PREFERRED P/N        | BASE QUANTITY | PACKAGING DESCRIPTION              |
| VS-6TQ035S-M3        | 50            | Antistatic plastic tubes           |
| VS-6TQ035STRL-M3     | 800           | 13" diameter plastic tape and reel |
| VS-6TQ035STRR-M3     | 800           | 13" diameter plastic tape and reel |
| VS-6TQ040S-M3        | 50            | Antistatic plastic tubes           |
| VS-6TQ040STRL-M3     | 800           | 13" diameter plastic tape and reel |
| VS-6TQ040STRR-M3     | 800           | 13" diameter plastic tape and reel |
| VS-6TQ045S-M3        | 50            | Antistatic plastic tubes           |
| VS-6TQ045STRL-M3     | 800           | 13" diameter plastic tape and reel |
| VS-6TQ045STRR-M3     | 800           | 13" diameter plastic tape and reel |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a> |

### D<sup>2</sup>PAK

#### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160  | 0.190 |       |
| A1     | 0.00        | 0.254 | 0.000  | 0.010 |       |
| b      | 0.51        | 0.99  | 0.020  | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020  | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045  | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015  | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015  | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045  | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335  | 0.380 | 2     |

| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| H      | 14.61       | 15.88 | 0.575     | 0.625 |       |
| L      | 1.78        | 2.79  | 0.070     | 0.110 |       |
| L1     | -           | 1.65  | -         | 0.066 | 3     |
| L2     | 1.27        | 1.78  | 0.050     | 0.070 |       |
| L3     | 0.25 BSC    |       | 0.010 BSC |       |       |
| L4     | 4.78        | 5.28  | 0.188     | 0.208 |       |

#### Notes

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inches
- (7) Outline conforms to JEDEC® outline TO-263AB



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