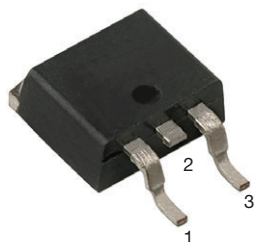
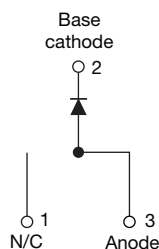


# HEXFRED® Ultrafast Soft Recovery Diode, 25 A


**D²PAK (TO-263AB)**


## FEATURES

- Ultrafast and ultrasoft recovery
- Very low  $I_{RRM}$  and  $Q_{rr}$
- Specified at operating conditions
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified, meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

## BENEFITS

- Reduced RFI and EMI
- Reduced power loss in diode and switching transistor
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

## DESCRIPTION

VS-HFA25TB60S is a state of the art ultrafast recovery diode. Employing the latest in epitaxial construction and advanced processing techniques it features a superb combination of characteristics which result in performance which is unsurpassed by any rectifier previously available. With basic ratings of 600 V and 25 A continuous current, the VS-HFA25TB60S is especially well suited for use as the companion diode for IGBTs and MOSFETs. In addition to ultrafast recovery time, the HEXFRED® product line features extremely low values of peak recovery current ( $I_{RRM}$ ) and does not exhibit any tendency to “snap-off” during the  $t_b$  portion of recovery. The HEXFRED features combine to offer designers a rectifier with lower noise and significantly lower switching losses in both the diode and the switching transistor. These HEXFRED advantages can help to significantly reduce snubbing, component count and heatsink sizes. The HEXFRED VS-HFA25TB60S is ideally suited for applications in power supplies and power conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.

## PRIMARY CHARACTERISTICS

|                       |                  |
|-----------------------|------------------|
| $I_{F(AV)}$           | 25 A             |
| $V_R$                 | 600 V            |
| $V_F$ at $I_F$        | 1.3 V            |
| $t_{rr}$ (typ.)       | 23 ns            |
| $T_J$ max.            | 150 °C           |
| Package               | D²PAK (TO-263AB) |
| Circuit configuration | Single           |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                        | SYMBOL         | TEST CONDITIONS       | VALUES      | UNITS |
|--------------------------------------------------|----------------|-----------------------|-------------|-------|
| Cathode to anode voltage                         | $V_R$          |                       | 600         | V     |
| Maximum continuous forward current               | $I_F$          | $T_C = 100\text{ °C}$ | 25          | A     |
| Single pulse forward current                     | $I_{FSM}$      |                       | 225         |       |
| Maximum repetitive forward current               | $I_{FRM}$      |                       | 100         |       |
| Maximum power dissipation                        | $P_D$          | $T_C = 25\text{ °C}$  | 125         | W     |
|                                                  |                | $T_C = 100\text{ °C}$ | 50          |       |
| Operating junction and storage temperature range | $T_J, T_{Stg}$ |                       | -55 to +150 | °C    |



| ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |          |                                                                        |            |      |      |                    |
|--------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------|------------|------|------|--------------------|
| PARAMETER                                                                                  | SYMBOL   | TEST CONDITIONS                                                        |            | MIN. | TYP. | MAX. UNITS         |
| Cathode to anode breakdown voltage                                                         | $V_{BR}$ | $I_R = 100\text{ }\mu\text{A}$                                         |            | 600  | -    | - V                |
| Maximum forward voltage                                                                    | $V_{FM}$ | $I_F = 25\text{ A}$                                                    | See fig. 1 | -    | 1.3  | 1.7                |
|                                                                                            |          | $I_F = 50\text{ A}$                                                    |            | -    | 1.5  | 2.0                |
|                                                                                            |          | $I_F = 25\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$                 |            | -    | 1.3  | 1.7                |
| Maximum reverse leakage current                                                            | $I_{RM}$ | $V_R = V_R\text{ rated}$                                               | See fig. 2 | -    | 1.5  | 20                 |
|                                                                                            |          | $T_J = 125\text{ }^{\circ}\text{C}, V_R = 0.8 \times V_R\text{ rated}$ |            | -    | 600  | 2000 $\mu\text{A}$ |
| Junction capacitance                                                                       | $C_T$    | $V_R = 200\text{ V}$                                                   | See fig. 3 | -    | 55   | 100 pF             |
| Series inductance                                                                          | $L_S$    | Measured lead to lead 5 mm from package body                           |            | -    | 8.0  | - nH               |

| DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |                   |                                                                             |                                                                                     |      |      |                    |
|---------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------|------|--------------------|
| PARAMETER                                                                                         | SYMBOL            | TEST CONDITIONS                                                             |                                                                                     | MIN. | TYP. | MAX. UNITS         |
| Reverse recovery time<br>See fig. 5                                                               | $t_{rr}$          | $I_F = 1.0\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 30\text{ V}$ |                                                                                     | -    | 23   | -                  |
|                                                                                                   | $t_{rr1}$         | $T_J = 25\text{ }^{\circ}\text{C}$                                          | $I_F = 25\text{ A}$<br>$dI_F/dt = 200\text{ A}/\mu\text{s}$<br>$V_R = 200\text{ V}$ | -    | 50   | - ns               |
|                                                                                                   | $t_{rr2}$         | $T_J = 125\text{ }^{\circ}\text{C}$                                         |                                                                                     | -    | 105  | -                  |
| Peak recovery current<br>See fig. 6                                                               | $I_{RRM1}$        | $T_J = 25\text{ }^{\circ}\text{C}$                                          |                                                                                     | -    | 4.5  | - A                |
|                                                                                                   | $I_{RRM2}$        | $T_J = 125\text{ }^{\circ}\text{C}$                                         |                                                                                     | -    | 8.0  | -                  |
| Reverse recovery charge<br>See fig. 7                                                             | $Q_{rr1}$         | $T_J = 25\text{ }^{\circ}\text{C}$                                          |                                                                                     | -    | 112  | - nC               |
|                                                                                                   | $Q_{rr2}$         | $T_J = 125\text{ }^{\circ}\text{C}$                                         |                                                                                     | -    | 420  | -                  |
| Peak rate of fall recovery<br>current during $t_b$<br>See fig. 8                                  | $dI_{(rec)M}/dt1$ | $T_J = 25\text{ }^{\circ}\text{C}$                                          |                                                                                     | -    | 250  | - A/ $\mu\text{s}$ |
|                                                                                                   | $dI_{(rec)M}/dt2$ | $T_J = 125\text{ }^{\circ}\text{C}$                                         |                                                                                     | -    | 160  | -                  |

| THERMAL - MECHANICAL SPECIFICATIONS        |            |                                          |  |             |      |                        |
|--------------------------------------------|------------|------------------------------------------|--|-------------|------|------------------------|
| PARAMETER                                  | SYMBOL     | TEST CONDITIONS                          |  | MIN.        | TYP. | MAX. UNITS             |
| Lead temperature                           | $T_{lead}$ | 0.063" from case (1.6 mm) for 10 s       |  | -           | -    | 300 $^{\circ}\text{C}$ |
| Thermal resistance,<br>junction to case    | $R_{thJC}$ |                                          |  | -           | -    | 1.0                    |
| Thermal resistance,<br>junction to ambient | $R_{thJA}$ | Typical socket mount                     |  | -           | -    | 80                     |
| Weight                                     |            |                                          |  | -           | 2.0  | - g                    |
|                                            |            |                                          |  | -           | 0.07 | - oz.                  |
| Marking device                             |            | Case style D <sup>2</sup> PAK (TO-263AB) |  | HFA25TB60SH |      |                        |

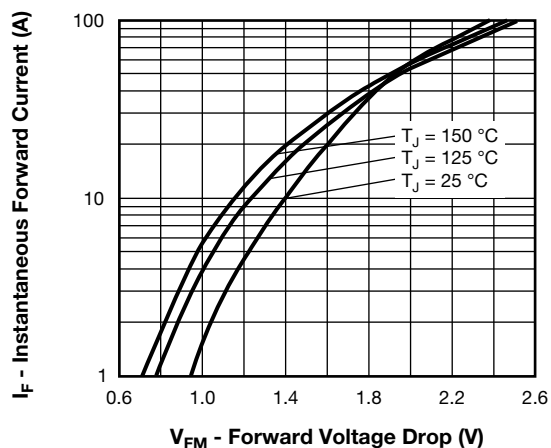


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

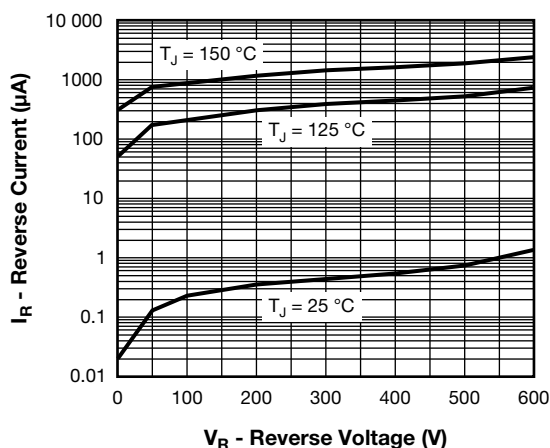


Fig. 2 - Typical Reverse Current vs. Reverse Voltage

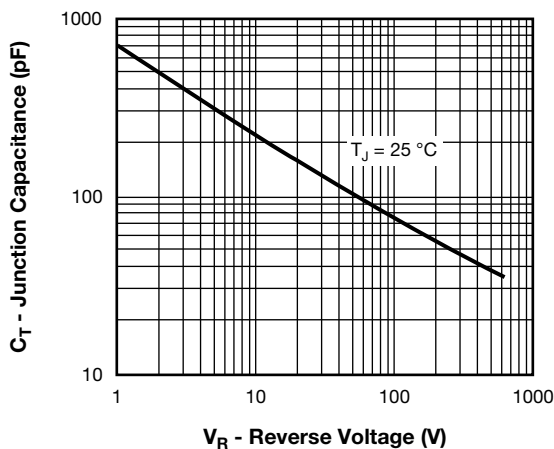


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

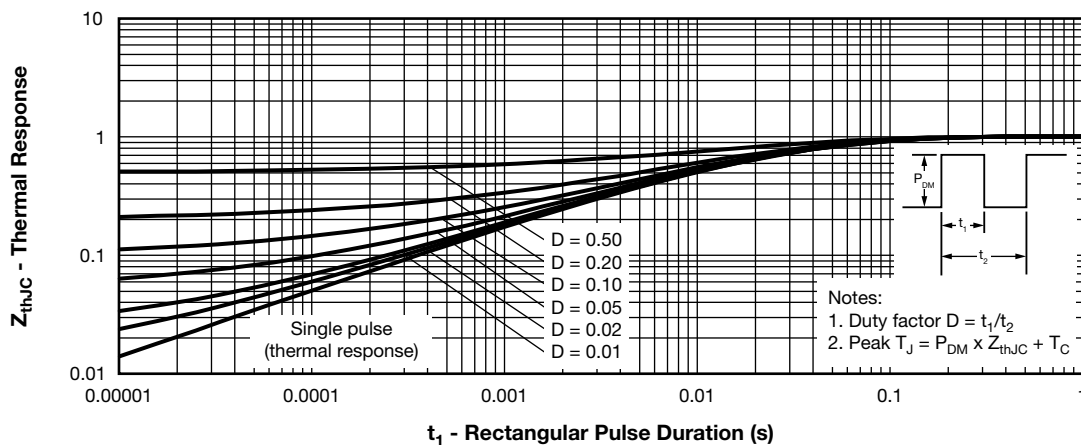


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

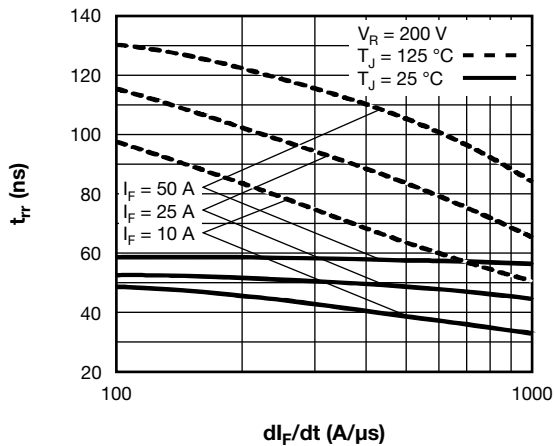
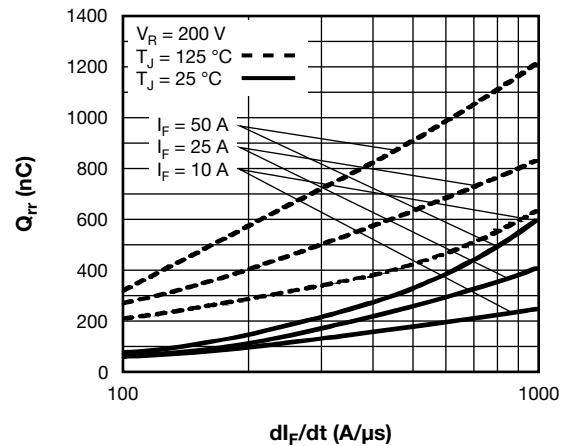
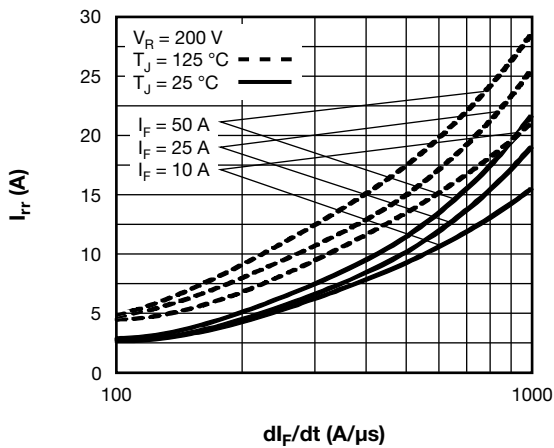
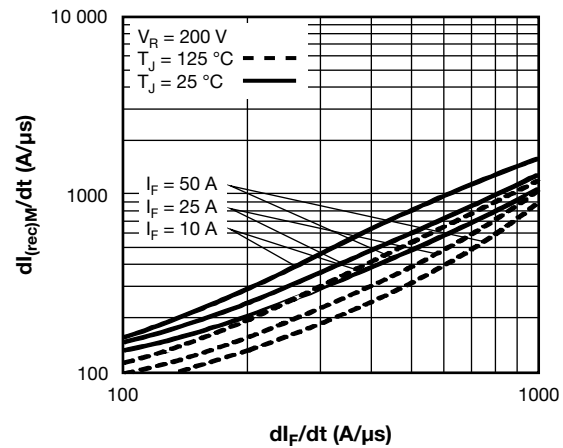
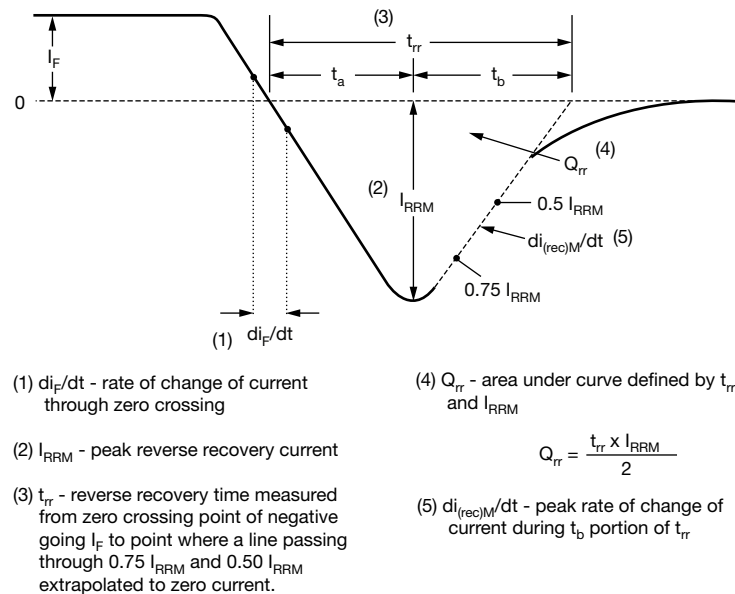

Fig. 5 - Typical Reverse Recovery Time vs.  $di_F/dt$ 

Fig. 7 - Typical Stored Charge vs.  $di_F/dt$ 

Fig. 6 - Typical Recovery Current vs.  $di_F/dt$ 

Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_F/dt$ 


Fig. 9 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

|             |            |           |          |           |           |           |          |           |          |           |
|-------------|------------|-----------|----------|-----------|-----------|-----------|----------|-----------|----------|-----------|
| Device code | <b>VS-</b> | <b>HF</b> | <b>A</b> | <b>25</b> | <b>TB</b> | <b>60</b> | <b>S</b> | <b>TR</b> | <b>H</b> | <b>M3</b> |
|             | 1          | 2         | 3        | 4         | 5         | 6         | 7        | 8         | 9        | 10        |

- |           |   |                                                                                                                                                          |
|-----------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>  | - | Vishay Semiconductors product                                                                                                                            |
| <b>2</b>  | - | HEXFRED® family                                                                                                                                          |
| <b>3</b>  | - | Process designator: A = electron irradiated                                                                                                              |
| <b>4</b>  | - | Current rating (25 = 25 A)                                                                                                                               |
| <b>5</b>  | - | Package outline (TB = TO-220, 2 leads)                                                                                                                   |
| <b>6</b>  | - | Voltage rating (60 = 600 V)                                                                                                                              |
| <b>7</b>  | - | S = D <sup>2</sup> PAK                                                                                                                                   |
| <b>8</b>  | - | <ul style="list-style-type: none"><li>• None = tube</li><li>• TL = tape and reel (left oriented)</li><li>• TR = tape and reel (right oriented)</li></ul> |
| <b>9</b>  | - | <ul style="list-style-type: none"><li>• H = AEC-Q101 qualified</li></ul>                                                                                 |
| <b>10</b> | - | <ul style="list-style-type: none"><li>• M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free</li></ul>                                      |

**ORDERING INFORMATION** (Example)

| PREFERRED P/N      | BASE QUANTITY | PACKAGING DESCRIPTION   |
|--------------------|---------------|-------------------------|
| VS-HFA25TB60SHM3   | 50            | Antistatic plastic tube |
| VS-HFA25TB60STRHM3 | 800           | 13" diameter reel       |
| VS-HFA25TB60STLHM3 | 800           | 13" diameter reel       |

**LINKS TO RELATED DOCUMENTS**

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</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?95032">www.vishay.com/doc?95032</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

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB



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