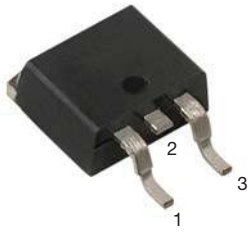
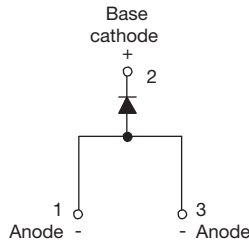




**THE DATASHEET OF
VS-20ETF04SPBF**



Surface Mount Fast Soft Recovery Rectifier Diode, 20 A


TO-263AB (D²PAK)

FEATURES

- Glass passivated pellet chip junction
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
 COMPLIANT
 HALOGEN
FREE

| PRODUCT SUMMARY | |
|-----------------|-------------------------------|
| Package | TO-263AB (D ² PAK) |
| $I_{F(AV)}$ | 20 A |
| V_R | 200 V, 400 V, 600 V |
| V_F at I_F | 1.3 V |
| I_{FSM} | 300 A |
| t_{rr} | 60 ns |
| T_J max. | 150 °C |
| Diode variation | Single die |
| Snap factor | 0.6 |

APPLICATIONS

- Output rectification and freewheeling in inverters, choppers and converters
- Input rectifications where severe restrictions on conducted EMI should be met

DESCRIPTION

The VS-20ETF..SPbF 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 |
| $I_{F(AV)}$ | Sinusoidal waveform | 20 | A |
| V_{RRM} | | 200 to 600 | V |
| I_{FSM} | | 300 | A |
| V_F | 10 A, $T_J = 25$ °C | 1.2 | V |
| t_{rr} | 1 A, 100 A/ μ s | 60 | ns |
| T_J | Range | -40 to +150 | °C |

| VOLTAGE RATINGS | | | |
|-----------------|---|--|---------------------------|
| PART NUMBER | V_{RRM} , MAXIMUM PEAK REVERSE VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM} AT 150 °C mA |
| VS-20ETF02SPbF | 200 | 300 | 5 |
| VS-20ETF04SPbF | 400 | 500 | |
| VS-20ETF06SPbF | 600 | 700 | |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---------------|---|--------|---------------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum average forward current | $I_{F(AV)}$ | $T_C = 97$ °C, 180° conduction half sine wave | 20 | A |
| Maximum peak one cycle non-repetitive surge current | I_{FSM} | 10 ms sine pulse, rated V_{RRM} applied | 250 | |
| | | 10 ms sine pulse, no voltage reapplied | 300 | |
| Maximum I^2t for fusing | I^2t | 10 ms sine pulse, rated V_{RRM} applied | 316 | A ² s |
| | | 10 ms sine pulse, no voltage reapplied | 442 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | $t = 0.1$ ms to 10 ms, no voltage reapplied | 4420 | A ² \sqrt{s} |



| ELECTRICAL SPECIFICATIONS | | | | | |
|---------------------------------|-------------|--|-------------------------------|--------|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum forward voltage drop | V_{FM} | 20 A, $T_J = 25\text{ }^\circ\text{C}$ | | 1.30 | V |
| | | 60 A, $T_J = 25\text{ }^\circ\text{C}$ | | 1.67 | |
| Forward slope resistance | r_t | | | 12.5 | m Ω |
| Threshold voltage | $V_{F(TO)}$ | $T_J = 150\text{ }^\circ\text{C}$ | | 0.9 | V |
| Maximum reverse leakage current | I_{RM} | $T_J = 25\text{ }^\circ\text{C}$ | $V_R = \text{Rated } V_{RRM}$ | 0.1 | mA |
| | | $T_J = 150\text{ }^\circ\text{C}$ | | 5.0 | |

| RECOVERY CHARACTERISTICS | | | | | |
|--------------------------|----------|-----------------------------|--------|---------------|--|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS | |
| Reverse recovery time | t_{rr} | I_F at 20 A _{pk} | 160 | ns | |
| Reverse recovery current | I_{rr} | 100 A/ μs | 10 | A | |
| Reverse recovery charge | Q_{rr} | 25 $^\circ\text{C}$ | 1.25 | μC | |
| Snap factor | S | Typical | 0.6 | | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | |
|--|------------------|--|-------------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum junction and storage temperature range | T_J, T_{Stg} | | -40 to +150 | $^\circ\text{C}$ |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | 0.9 | $^\circ\text{C/W}$ |
| Maximum thermal resistance junction to ambient (PCB mount) | $R_{thJA}^{(1)}$ | | 40 | |
| Soldering temperature | T_S | | 260 | $^\circ\text{C}$ |
| Approximate weight | | | 2 | g |
| | | | 0.07 | oz. |
| Marking device | | Case style TO-263AB (D ² PAK) | 20ETF02S | |
| | | | 20ETF04S | |
| | | | 20ETF06S | |

Note

⁽¹⁾ When mounted on 1" square (650 mm²) PCB of FR-4 or G-10 material 4 oz. (140 μm) copper 40 $^\circ\text{C/W}$. For recommended footprint and soldering techniques refer to application note #AN-994.

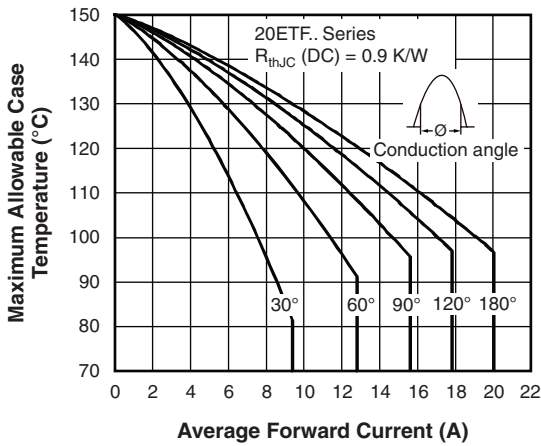


Fig. 1 - Current Rating Characteristics

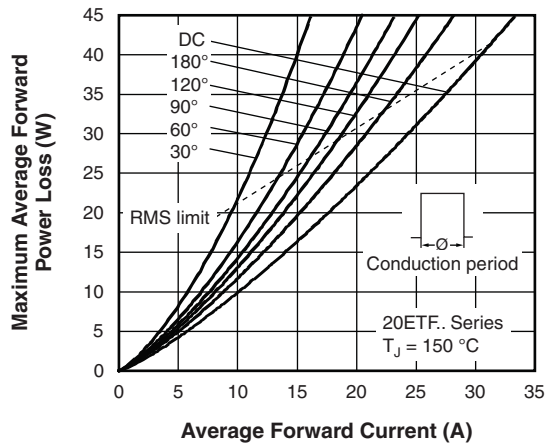


Fig. 4 - Forward Power Loss Characteristics

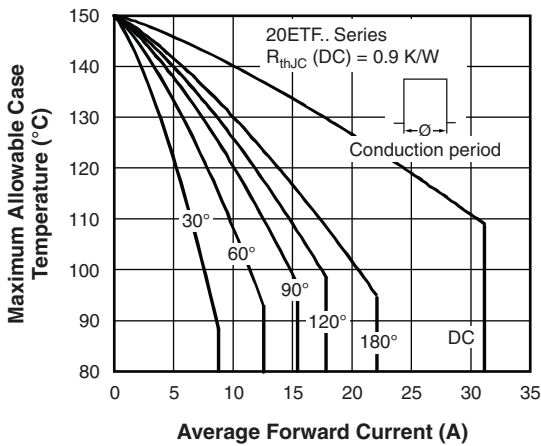


Fig. 2 - Current Rating Characteristics

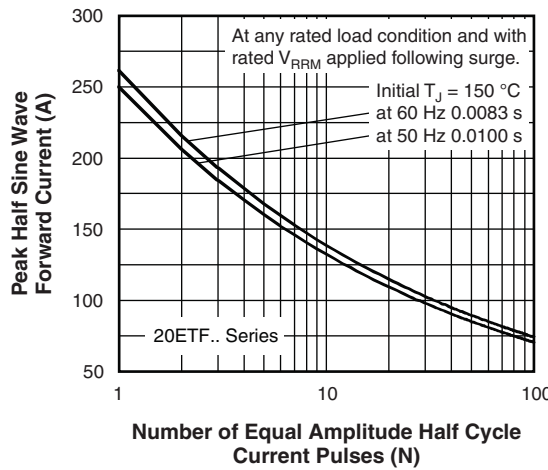


Fig. 5 - Maximum Non-Repetitive Surge Current

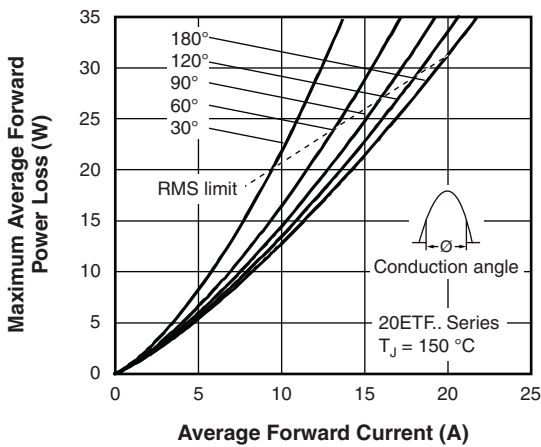


Fig. 3 - Forward Power Loss Characteristics

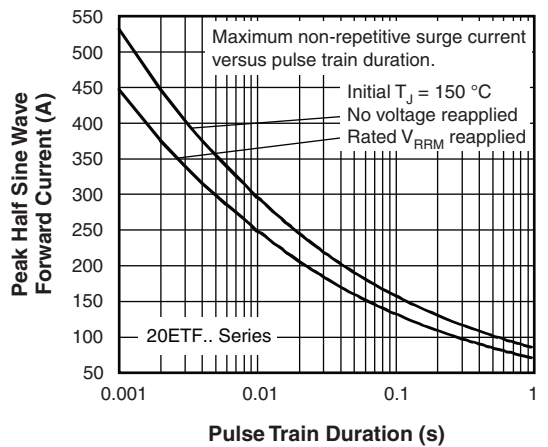


Fig. 6 - Maximum Non-Repetitive Surge Current

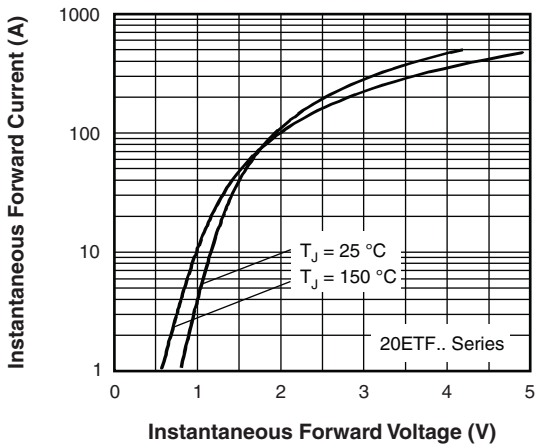


Fig. 7 - Forward Voltage Drop Characteristics

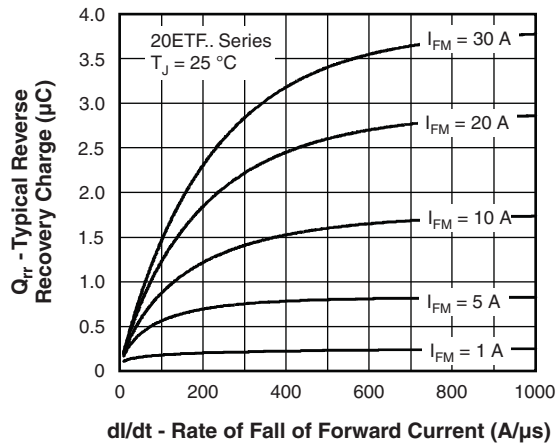


Fig. 10 - Recovery Charge Characteristics, $T_J = 25\text{ }^\circ\text{C}$

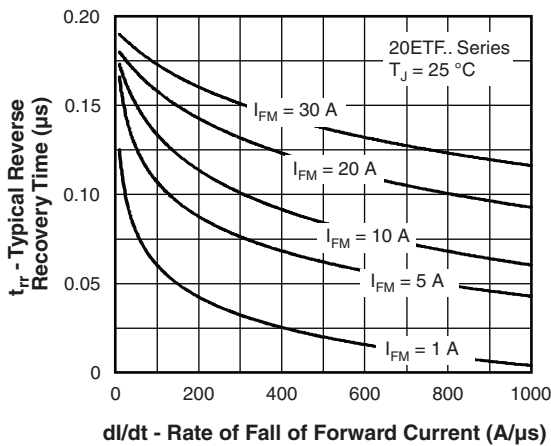


Fig. 8 - Recovery Time Characteristics, $T_J = 25\text{ }^\circ\text{C}$

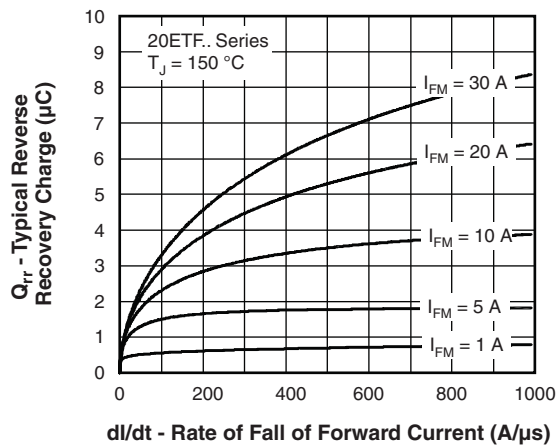


Fig. 11 - Recovery Charge Characteristics, $T_J = 150\text{ }^\circ\text{C}$

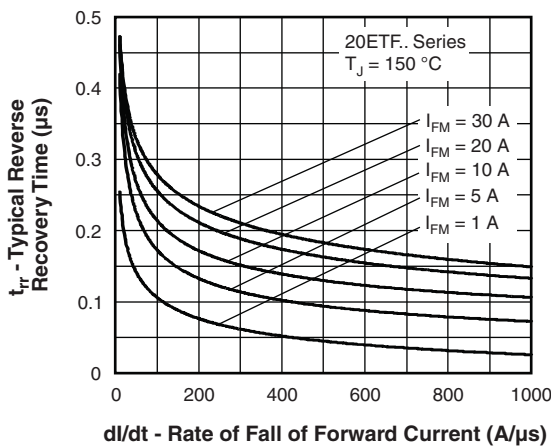


Fig. 9 - Recovery Time Characteristics, $T_J = 150\text{ }^\circ\text{C}$

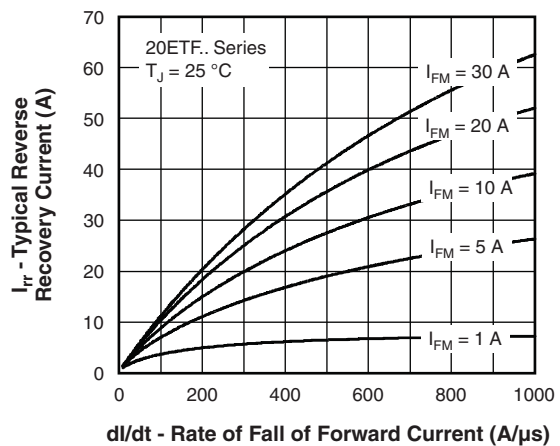


Fig. 12 - Recovery Current Characteristics, $T_J = 25\text{ }^\circ\text{C}$

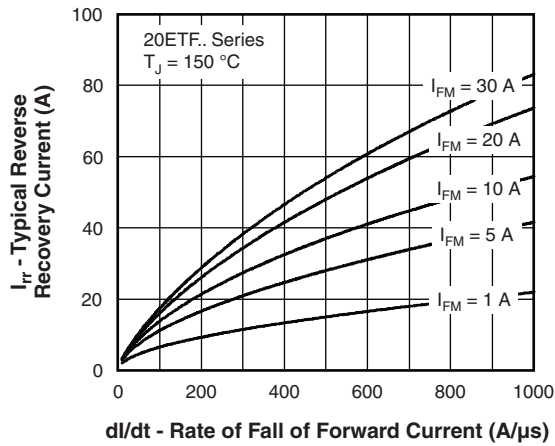


Fig. 13 - Recovery Current Characteristics, T_J = 150 °C

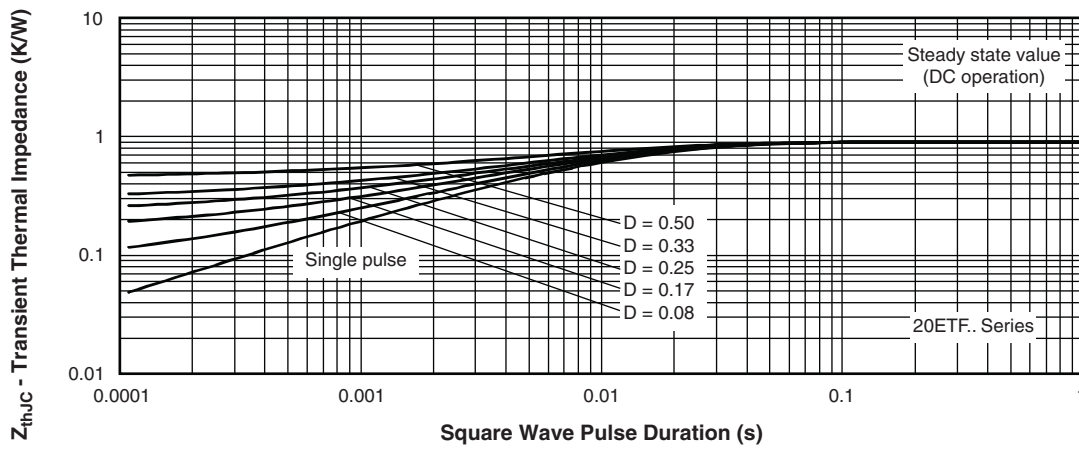
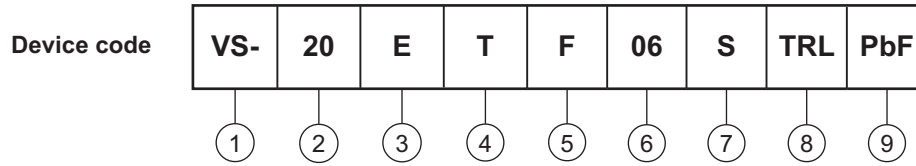


Fig. 14 - Thermal Impedance Z_{thJC} Characteristics



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (20 = 20 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** - S = D²PAK
- 8** -
 - None = tube
 - TRR = tape and reel (right oriented)
 - TRL = tape and reel (left oriented)
- 9** - PbF = lead (Pb)-free

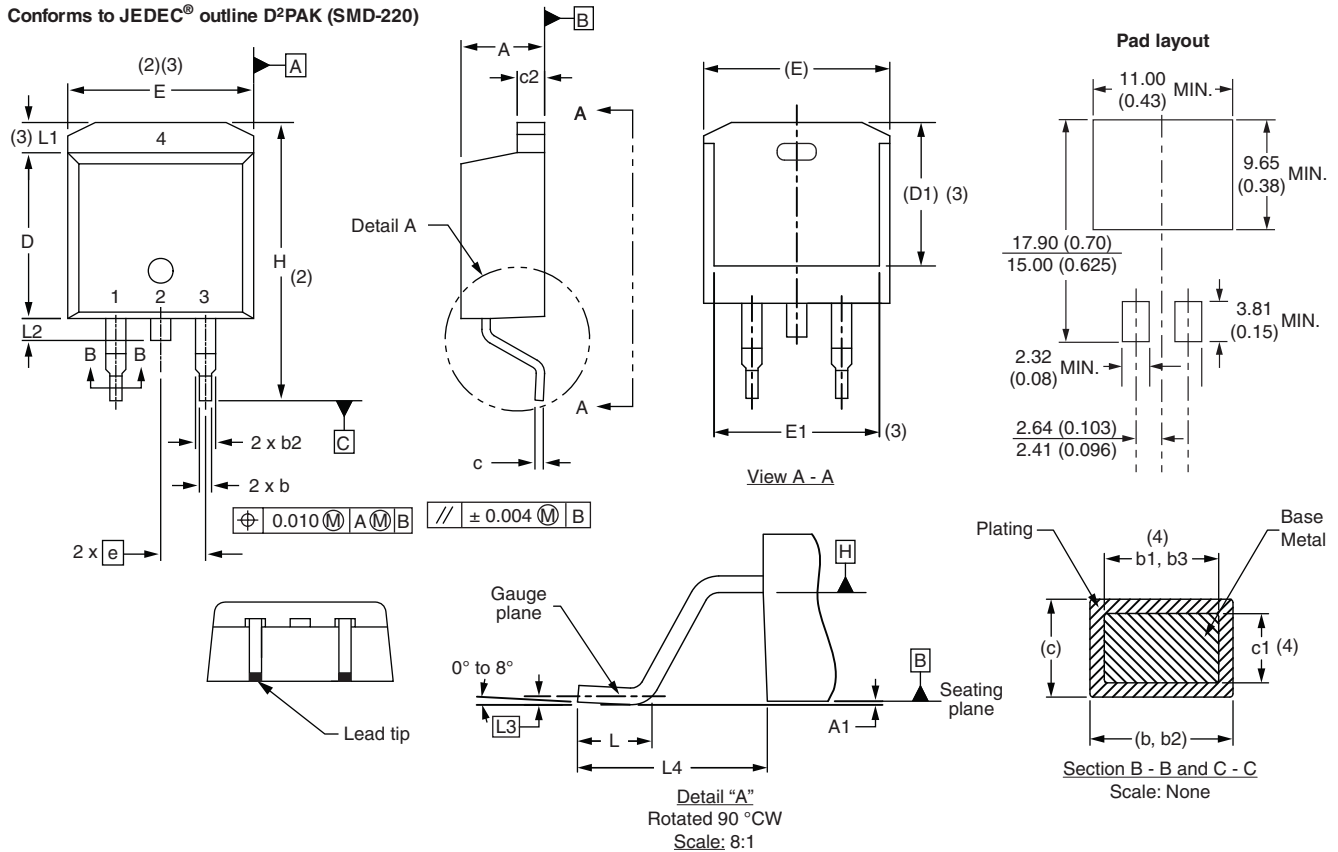
| ORDERING INFORMATION (Example) | | | |
|--------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-20ETF02SPbF | 50 | 1000 | Antistatic plastic tubes |
| VS-20ETF02STRRPbF | 800 | 800 | 13" diameter reel |
| VS-20ETF02STRLPbF | 800 | 800 | 13" diameter reel |
| VS-20ETF04SPbF | 50 | 1000 | Antistatic plastic tubes |
| VS-20ETF04STRRPbF | 800 | 800 | 13" diameter reel |
| VS-20ETF04STRLPbF | 800 | 800 | 13" diameter reel |
| VS-20ETF06SPbF | 50 | 1000 | Antistatic plastic tubes |
| VS-20ETF06STRRPbF | 800 | 800 | 13" diameter reel |
| VS-20ETF06STRLPbF | 800 | 800 | 13" diameter reel |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95046 |
| Part marking information | www.vishay.com/doc?95054 |
| Packaging information | www.vishay.com/doc?95032 |

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC[®] outline D²PAK (SMD-220)



| SYMBOL | MILLIMETERS | | INCHES | | NOTES | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | | D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | | E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| b | 0.51 | 0.99 | 0.020 | 0.039 | | E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 | e | 2.54 BSC | | 0.100 BSC | | |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | | H | 14.61 | 15.88 | 0.575 | 0.625 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | L | 1.78 | 2.79 | 0.070 | 0.110 | |
| c | 0.38 | 0.74 | 0.015 | 0.029 | | L1 | - | 1.65 | - | 0.066 | 3 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 | L2 | 1.27 | 1.78 | 0.050 | 0.070 | |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | | L3 | 0.25 BSC | | 0.010 BSC | | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 | 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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