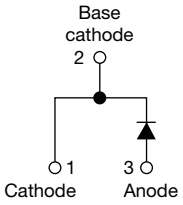
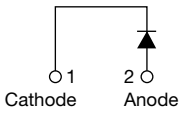
# Hyperfast Rectifier, 8 A FRED Pt®

2L TO-220AC

2L TO-220 FULL-PAK




VS-8E2TH06




VS-8E2TH06FP

## FEATURES

- Hyperfast recovery time, reduced $Q_{rr}$ and soft recovery
- 175 °C maximum operating junction temperature
- For PFC CRM/CCM operation
- True 2 pin package
- Low forward voltage drop
- Low leakage current
- Fully isolated package ($V_{INS}$ = 2500 $V_{RMS}$)
- Compliant to RoHS directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- Designed and qualified for industrial level

RoHS COMPLIANT
HALOGEN FREE Available

## DESCRIPTION/APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop and hyperfast recovery time, and soft recovery.
The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.
These devices are intended for use in PFC boost stage in the ac-to-dc section of SMPS, inverters or as freewheeling diodes.
Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

| PRODUCT SUMMARY | |
|---|---|
| Package | 2L TO-220AC, 2L TO-220 FP |
| $I_{F(AV)}$ | 8 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ | 2.5 V |
| $t_{rr}$ (typ.) | 17 ns |
| $T_J$ max. | 175 °C |
| Diode variation | Single die |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Peak repetitive reverse voltage | | $V_{RRM}$ | | 600 | V |
| Average rectified forward current | | $I_{F(AV)}$ | $T_C$ = 133 °C | 8 | A |
| | FULL-PAK | | $T_C$ = 78 °C | | |
| Non-repetitive peak surge current | | $I_{FSM}$ | $T_J$ = 25 °C | 70 | |
| Peak repetitive forward current | | $I_{FM}$ | | 16 | |
| Operating junction and storage temperatures | | $T_J$, $T_{Stg}$ | | - 65 to 175 | °C |

| ELECTRICAL SPECIFICATIONS ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Breakdown voltage, blocking voltage | $V_{BR}$, $V_R$ | $I_R$ = 100 µA | 600 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 8 A | - | 2.1 | 2.5 | |
| | | $I_F$ = 8 A, $T_J$ = 150 °C | - | 1.6 | 1.9 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.2 | 35 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 50 | 350 | |
| Junction capacitance | $C_T$ | $V_R$ = 600 V | - | 6 | - | pF |
| Series inductance | $L_S$ | Measured lead to lead 5 mm from package body | - | 8 | - | nH |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 17 | 23 | ns |
| | | $I_F$ = 8.0 A, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 22 | 25 | |
| | | $T_J$ = 25 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 390 V | - | 22 | - | |
| | | $T_J$ = 125 °C | | - | 43 | - | |
| | | $T_J$ = 125 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 600 A/µs<br>$V_R$ = 390 V | - | 33 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 390 V | - | 3.1 | - | A |
| | | $T_J$ = 125 °C | | - | 5.2 | - | |
| | | $T_J$ = 125 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 600 A/µs<br>$V_R$ = 390 V | - | 13 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 390 V | - | 32 | - | nC |
| | | $T_J$ = 125 °C | | - | 120 | - | |
| | | $T_J$ = 125 °C | $I_F$ = 8 A<br>$dI_F/dt$ = 600 A/µs<br>$V_R$ = 390 V | - | 230 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | - 65 | - | 175 | °C |
| Thermal resistance, junction to case | $R_{thJC}$ | | - | 2 | 2.4 | °C/W |
| FULL-PAK | | | - | 5 | 5.5 | |
| Thermal resistance, junction to ambient per leg | $R_{thJA}$ | Typical socket mount | - | - | 70 | |
| Typical thermal resistance, case to heatsink | $R_{thCS}$ | Mounting surface, flat, smooth and greased | - | 0.5 | - | |
| Weight | | | - | 2 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6<br>(5) | - | 12<br>(10) | kgf · cm<br>(lbf · in) |
| Marking device | | Case style TO-220 | 8E2TH06 | | | |
| | | Case style TO-220 FULL-PAK | 8E2TH06FP | | | |



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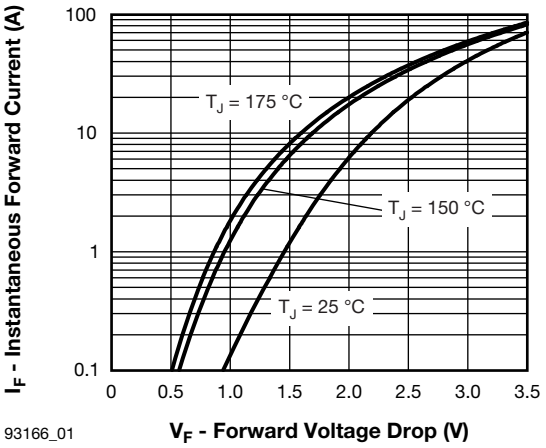



Fig. 1 - Typical Forward Voltage Drop Characteristics

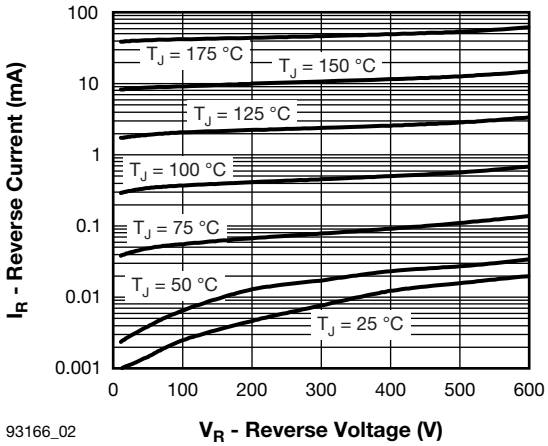



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

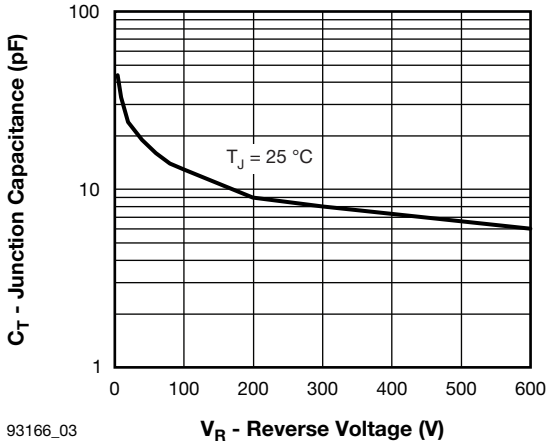



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

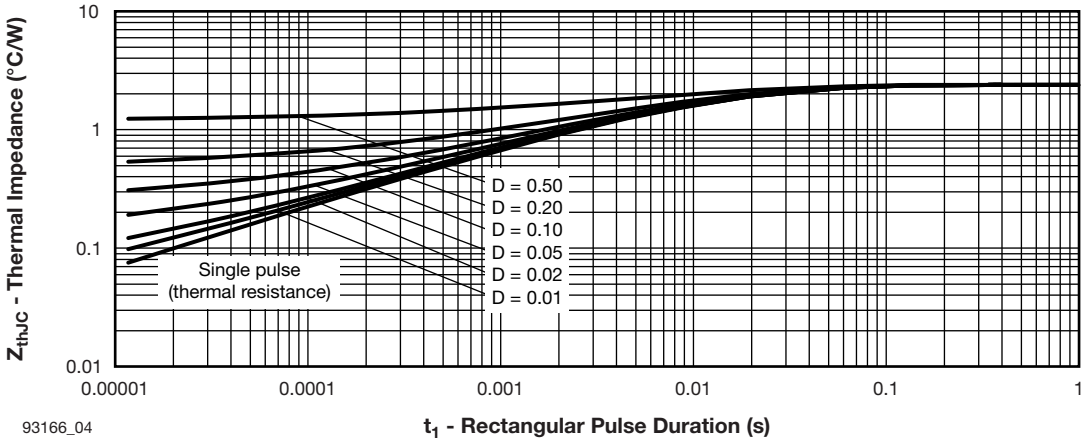



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics (TO-220)

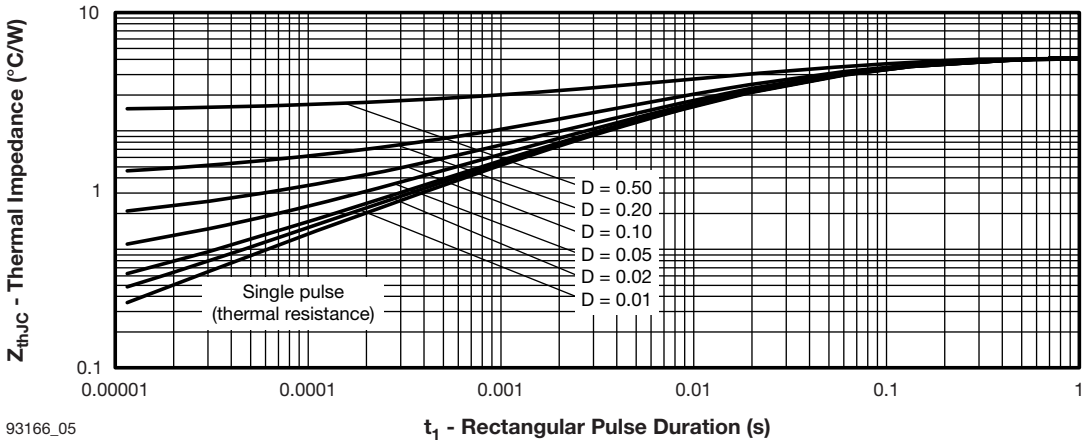



Fig. 5 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics (FULL-PAK)

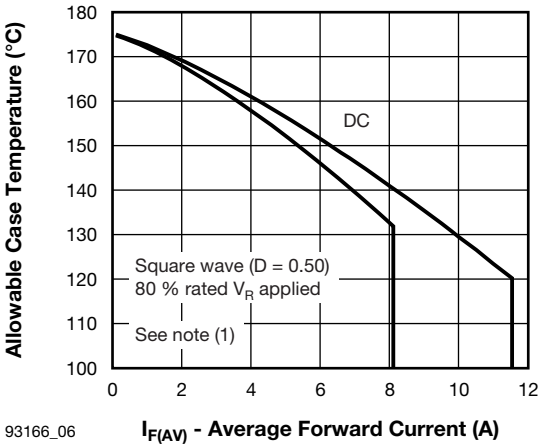



Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current (TO-220)

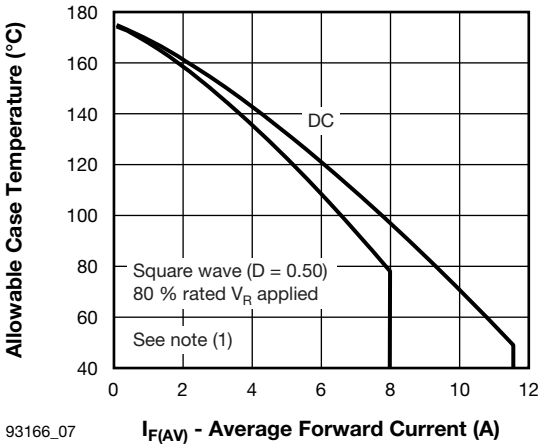



Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

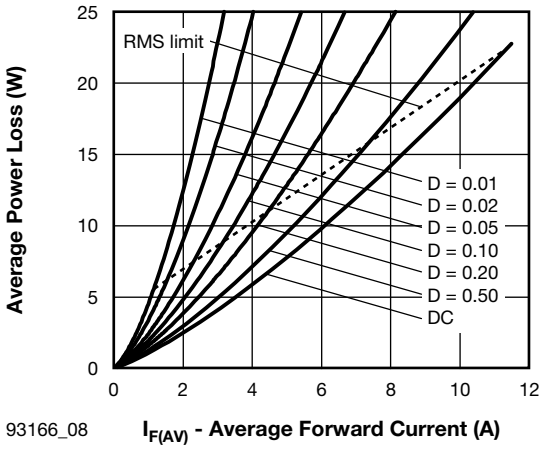



Fig. 8 - Forward Power Loss Characteristics

**Note**

(1) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$; Pd = Forward power loss = $I_{F(AV)} \times V_{FM}$ at ($I_{F(AV)}$/D) (see fig. 6); $Pd_{REV}$ = Inverse power loss = $V_{R1} \times I_R (1 - D)$; $I_R$ at $V_{R1}$ = Rated $V_R$

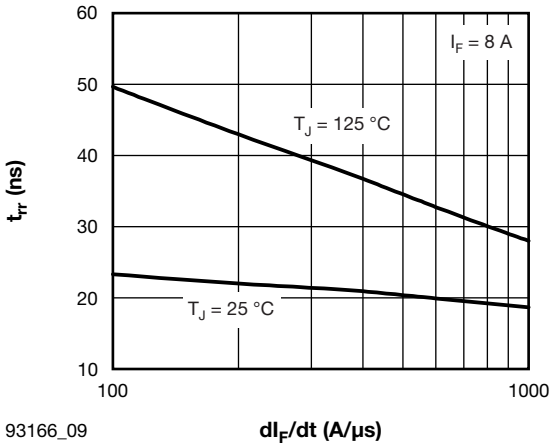



Fig. 9 - Typical Reverse Recovery Time vs. $dI_F/dt$

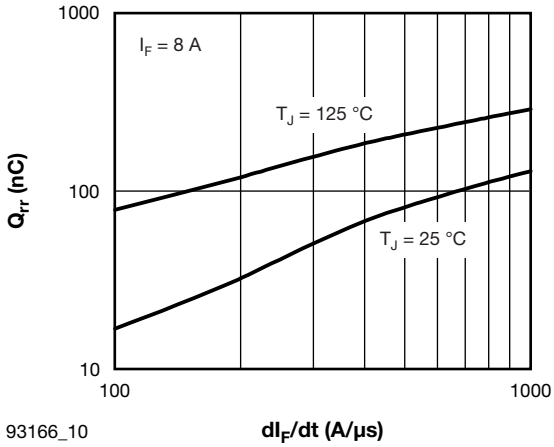



Fig. 10 - Typical Stored Charge vs. $dI_F/dt$

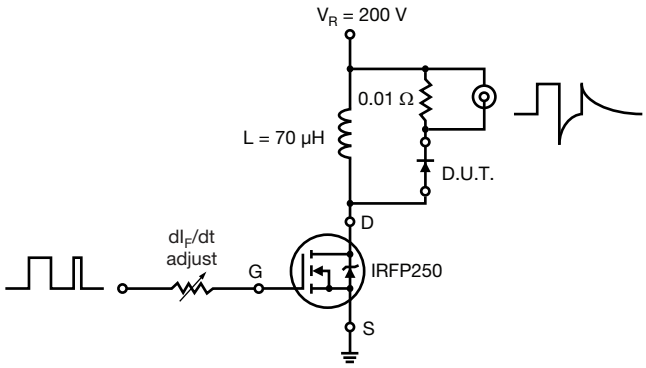
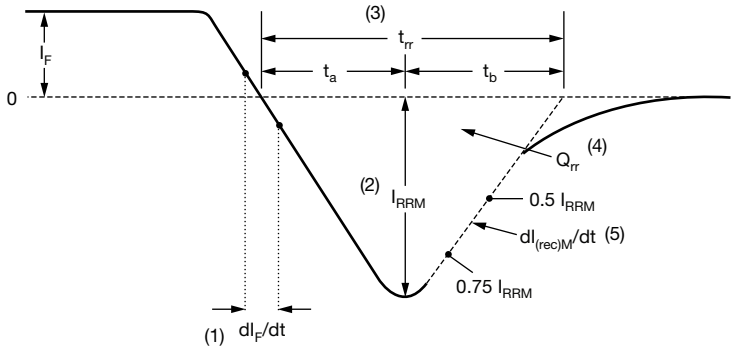



Fig. 11 - Reverse Recovery Parameter Test Circuit




(1) $dI_F/dt$ - rate of change of current through zero crossing

(2) $I_{RRM}$ - peak reverse recovery current

(3) $t_{rr}$ - reverse recovery time measured from zero crossing point of negative going $I_F$ to point where a line passing through 0.75 $I_{RRM}$ and 0.50 $I_{RRM}$ extrapolated to zero current.

(4) $Q_{rr}$ - area under curve defined by $t_{rr}$ and $I_{RRM}$

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during $t_b$ portion of $t_{rr}$

Fig. 12 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

Device code

| VS- | 8 | E | 2 | T | H | 06 | FP | -E |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |

1 - Vishay Semiconductors product suffix

2 - Current rating (8 = 8 A)

3 - Circuit configuration:
E = Single diode

4 - 2 = True 2 pin package

5 - T = TO-220

6 - H = Hyperfast recovery time

7 - Voltage code (06 = 600 V)

8 -
- None = TO-220
- FP = FULL-PAK

9 - Environmental digit:
- -E = RoHS compliant and terminations lead (Pb)-free
- -M = Halogen-free, RoHS compliant and terminations lead (Pb)-free

**ORDERING INFORMATION** (Example)

| PREFERRED P/N | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
|---|---|---|---|
| VS-8E2TH06-E | 50 | 1000 | Antistatic plastic tubes |
| VS-8E2TH06-M | 50 | 1000 | Antistatic plastic tubes |
| VS-8E2TH06FP-E | 50 | 1000 | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | | |
|---|---|---|
| Dimensions | TO-220AC | www.vishay.com/doc?95259 |
| | TO-220 FULL-PAK | www.vishay.com/doc?95260 |
| Part marking information | TO-220AC | www.vishay.com/doc?95391 |
| | TO-220 FULL-PAK | www.vishay.com/doc?95392 |
| Packaging information | | www.vishay.com/doc?95388 |

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