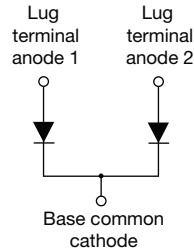


# HEXFRED®

## Ultrafast Soft Recovery Diode, 210 A


**TO-244**

**FEATURES**

- Very low  $Q_{rr}$  and  $t_{rr}$
- UL approved file E222165
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

**BENEFITS**

- Reduced RFI and EMI
- Reduced snubbing

**DESCRIPTION / APPLICATIONS**

HEXFRED® diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. An extensive characterization of the recovery behavior for different values of current, temperature and  $di_f/dt$  simplifies the calculations of losses in the operating conditions. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for power converters, motors drives and other applications where switching losses are significant portion of the total losses.

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	210 A
$V_R$	600 V
$I_{F(DC)}$ at $T_C$	120 A at 100 °C
Package	TO-244
Circuit configuration	Two diodes common cathode

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Cathode to anode voltage	$V_R$		600	V
Continuous forward current	$I_F$	$T_C = 25\text{ °C}$	235	A
		$T_C = 100\text{ °C}$	120	
Single pulse forward current	$I_{FSM}$	Limited by junction temperature	600	
Non-repetitive avalanche energy	$E_{AS}$	$L = 100\text{ }\mu\text{H}$ , duty cycle limited by maximum $T_J$	2.2	mJ
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	463	W
		$T_C = 100\text{ °C}$	185	
Operating junction and storage temperature range	$T_J, T_{Stg}$		-55 to +150	°C

ELECTRICAL SPECIFICATIONS PER LEG ( $T_J = 25\text{ °C}$ 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	$V_{FM}$	$I_F = 105\text{ A}$	See fig. 1	-	1.38	1.9	
		$I_F = 210\text{ A}$		-	1.6	2.25	
		$I_F = 105\text{ A}, T_J = 125\text{ °C}$		-	1.3	1.56	
Maximum reverse leakage current	$I_{RM}$	$T_J = 125\text{ °C}, V_R = 480\text{ V}$	See fig. 2	-	1.8	6.0	mA
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	See fig. 3	-	200	300	pF
Series inductance	$L_S$	From top of terminal hole to mounting plane		-	6.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time (fig. 5)	t <sub>rr</sub>	I <sub>F</sub> = 1.0 A, di <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 30 V	-	35	-	ns
		T <sub>J</sub> = 25 °C	-	90	140	
		T <sub>J</sub> = 125 °C	-	160	240	
Peak recovery current (fig. 6)	I <sub>R</sub> RM	T <sub>J</sub> = 25 °C	-	10	18	A
		T <sub>J</sub> = 125 °C	-	15	30	
Reverse recovery charge (fig. 7)	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	450	1300	nC
		T <sub>J</sub> = 125 °C	-	1200	3600	
Peak rate of recovery current (fig. 8)	di <sub>(rec)M</sub> /dt	T <sub>J</sub> = 25 °C	-	310	-	A/μs
		T <sub>J</sub> = 125 °C	-	240	-	

THERMAL - MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>	-55	-	150	°C
Thermal resistance, junction to case	per leg	-	-	0.27	°C/W K/W
	per module	-	-	0.135	
Typical thermal resistance, case to heatsink	R <sub>thCS</sub>	-	0.10	-	
Weight		-	68	-	g
		-	2.4	-	oz.
Mounting torque <sup>(1)</sup>		30 (3.4)	-	40 (4.6)	lbf · in (N · m)
Mounting torque center hole		12 (1.4)	-	18 (2.1)	
Terminal torque		30 (3.4)	-	40 (4.6)	
Vertical pull		-	-	80	lbf · in
2" lever pull		-	-	35	

**Note**

- (1) Mounting surface must be smooth, flat, free of burrs or other protrusions. Apply a thin even film or thermal grease to mounting surface. Gradually tighten each mounting bolt in 5 to 10 lbf · in steps until desired or maximum torque limits are reached

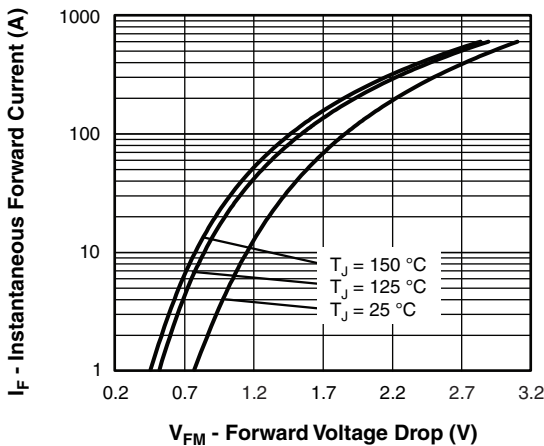


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

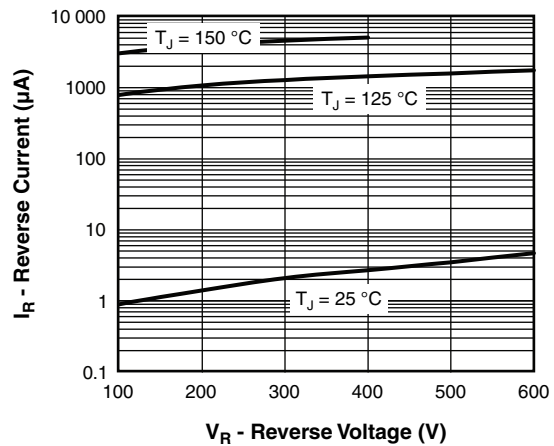


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

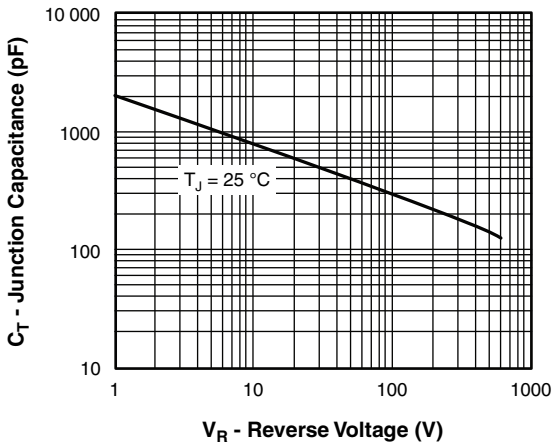


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

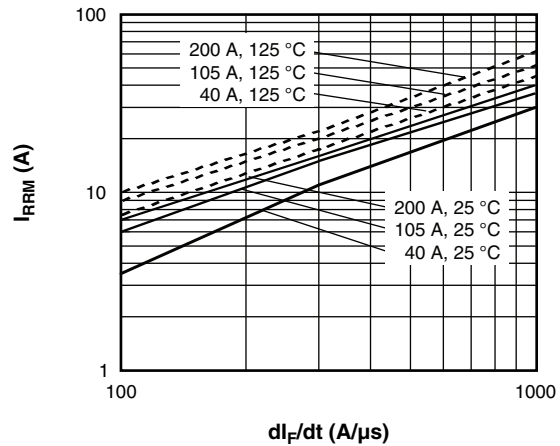


Fig. 6 - Typical Recovery Current vs.  $dI_F/dt$  (Per Leg)

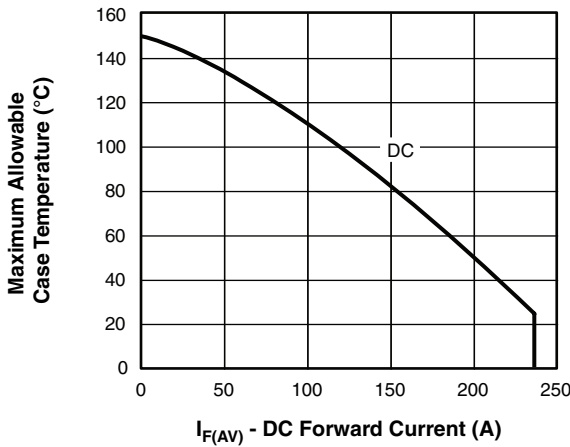


Fig. 4 - Maximum Allowable Case Temperature vs. DC Forward Current (Per Leg)

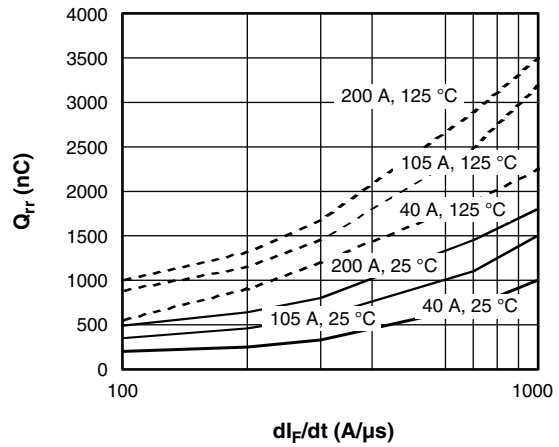


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$  (Per Leg)

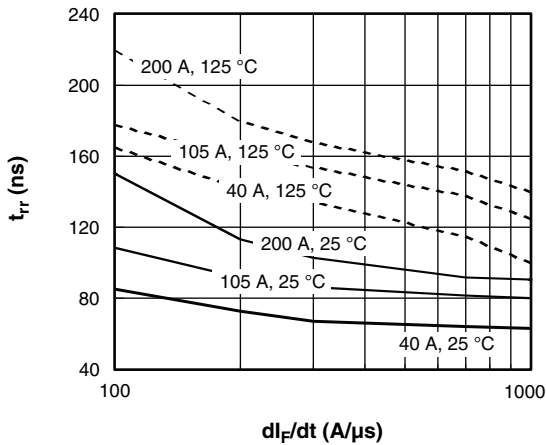


Fig. 5 - Typical Reverse Recovery Time vs.  $dI_F/dt$  (Per Leg)

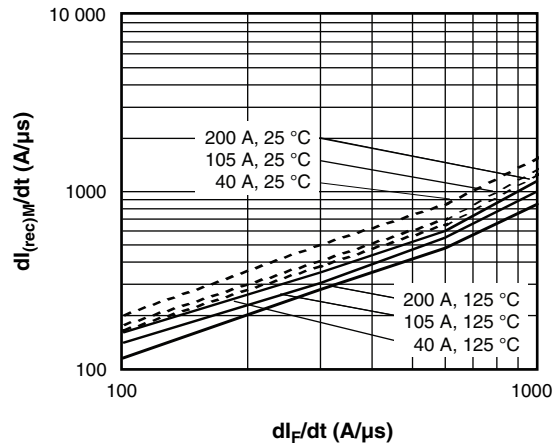


Fig. 8 - Typical  $dI_{(rec)M}/dt$  vs.  $dI_F/dt$  (Per Leg)

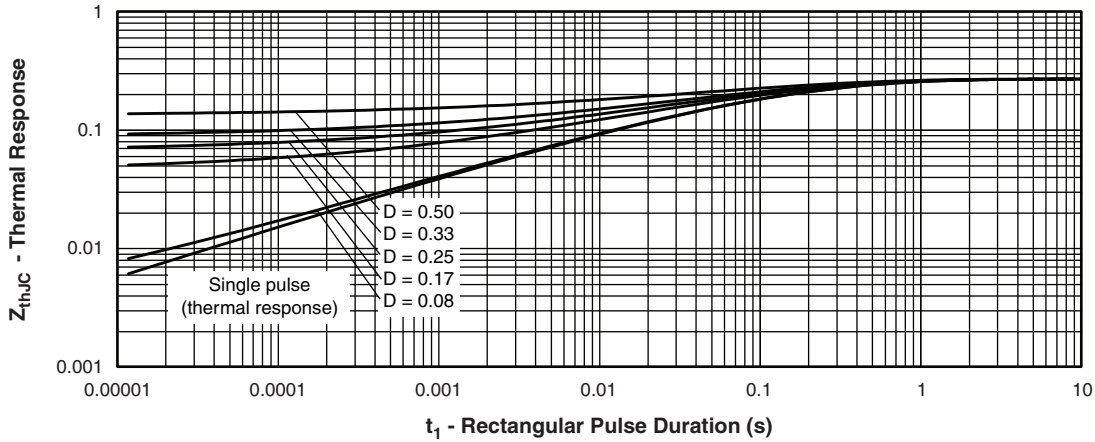


Fig. 9 - - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

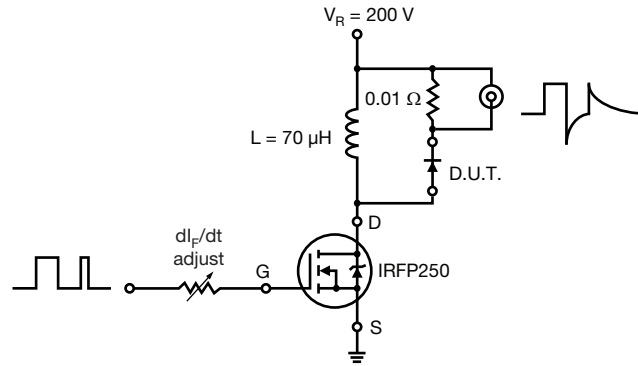
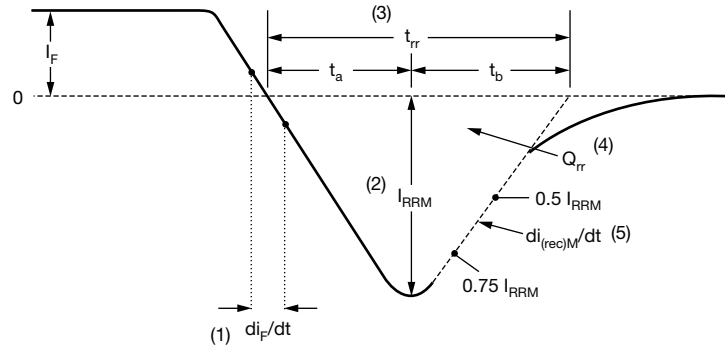


Fig. 10 - - Reverse Recovery Parameter Test Circuit



- (1)  $di_p/dt$  - 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  $I_{RRM}$
- (5)  $di_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

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

Fig. 11 - Reverse Recovery Waveform and Definitions

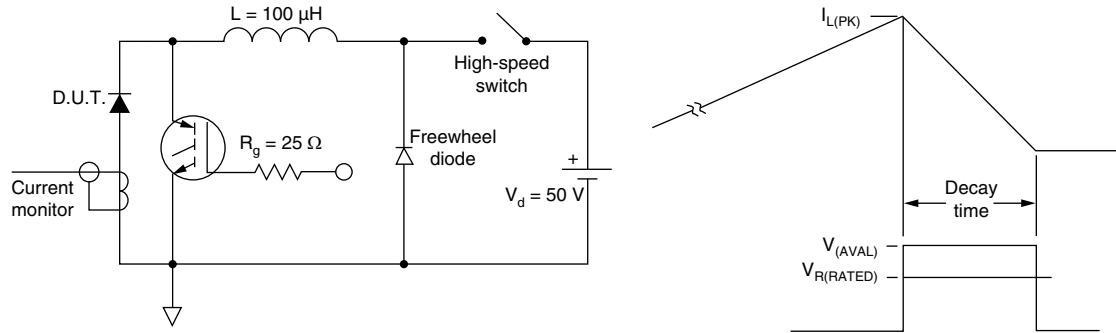


Fig. 12 - Avalanche Test Circuit and Waveforms

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>HFA</b>	<b>210</b>	<b>NJ</b>	<b>60</b>	<b>C</b>	<b>PbF</b>
	①	②	③	④	⑤	⑥	⑦
	1	2	3	4	5	6	7
	1	2	3	4	5	6	7
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

- 1 - Vishay Semiconductors product
- 2 - HEXFRED® family, electron irradiated
- 3 - Average current rating
- 4 - NJ = TO-244
- 5 - Voltage rating (60 = 600 V)
- 6 - C = two diodes common cathode
- 7 - Lead (Pb)-free

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95021">www.vishay.com/doc?95021</a>
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## TO-244

**DIMENSIONS** in millimeters (inches)





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