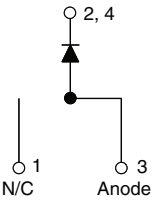
HEXFRED®, Ultrafast Soft Recovery Diode, 4 A



DPAK (TO-252AA)



FEATURES

- Ultrafast recovery time
- Ultrasoft recovery
- Very low I_{RRM}
- Very low Q_{rr}
- Guaranteed avalanche
- Specified at operating temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Material categorization: for definitions of compliance please see 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

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	4 A
V_R	600 V
V_F at I_F	1.4 V
t_{rr} typ.	17 ns
T_J max.	150 °C
Package	DPAK (TO-252AA)
Circuit configuration	Single

DESCRIPTION / APPLICATIONS

These diodes are optimized to reduce losses and EMI / RFI in high frequency power conditioning systems. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for freewheeling, flyback, power converters, motor drives, and other applications where high speed and reduced switching losses are design requirements.

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	V_{RRM}		600	V
Maximum continuous forward current	$I_{F(AV)}$	T_C = 100 °C	4	A
Single pulse forward current	I_{FSM}		25	
Repetitive peak forward current	I_{FRM}	T_C = 116 °C	16	
Maximum power dissipation	P_D	T_C = 100 °C	10	W
Operating junction and storage temperatures	T_J, T_{Stg}		-55 to +150	°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 See fig. 1	V_F	I_F = 4 A	-	1.5	1.8	
		I_F = 8 A	-	1.8	2.2	
		I_F = 4 A, T_J = 125 °C	-	1.4	1.7	
Maximum reverse leakage current	I_R	V_R = V_R rated	-	0.17	3.0	µA
		T_J = 125 °C, V_R = 0.8 x V_R rated	-	44	300	
Junction capacitance	C_T	V_R = 200 V	-	4	8	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8.0	-	nH

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DYNAMIC RECOVERY CHARACTERISTICS (T_C = 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 = 200 A/μA, V_R = 30 V		-	17	-	ns
		T_J = 25 °C	I_F = 4 A dI_F/dt = 200 A/μs V_R = 200 V	-	28	42	
		T_J = 125 °C		-	38	57	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	2.9	5.2	A
		T_J = 125 °C		-	3.7	6.7	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	40	60	nC
		T_J = 125 °C		-	70	105	
Rate of fall of recovery current	$dI_{(rec)M}/dt$	T_J = 25 °C		-	280	-	A/μs
		T_J = 125 °C		-	235	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Maximum junction and storage temperature range	T_J, T_{Stg}		-55	-	150	°C
Thermal resistance, junction to case	R_{thJC}		-	-	5.0	°C/W
Thermal resistance, junction to ambient	R_{thJA}	Typical socket mount	-	-	80	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style DPAK (TO-252AA)	HFA04SD60S			

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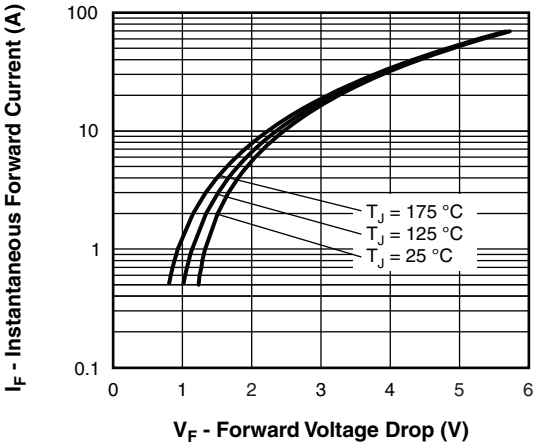


Fig. 1 - Typical Forward Voltage Drop Characteristics

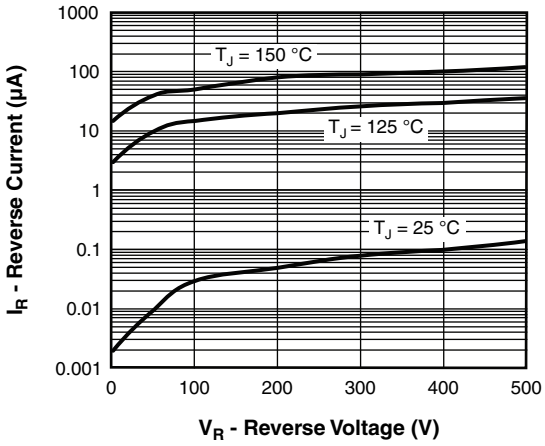


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

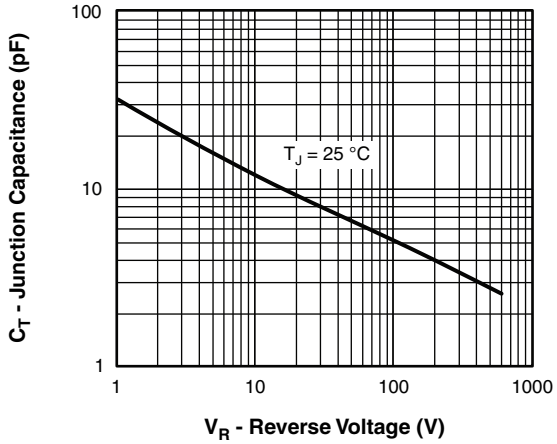


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

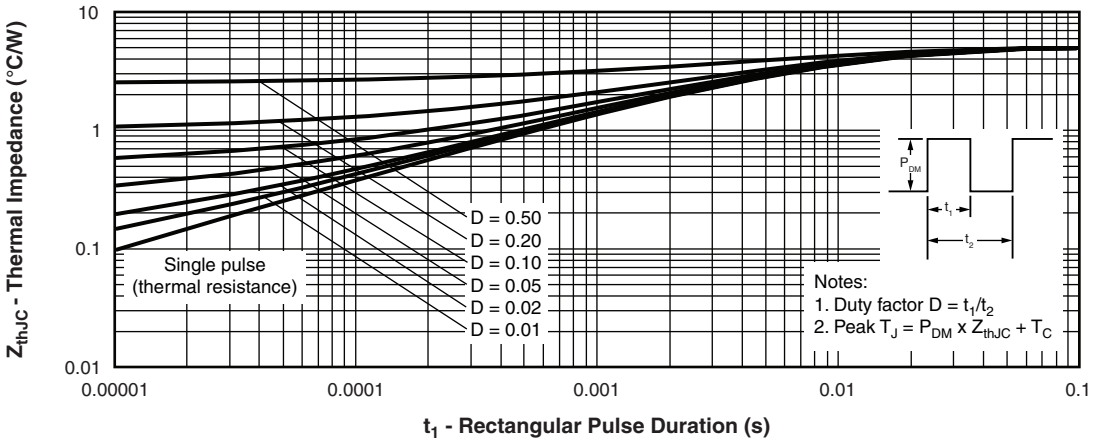


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

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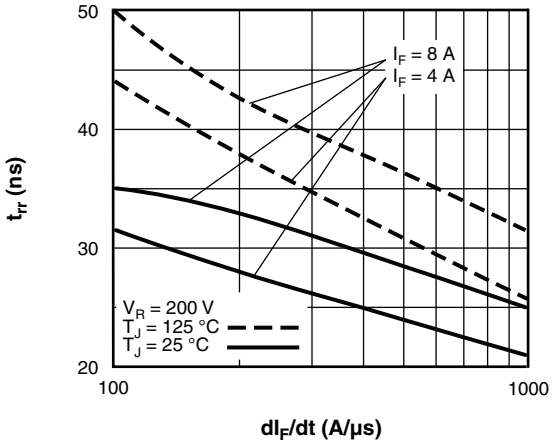


Fig. 5 - Typical Reverse Recovery Time vs. dI_F/dt

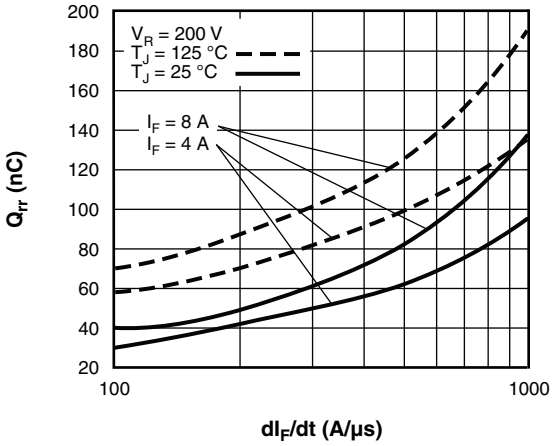


Fig. 7 - Typical Stored Charge vs. dI_F/dt

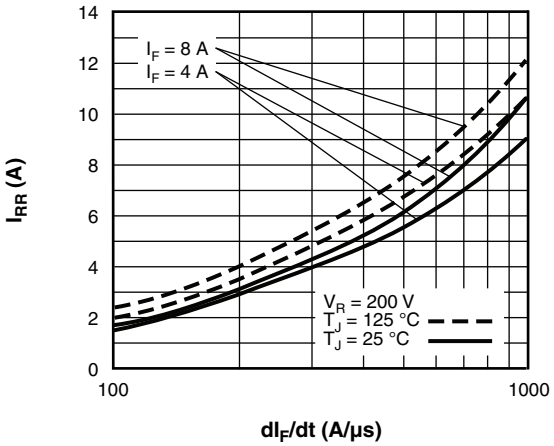


Fig. 6 - Typical Recovery Current vs. dI_F/dt

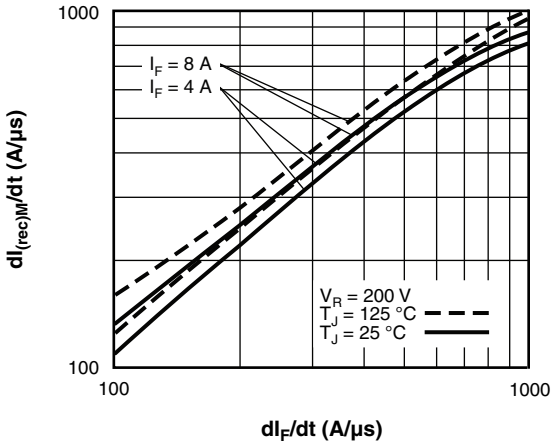


Fig. 8 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

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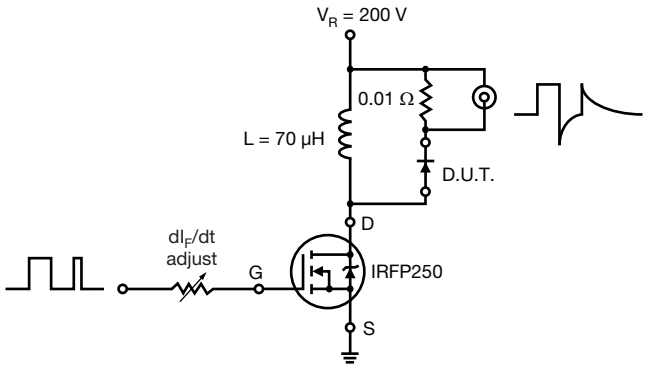
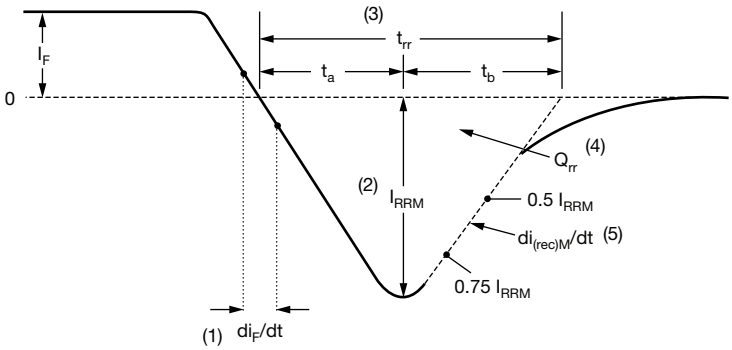


Fig. 9 - Reverse Recovery Parameter Test Circuit



(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. 10 - Reverse Recovery Waveform and Definitions

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ORDERING INFORMATION TABLE

Device code

VS-	HF	A	04	SD	60	S	TR	-M3
1	2	3	4	5	6	7	8	9

1 - Vishay Semiconductors product

2 - HEXFRED® family

3 - Electron irradiated

4 - Current rating (04 = 4 A)

5 - D-PAK

6 - Voltage rating (60 = 600 V)

7 - S = D-PAK

8 - • TR = tape and reel
• R = tape and reel (right oriented)
• L = tape and reel (left oriented)

9 - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

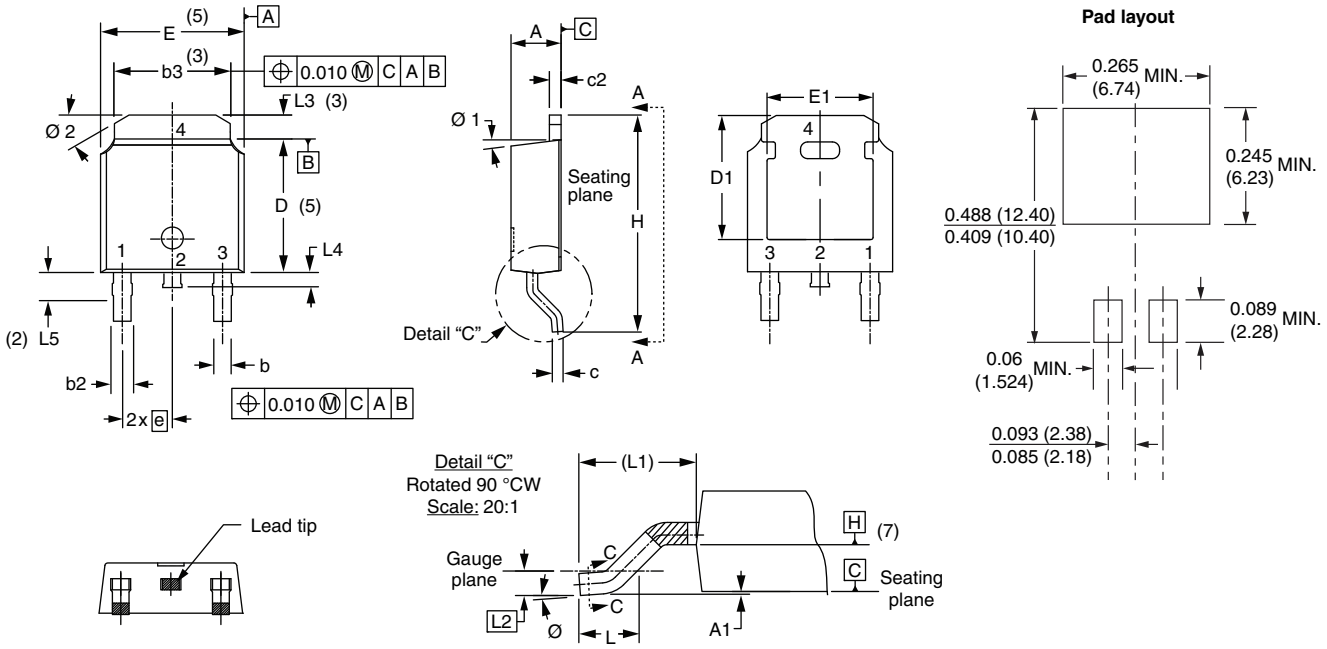
ORDERING INFORMATION (Example)		
PREFERRED P/N	**BASE QUANTITY**	**PACKAGING DESCRIPTION**
VS-HFA04SD60S-M3	75	Antistatic plastic tube
VS-HFA04SD60STR-M3	2000	13" diameter reel
VS-HFA04SD60SL-M3	3000	13" diameter reel
VS-HFA04SD60SR-M3	3000	13" diameter reel

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95627
Part marking information	www.vishay.com/doc?95176
Packaging information	www.vishay.com/doc?95033

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D-PAK (TO-252AA) "M"

DIMENSIONS in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	0.094	
A1	-	0.13	-	0.005	
b	0.64	0.89	0.025	0.035	
b2	0.76	1.14	0.030	0.045	
b3	4.95	5.46	0.195	0.215	3
c	0.46	0.61	0.018	0.024	
c2	0.46	0.89	0.018	0.035	
D	5.97	6.22	0.235	0.245	5
D1	5.21	-	0.205	-	3
E	6.35	6.73	0.250	0.265	5
E1	4.32	-	0.170	-	3

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
e	2.29 BSC		0.090 BSC		
H	9.40	10.41	0.370	0.410	
L	1.40	1.78	0.055	0.070	
L1	2.74 BSC		0.108 REF.		
L2	0.51 BSC		0.020 BSC		
L3	0.89	1.27	0.035	0.050	3
L4	-	1.02	-	0.040	
L5	1.14	1.52	0.045	0.060	2
Ø	0°	10°	0°	10°	
Ø1	0°	15°	0°	15°	
Ø2	25°	35°	25°	35°	

Notes

(1) Dimensioning and tolerancing as per ASME Y14.5M-1994
(2) Lead dimension uncontrolled in L5
(3) Dimension D1, E1, L3 and b3 establish a minimum mounting surface for thermal pad
(4) Section C - C dimension apply to the flat section of the lead between 0.13 and 0.25 mm (0.005 and 0.10") from the lead tip
(5) 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 outermost extremes of the plastic body
(6) Dimension b1 and c1 applied to base metal only
(7) Datum A and B to be determined at datum plane H
(8) Outline conforms to JEDEC® outline TO-252AA

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