



## Fast Recovery Diodes (Stud Version), 40 A, 70 A, 85 A



DO-5 (DO-203AB)

### FEATURES

- Short reverse recovery time
- Low stored charge
- Wide current range
- Excellent surge capabilities
- Stud cathode and stud anode versions
- Types up to 100 V<sub>RRM</sub>
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT

### TYPICAL APPLICATIONS

- DC power supplies
- Inverters
- Converters
- Choppers
- Ultrasonic systems
- Freewheeling diodes

PRIMARY CHARACTERISTICS	
I <sub>F(AV)</sub>	40 A, 70 A, 85 A
Package	DO-5 (DO-203AB)
Circuit Configuration	Single

MAJOR RATINGS AND CHARACTERISTICS					
PARAMETER	TEST CONDITIONS	40HFL	70HFL	85HFL	UNITS
I <sub>F(AV)</sub>		40	70	85	A
	T <sub>C</sub> maximum	85	85	85	°C
I <sub>FSM</sub>	50 Hz	400	700	1100	A
	60 Hz	420	730	1151	
I <sup>2</sup> t	50 Hz	800	2450	6050	A <sup>2</sup> s
	60 Hz	730	2240	5523	
I <sup>2</sup> √t		11 300	34 650	85 560	I <sup>2</sup> √s
V <sub>RRM</sub>	Range	100 to 1000	100 to 1000	100 to 1000	V
t <sub>rr</sub>		See Recovery Characteristics table	See Recovery Characteristics table	See Recovery Characteristics table	ns
T <sub>J</sub>	Range	-40 to +125	-40 to +125	-40 to +125	°C



**ELECTRICAL SPECIFICATIONS**

<b>VOLTAGE RATINGS</b>				
TYPE NUMBER <sup>(1)</sup>	V <sub>RRM</sub> , MAXIMUM PEAK REPETITIVE REVERSE VOLTAGE T <sub>J</sub> = - 40 °C TO 125 °C V	V <sub>RSM</sub> , MAXIMUM PEAK NON-REPETITIVE REVERSE VOLTAGE T <sub>J</sub> = 25 °C TO 125 °C V	I <sub>FM</sub> , MAXIMUM PEAK REVERSE CURRENT AT RATED V <sub>RRM</sub> mA	
			T <sub>J</sub> = 25 °C	T <sub>J</sub> = 125 °C
VS-40HFL10S02, VS-40HFL10S05	100	150	0.1	10
VS-40HFL20S02, VS-40HFL20S05	200	300		
VS-40HFL40S02, VS-40HFL40S05	400	500		
VS-40HFL60S02, VS-40HFL60S05	600	700		
VS-40HFL80S05	800	900		
VS-40HFL100S05	1000	1100		
VS-70HFL10S02, VS-70HFL10S05	100	150	0.1	15
VS-70HFL20S02, VS-70HFL20S05	200	300		
VS-70HFL40S02, VS-70HFL40S05	400	500		
VS-70HFL60S02, VS-70HFL60S05	600	700		
VS-70HFL80S05	800	900		
VS-70HFL100S05	1000	1100		
VS-85HFL10S02, VS-85HFL10S05	100	150	0.1	20
VS-85HFL20S02, VS-85HFL20S05	200	300		
VS-85HFL40S02, VS-85HFL40S05	400	500		
VS-85HFL60S02, VS-85HFL60S05	600	700		
VS-85HFL80S05	800	900		
VS-85HFL100S05	1000	1100		

**Note**

<sup>(1)</sup> Types listed are cathode case, for anode case add "R" to code, i.e. 40HFLR20S02, 85HFLR100S05 etc.

<b>FORWARD CONDUCTION</b>							
PARAMETER	SYMBOL	TEST CONDITIONS	40HFL	70HFL	85HFL	UNITS	
Maximum average forward current at maximum case temperature	I <sub>F(AV)</sub>	180° conduction, half sine wave	40	70	85	A	
			75			°C	
Maximum RMS forward current	I <sub>F(RMS)</sub>		63	110	134	A	
Maximum peak repetitive forward current	I <sub>FRM</sub>	Sinusoidal half wave, 30° conduction	220	380	470	A	
Maximum peak, one-cycle non-repetitive forward current	I <sub>FSM</sub>	t = 10 ms	Sinusoidal half wave, 100 % V <sub>RRM</sub> reapplied, initial T <sub>J</sub> = T <sub>J</sub> maximum	400	700	1100	A
		t = 8.3 ms		420	730	1151	
		t = 10 ms	Sinusoidal half wave, no voltage reapplied, initial T <sub>J</sub> = T <sub>J</sub> maximum	475	830	1308	
		t = 8.3 ms		500	870	1369	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	100 % V <sub>RRM</sub> reapplied, initial T <sub>J</sub> = T <sub>J</sub> maximum	800	2450	6050	A <sup>2</sup> s
		t = 8.3 ms		730	2240	5523	
		t = 10 ms	No voltage reapplied, initial T <sub>J</sub> = T <sub>J</sub> maximum	1130	3460	8556	
		t = 8.3 ms		1030	3160	7810	
Maximum I <sup>2</sup> √t for fusing <sup>(1)</sup>	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reapplied	11 300	34 650	85 560	A <sup>2</sup> √s	
Maximum value of threshold voltage	V <sub>F(TO)</sub>	T <sub>J</sub> = 125 °C	1.081	1.085	1.128	V	
Maximum value of forward slope resistance	r <sub>F</sub>		6.33	3.40	2.11	mΩ	
Maximum forward voltage drop	V <sub>FM</sub>	T <sub>J</sub> = 25 °C, I <sub>FM</sub> = π x I <sub>F(AV)</sub>	1.95	1.85	1.75	V	

**Note**

<sup>(1)</sup> I<sup>2</sup>t for time t<sub>x</sub> = I<sup>2</sup>√t x √t<sub>x</sub>

RECOVERY CHARACTERISTICS									
PARAMETER	SYMBOL	TEST CONDITIONS	40HFL...		70HFL...		85HFL...		UNITS
			S02	S05	S02	S05	S02	S05	
Typical reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = 1\text{ A}$ to $V_R = 30\text{ V}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	70	180	60	150	50	120	ns
		$T_J = 25\text{ }^\circ\text{C}$ , $-di_F/dt = 25\text{ A}/\mu\text{s}$ , $I_{FM} = \pi \times \text{rated } I_{F(AV)}$	200	500	200	500	200	500	
Typical reverse recovered charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = 1\text{ A}$ to $V_R = 30\text{ V}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	160	750	90	500	70	340	nC
		$T_J = 25\text{ }^\circ\text{C}$ , $-di_F/dt = 25\text{ A}/\mu\text{s}$ , $I_{FM} = \pi \times \text{rated } I_{F(AV)}$	240	1300	240	1300	240	1300	

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	40HFL	70HFL	85HFL	UNITS
Junction operating temperature range	$T_J$		-40 to 125			°C
Storage temperature range	$T_{Stg}$		-40 to 150			
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	0.60	0.36	0.30	K/W
Maximum thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth, flat and greased	0.25			
Maximum allowable mounting torque (+ 0 %, - 10 %)		Not lubricated thread, tightening on nut <sup>(1)</sup>	3.4 (30)			N · m (lbf · in)
		Lubricated thread, tightening on nut <sup>(1)</sup>	2.3 (20)			
		Not lubricated thread, tightening on hexagon <sup>(2)</sup>	4.2 (37)			
		Lubricated thread, tightening on hexagon <sup>(2)</sup>	3.2 (28)			
Approximate weight			25			
			0.88			
Case style		JEDEC®	DO-5 (DO-203AB)			

**Notes**

- (1) Recommended for pass-through holes  
 (2) Recommended for holed threaded heatsinks



- $I_F$ ,  $I_{FM}$  - Peak forward current prior to commutation  
 $-di_F/dt$  - Rate of fall forward current  
 $I_{RRM(REC)}$  - Peak reverse recovery current  
 $t_{rr}$  - Reverse recovery time  
 $Q_{rr}$  - Reverse recovered charge

Fig. 1 - Reverse Recovery Time Test Waveform



Fig. 2 - Current Rating Nomogram (Sinusoidal Waveforms), 40HFL Series



Fig. 3 - Current Rating Nomogram (Rectangular Waveforms), 40HFL Series

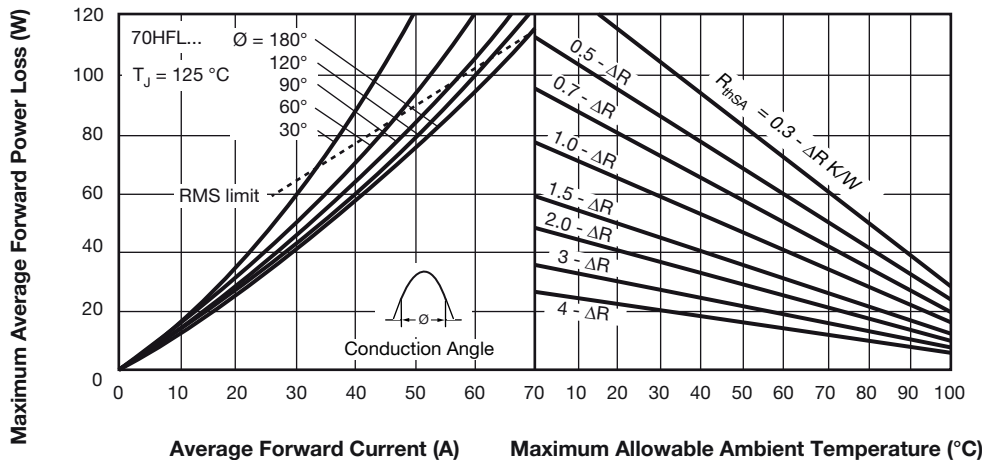


Fig. 4 - Current Rating Nomogram (Sinusoidal Waveforms), 70HFL Series



Fig. 5 - Current Rating Nomogram (Rectangular Waveforms), 70HFL Series



Fig. 6 - Current Rating Nomogram (Sinusoidal Waveforms), 85HFL Series

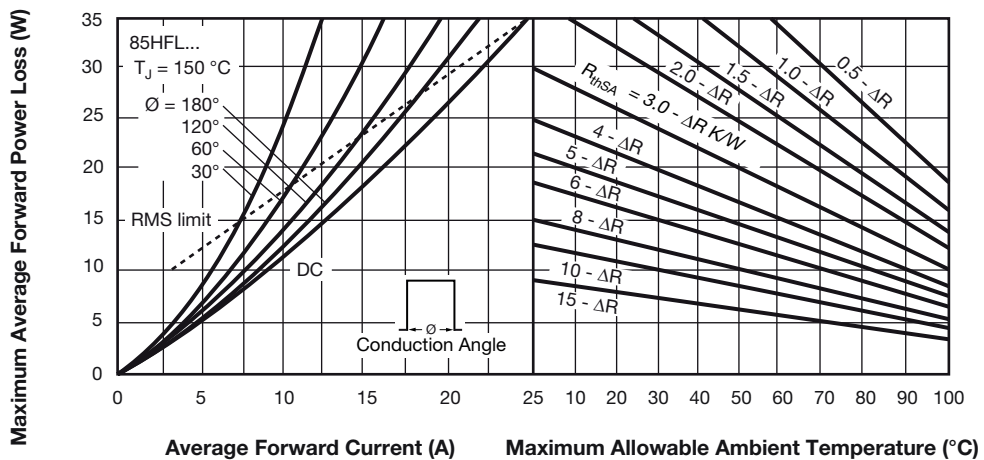


Fig. 7 - Current Rating Nomogram (Rectangular Waveforms), 85HFL Series



Fig. 8 - Maximum High Level Forward Power Loss vs. Average Forward Current, 40HFL Series

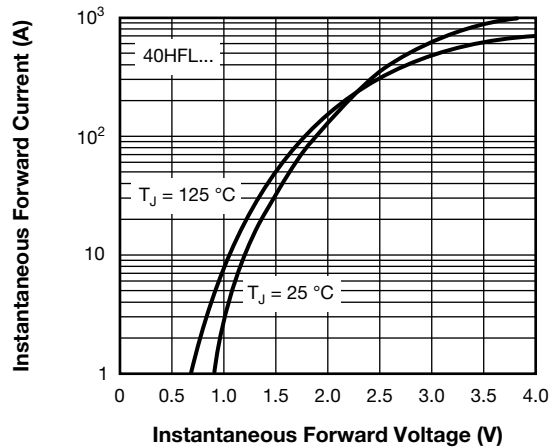


Fig. 11 - Maximum Forward Voltage vs. Forward Current, 40HFL Series



Fig. 9 - Maximum High Level Forward Power Loss vs. Average Forward Current, 70HFL Series

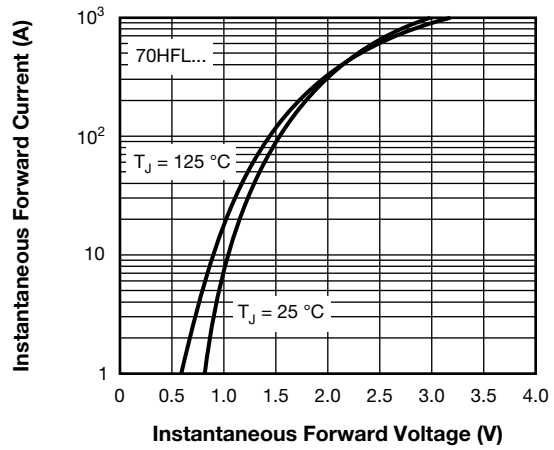


Fig. 12 - Maximum Forward Voltage vs. Forward Current, 70HFL Series



Fig. 10 - Maximum High Level Forward Power Loss vs. Average Forward Current, 85HFL Series

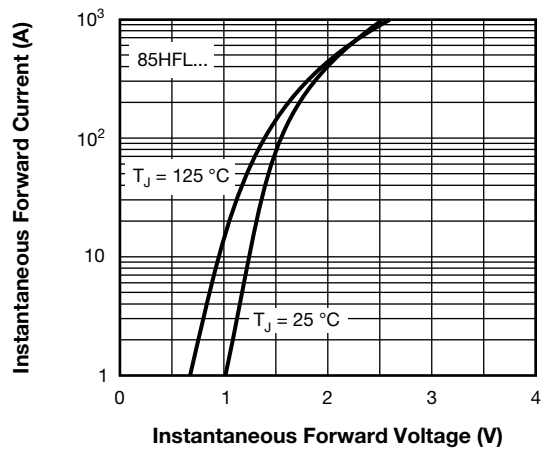


Fig. 13 - Maximum Forward Voltage vs. Forward Current, 85HFL Series

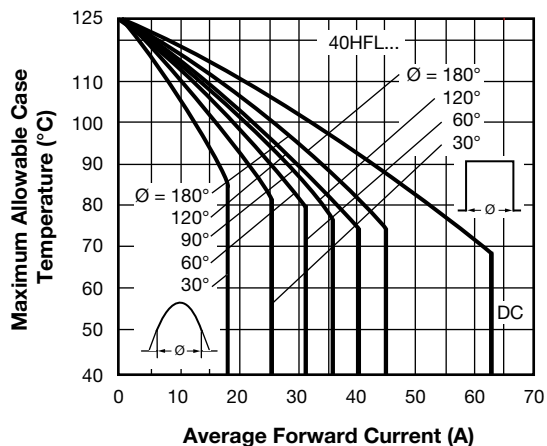


Fig. 14 - Average Forward Current vs. Maximum Allowable Case Temperature, 40HFL Series

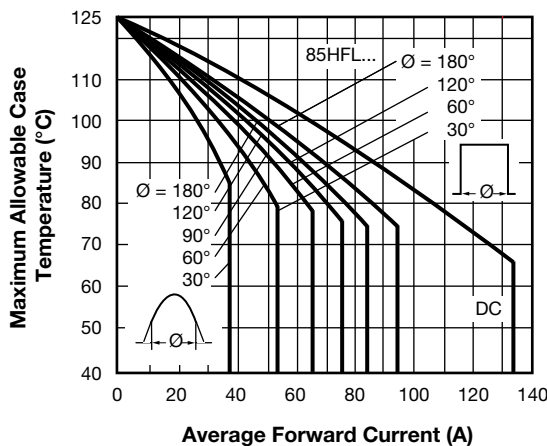


Fig. 16 - Average Forward Current vs. Maximum Allowable Case Temperature, 85HFL Series

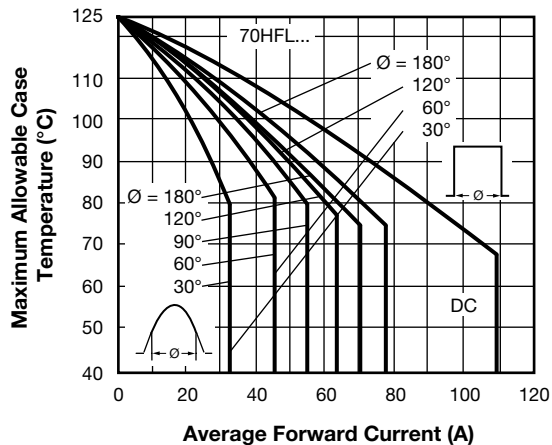


Fig. 15 - Average Forward Current vs. Maximum Allowable Case Temperature, 70HFL Series

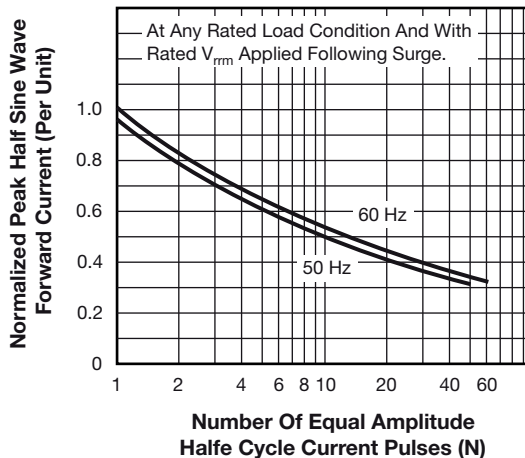


Fig. 17 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, All Series

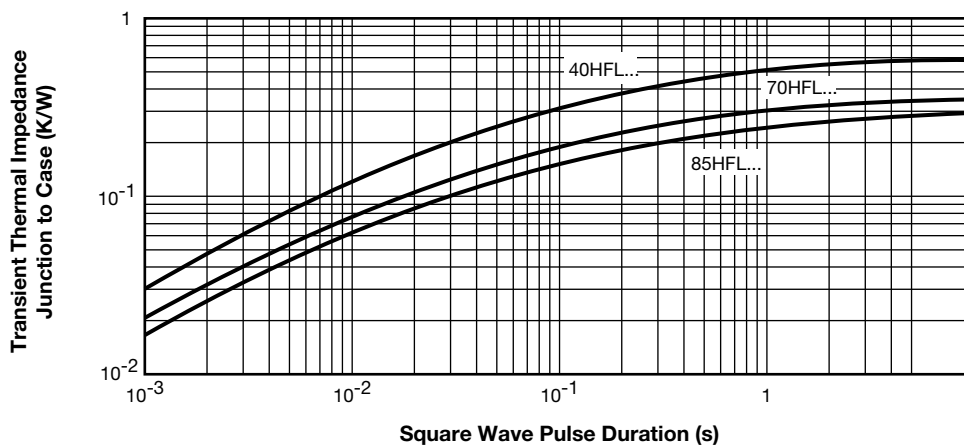


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case vs. Pulse Duration, All Series



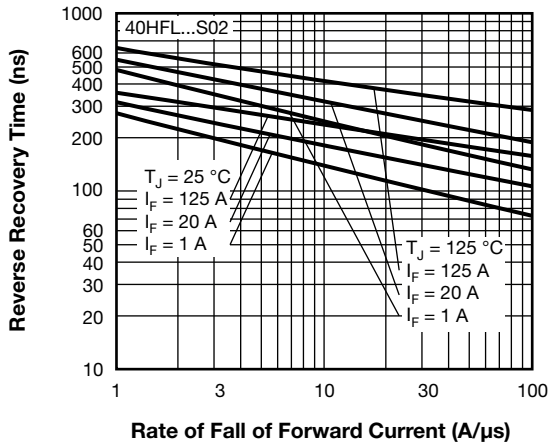


Fig. 19 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...S02 Series

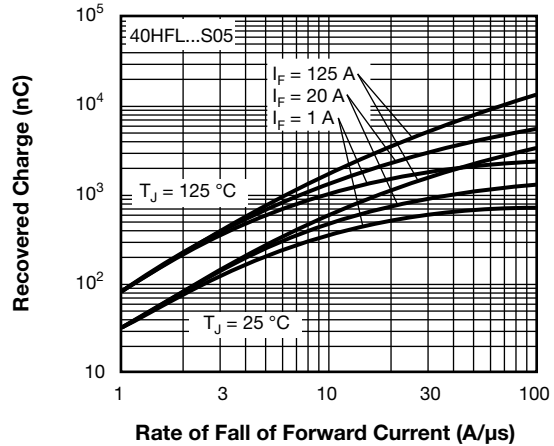


Fig. 22 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...S05 Series

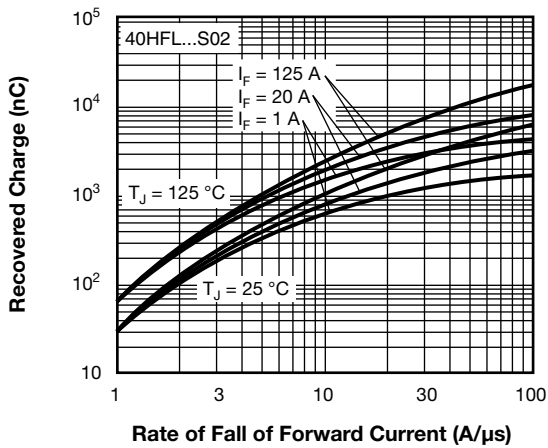


Fig. 20 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...S02 Series

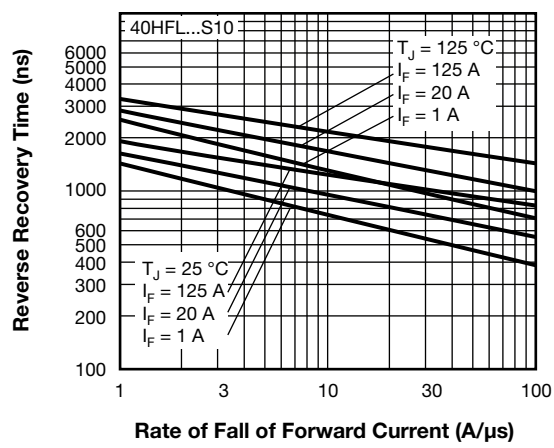


Fig. 23 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...Series

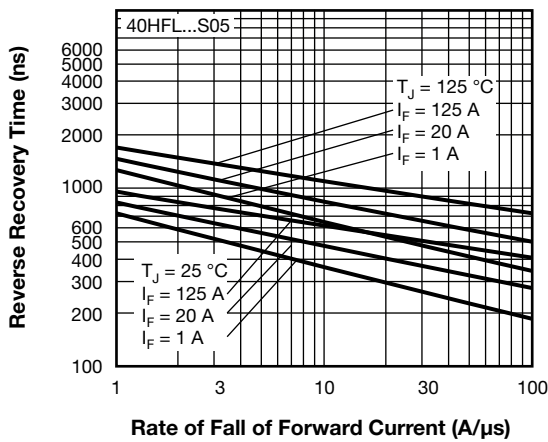


Fig. 21 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...S05 Series

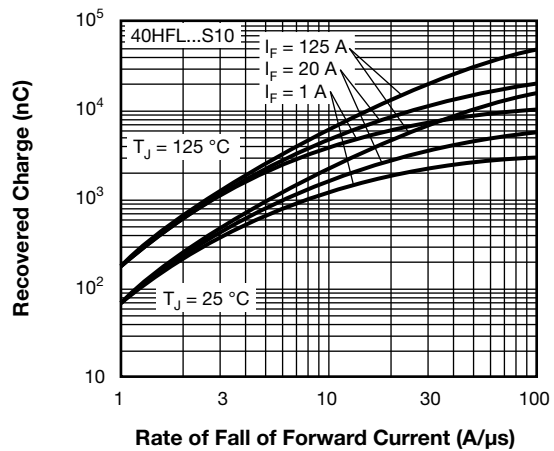


Fig. 24 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...Series



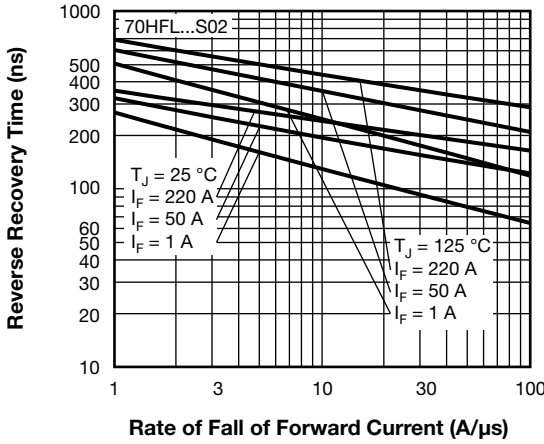


Fig. 25 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL...S02 Series

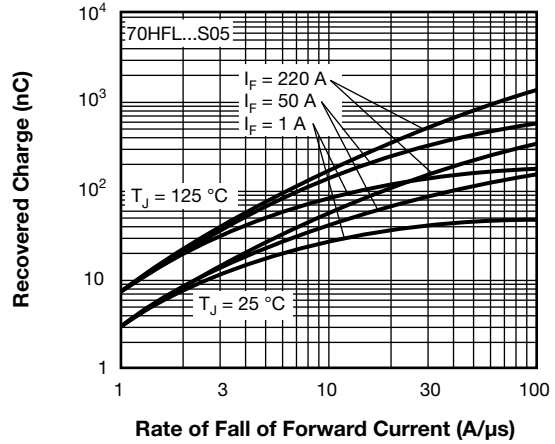


Fig. 28 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL...S05 Series

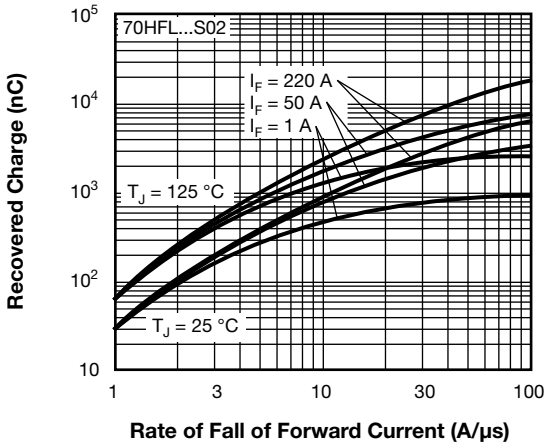


Fig. 26 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL...S02 Series

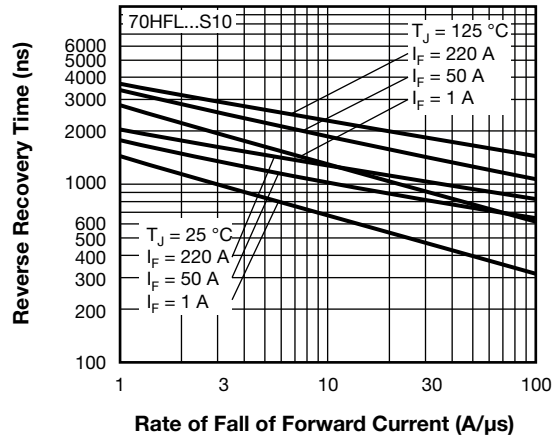


Fig. 29 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL... Series

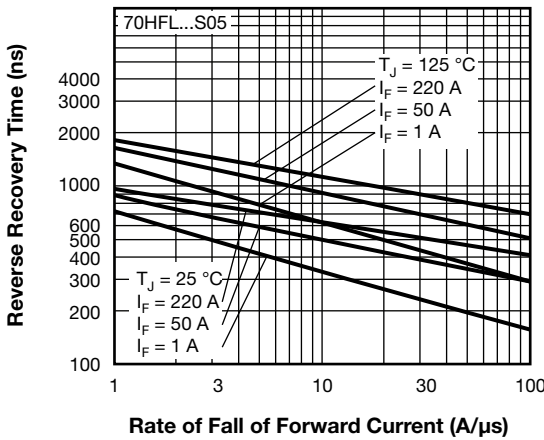


Fig. 27 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL...S05 Series

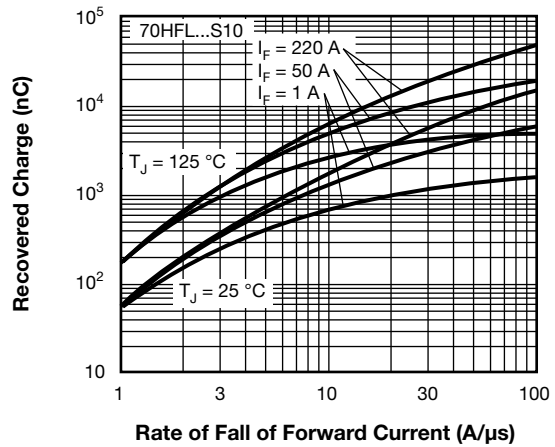
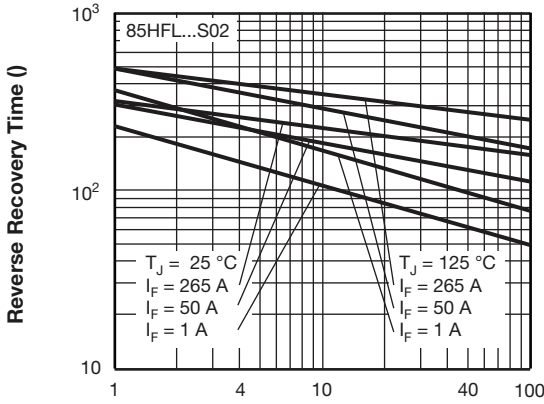
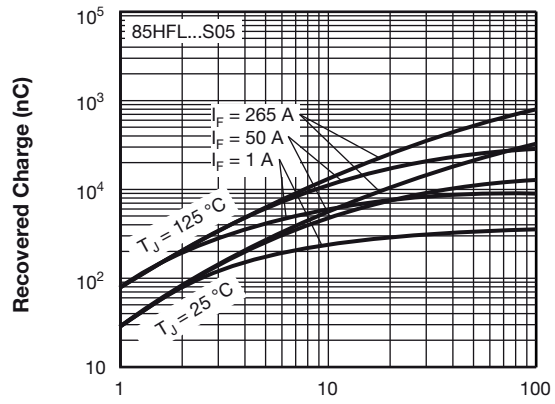


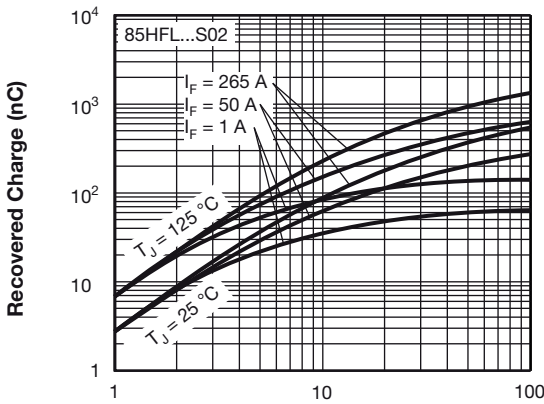
Fig. 30 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL... Series



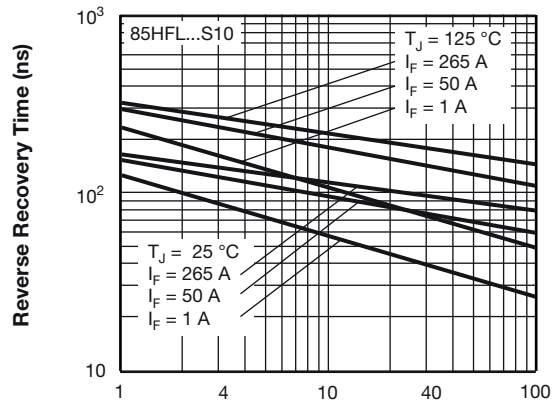
**Rate of Fall of Forward Current (A/μs)**  
 Fig. 31 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 85HFL...S02 Series



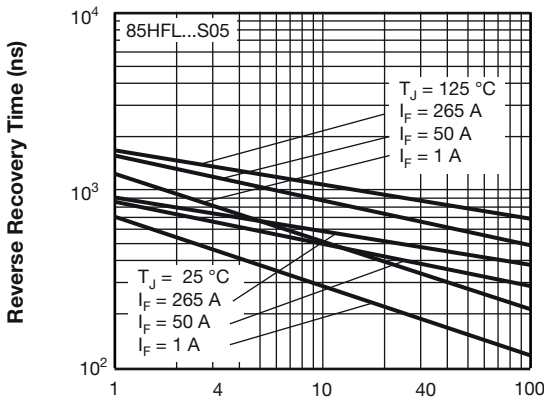
**Rate of Fall of Forward Current (A/μs)**  
 Fig. 34 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 85HFL...S05 Series



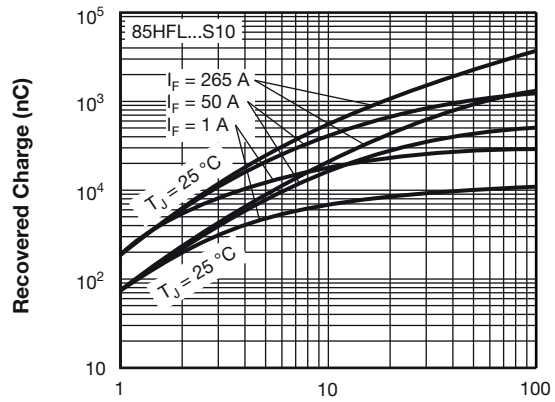
**Rate of Fall of Forward Current (A/μs)**  
 Fig. 32 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 85HFL...S02 Series



**Rate of Fall of Forward Current (A/μs)**  
 Fig. 35 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 85HFL... Series



**Rate of Fall of Forward Current (A/μs)**  
 Fig. 33 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 85HFL...S05 Series



**Rate of Fall of Forward Current (A/μs)**  
 Fig. 36 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 85HFL... Series



## ORDERING INFORMATION TABLE

Device code	<b>VS-</b>	<b>70</b>	<b>HFL</b>	<b>R</b>	<b>100</b>	<b>S02</b>	<b>M</b>
	①	②	③	④	⑤	⑥	⑦

- 1** - Vishay Semiconductors product
- 2** -
  - 70 = standard device (current rating: 40 = 40 A, 70 = 70 A, 85 = 85 A)
  - 71 = not isolated lead
  - 72, 87 = isolated lead with silicone sleeve  
(red = reverse polarity)  
(blue = normal polarity)
- 3** - HFL = fast recovery diode
- 4** -
  - None = stud normal polarity (cathode to stud)
  - R = stud reverse polarity (anode to stud)
- 5** - Voltage code x 10 =  $V_{RRM}$  (see "Voltage Ratings" table)
- 6** - Refer to "Recovery Characteristics" table
- 7** -
  - None = stud base DO-5 (DO-203AB) 1/4" 28UNF-2A
  - M = stud base DO-5 (DO-203AB) M6 x 1

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95312">www.vishay.com/doc?95312</a>

## DO-203AB (DO-5) for 40HFL, 70HFL and 85HFL

### DIMENSIONS FOR 40HFL/70HFL in millimeters (inches)



# Outline Dimensions

Vishay Semiconductors

DO-203AB (DO-5) for  
40HFL, 70HFL and 85HFL



## DIMENSIONS FOR 85HFL in millimeters (inches)





## Disclaimer

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