

Data Sheet No. PD-2.093

INTERNATIONAL RECTIFIER



## 40HFL, 70HFL, 85HFL SERIES

### 40A, 70A, 85A Fast Recovery Rectifiers

#### Major Ratings and Characteristics

	40HFL...	70HFL...	85HFL...	Units	
$I_F(AV)$	40	70	85	A	
@ Max $T_C$	75	75	75	$^{\circ}C$	
$I_{FSM}$	50Hz	400	700	1100	A
	60Hz	420	730	1151	A
$I^2t$	50Hz	800	2450	6050	$A^2s$
	60Hz	730	2240	5523	$A^2s$
$I^2\sqrt{t}$	11 300	34 650	85 560	$A^2\sqrt{s}$	
$t_{rr}$ range	see table				
$V_{RRM}$ range	100 to 1000			V	
$T_J$ range	-40 to 125			$^{\circ}C$	

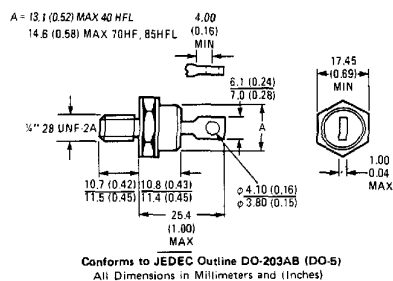
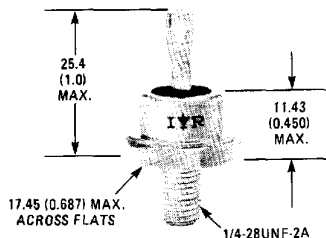
#### Description

This range of fast recovery diodes is designed for applications in DC power supplies, inverters, converters, choppers, ultrasonic systems and for use as a free wheeling diode.

#### Features

- Short reverse recovery time
- Low stored charge.
- Wide current range.
- Excellent surge capabilities.
- Stud cathode and stud anode versions.
- Types up to 1000V  $V_{RRM}$ .

#### CASE STYLE AND DIMENSIONS



40HFL, 70HFL, 85HFL Series

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ELECTRICAL SPECIFICATIONS

Reverse voltage ratings

Part number ①	V <sub>RRM</sub> , Maximum peak repetitive reverse voltage T <sub>J</sub> = -40 to 125°C		V <sub>RRM</sub> , Maximum peak non-repetitive reverse voltage T <sub>J</sub> = 25 to 125°C		I <sub>FM</sub> , Maximum peak reverse current at rated V <sub>RRM</sub> T <sub>J</sub> = 25°C		T <sub>J</sub> = 125°C	
	V		V		mA		mA	
40HFL10S02, 40HFL10S05, 40HFL10S10	100		150		0.1		10	
40HFL20S02, 40HFL20S05, 40HFL20S10	200		300		0.1		10	
40HFL40S02, 40HFL40S05, 40HFL40S10	400		500		0.1		10	
40HFL60S02, 40HFL60S05, 40HFL60S10	600		700		0.1		10	
40HFL80S02, 40HFL80S05, 40HFL80S10	800		900		0.1		10	
40HFL100S05, 40HFL100S10	1000		1100		0.1		10	
70HFL10S02, 70HFL10S05, 70HFL10S10	100		150		0.1		15	
70HFL20S02, 70HFL20S05, 70HFL20S10	200		300		0.1		15	
70HFL40S02, 70HFL40S05, 70HFL40S10	400		500		0.1		15	
70HFL60S02, 70HFL60S05, 70HFL60S10	600		700		0.1		15	
70HFL80S02, 70HFL80S05, 70HFL80S10	800		900		0.1		15	
70HFL100S05, 70HFL100S10	1000		1100		0.1		15	
85HFL10S02, 85HFL10S05, 85HFL10S10	100		150		0.1		20	
85HFL20S02, 85HFL20S05, 85HFL20S10	200		300		0.1		20	
85HFL40S02, 85HFL40S05, 85HFL40S10	400		500		0.1		20	
85HFL60S02, 85HFL60S05, 85HFL60S10	600		700		0.1		20	
85HFL80S02, 85HFL80S05, 85HFL80S10	800		900		0.1		20	
85HFL100S05, 85HFL100S10	1000		1100		0.1		20	

① Types listed are cathode case, for anode case add "R" to code, i.e. 40HFLR20S02, 85HFLR100S05 etc.

Reverse recovery characteristics

	40HFL...			70HFL...			85HFL...			Units	Conditions
	S02	S05	S10	S02	S05	S10	S02	S05	S10		
t <sub>rr</sub> Maximum reverse recovery time	70	180	350	60	150	290	50	120	270	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 1A to V <sub>R</sub> = 30V -dI <sub>F</sub> /dt = 100A/μs
	200	500	1000	200	500	1000	200	500	1000	ns	T <sub>J</sub> = 25°C, -dI <sub>F</sub> /dt = 25A/μs I <sub>FM</sub> = τ × rated I <sub>F(AV)</sub>
Q <sub>RR</sub> Maximum reverse recovered charge	160	750	3100	90	500	1600	70	340	1350	nC	T <sub>J</sub> = 25°C, I <sub>F</sub> = 1A to V <sub>R</sub> = 30V -dI <sub>F</sub> /dt = 100A/μs
	240	1300	6000	240	1300	6000	240	1300	6000	nC	T <sub>J</sub> = 25°C, -dI <sub>F</sub> /dt = 25A/μs I <sub>FM</sub> = τ × rated I <sub>F(AV)</sub>

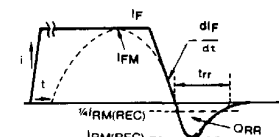
Forward conduction

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

① I<sup>2</sup>t for time t<sub>x</sub> = I<sup>2</sup>√t × √t<sub>x</sub>.

**THERMAL AND MECHANICAL SPECIFICATIONS**

		40HFL...	70HFL...	85HFL...	Units	Conditions	
$T_j$	Junction operating temperature range		-40 to 125		$^{\circ}\text{C}$		
$T_{stg}$	Storage temperature range		-40 to 150		$^{\circ}\text{C}$		
$R_{thJC}$	Maximum internal thermal resistance, junction to case	0.60	0.36	0.30	K/W	DC operation	
$R_{thCS}$	Maximum thermal resistance, case to heatsink	0.25			K/W	Mounting surface, smooth, flat and greased	
T	Mounting torque 10%	to nut			20 (27)	lbf·in	Lubricated threads (non-lubricated threads)
					0.23 (0.29)	kgf·m	
		to device			2.2 (2.7)	N·m	
					22	lbf·in	
			0.25	kgf·m			
			2.5	N·m			
wt	Approximate weight	25 (0.88)			g (oz)		
	Outline	DO-203AB (DO-51)				JEDEC	



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

**Fig. 1 – Reverse Recovery Time Test Waveform**

40HFL, 70HFL, 85HFL Series

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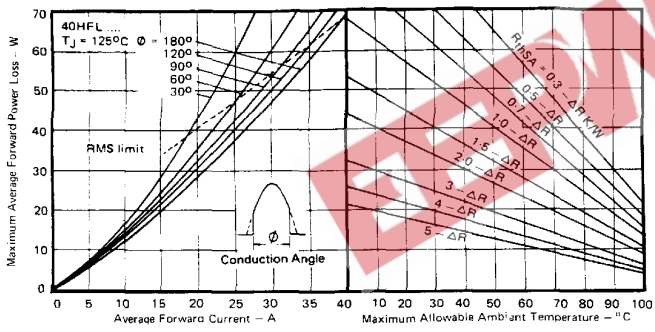


Fig. 2 - Current Rating Nomogram (Sinusoidal Waveforms), 40HFL Series

Conduction angle - $\phi$	$\Delta R$	K/W
180°	0.14	
120°	0.15	
90°	0.20	
60°	0.31	
30°	0.53	

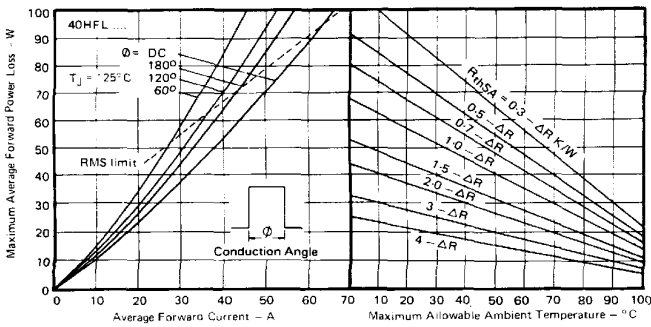


Fig. 3 - Current Rating Nomogram (Rectangular Waveforms), 40HFL Series

Conduction angle - $\phi$	$\Delta R$	K/W
DC	0	
180°	0.08	
120°	0.14	
60°	0.30	

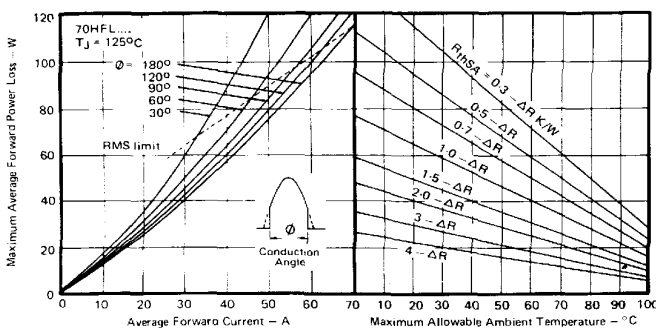


Fig. 4 - Current Rating Nomogram (Sinusoidal Waveforms), 70HFL Series

Conduction angle - $\phi$	$\Delta R$	K/W
180°	0.08	
120°	0.09	
90°	0.12	
60°	0.18	
30°	0.32	

1N3879, 1N3889, 6FL, 12FL, 16FL Series

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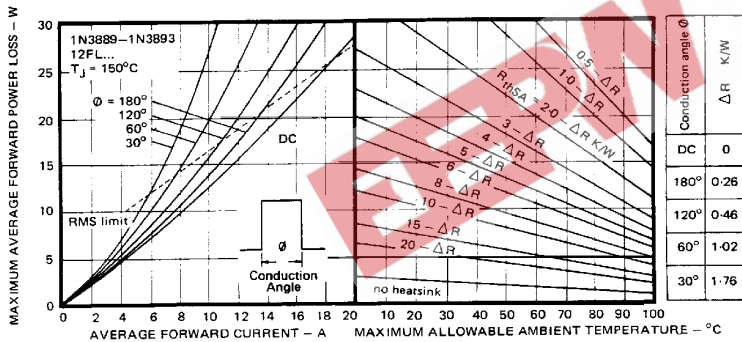


Fig. 8 – Current Rating Nomogram (Rectangular Waveforms), 1N3889 and 12FL Series

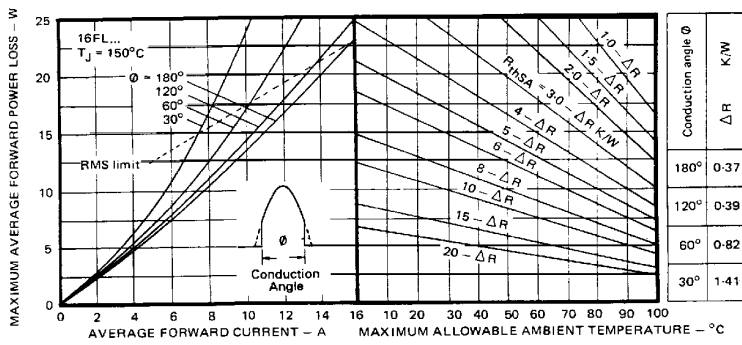


Fig. 9 – Current Rating Nomogram (Sinusoidal Waveforms), 16FL Series

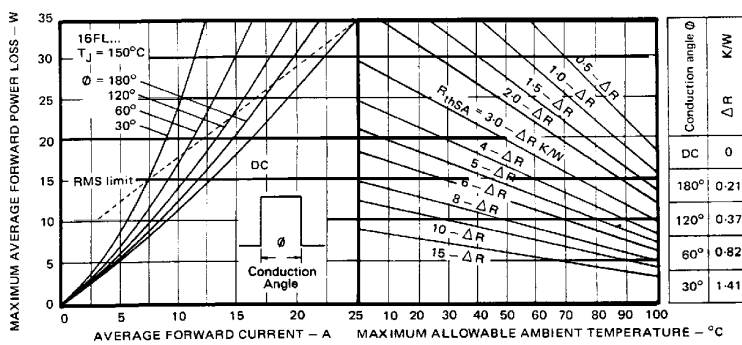


Fig. 10 – Current Rating Nomogram (Rectangular Waveforms), 16FL Series

40HFL, 70HFL, 85HFL Series

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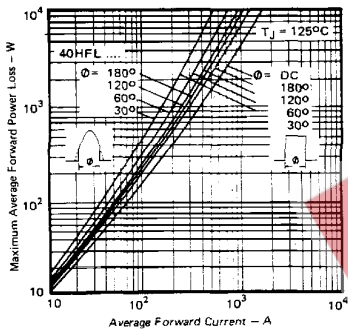


Fig. 8 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 40HFL Series

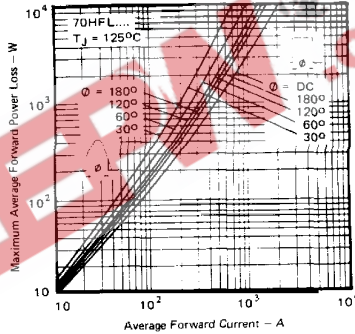


Fig. 9 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 70HFL Series

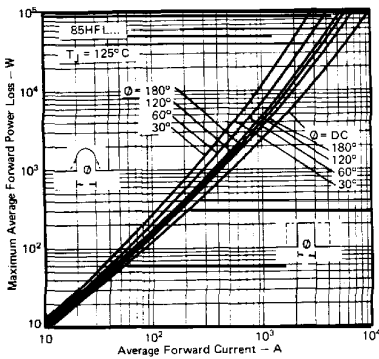


Fig. 10 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 85HFL Series

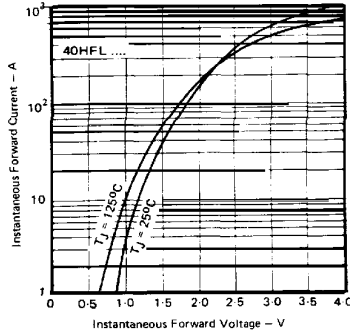


Fig. 11 – Maximum Forward Voltage Vs. Forward Current, 40HFL Series

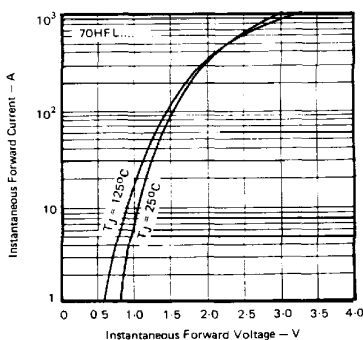


Fig. 12 – Maximum Forward Voltage Vs. Forward Current, 70HFL Series

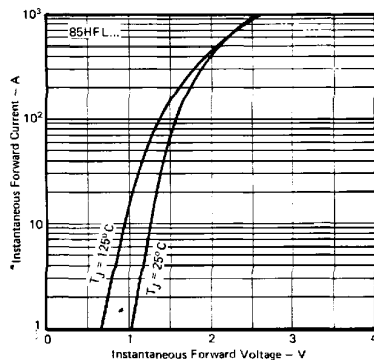


Fig. 13 – Maximum Forward Voltage Vs. Forward Current, 85HFL Series

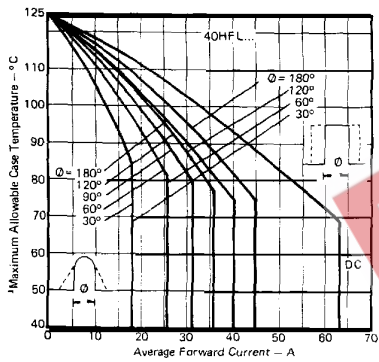


Fig. 14 — Average Forward Current Vs. Maximum Allowable Case Temperature, 40HFL Series

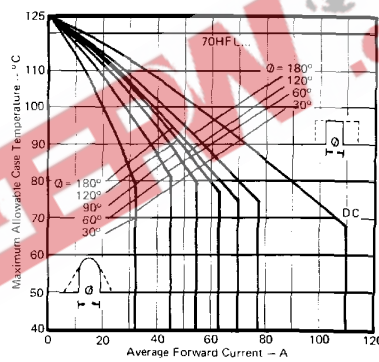


Fig. 15 — Average Forward Current Vs. Maximum Allowable Case Temperature, 70HFL Series

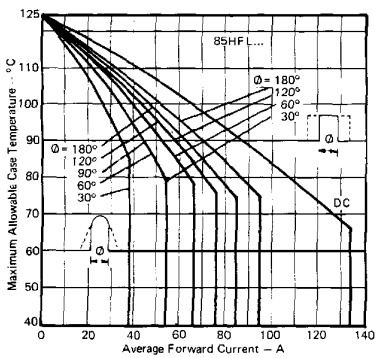


Fig. 16 — Average Forward Current Vs. Maximum Allowable Case Temperature, 85HFL Series

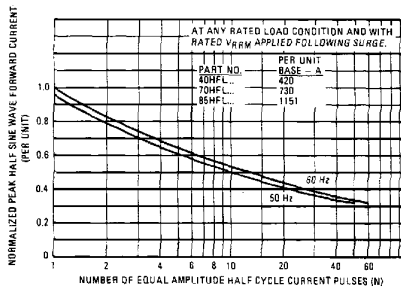


Fig. 17 — Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses, All Series

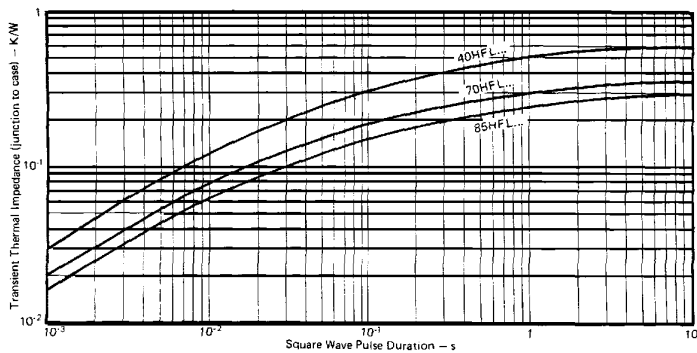


Fig. 18 — Maximum Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration, All Series

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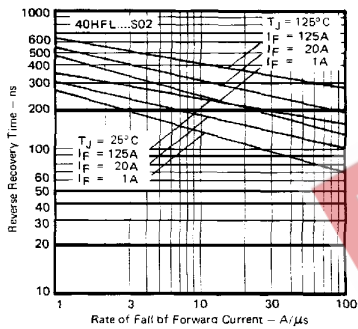


Fig. 19 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 40HFL...S02 Series

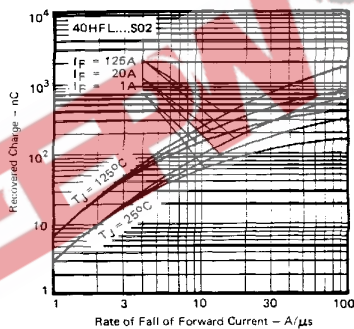


Fig. 20 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 40HFL...S02 Series

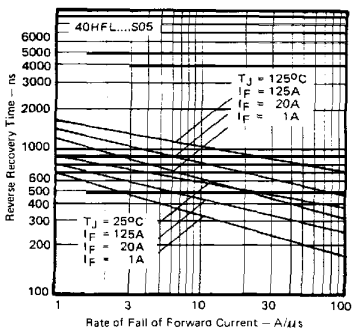


Fig. 21 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 40HFL...S05 Series

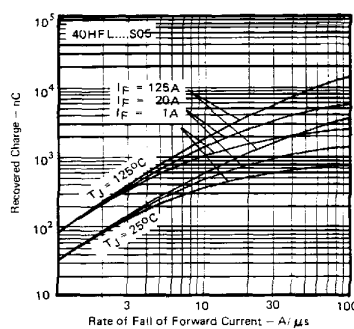


Fig. 22 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 40HFL...S05 Series

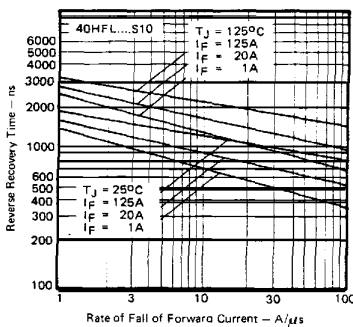


Fig. 23 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 40HFL...S10 Series

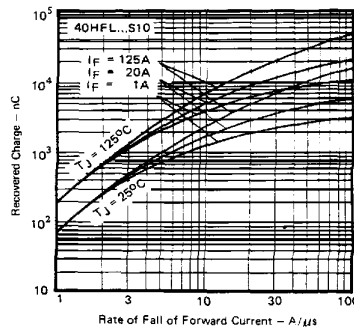


Fig. 24 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 40HFL...S10 Series



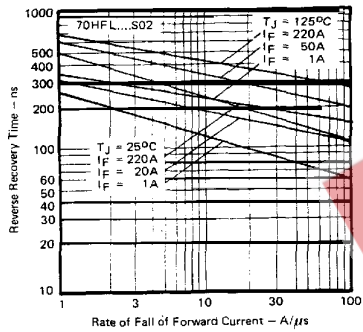


Fig. 25 — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 70HFL...S02 Series

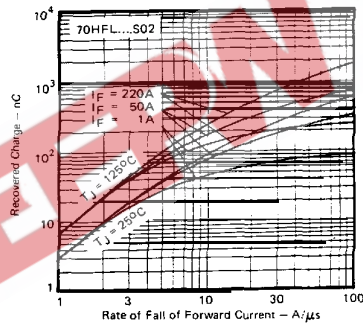


Fig. 26 — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 70HFL...S02 Series

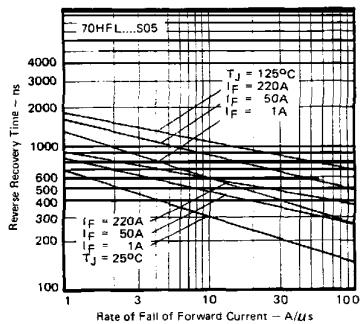


Fig. 27 — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 70HFL...S05 Series

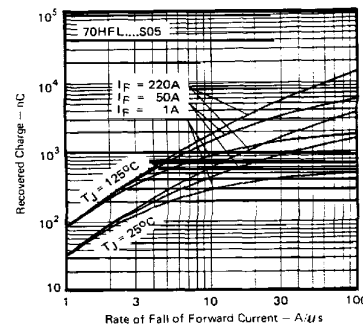


Fig. 28 — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 70HFL...S05 Series

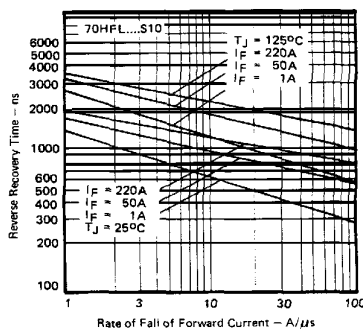


Fig. 29 — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 70HFL...S10 Series

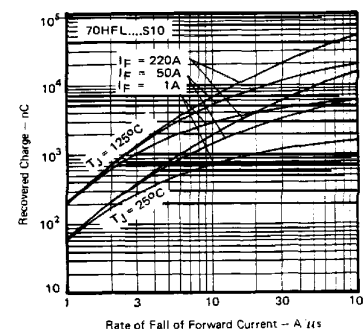


Fig. 30 — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 70HFL...S10 Series

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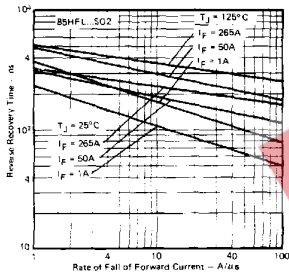


Fig. 31 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 85HFL\_S02 Series

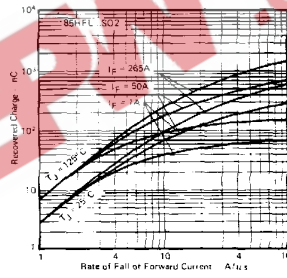


Fig. 32 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 85HFL\_S02 Series

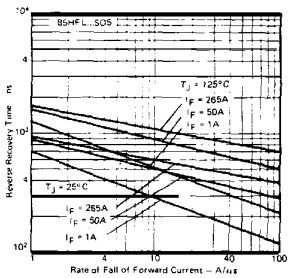


Fig. 33 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 85HFL\_S05 Series

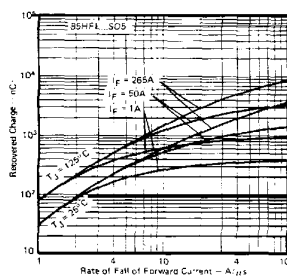


Fig. 34 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 85HFL\_S05 Series

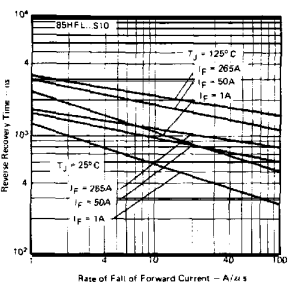


Fig. 35 – Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, 85HFL\_S10 Series

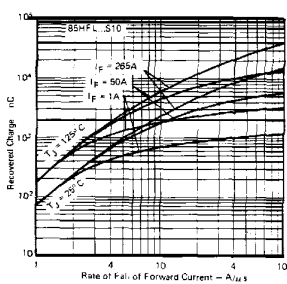


Fig. 36 – Maximum Recovered Charge Vs. Rate of Fall of Forward Current, 85HFL\_S10 Series