

## Fast Recovery Diodes (T-Modules), 40 A, 70 A, 85 A



D-55 (T-module)

### FEATURES

- Fast recovery time characteristics
- Electrically isolated base plate
- 3500 V<sub>RMS</sub> isolating voltage
- Standard JEDEC® package
- Simplified mechanical designs, rapid assembly
- Large creepage distances
- UL E78996 approved 
- 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

### DESCRIPTION

The series of T-modules uses fast recovery power diodes in a single diode configuration. The semiconductors are electrically isolated from the metal base, allowing common heatsink and compact assemblies to be built.

These single diode modules can be used in conjunction with the thyristor modules as a freewheel diode. Application includes self-commutated inverters, DC choppers, motor control, inductive heating and electronic welders. These modules are intended for those applications where very fast recovery characteristics are required and for general power switching applications.

PRODUCT SUMMARY	
I <sub>F(AV)</sub>	40 A, 70 A, 85 A
Type	Modules - Diode, Fast

MAJOR RATINGS AND CHARACTERISTICS					
SYMBOL	CHARACTERISTICS	T40HFL	T70HFL	T85HFL	UNITS
I <sub>F(AV)</sub>		40	70	85	A
	T <sub>C</sub>	70	70	70	°C
I <sub>F(RMS)</sub>		63	110	133	A
I <sub>FSM</sub>	50 Hz	475	830	1300	A
	60 Hz	500	870	1370	
I <sup>2</sup> t	50 Hz	1130	3460	8550	A <sup>2</sup> s
	60 Hz	1030	3160	7810	
V <sub>RRM</sub>	Range	100 to 1000			V
t <sub>rr</sub>	Range	200 to 1000			ns
T <sub>J</sub>	Range	-40 to +125			°C



**ELECTRICAL SPECIFICATIONS**

VOLTAGE RATINGS					
TYPE NUMBER	VOLTAGE CODE	t <sub>rr</sub> CODE	V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I <sub>RRM</sub> MAXIMUM AT T <sub>J</sub> = 25 °C μA
VS_T40HFL.. VS_T70HFL.. VS_T85HFL..	10	S02, S05, S10	100	150	100
	20	S02, S05, S10	200	300	
	40	S02, S05, S10	400	500	
	60	S02, S05, S10	600	700	
	80	S05, S10	800	900	
	100	S05, S10	1000	1100	

FORWARD CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES			UNITS
					T40HFL	T70HFL	T85HFL	
Maximum average forward current at case temperature	I <sub>F(AV)</sub>	180° conduction, half sine wave			40	70	85	A
					70			°C
Maximum RMS forward current	I <sub>F(RMS)</sub>				63	110	133	A
Maximum peak, one-cycle forward, non-repetitive surge current	I <sub>FSM</sub>	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	475	830	1300	A
		t = 8.3 ms			500	870	1370	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		400	700	1100	
		t = 8.3 ms			420	730	1150	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reappplied		1130	3460	8550	A <sup>2</sup> s
		t = 8.3 ms			1030	3160	7810	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		800	2450	6050	
		t = 8.3 ms			730	2230	5520	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reappplied			11 300	34 600	85 500	A <sup>2</sup> √s
Low level value of threshold voltage	V <sub>F(TO)1</sub>	T <sub>J</sub> = 25 °C, (16.7 % × π × I <sub>F(AV)</sub> ) < I < π × I <sub>F(AV)</sub>			0.82	0.87	0.84	V
High level value of threshold voltage	V <sub>F(TO)2</sub>	T <sub>J</sub> = 25 °C, (I > π × I <sub>F(AV)</sub> )			0.84	0.90	0.86	
Low level value of forward slope resistance	r <sub>f1</sub>	T <sub>J</sub> = 25 °C, (16.7 % × π × I <sub>F(AV)</sub> ) < I < π × I <sub>F(AV)</sub>			7.0	2.77	2.15	mΩ
High level value of forward slope resistance	r <sub>f2</sub>	T <sub>J</sub> = 25 °C, (I > π × I <sub>F(AV)</sub> )			6.8	2.67	2.07	
Maximum forward voltage drop	V <sub>FM</sub>	I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = 25 °C, t <sub>p</sub> = 400 μs square wave Average power = V <sub>F(TO)</sub> × I <sub>F(AV)</sub> + r <sub>f</sub> × (I <sub>F(RMS)</sub> ) <sup>2</sup>			1.60	1.73	1.55	V

REVERSE RECOVERY CHARACTERISTICS												
PARAMETER	SYMBOL	TEST CONDITIONS <sup>(1)</sup>	T40HFL			T70HFL			T85HFL			UNITS
			S02	S05	S10	S02	S05	S10	S02	S05	S10	
Maximum reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, -di <sub>F</sub> /dt = 100 A/μs I <sub>F</sub> = 1 A to V <sub>R</sub> = 30 V	70	110	270	70	110	270	80	120	290	ns
		T <sub>J</sub> = 25 °C, -di <sub>F</sub> /dt = 25 A/μs I <sub>FM</sub> = π × rated I <sub>F(AV)</sub> , V <sub>R</sub> = -30 V	200	500	1000	200	500	1000	200	500	1000	
Maximum reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C, -di <sub>F</sub> /dt = 100 A/μs I <sub>F</sub> = 1 A to V <sub>R</sub> = 30 V	0.25	0.4	1.35	0.25	0.4	1.35	0.3	0.6	1.6	μC
		T <sub>J</sub> = 25 °C, -di <sub>F</sub> /dt = 25 A/μs I <sub>FM</sub> = π × rated I <sub>F(AV)</sub> , V <sub>R</sub> = -30 V	0.55	2.0	8.0	0.6	2.1	8.5	0.8	3.5	1.5	

**Note**

<sup>(1)</sup> Tested on LEM 300 A diodometer tester



<b>BLOCKING</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	T40HFL	T70HFL	T85HFL	UNITS
Maximum peak reverse leakage current	$I_{RRM}$	$T_J = 125\text{ }^\circ\text{C}$	20			mA
RMS isolation voltage	$V_{ISOL}$	50 Hz, circuit to base, all terminals shorted, $T_J = 25\text{ }^\circ\text{C}$ , $t = 1\text{ s}$	3500			V

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS		
Junction operating temperature range	$T_J$		-40 to +125	°C		
Storage temperature range	$T_{Stg}$		-40 to +150			
Maximum internal thermal resistance, junction to case per module	T40HFL	DC operation	0.85	K/W		
	T70HFL		0.53			
	T85HFL		0.46			
Thermal resistance, case to heatsink per module	$R_{thCS}$	Mounting surface, flat, smooth and greased	0.2			
Mounting torque $\pm 10\%$	base to heatsink	Non-lubricated threads	M3.5 mounting screws <sup>(1)</sup>	1.3 $\pm 10\%$	Nm	
	busbar to terminal		M5 screws terminals	3 $\pm 10\%$		
Approximate weight		See dimensions - link at the end of datasheet	54	g		
			19	oz.		
Case style			D-55 (T-module)			

**Note**

<sup>(1)</sup> A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound

<b><math>\Delta R</math> CONDUCTION</b>											
DEVICES	SINUSOIDAL CONDUCTION AT $T_J$ MAXIMUM					RECTANGULAR CONDUCTION AT $T_J$ MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
T40HFL	0.06	0.08	0.10	0.14	0.24	0.05	0.08	0.10	0.15	0.24	K/W
T70HFL	0.05	0.06	0.08	0.11	0.19	0.04	0.06	0.08	0.12	0.19	
T85HFL	0.04	0.05	0.06	0.09	0.15	0.03	0.05	0.07	0.09	0.15	

**Note**

• The table above shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC



Fig. 1 - Current Ratings Characteristics



Fig. 2 - Current Ratings Characteristics



Fig. 3 - Current Ratings Characteristics



Fig. 6 - Current Ratings Characteristics



Fig. 4 - Current Ratings Characteristics



Fig. 7 - Forward Power Loss Characteristics



Fig. 5 - Current Ratings Characteristics



Fig. 8 - Forward Power Loss Characteristics



Fig. 9 - Forward Power Loss Characteristics



Fig. 12 - Forward Power Loss Characteristics



Fig. 10 - Forward Power Loss Characteristics



Fig. 13 - Maximum Non-Repetitive Surge Current



Fig. 11 - Forward Power Loss Characteristics



Fig. 14 - Maximum Non-Repetitive Surge Current



Fig. 15 - Maximum Non-Repetitive Surge Current



Fig. 18 - Maximum Non-Repetitive Surge Current



Fig. 16 - Maximum Non-Repetitive Surge Current

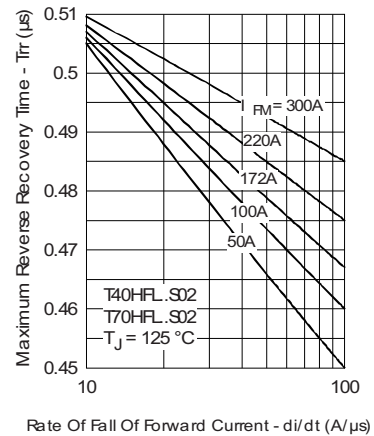


Fig. 19 - Recovery Time Characteristics



Fig. 17 - Maximum Non-Repetitive Surge Current



Fig. 20 - Recovery Charge Characteristics



Fig. 21 - Recovery Current Characteristics



Fig. 24 - Recovery Current Characteristics



Fig. 22 - Recovery Time Characteristics



Fig. 25 - Recovery Time Characteristics



Fig. 23 - Recovery Charge Characteristics



Fig. 26 - Recovery Charge Characteristics



Fig. 27 - Recovery Current Characteristics



Fig. 30 - Recovery Current Characteristics



Fig. 28 - Recovery Time Characteristics



Fig. 31 - Recovery Time Characteristics

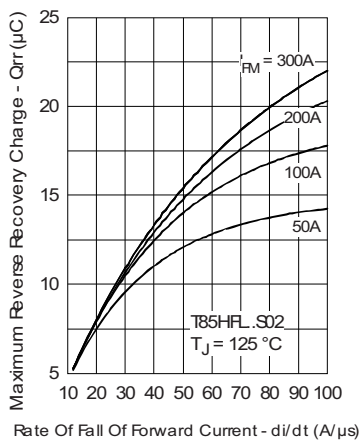


Fig. 29 - Recovery Charge Characteristics

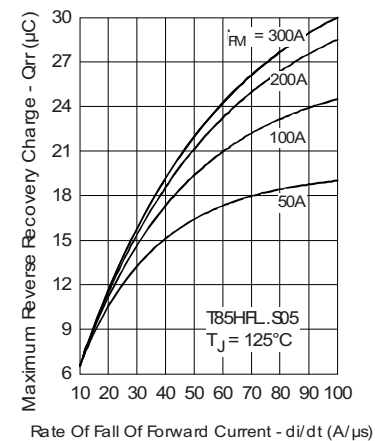


Fig. 32 - Recovery Charge Characteristics





Fig. 33 - Recovery Current Characteristics



Fig. 35 - Recovery Charge Characteristics



Fig. 34 - Recovery Time Characteristics



Fig. 36 - Recovery Current Characteristics



Fig. 37 - Frequency Characteristics



Fig. 38 - Frequency Characteristics



Fig. 39 - Maximum Forward Energy Power Loss Characteristics



Fig. 40 - Frequency Characteristics

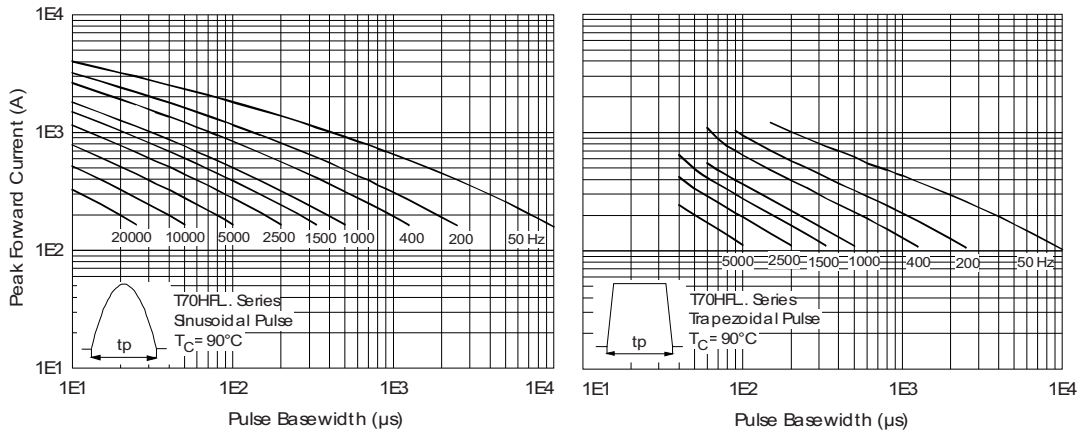


Fig. 41 - Frequency Characteristics

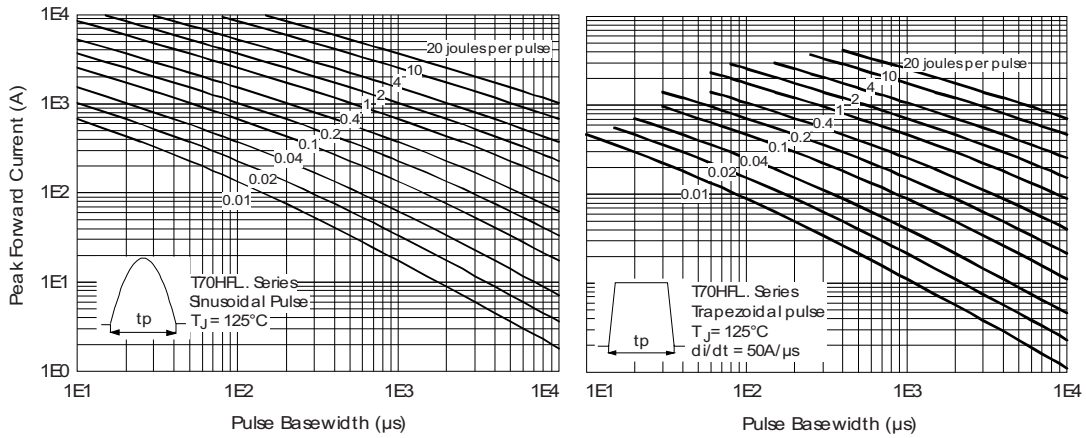


Fig. 42 - Maximum Forward Energy Power Loss Characteristics



Fig. 43 - Frequency Characteristics



Fig. 44 - Frequency Characteristics



Fig. 45 - Maximum Forward Energy Power Loss Characteristics



Fig. 46 - Forward Voltage Drop Characteristics



Fig. 47 - Forward Voltage Drop Characteristics

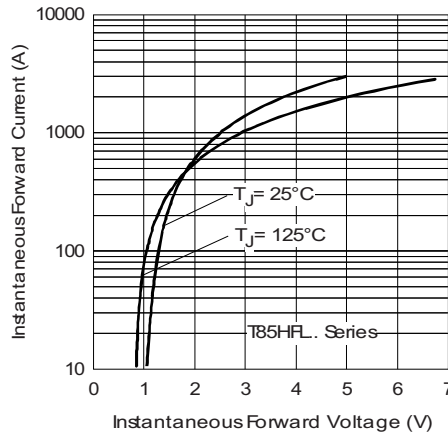


Fig. 48 - Forward Voltage Drop Characteristics



Fig. 49 - Thermal Impedance  $Z_{thJC}$  Characteristics

## ORDERING INFORMATION TABLE

Device code	VS-	T	40	HFL	100	S10
	1	2	3	4	5	6
	1	2	3	4	5	6

1 - Vishay Semiconductors product  
2 - Module type  
3 - Current rating ———— 40 = 40 A (average)  
70 = 70 A (average)  
85 = 85 A (average)  
4 - Fast recovery diode  
5 - Voltage code x 10 =  $V_{RRM}$   
6 -  $t_{rr}$  code ———— S02 = 200 ns  
S05 = 500 ns  
S10 = 1000 ns



CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch diode	N/A	

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95313">www.vishay.com/doc?95313</a>



## D-55 T-Module Diode Standard and Fast Recovery

**DIMENSIONS** in millimeters (inches)



**Note**

- 1 = Anode
- 2 = Cathode



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