Bulletin I27107 rev. A 09/97

International
IOR Rectifier

T..HFL SERIES

FAST RECOVERY DIODES

T-Modules

40 A
70 A
85 A

Features

- Fast recovery time characteristics
- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Standard JEDEC package
- Simplified mechanical designs, rapid assembly
- Large creepage distances
- UL E78996 approved

Description

This serie of T-module 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.

Major Ratings and Characteristics

Parameters		T40HFL	T70HFL	T85HFL	Units
$I_{F(AV)}$		40	70	85	A
$I_{F(RMS)}$		63	110	133	A
I_{FSM}	50Hz	475	830	1300	A
	60Hz	500	870	1370	A
I^2t	50Hz	1130	3460	8550	A^2s
	60Hz	1030	3160	7810	A^2s
V_{RRM} range		100 to 1000			V
t_{rr} range		200 to 1000			ns
T_J range		-40 to 125			°C

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	t_{rr} Code	V_{RRM}, maximum repetitive peak reverse voltage V	V_{RSM}, maximum non-repetitive peak reverse voltage V	I_{RRM} max. T_J = @25°C µA
	10	S02, S05, S10	100	150	100
T40HFL..	20	S02, S05, S10	200	300	
T70HFL..	40	S02, S05, S10	400	500	
T85HFL..	60	S02, S05, S10	600	700	
	80	S05, S10	800	900	
	100	S05, S10	1000	1100	

Forward Conduction

	Parameters	T40HFL	T70HFL	T85HFL	Units	Conditions		
$I_{F(AV)}$	Max. average fwd current	40	70	85	A	180° conduction, half sine wave		
	@ Case temperature	70	70	70	°C			
$I_{F(RMS)}$	Max. RMS forward current	63	110	133	A			
I_{FSM}	Max. peak, one-cycle	475	830	1300	A	t = 10ms	No voltage	
	forward, non-repetitive	500	870	1370		t = 8.3ms	reapplied	
	surge current	400	700	1100		t = 10ms	100% V_{RRM}	
		420	730	1150		t = 8.3ms	reapplied	Sinusoidal half wave,
I^2t	Maximum I^2t for fusing	1130	3460	8550	A^2s	t = 10ms	No voltage	Initial $T_J = T_J$ max.
		1030	3160	7810		t = 8.3ms	reapplied	
		800	2450	6050		t = 10ms	100% V_{RRM}	
		730	2230	5520		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	11300	34600	85500	$A^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{F(TO)1}$	Low level value of threshold voltage	0.82	0.87	0.84	V	T_J = 25 °C, (16.7% x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$)		
$V_{F(TO)2}$	High level value of threshold voltage	0.84	0.90	0.86		T_J = 25 °C, (I > π x $I_{F(AV)}$)		
r_{f1}	Low level value of forward slope resistance	7.0	2.77	2.15	mΩ	T_J = 25 °C, (16.7% x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$)		
r_{f2}	High level value of forward slope resistance	6.8	2.67	2.07		T_J = 25 °C, (I > π x $I_{F(AV)}$)		
V_{FM}	Max. forward voltage drop	1.60	1.73	1.55	V	I_{FM} = π x $I_{F(AV)}$, T_J = 25°C, tp = 400µs square wave Av. power = $V_{F(TO)}$ x $I_{F(AV)}$ + r_f x $(I_{F(RMS)})^2$		

Blocking

	Parameters	T40HFL	T70HFL	T85HFL	Units	Conditions
I_{RRM}	Max. peak rev. leak. current	20			mA	T_J = 125°C
V_{INS}	RMS isolation voltage	3500			V	50Hz, circuit to base, all terminals shorted T_J = 25°C, t = 1 s

Thermal and Mechanical Specifications

	Parameters	T40HFL	T70HFL	T85HFL	Units	Conditions
T_J	Junction operating temp.	-40 to 125			°C	
T_{stg}	Storage temperature range	-40 to 150			°C	
R_{thJC}	Max. internal thermal resistance junction to case	0.85	0.53	0.46	K/W	Per module, DC operation
R_{thC-S}	Thermal resistance, case to heatsink	0.2			K/W	Mounting surface flat, smooth and greased. Per module
T	Mounting Base to torque ±10% heatsink	1.3±10%			Nm	M3.5 mounting screws **(2)** Non-lubricated threads
	Busbar to Terminal	3±10%			Nm	M5 screws terminals; non-lubricated threads
wt	Approximate weight	54 (19)			g (oz)	See outline table
	Case style	D-56				T-MODULE

(2) 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

ΔR Conduction

(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

Devices	Sinusoidal conduction @ T_J max.					Rectangular conduction @ T_J max.					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	0.015	

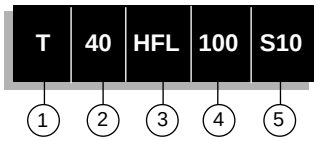
Reverse Recovery Characteristics

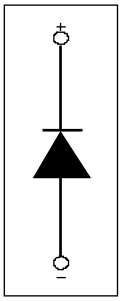
Parameter		T40HFL			T70HFL			T85HFL			Units	Conditions (*)
		S02	S05	S10	S02	S05	S10	S02	S05	S10		
t_{rr}	Maximum reverse recovery time	70	110	270	70	110	270	80	120	290	ns	T_J = 25 °C, $-di_F/dt$ = 100A/µs I_F = 1 A to V_R = 30V
		200	500	1000	200	500	1000	200	500	1000	ns	T_J = 25 °C, $-di_F/dt$ = 25A/µs I_{FM} = π x rated $I_{F(AV)}$, V_R = -30 V
Q_{rr}	Maximum reverse recovered charge	0.25	0.4	1.35	0.25	0.4	1.35	0.3	0.6	1.6	µC	T_J = 25 °C, $-di_F/dt$ = 100A/µs I_F = 1 A to V_R = 30V
		0.55	2.0	8.0	0.6	2.1	8.5	0.8	3.5	1.5	µC	T_J = 25 °C, $-di_F/dt$ = 25A/µs I_{FM} = π x rated $I_{F(AV)}$ V_R = -30 V

(*) Tested on LEM 300A Diodemeter Tester

Ordering Information Table

Device Code





1 - Module type

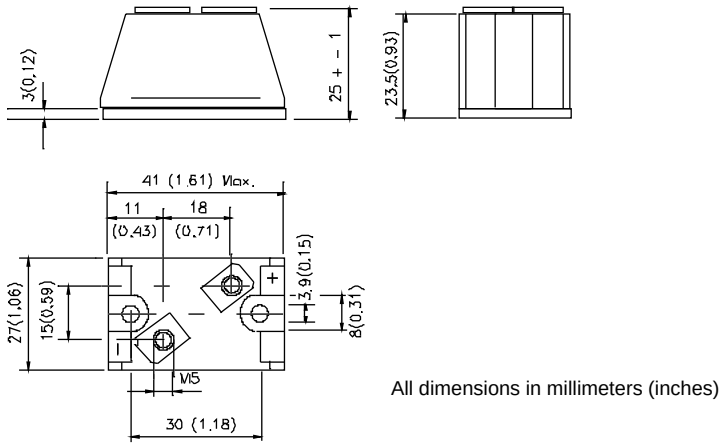
2 - Current rating: 40 = 40A (avg)
70 = 70A (avg)
85 = 85A (avg)

3 - Fast recovery diode

4 - Voltage code : code x 10 = V_{RRM}

5 - trr code: S02 = 200ns
S05 = 500ns
S10 = 1000ns

Outline Table



All dimensions in millimeters (inches)

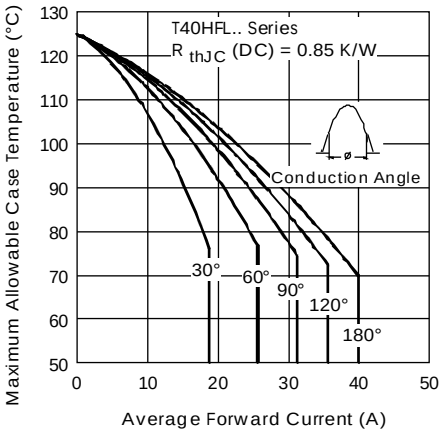


Fig. 1 - Current Ratings Characteristics

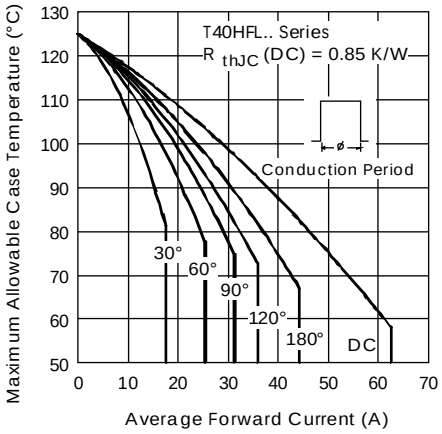


Fig. 2 - Current Ratings Characteristics

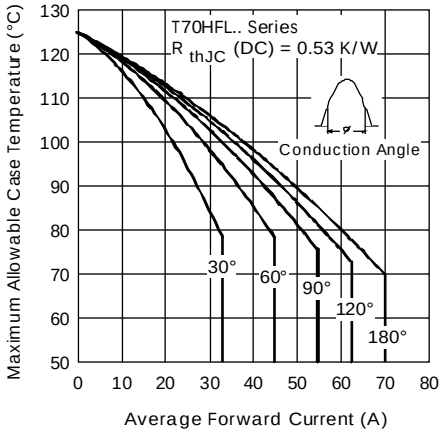


Fig. 3 - Current Ratings Characteristics

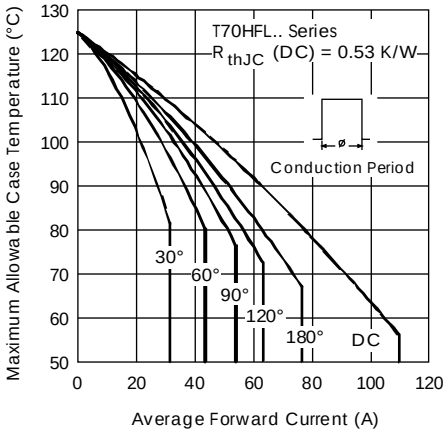


Fig. 4 - Current Ratings Characteristics

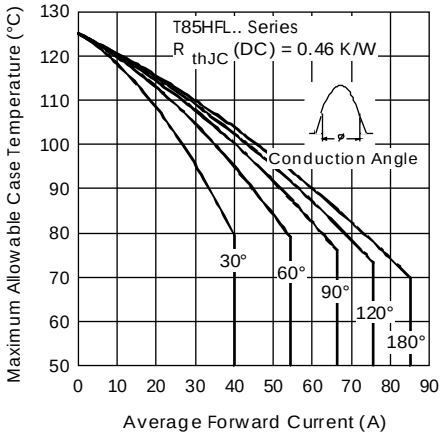


Fig. 5 - Current Ratings Characteristics

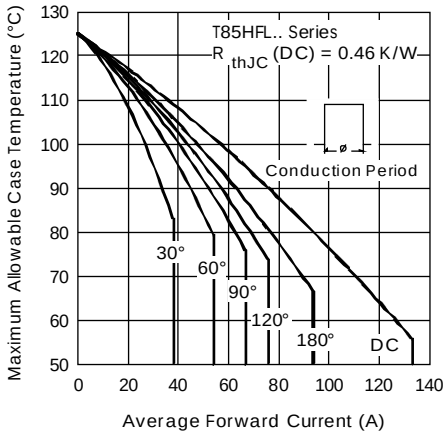


Fig. 6 - Current Ratings Characteristics

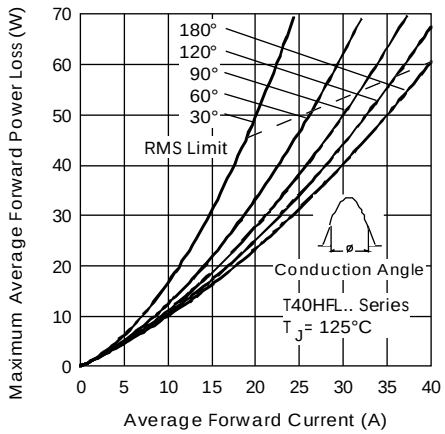


Fig. 7 - Forward Power Loss Characteristics

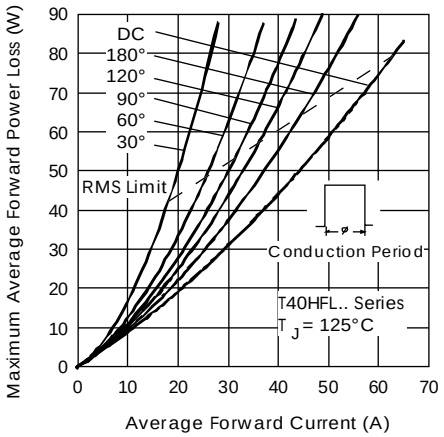


Fig. 8 - Forward Power Loss Characteristics

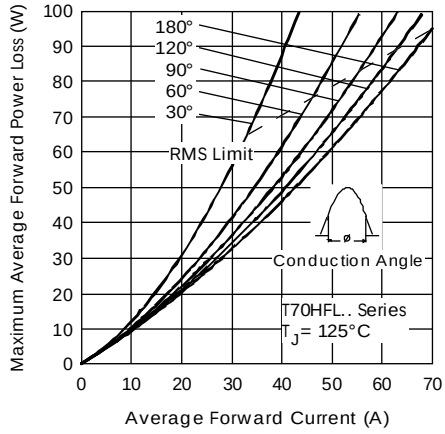


Fig. 9 - Forward Power Loss Characteristics

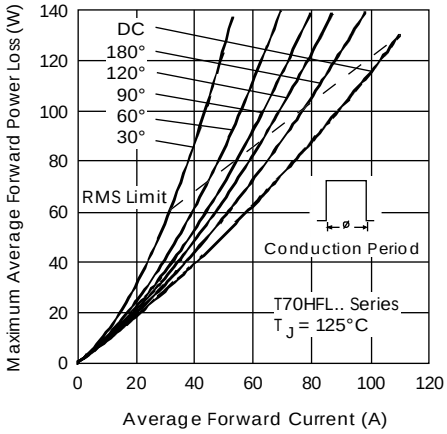


Fig. 10 - Forward Power Loss Characteristics

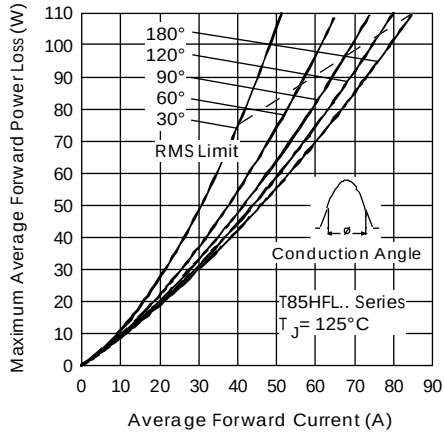


Fig. 11 - Forward Power Loss Characteristics

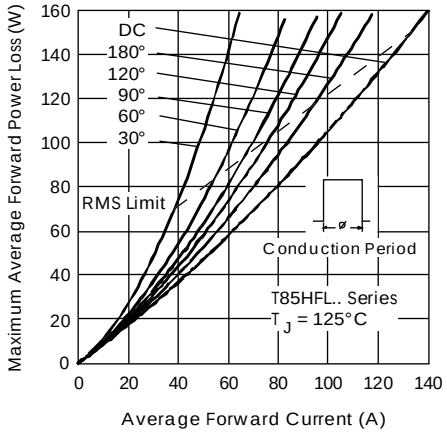


Fig. 12 - Forward Power Loss Characteristics

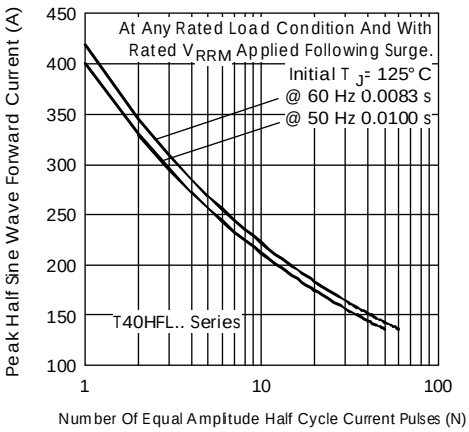


Fig. 13 - Maximum Non-Repetitive Surge Current

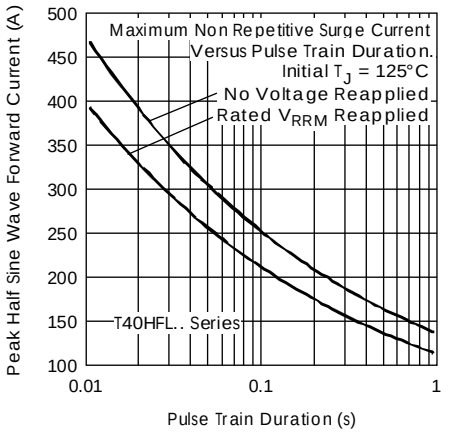


Fig. 14 - Maximum Non-Repetitive Surge Current

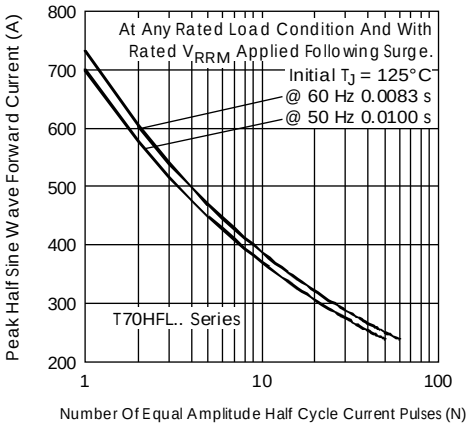


Fig. 15 - Maximum Non-Repetitive Surge Current

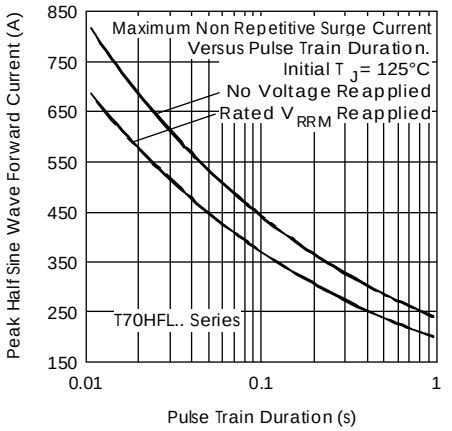


Fig. 16 - Maximum Non-Repetitive Surge Current

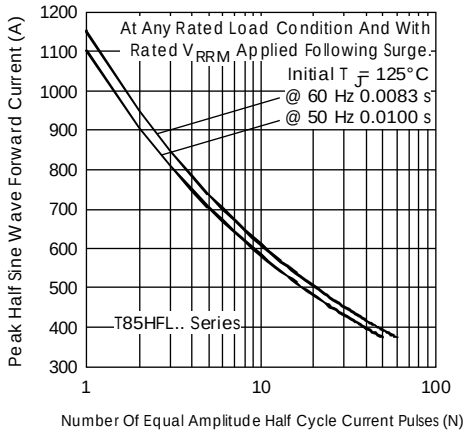


Fig. 17 - Maximum Non-Repetitive Surge Current

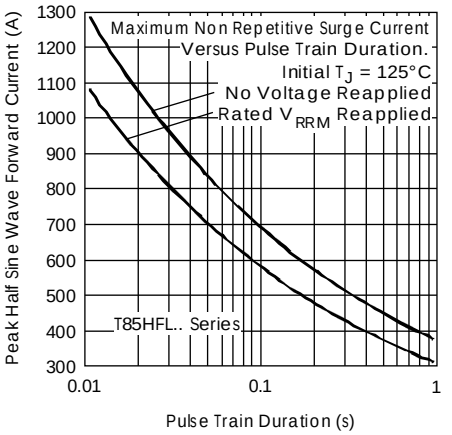


Fig. 18 - Maximum Non-Repetitive Surge Current

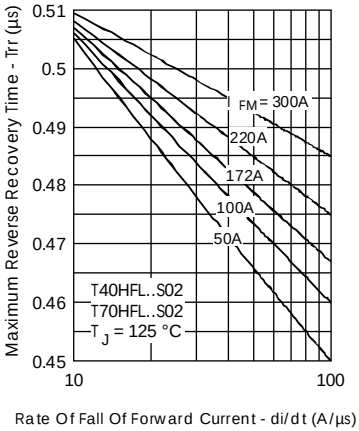


Fig. 19 - Recovery Time Characteristics

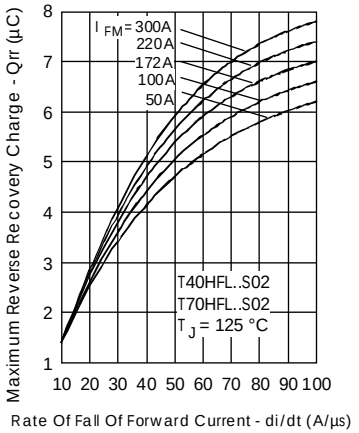


Fig. 20 - Recovery Charge Characteristics

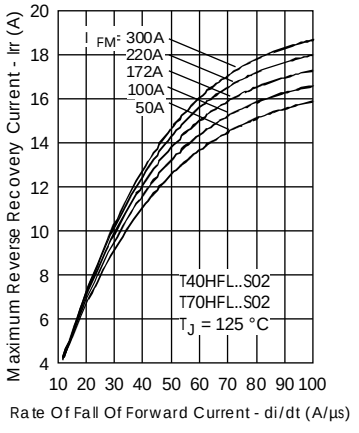


Fig. 21 - Recovery Current Characteristics

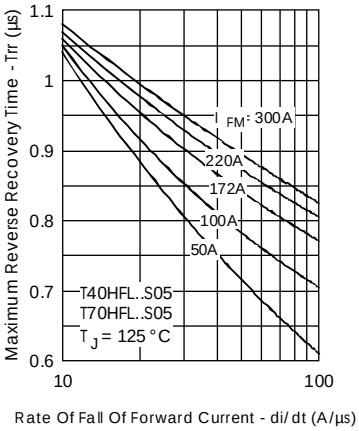


Fig. 22 - Recovery Time Characteristics

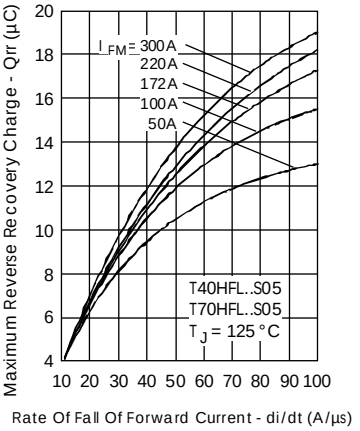


Fig. 23 - Recovery Charge Characteristics

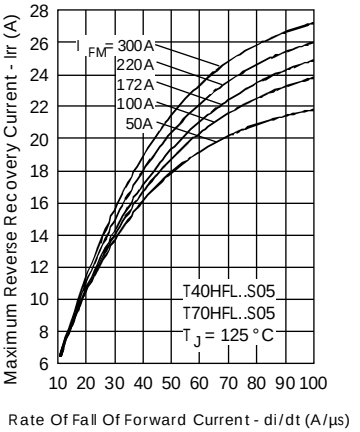


Fig. 24 - Recovery Current Characteristics

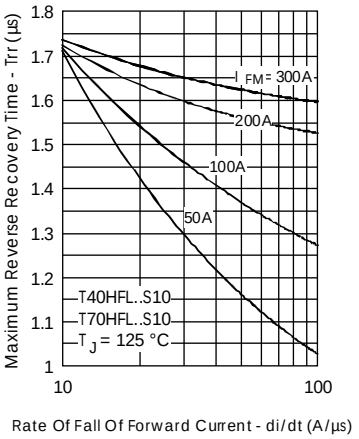


Fig. 25 - Recovery Time Characteristics

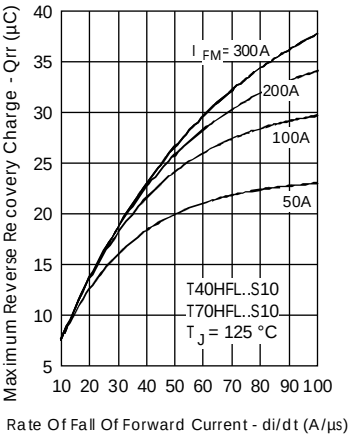


Fig. 26 - Recovery Charge Characteristics

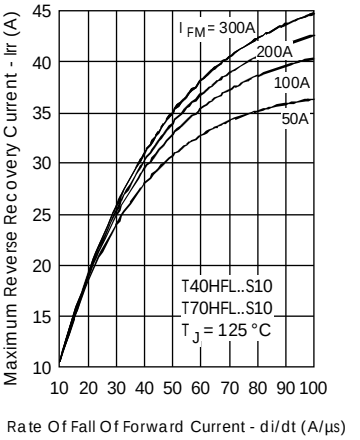


Fig. 27 - Recovery Current Characteristics

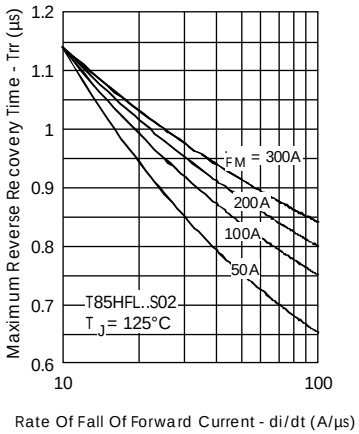


Fig. 28 - Recovery Time Characteristics

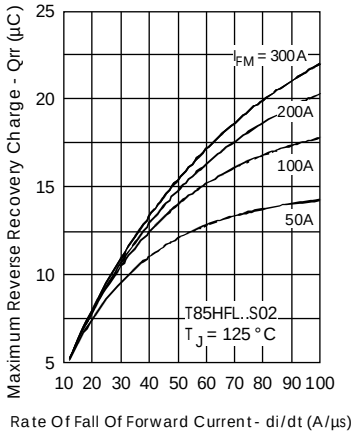


Fig. 29 - Recovery Charge Characteristics

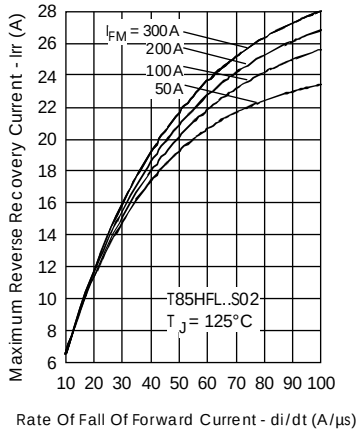


Fig. 30 - Recovery Current Characteristics

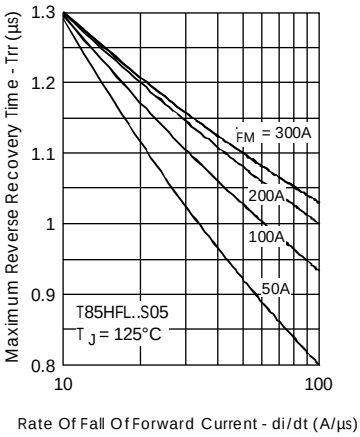


Fig. 31 - Recovery Time Characteristics

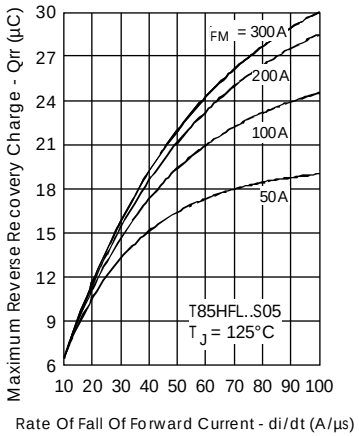


Fig. 32 - Recovery Charge Characteristics

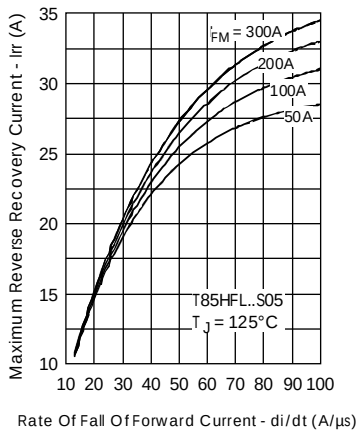


Fig. 33 - Recovery Current Characteristics

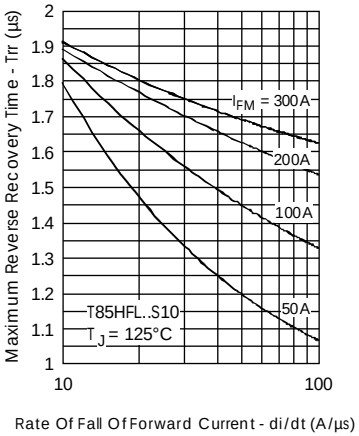


Fig. 34 - Recovery Time Characteristics

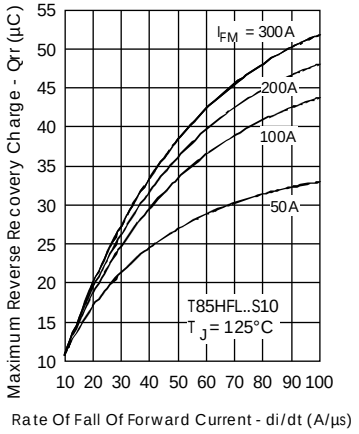


Fig. 35 - Recovery Charge Characteristics

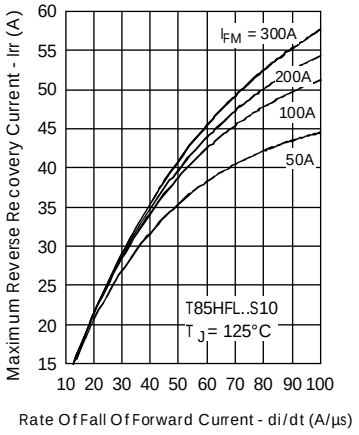


Fig. 36 - Recovery Current Characteristics

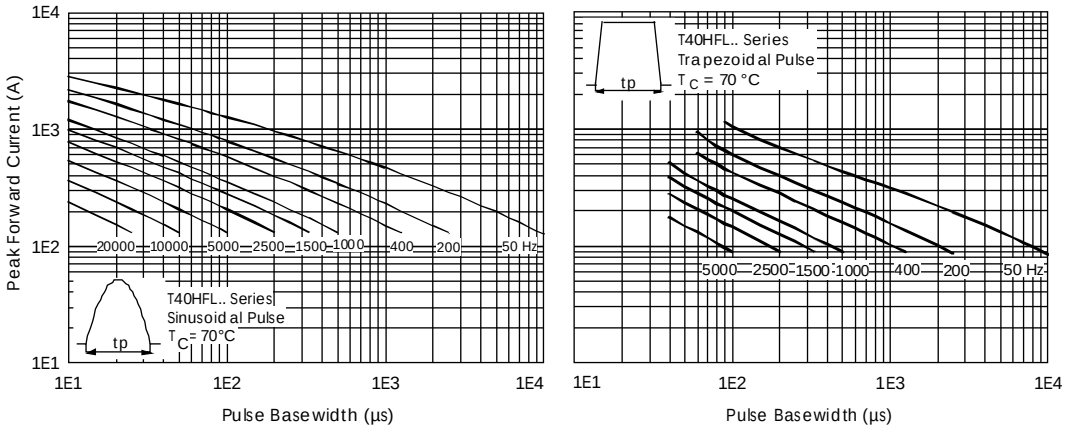


Fig. 37 - Frequency Characteristics

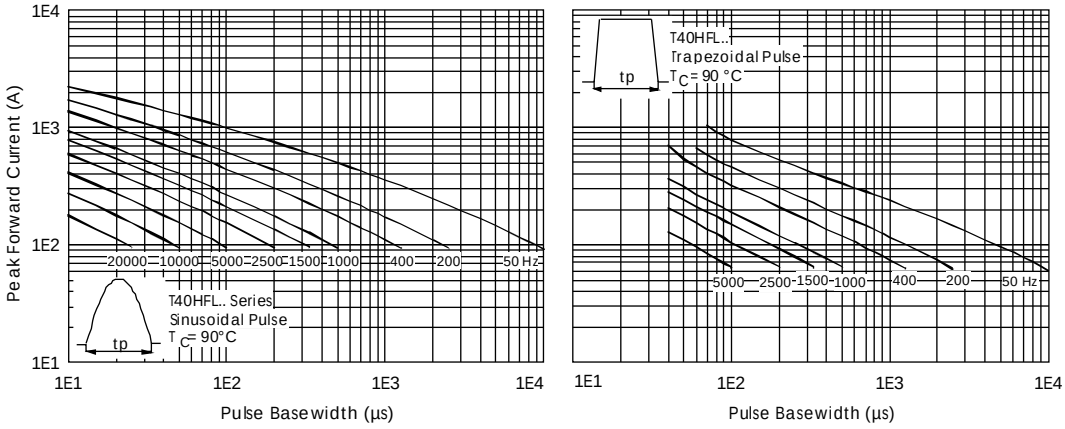


Fig. 38 - Frequency Characteristics

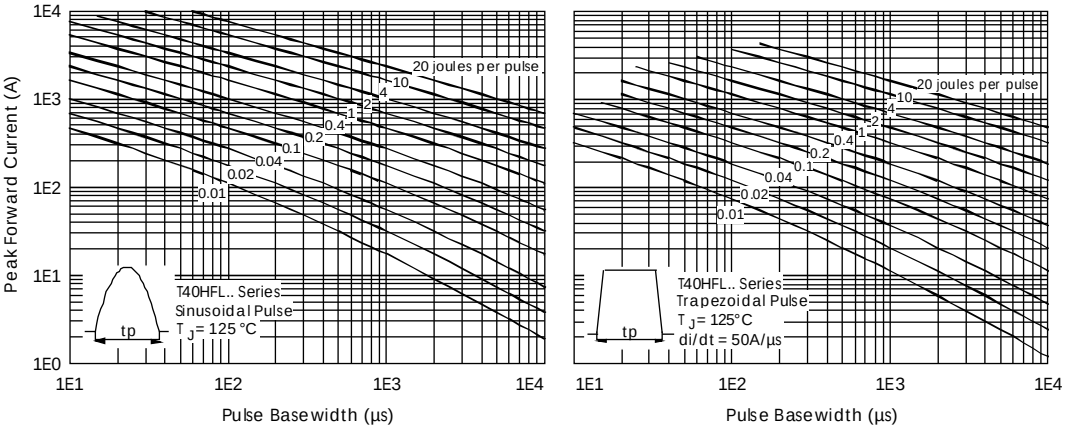


Fig. 39 - Maximum Forward Energy Power Loss Characteristics

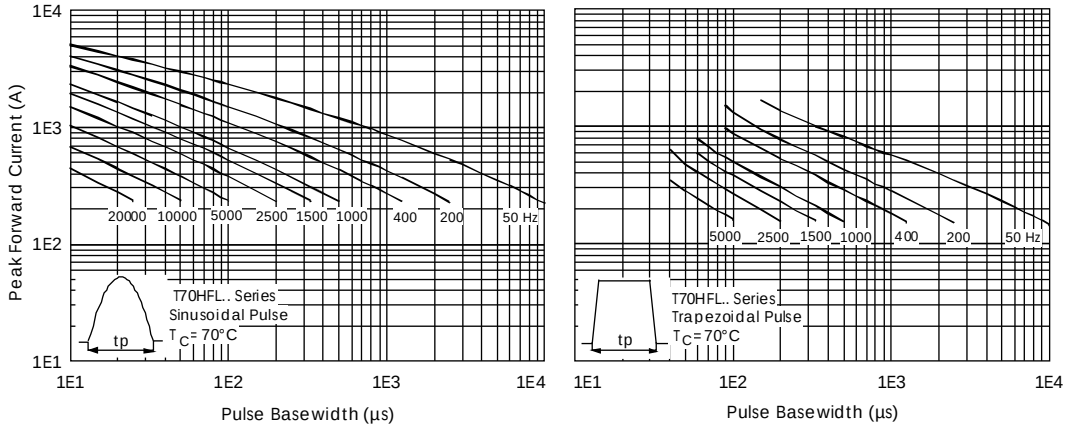


Fig. 40 - Frequency Characteristics

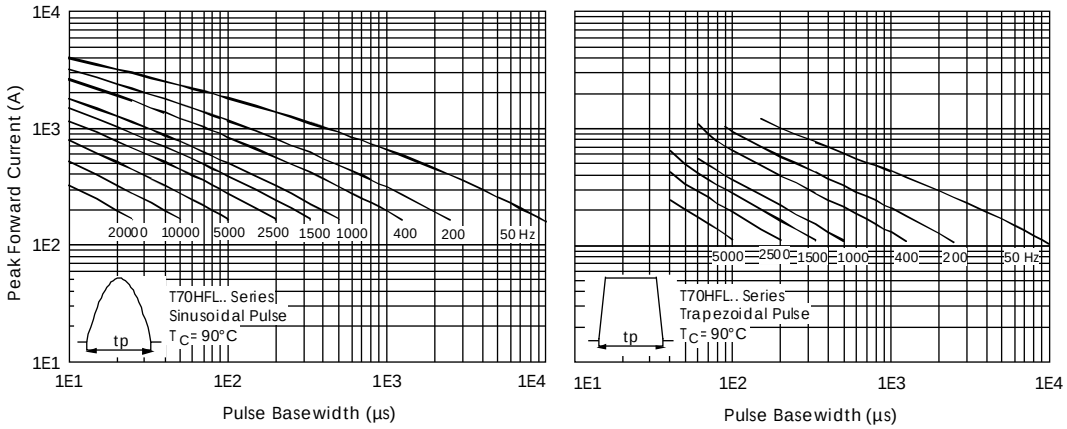


Fig. 41 - Frequency Characteristics

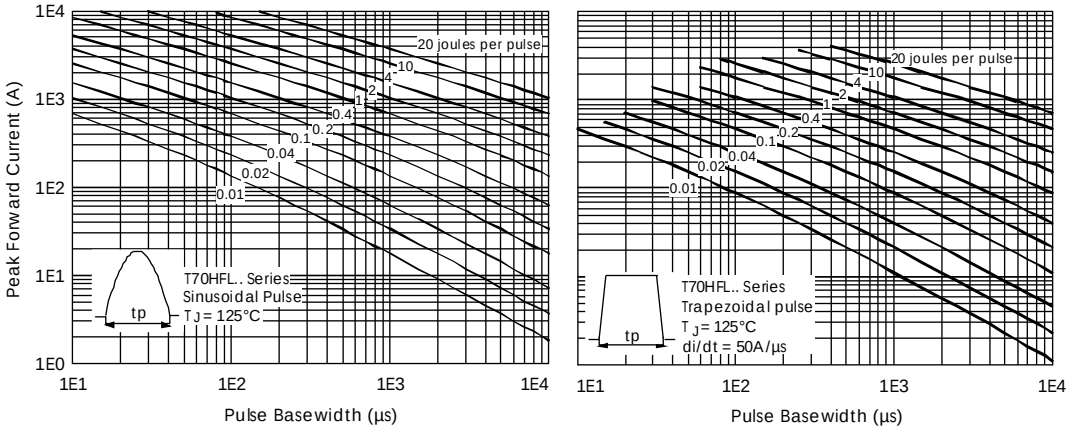


Fig. 42 - Maximum Forward Energy Power Loss Characteristics

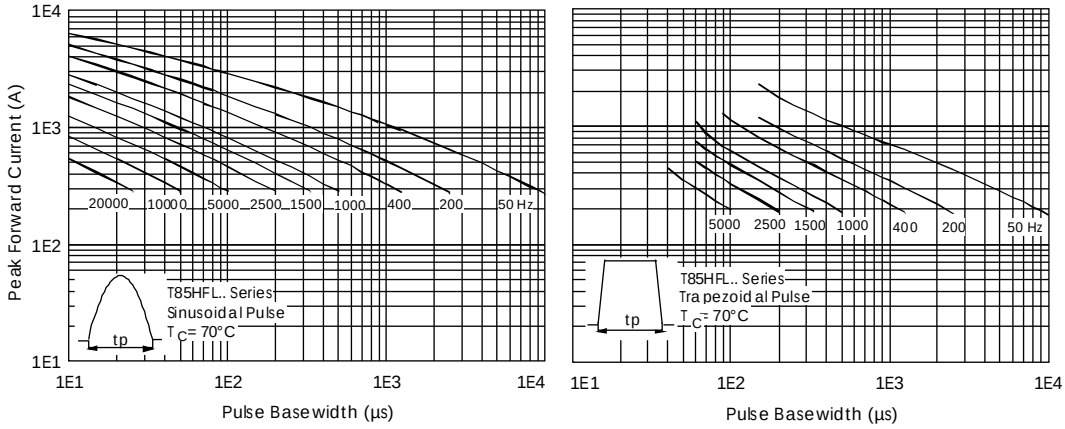


Fig. 43 - Frequency Characteristics

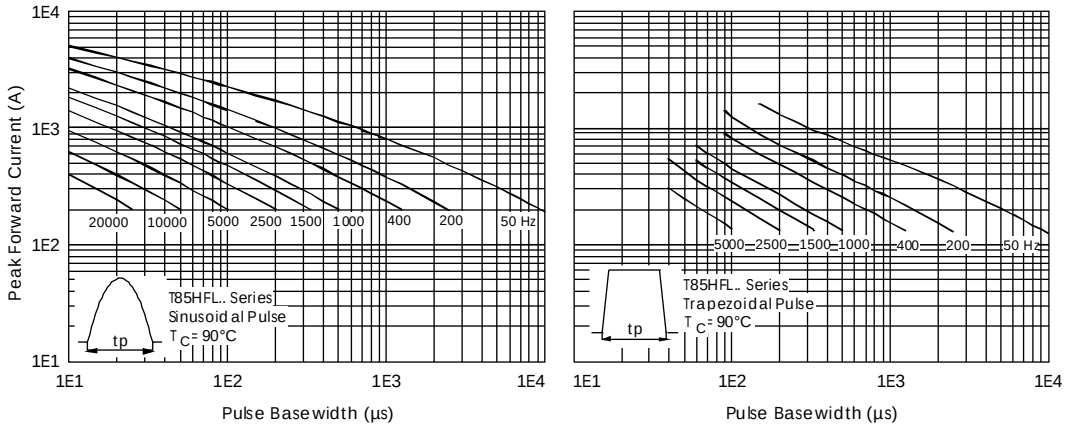


Fig. 44 - Frequency Characteristics

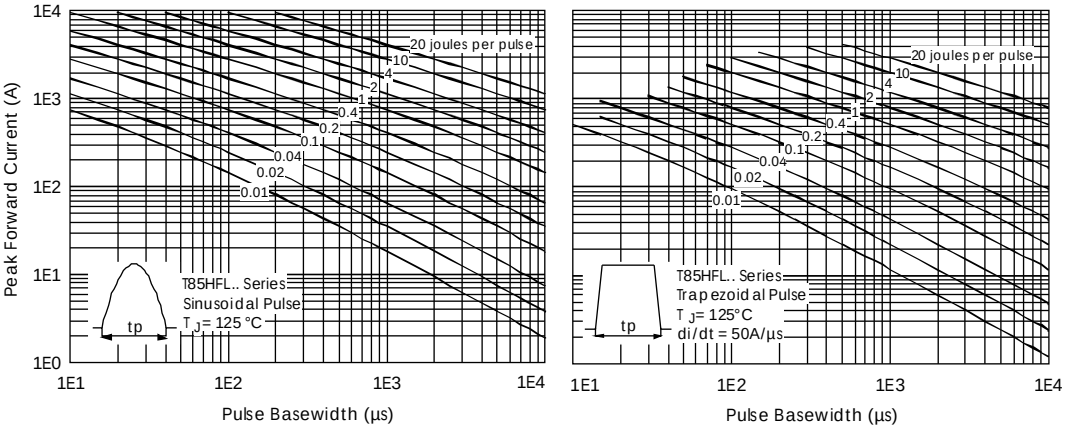


Fig. 45 - Maximum Forward Energy Power Loss Characteristics

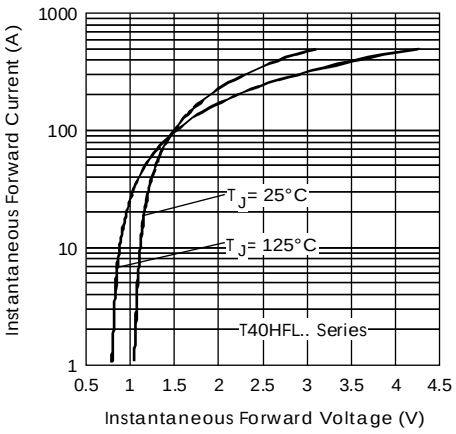


Fig. 46 - Forward Voltage Drop Characteristics

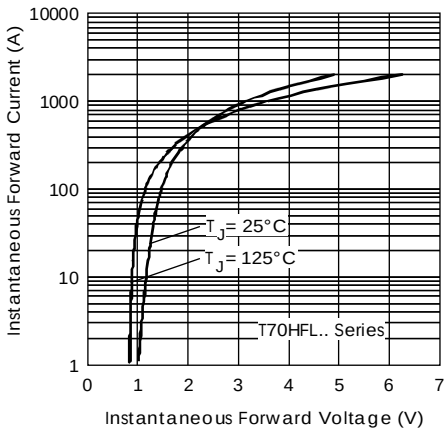


Fig. 47 - Forward Voltage Drop Characteristics

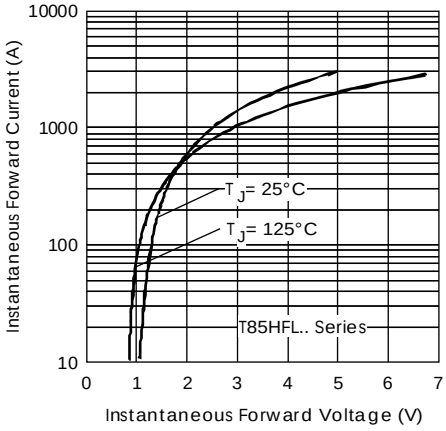


Fig. 48 - Forward Voltage Drop Characteristics

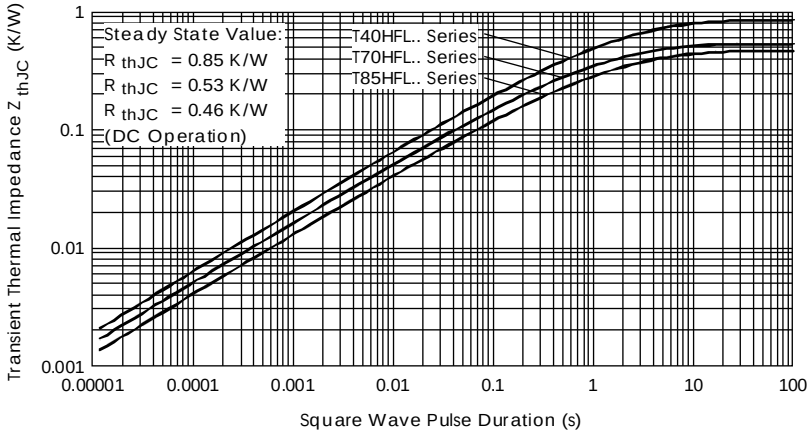


Fig. 49 - Thermal Impedance ZthJC Characteristics