

Bulletin I27107 rev. A 09/97

International
IR Rectifier

T..HFL SERIES

FAST RECOVERY DIODES

T-Modules

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 

40 A
70 A
85 A

Description

This series 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 ² t	50Hz	1130	3460	8550	A ² s
	60Hz	1030	3160	7810	A ² s
V _{RRM} range		100 to 1000			V
t _{rr} range		200 to 1000			ns
T _J range		-40 to 125			°C



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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
T40HFL... T70HFL... 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

Parameters	T40HFL	T70HFL	T85HFL	Units	Conditions
I _{F(AV)} Max. average fwd current @ Case temperature	40 70	70 70	85 70	A °C	180° conduction, half sine wave
I _{F(RMS)} Max. RMS forward current	63	110	133	A	
I _{FSM} Max. peak, one-cycle forward, non-repetitive surge current	475	830	1300	A	t = 10ms No voltage
	500	870	1370		t = 8.3ms reapplied
	400	700	1100		t = 10ms 100% V _{RRM}
	420	730	1150		t = 8.3ms reapplied
I ² t Maximum I ² t for fusing	1130	3460	8550	A ² s	t = 10ms No voltage
	1030	3160	7810		t = 8.3ms reapplied
	800	2450	6050		t = 10ms 100% V _{RRM}
	730	2230	5520		t = 8.3ms reapplied
I ² /t Maximum I ² /t for fusing	11300	34600	85500	A ² /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% × π × I _{F(AV)} < I < π × 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 × 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% × π × I _{F(AV)} < I < π × I _{F(AV)})
r _{f2} High level value of forward slope resistance	6.8	2.67	2.07		T _J = 25 °C, (I > π × I _{F(AV)})
V _{FM} Max. forward voltage drop	1.60	1.73	1.55	V	I _{FM} = π × I _{F(AV)} , T _J = 25 °C, tp = 400 μs square wave Av. power = V _{F(TO)} × I _{F(AV)} + r _f × (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 $\pm 10\%$ heatsink Busbar to Terminal	1.3 $\pm 10\%$			Nm	M3.5 mounting screws (2) Non-lubricated threads
	3 $\pm 10\%$			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	

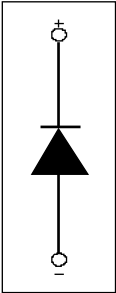
Reverse Recovery Characteristics

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	$T_J = 25^\circ\text{C}$, $-di_F/dt = 100\text{A}/\mu\text{s}$ $I_F = 1\text{ A}$ to $V_R = 30\text{V}$
	200	500	1000	200	500	1000	200	500	1000	ns	$T_J = 25^\circ\text{C}$, $-di_F/dt = 25\text{A}/\mu\text{s}$ $I_{FM} = \pi \times \text{rated } I_{F(AV)}$, $V_R = -30\text{ V}$
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	$T_J = 25^\circ\text{C}$, $-di_F/dt = 100\text{A}/\mu\text{s}$ $I_F = 1\text{ A}$ to $V_R = 30\text{V}$
	0.55	2.0	8.0	0.6	2.1	8.5	0.8	3.5	1.5	μC	$T_J = 25^\circ\text{C}$, $-di_F/dt = 25\text{A}/\mu\text{s}$ $I_{FM} = \pi \times \text{rated } I_{F(AV)}$, $V_R = -30\text{ V}$

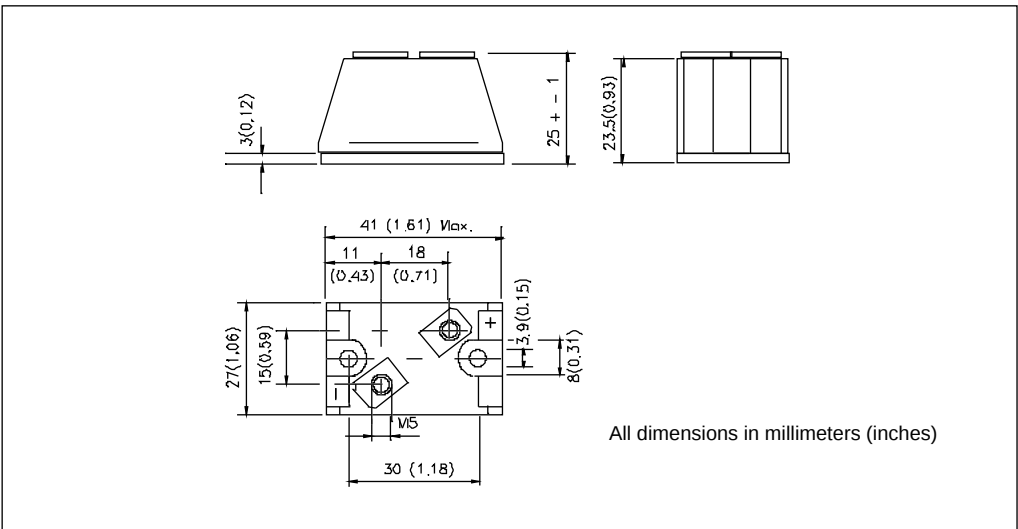
(*) Tested on LEM 300A Diode Tester

Ordering Information Table

Device Code		T	40	HFL	100	S10
		1	2	3	4	5
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



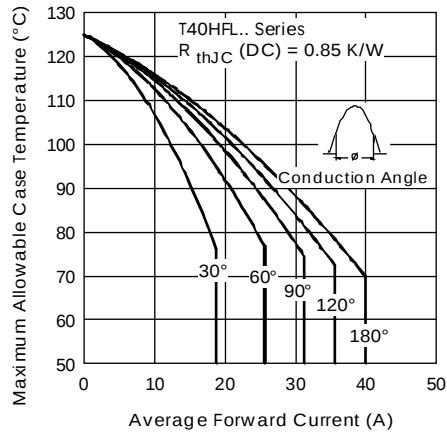


Fig. 1 - Current Ratings Characteristics

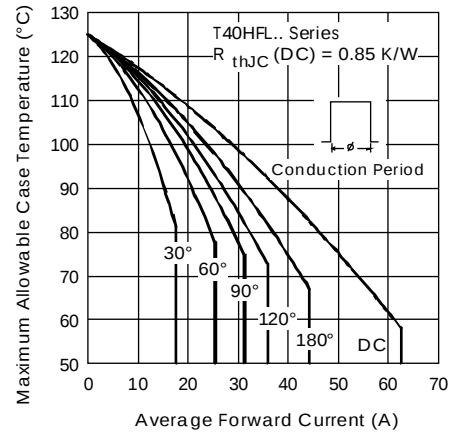


Fig. 2 - Current Ratings Characteristics

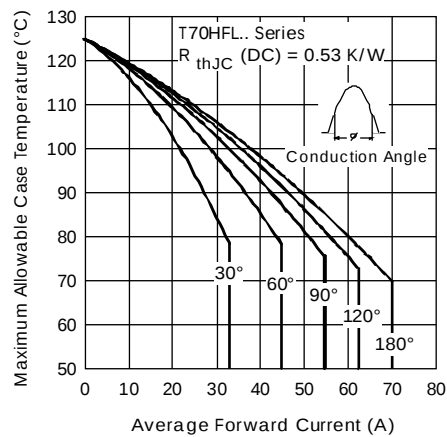


Fig. 3 - Current Ratings Characteristics

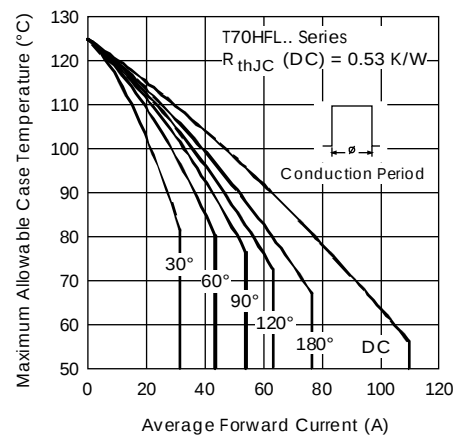


Fig. 4 - Current Ratings Characteristics

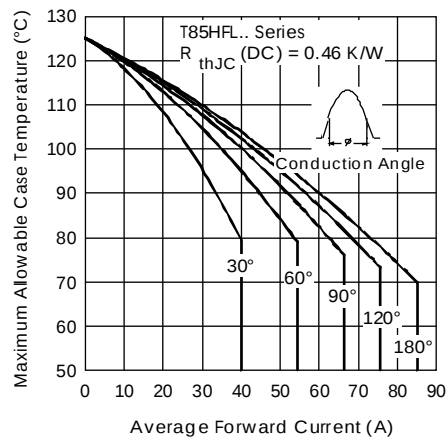


Fig. 5 - Current Ratings Characteristics

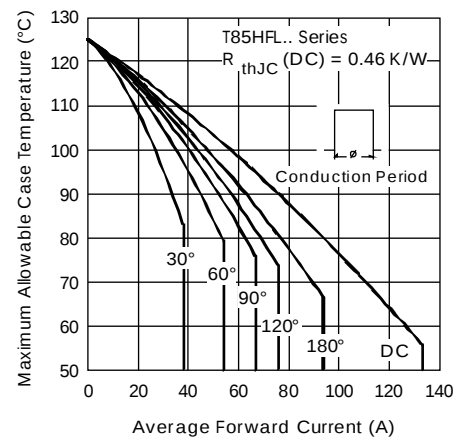


Fig. 6 - Current Ratings Characteristics

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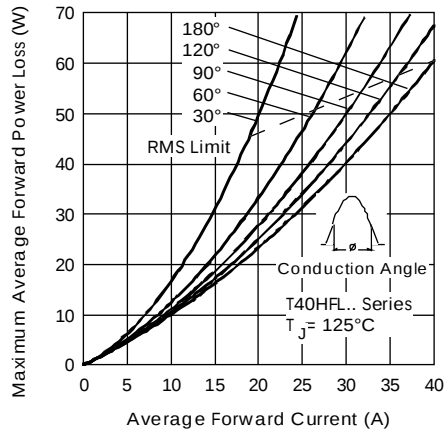


Fig. 7 - Forward Power Loss Characteristics

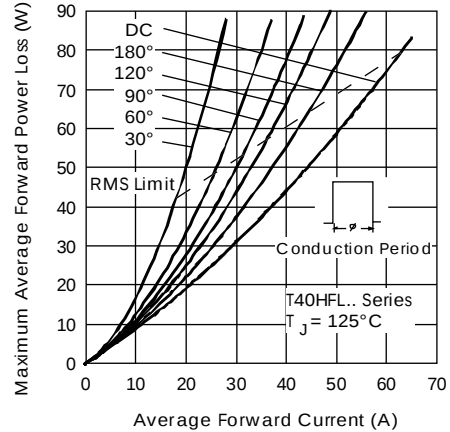


Fig. 8 - Forward Power Loss Characteristics

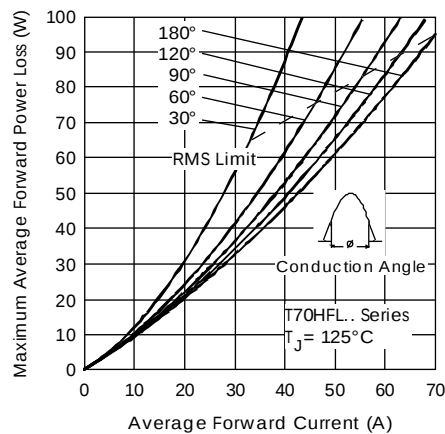


Fig. 9 - Forward Power Loss Characteristics

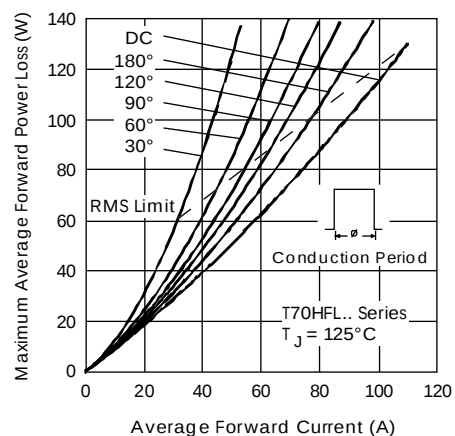


Fig. 10 - Forward Power Loss Characteristics

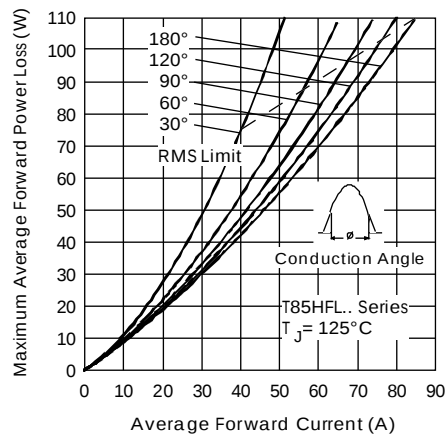


Fig. 11 - Forward Power Loss Characteristics

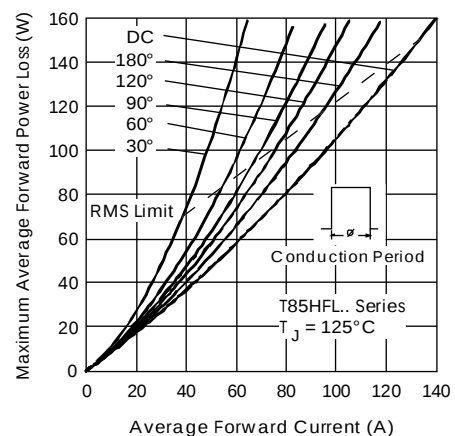


Fig. 12 - Forward Power Loss Characteristics

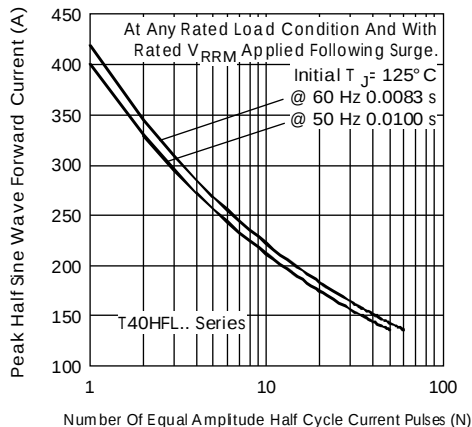


Fig. 13 - Maximum Non-Repetitive Surge Current

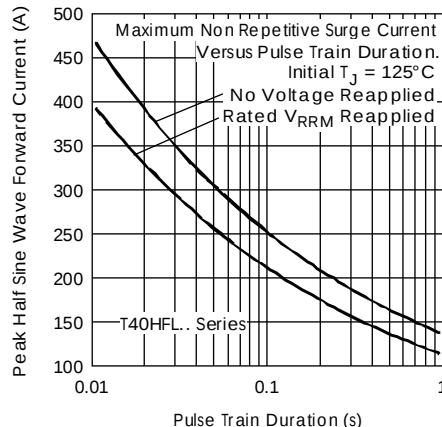


Fig. 14 - Maximum Non-Repetitive Surge Current

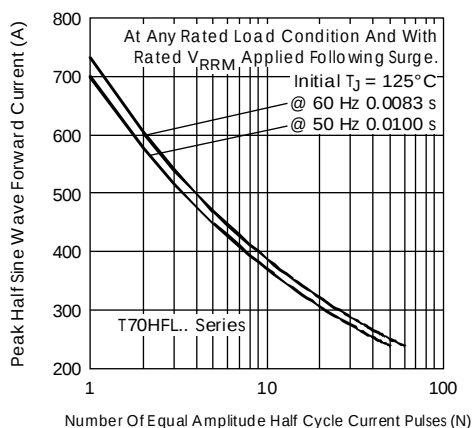


Fig. 15 - Maximum Non-Repetitive Surge Current

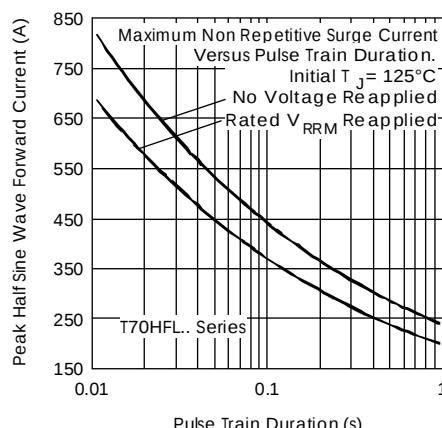


Fig. 16 - Maximum Non-Repetitive Surge Current

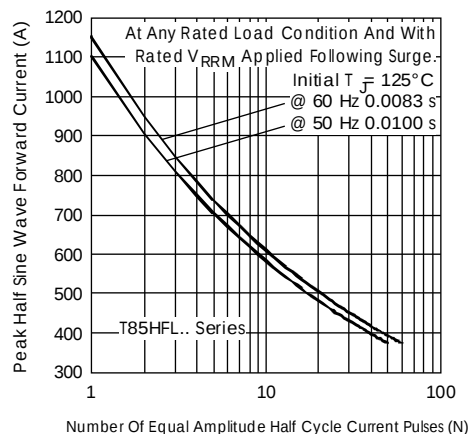


Fig. 17 - Maximum Non-Repetitive Surge Current

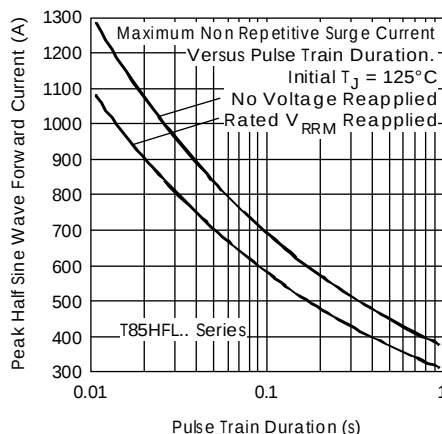


Fig. 18 - Maximum Non-Repetitive Surge Current

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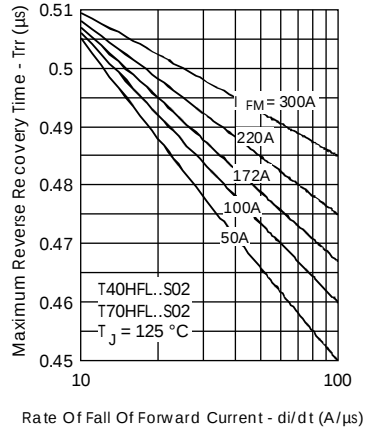


Fig. 19 - Recovery Time Characteristics

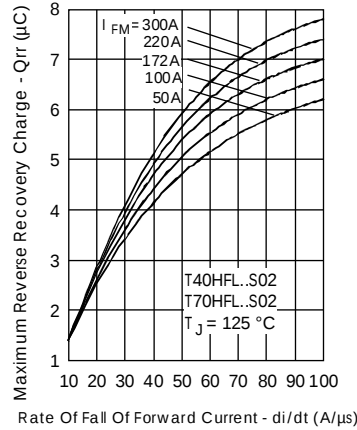


Fig. 20 - Recovery Charge Characteristics

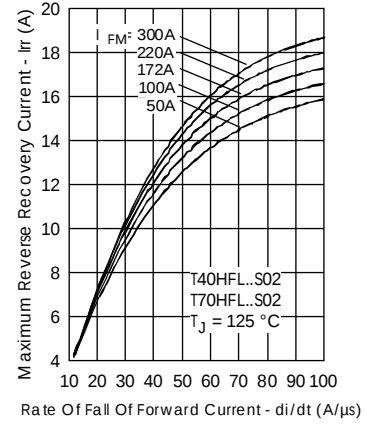


Fig. 21 - Recovery Current Characteristics

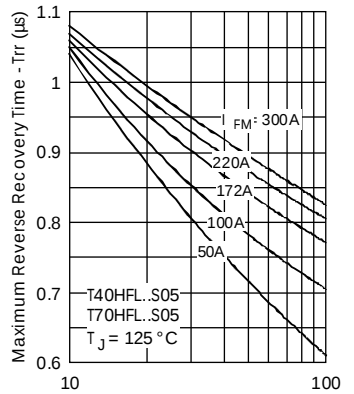


Fig. 22 - Recovery Time Characteristics

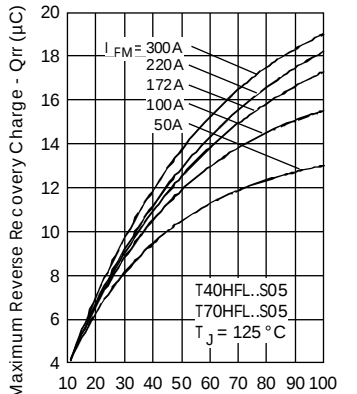


Fig. 23 - Recovery Charge Characteristics

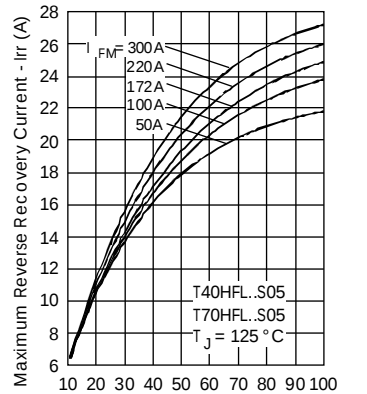


Fig. 24 - Recovery Current Characteristics

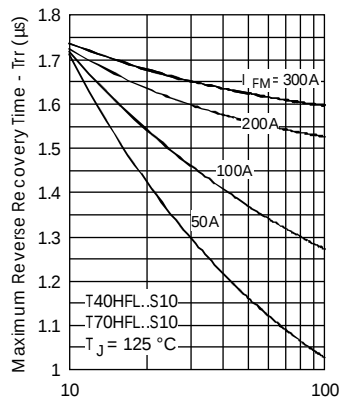


Fig. 25 - Recovery Time Characteristics

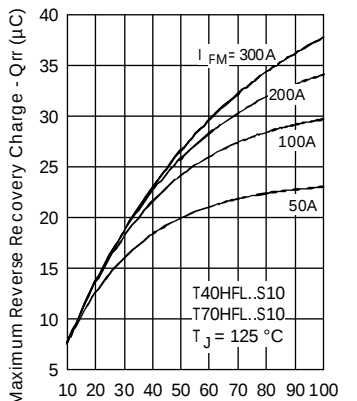


Fig. 26 - Recovery Charge Characteristics

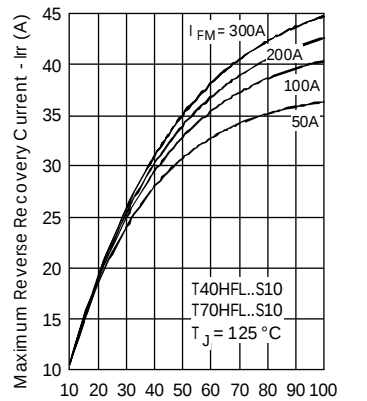
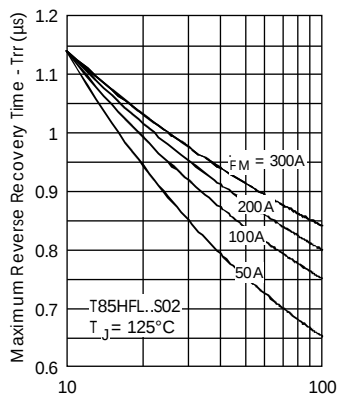
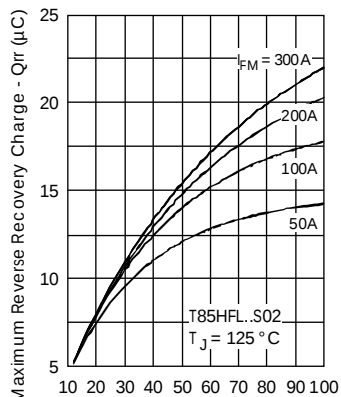


Fig. 27 - Recovery Current Characteristics



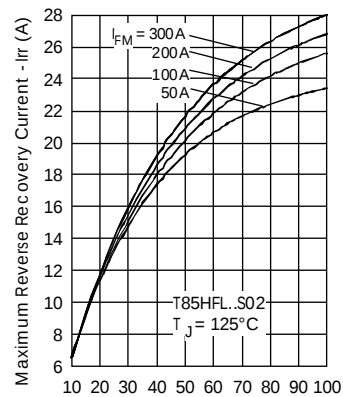
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 28 - Recovery Time Characteristics



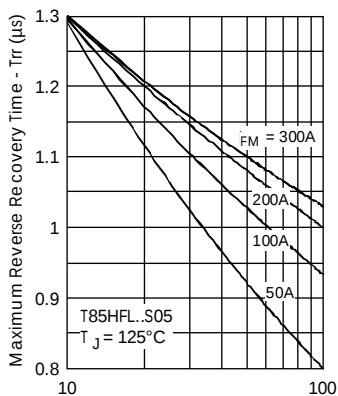
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 29 - Recovery Charge Characteristics



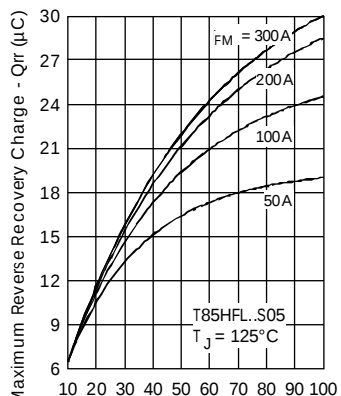
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 30 - Recovery Current Characteristics



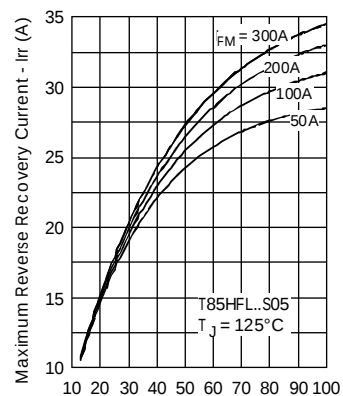
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 31 - Recovery Time Characteristics



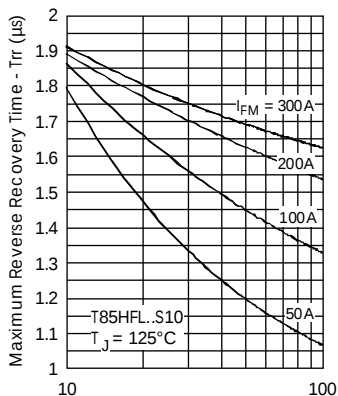
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 32 - Recovery Charge Characteristics



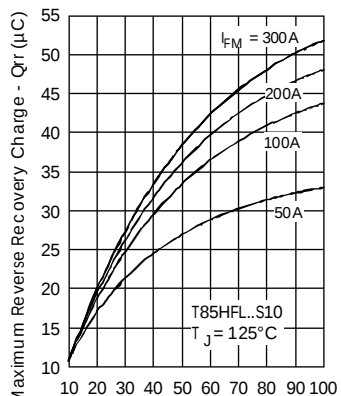
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 33 - Recovery Current Characteristics



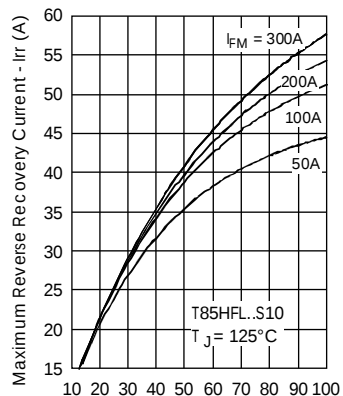
Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 34 - Recovery Time Characteristics



Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 35 - Recovery Charge Characteristics



Rate Of Fall Of Forward Current - di/dt (A/μs)

Fig. 36 - Recovery Current Characteristics

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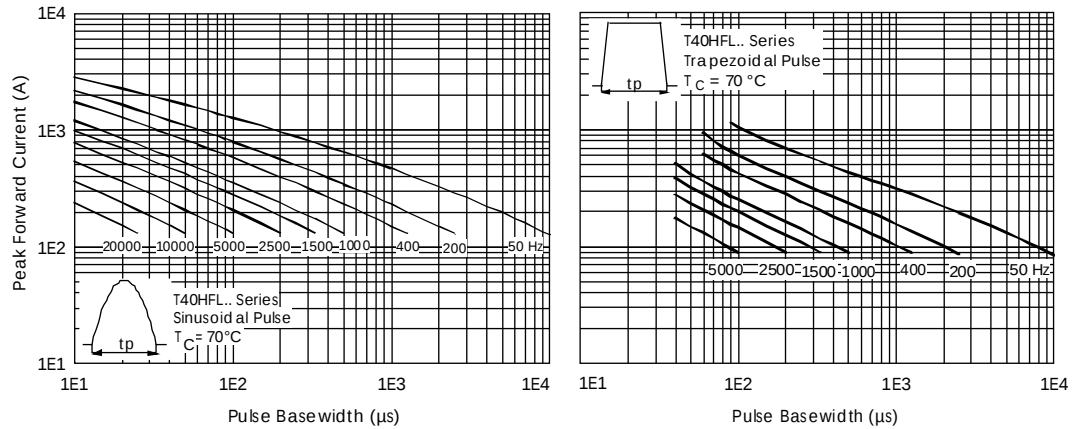


Fig. 37 - Frequency Characteristics

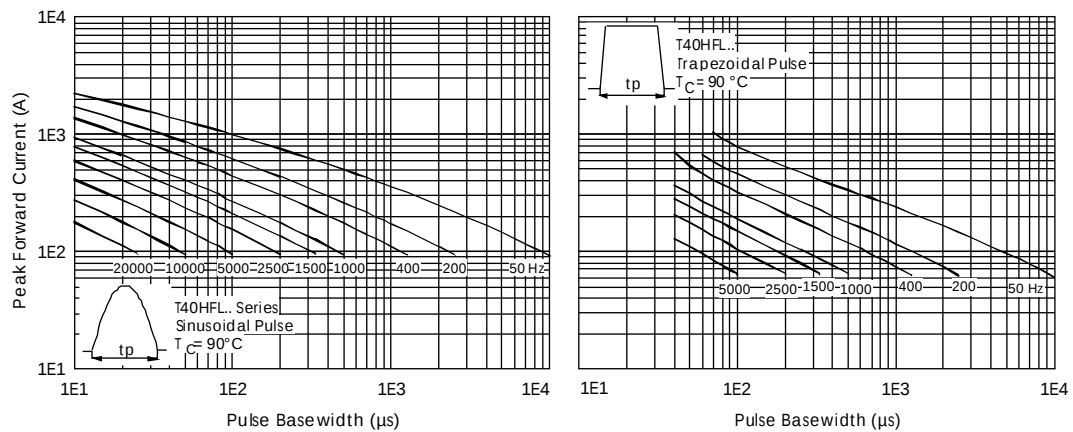


Fig. 38 - Frequency Characteristics

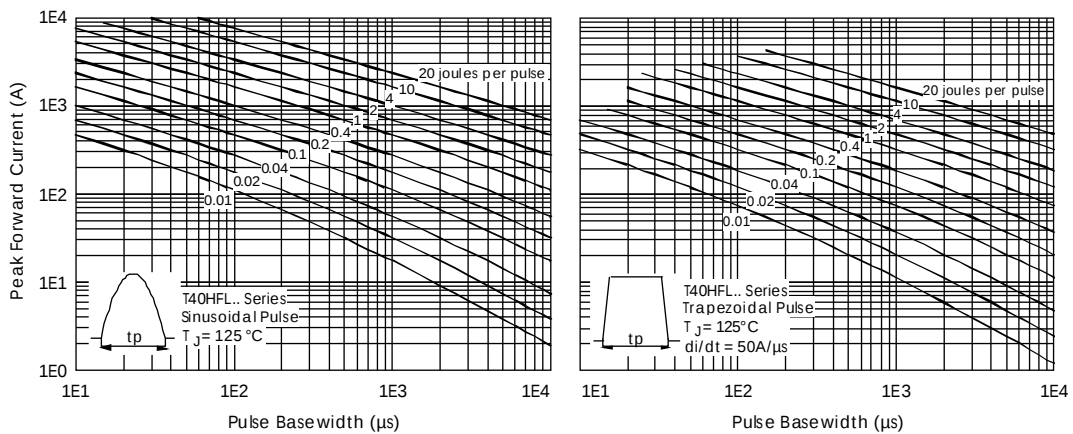


Fig. 39 - Maximum Forward Energy Power Loss Characteristics

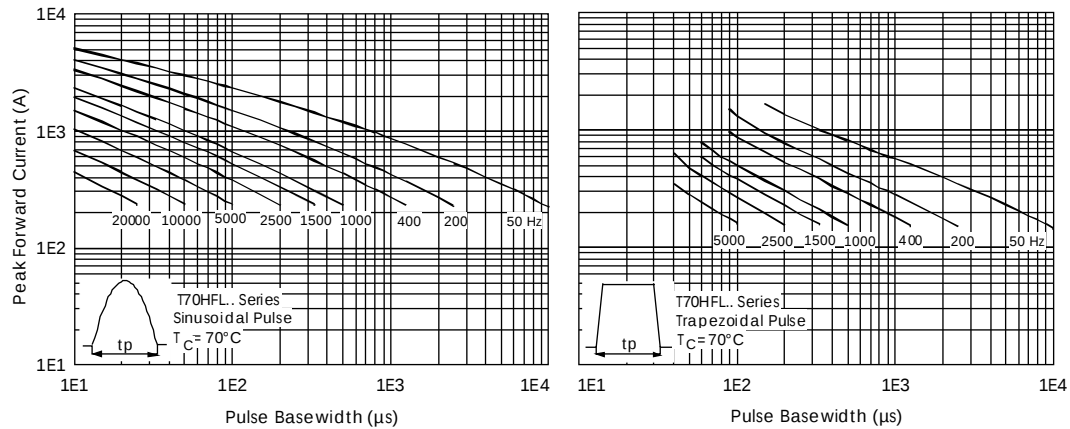


Fig. 40 - Frequency Characteristics

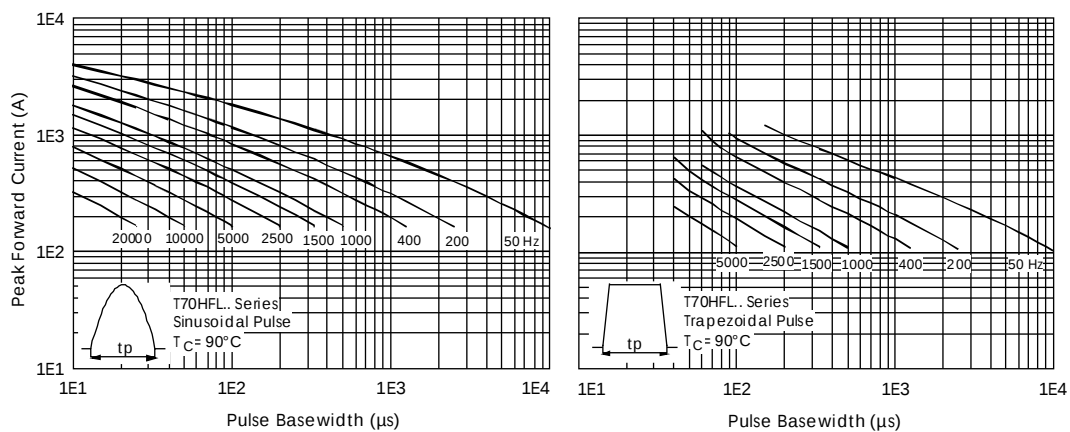


Fig. 41 - Frequency Characteristics

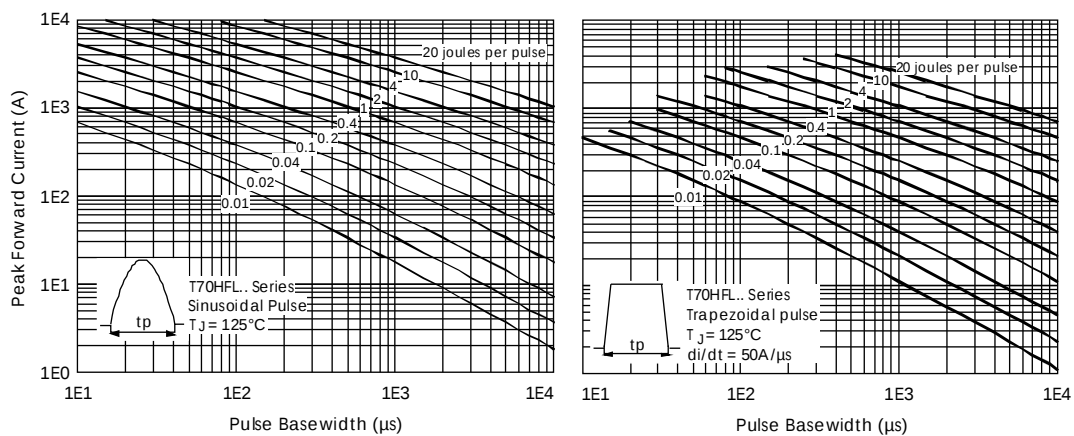


Fig. 42 - Maximum Forward Energy Power Loss Characteristics

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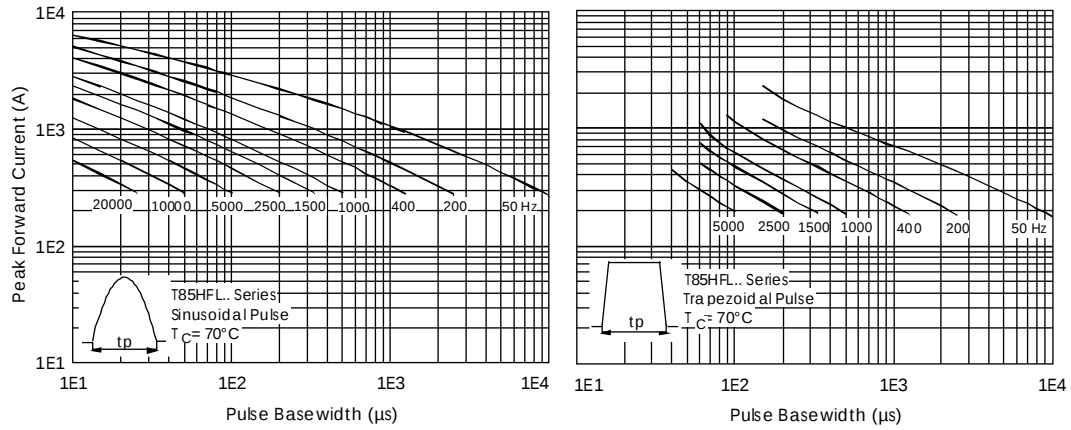


Fig. 43 - Frequency Characteristics

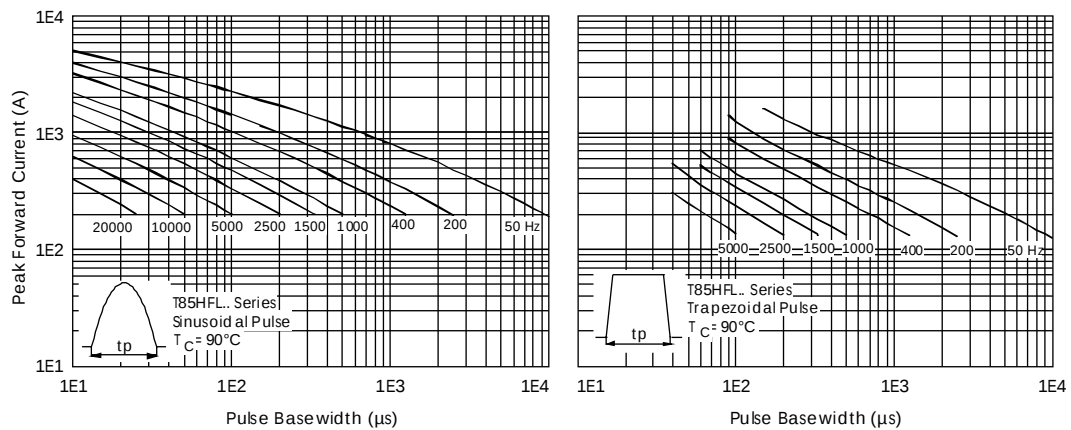


Fig. 44 - Frequency Characteristics

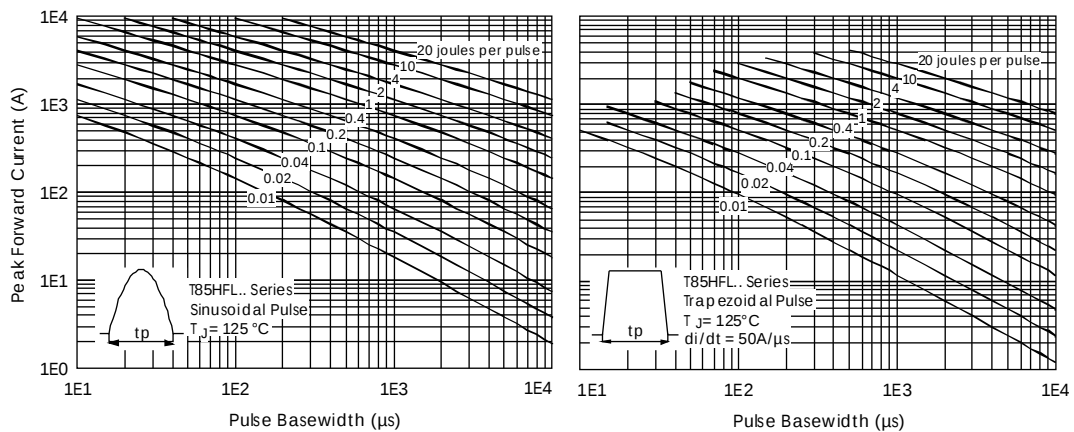


Fig. 45 - Maximum Forward Energy Power Loss Characteristics

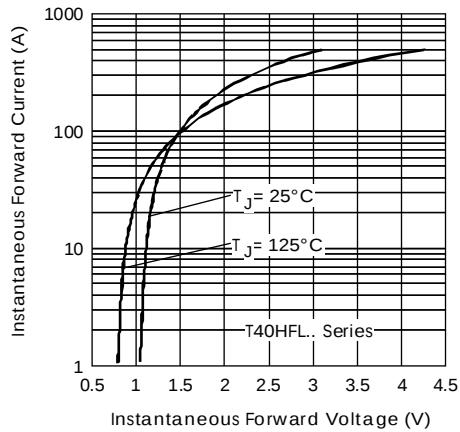


Fig. 46 - Forward Voltage Drop Characteristics

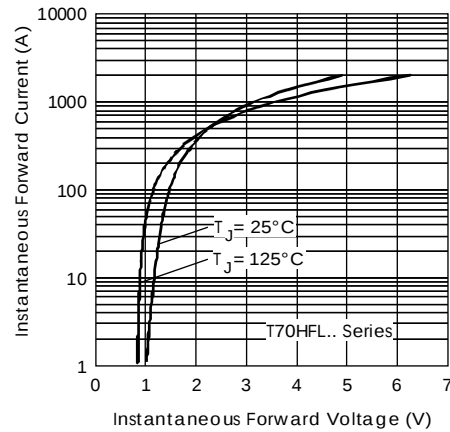


Fig. 47 - Forward Voltage Drop Characteristics

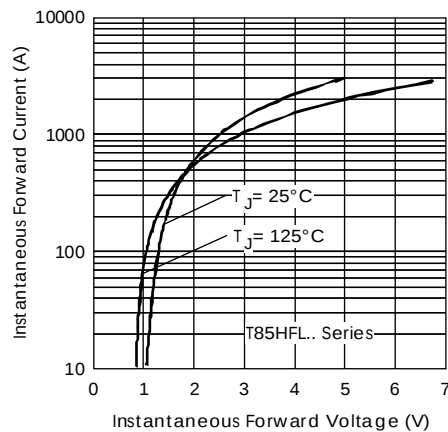


Fig. 48 - Forward Voltage Drop Characteristics

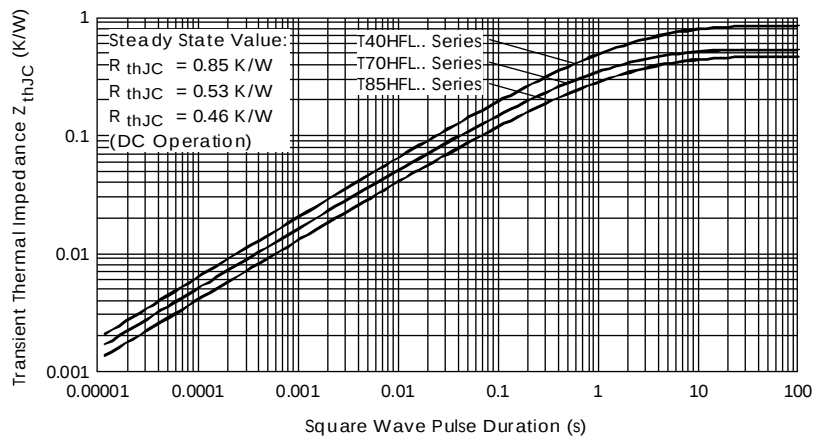


Fig. 49 - Thermal Impedance ZthJC Characteristics