# 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 $V_{RMS}$ 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

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.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 40 A, 70 A, 85 A |
| Type | Modules - diode, fast |
| $V_{RRM}$ | 100 V to 1000 V |
| Package | D-55 (T-module) |
| Circuit configuration | Single |

| MAJOR RATINGS AND CHARACTERISTICS | | | | | |
|---|---|---|---|---|---|
| SYMBOL | CHARACTERISTICS | VALUES | | | UNITS |
| | | T40HFL | T70HFL | T85HFL | |
| $I_{F(AV)}$ | | 40 | 70 | 85 | A |
| | $T_C$ | 70 | 70 | 70 | °C |
| $I_{F(RMS)}$ | | 63 | 110 | 133 | A |
| $I_{FSM}$ | 50 Hz | 475 | 830 | 1300 | A |
| | 60 Hz | 500 | 870 | 1370 | |
| $I^2t$ | 50 Hz | 1130 | 3460 | 8550 | $A^2s$ |
| | 60 Hz | 1030 | 3160 | 7810 | |
| $V_{RRM}$ | 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 | $I_{RRM}$ MAXIMUM AT $T_J$ = 25 °C µA |
| VS_T40HFL..<br>VS_T70HFL..<br>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 | |


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## FORWARD CONDUCTION

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

## REVERSE RECOVERY CHARACTERISTICS

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

**Note**

(1) Tested on LEM 300 A diodemeter tester

## BLOCKING

| PARAMETER | SYMBOL | TEST CONDITIONS | T40HFL | T70HFL | T85HFL | UNITS |
|---|---|---|---|---|---|---|
| Maximum peak reverse leakage current | $I_{RRM}$ | $T_J$ = 125 °C | 20 | | | mA |
| RMS isolation voltage | $V_{ISOL}$ | 50 Hz, circuit to base, all terminals shorted, $T_J$ = 25 °C, t = 1 s | 3500 | | | V |


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| 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 | $R_{thJC}$ | | 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 ± 10 % | base to heatsink | | Non-lubricated threads | M3.5 mounting screws (1) | 1.3 ± 10 % | Nm |
| | busbar to terminal | | | M5 screws terminals | 3 ± 10 % | |
| Approximate weight | | | | See dimensions - link at the end of datasheet | 54 | g |
| | | | | | 19 | oz. |
| Case style | | | | | D-55 (T-module) | |

**Note**

(1) 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 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 0.015 | |

**Note**

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

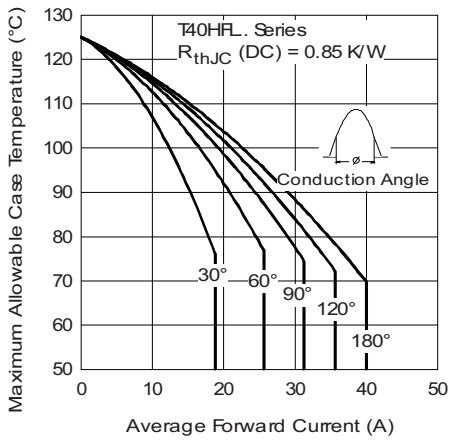



Fig. 1 - Current Ratings Characteristics

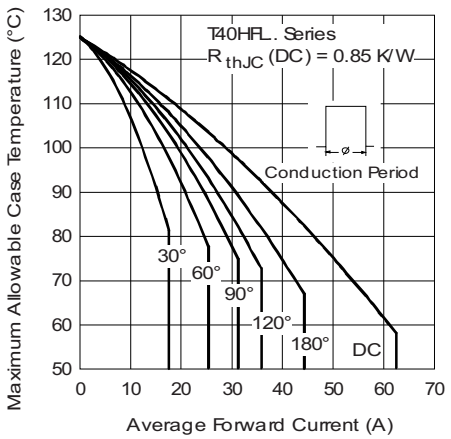



Fig. 2 - Current Ratings Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

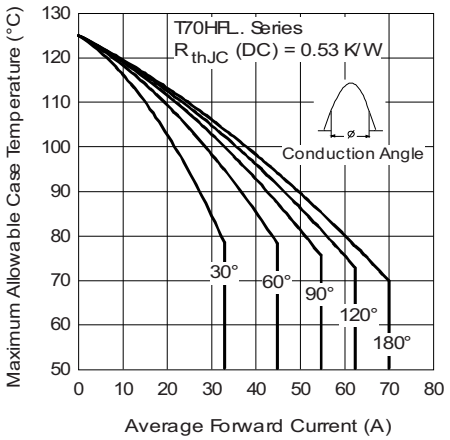



Fig. 3 - Current Ratings Characteristics

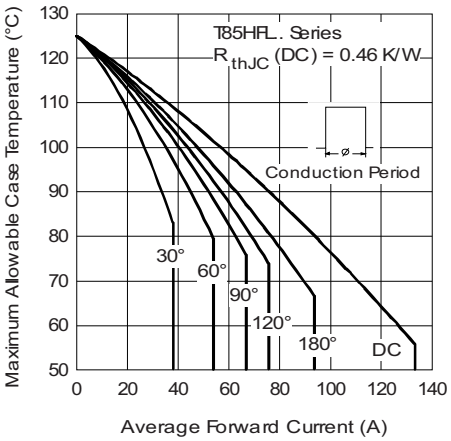



Fig. 6 - Current Ratings Characteristics

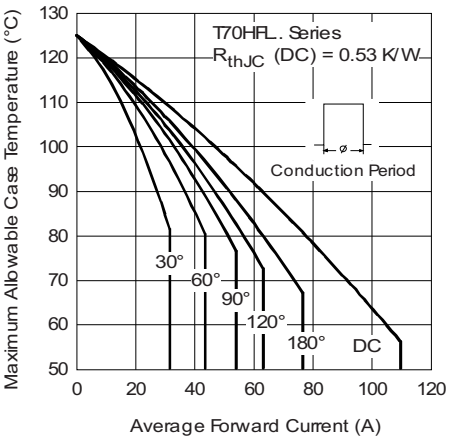



Fig. 4 - Current Ratings Characteristics

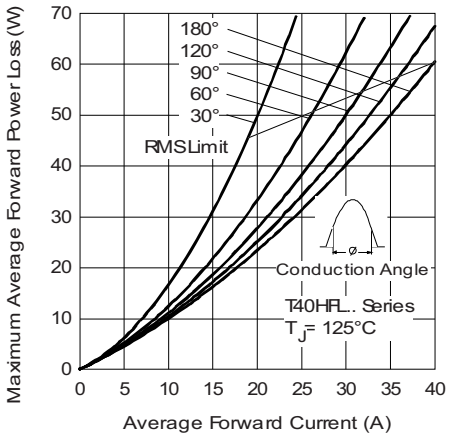



Fig. 7 - Forward Power Loss Characteristics

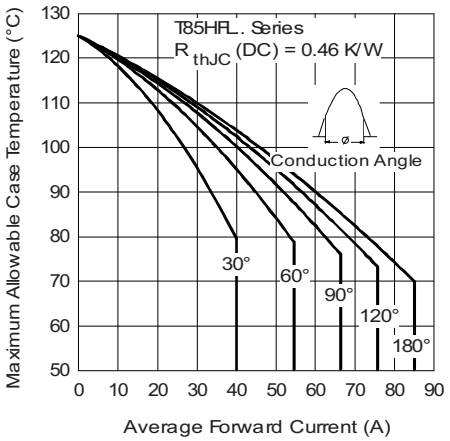



Fig. 5 - Current Ratings Characteristics

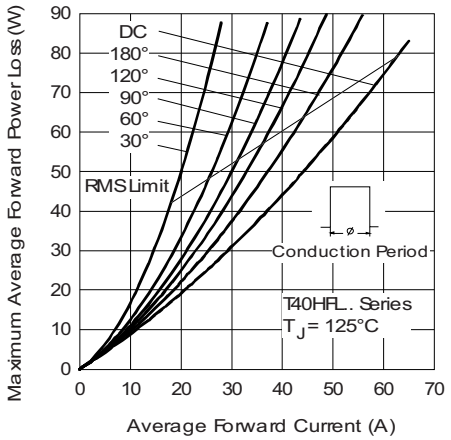



Fig. 8 - Forward Power Loss Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

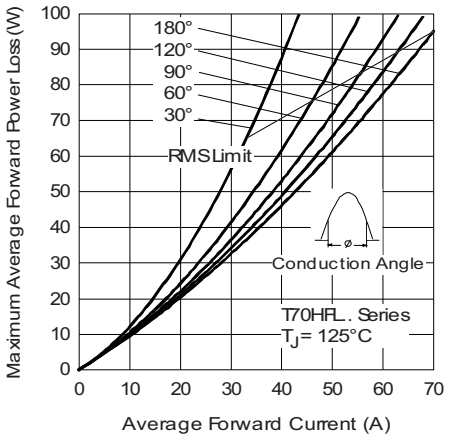



Fig. 9 - Forward Power Loss Characteristics

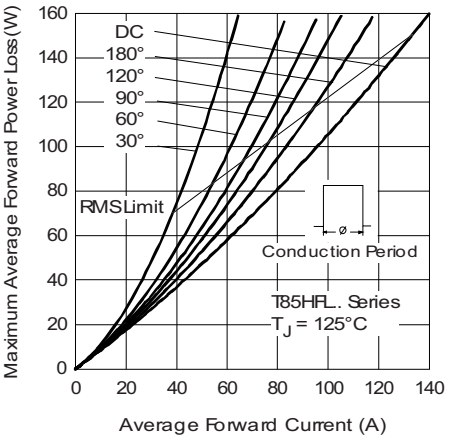



Fig. 12 - Forward Power Loss Characteristics

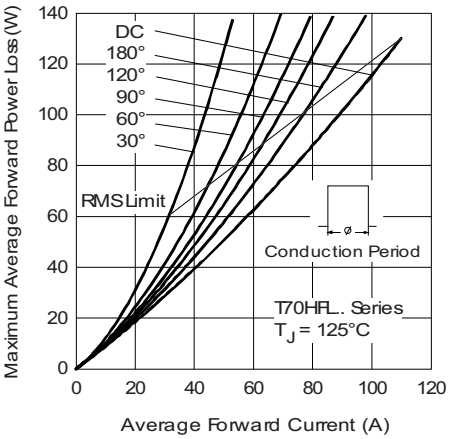



Fig. 10 - Forward Power Loss Characteristics

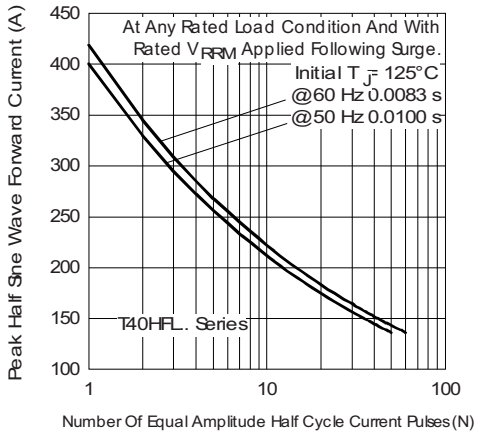



Fig. 13 - Maximum Non-Repetitive Surge Current

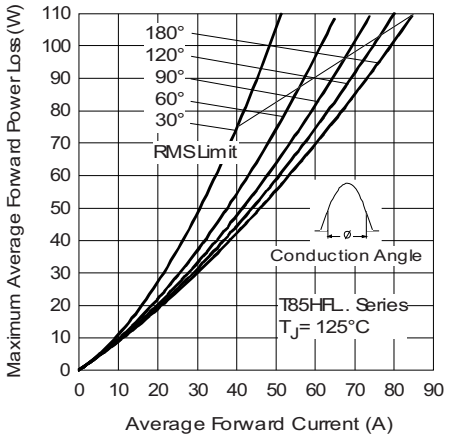



Fig. 11 - Forward Power Loss Characteristics

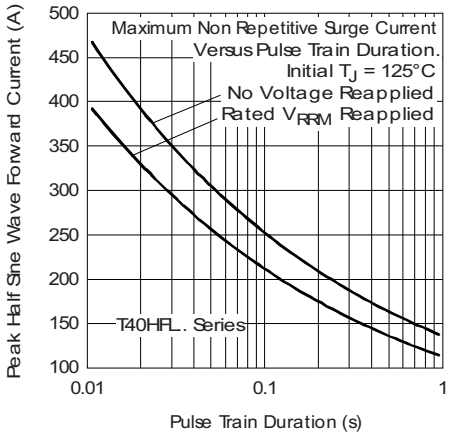



Fig. 14 - Maximum Non-Repetitive Surge Current


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

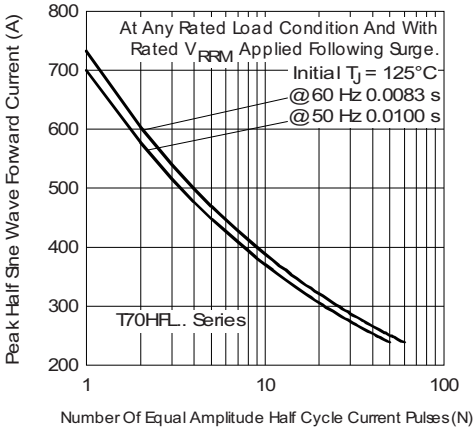



Fig. 15 - Maximum Non-Repetitive Surge Current

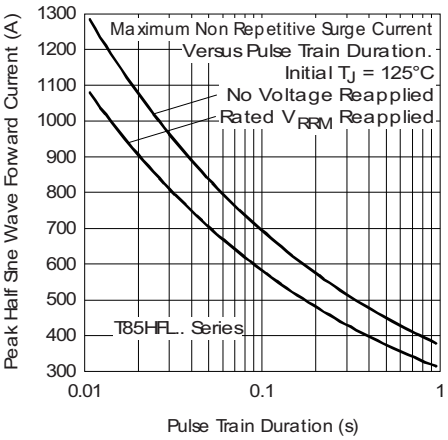



Fig. 18 - Maximum Non-Repetitive Surge Current

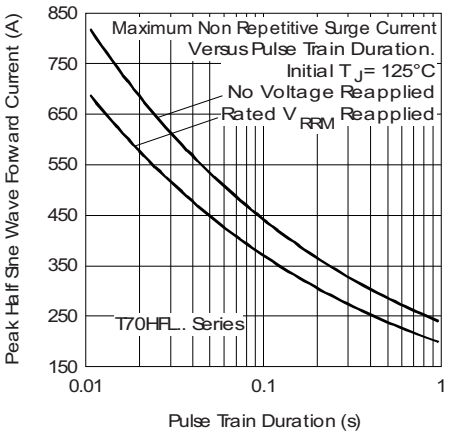



Fig. 16 - Maximum Non-Repetitive Surge Current

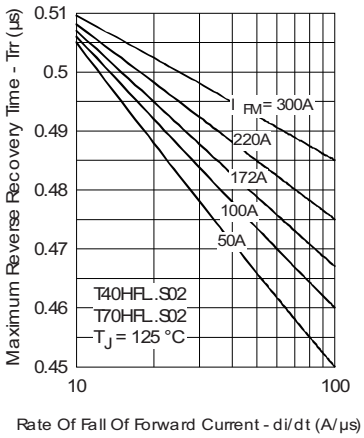



Fig. 19 - Recovery Time Characteristics

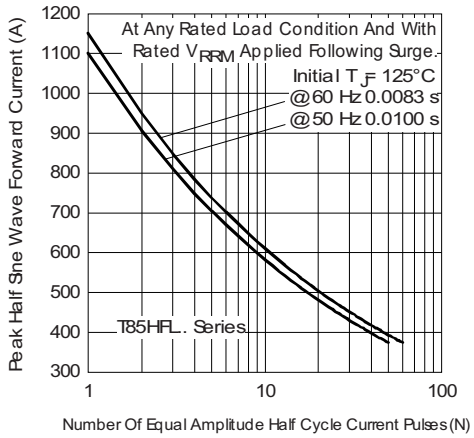



Fig. 17 - Maximum Non-Repetitive Surge Current

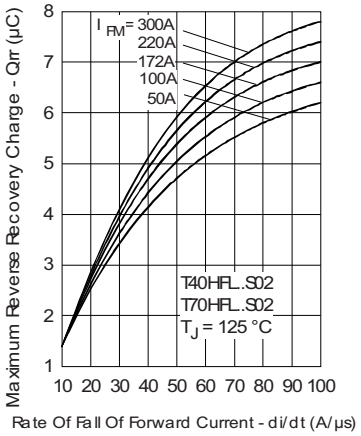



Fig. 20 - Recovery Charge Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

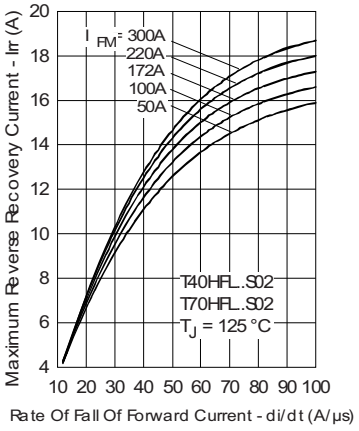



Fig. 21 - Recovery Current Characteristics

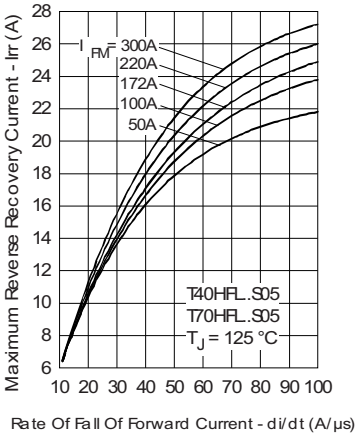



Fig. 24 - Recovery Current Characteristics

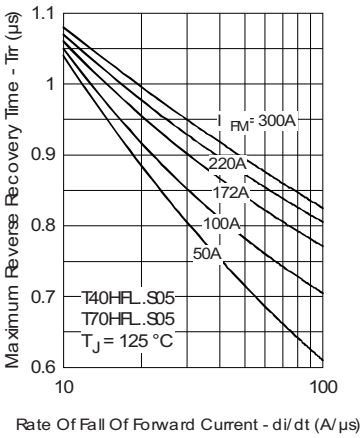



Fig. 22 - Recovery Time Characteristics

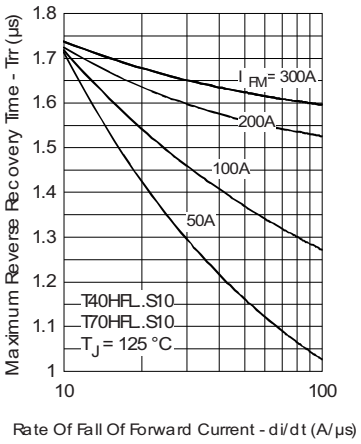



Fig. 25 - Recovery Time Characteristics

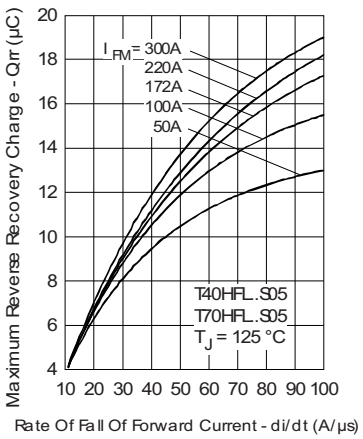



Fig. 23 - Recovery Charge Characteristics

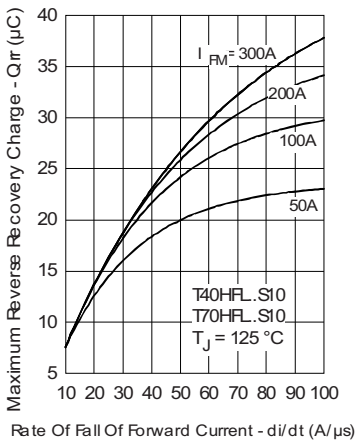



Fig. 26 - Recovery Charge Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

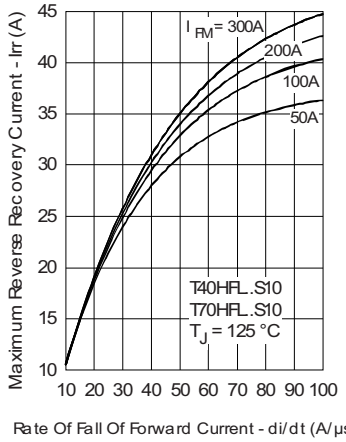



Fig. 27 - Recovery Current Characteristics

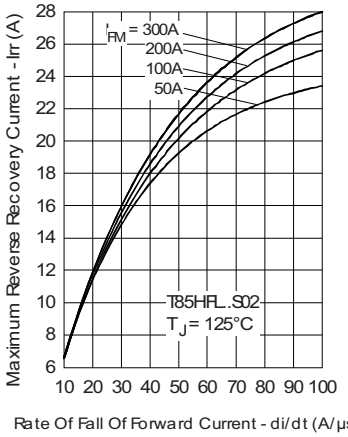



Fig. 30 - Recovery Current Characteristics

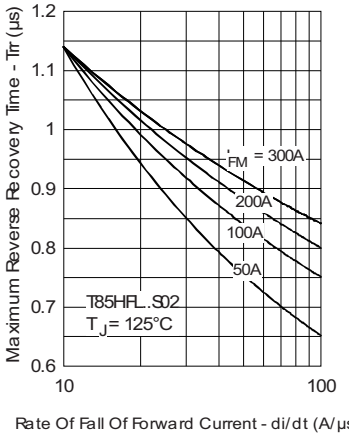



Fig. 28 - Recovery Time Characteristics

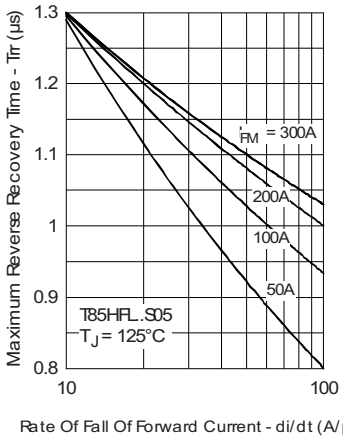



Fig. 31 - Recovery Time Characteristics

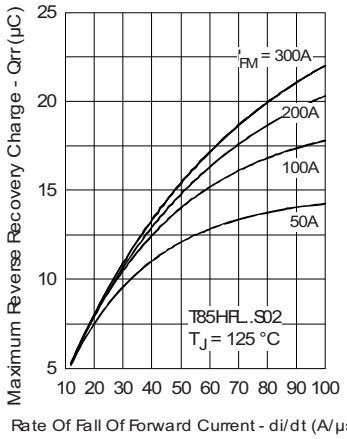



Fig. 29 - Recovery Charge Characteristics

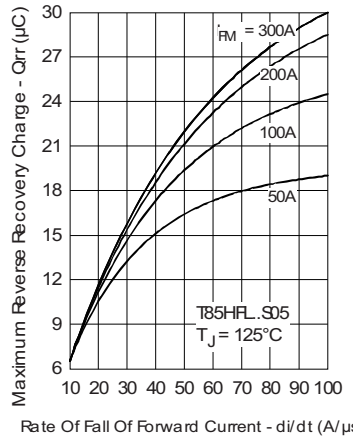



Fig. 32 - Recovery Charge Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

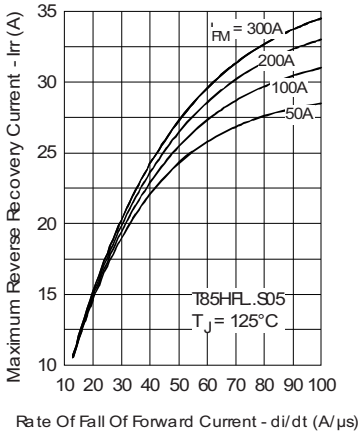



Fig. 33 - Recovery Current Characteristics

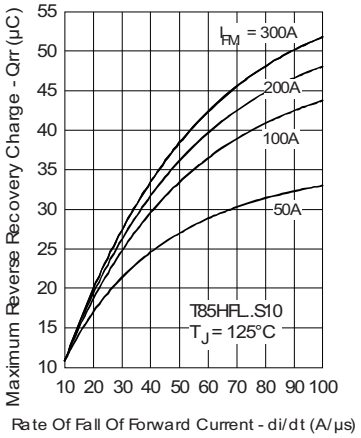



Fig. 35 - Recovery Charge Characteristics

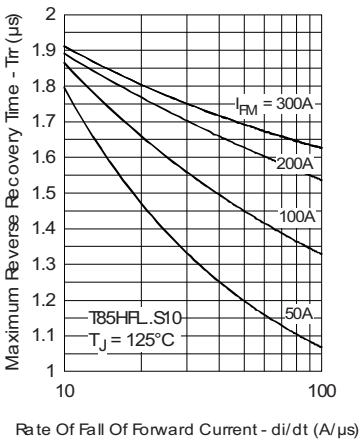



Fig. 34 - Recovery Time Characteristics

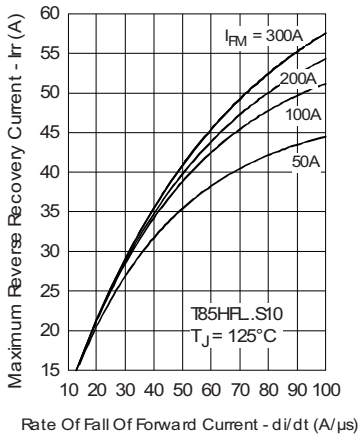



Fig. 36 - Recovery Current Characteristics

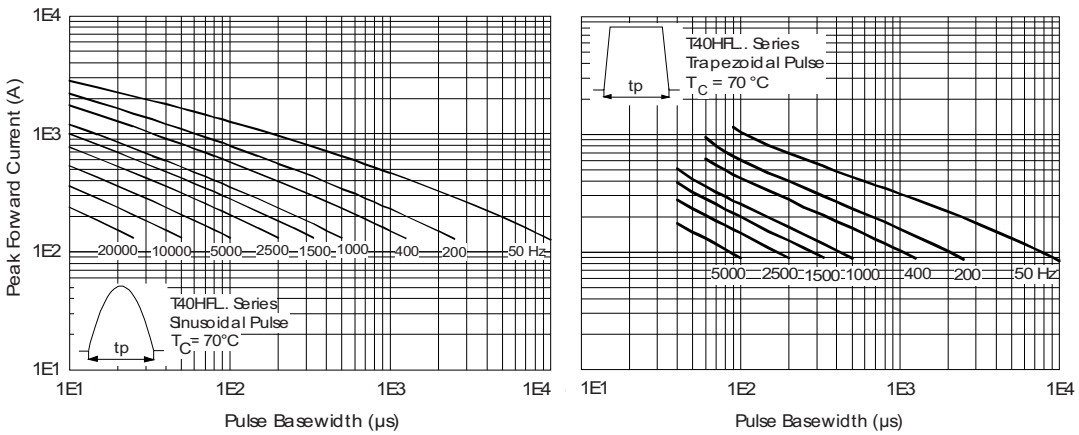



Fig. 37 - Frequency Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

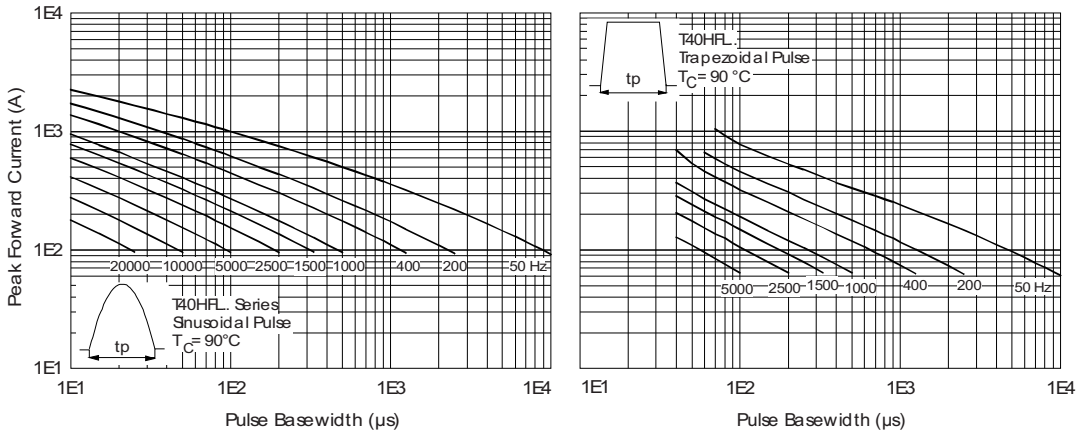



Fig. 38 - Frequency Characteristics

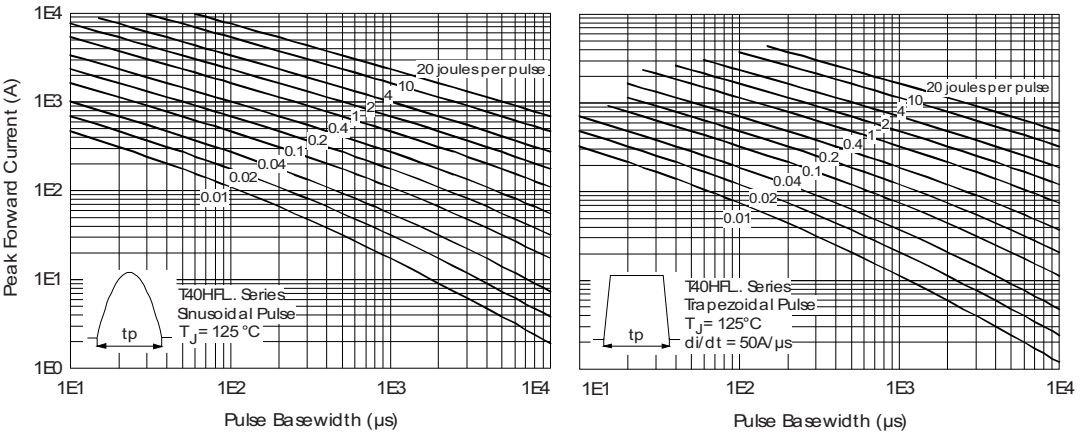



Fig. 39 - Maximum Forward Energy Power Loss Characteristics

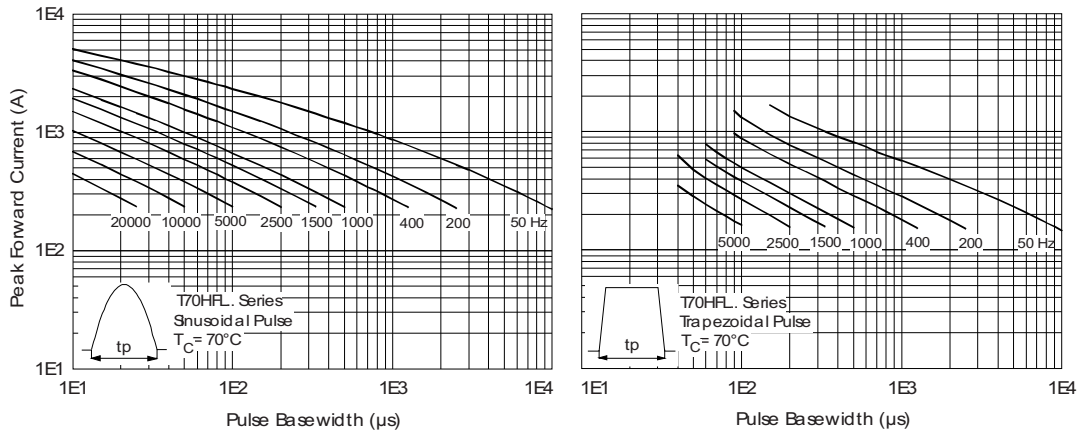



Fig. 40 - Frequency Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

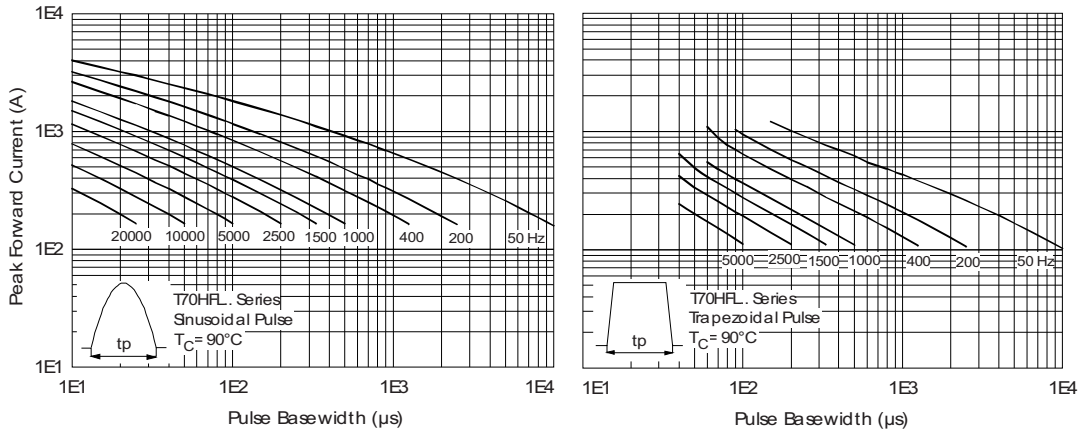



Fig. 41 - Frequency Characteristics

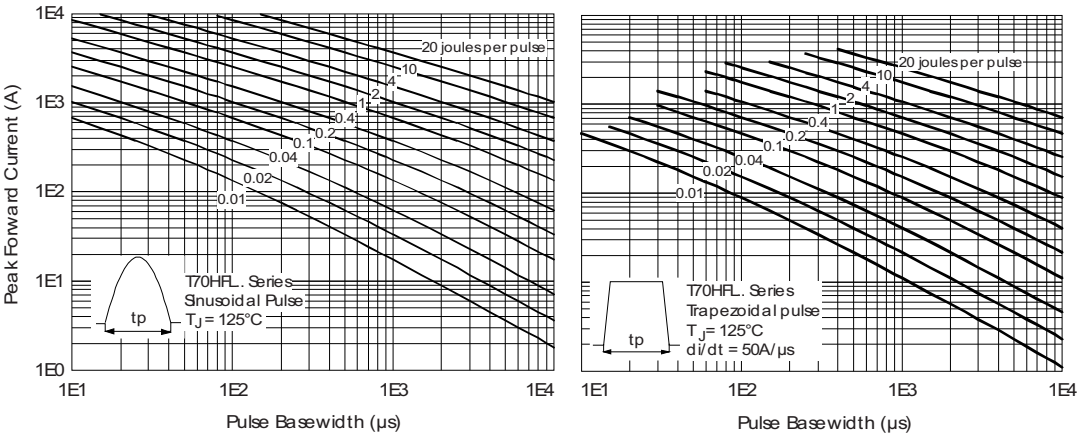



Fig. 42 - Maximum Forward Energy Power Loss Characteristics

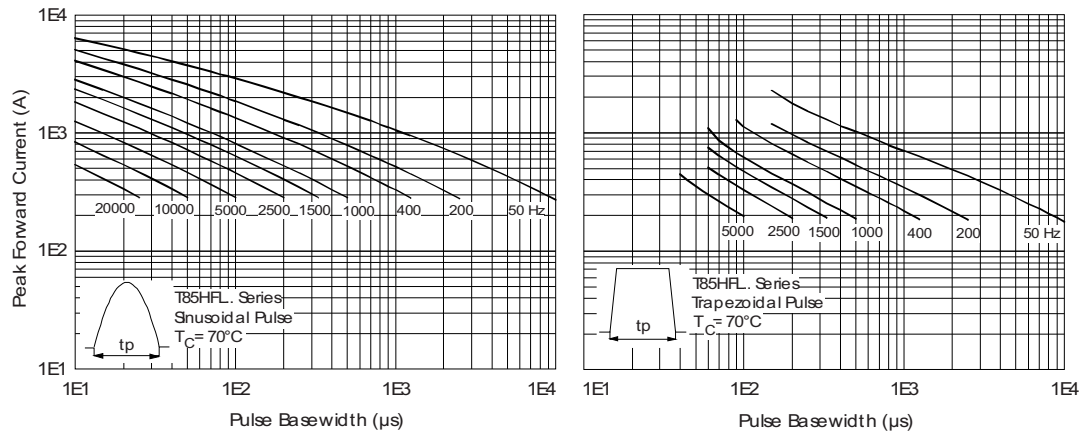



Fig. 43 - Frequency Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

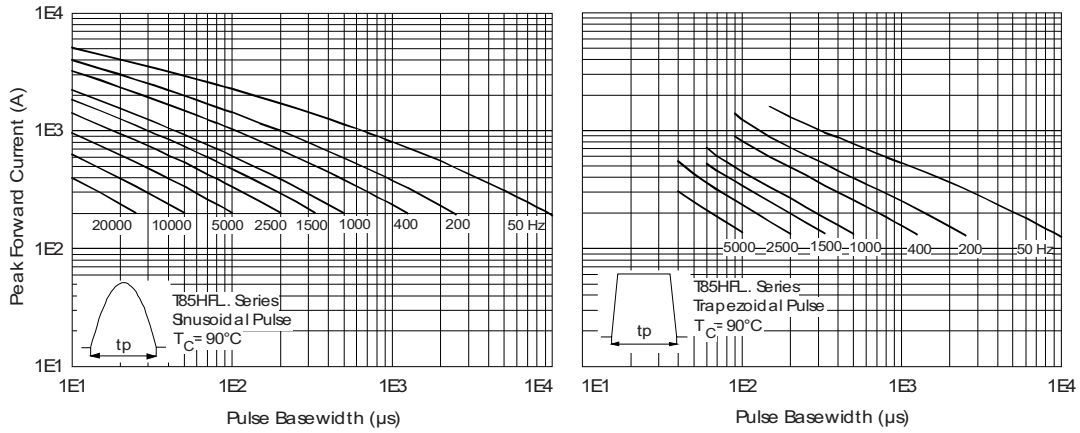



Fig. 44 - Frequency Characteristics

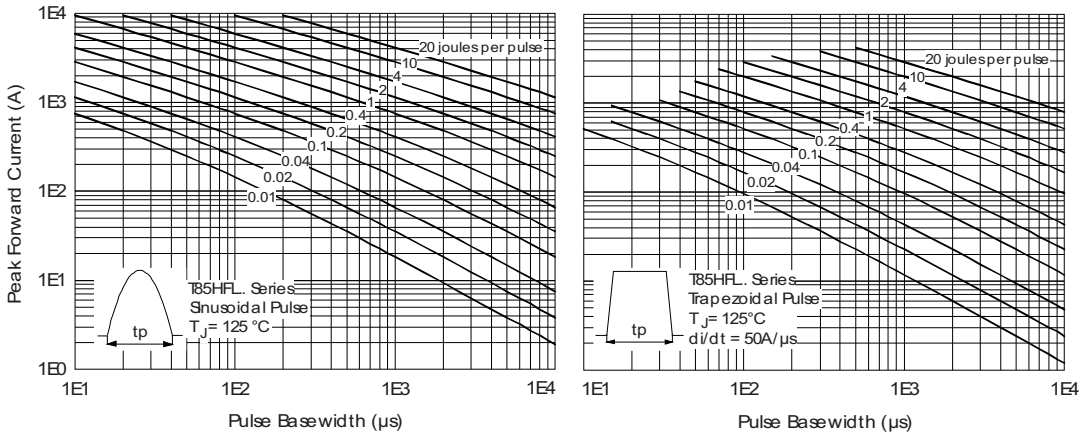



Fig. 45 - Maximum Forward Energy Power Loss Characteristics

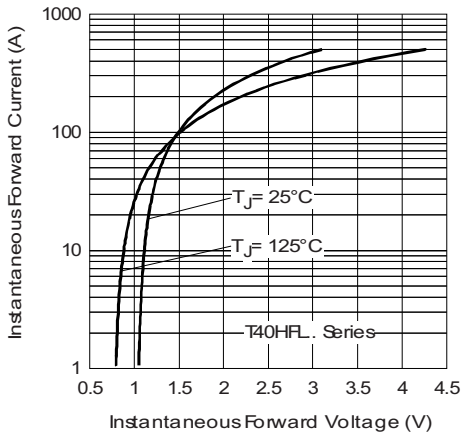



Fig. 46 - Forward Voltage Drop Characteristics

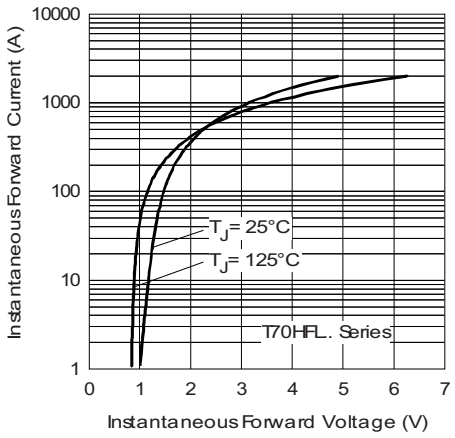



Fig. 47 - Forward Voltage Drop Characteristics


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

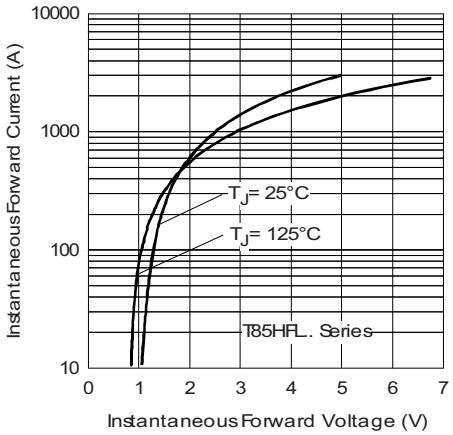



Fig. 48 - Forward Voltage Drop Characteristics

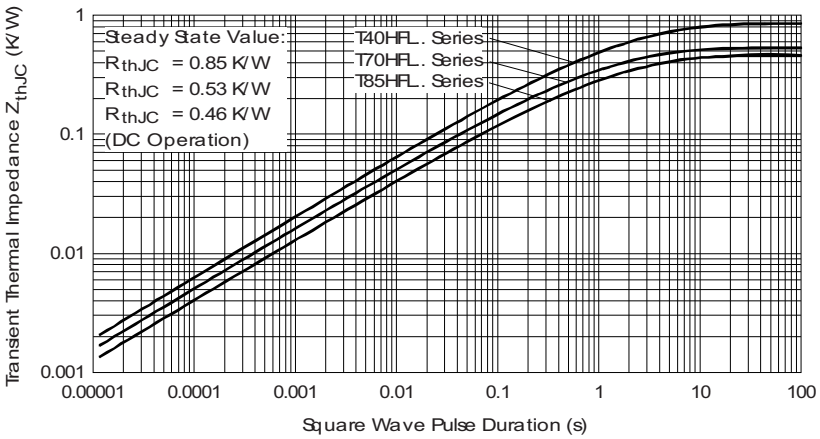
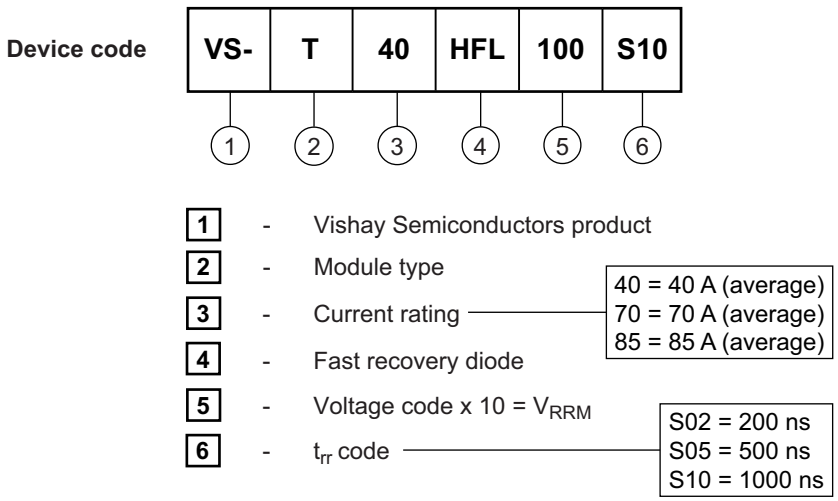


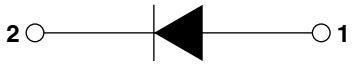

Fig. 49 - Thermal Impedance $Z_{thJC}$ Characteristics

## ORDERING INFORMATION TABLE





For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| CIRCUIT CONFIGURATION | | |
|---|---|---|
| **CIRCUIT** | **CIRCUIT CONFIGURATION CODE** | **CIRCUIT DRAWING** |
| Single | HFL |  |

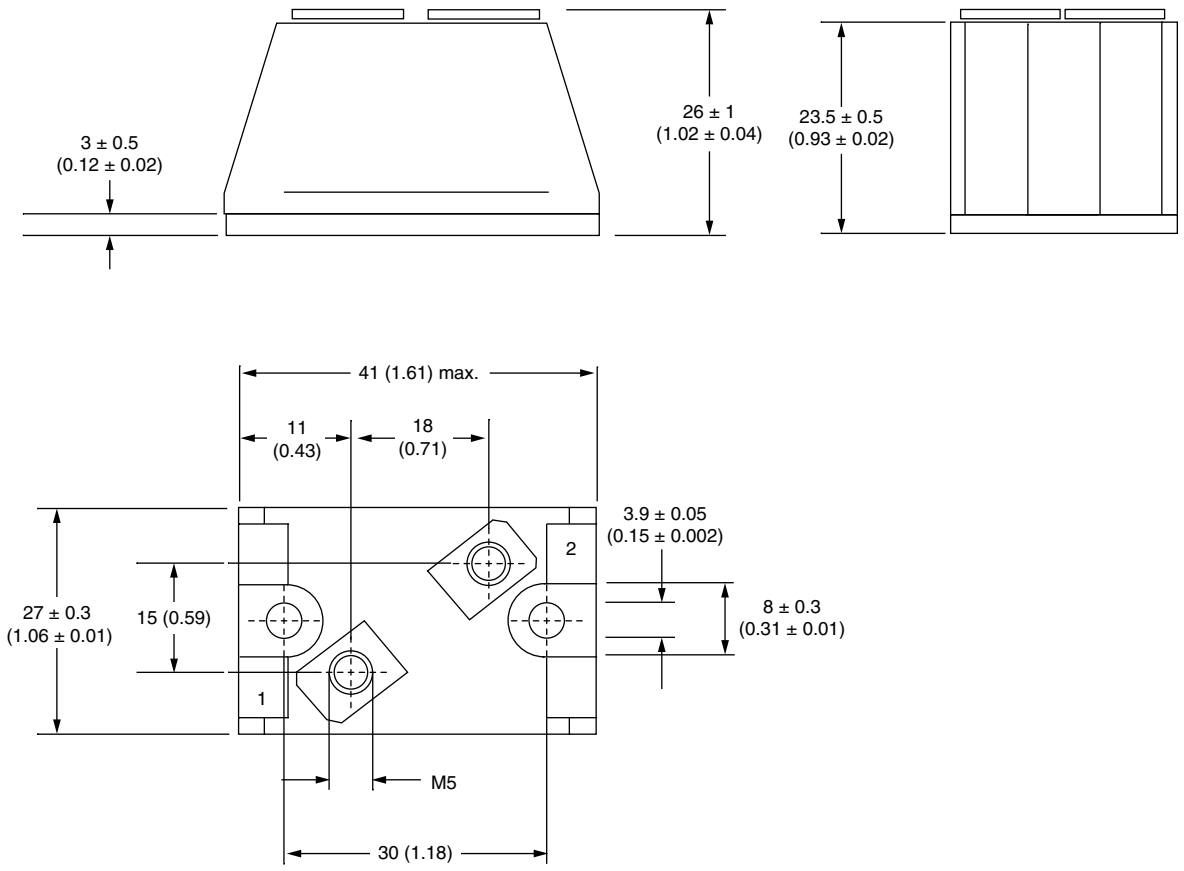


| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95313 |


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

**DIMENSIONS** in millimeters (inches)




**Note**

- 1 = Anode
  2 = Cathode



For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

*© 2021 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED*