

Surface Mounted Power Resistor Thick Film Technology



FEATURES

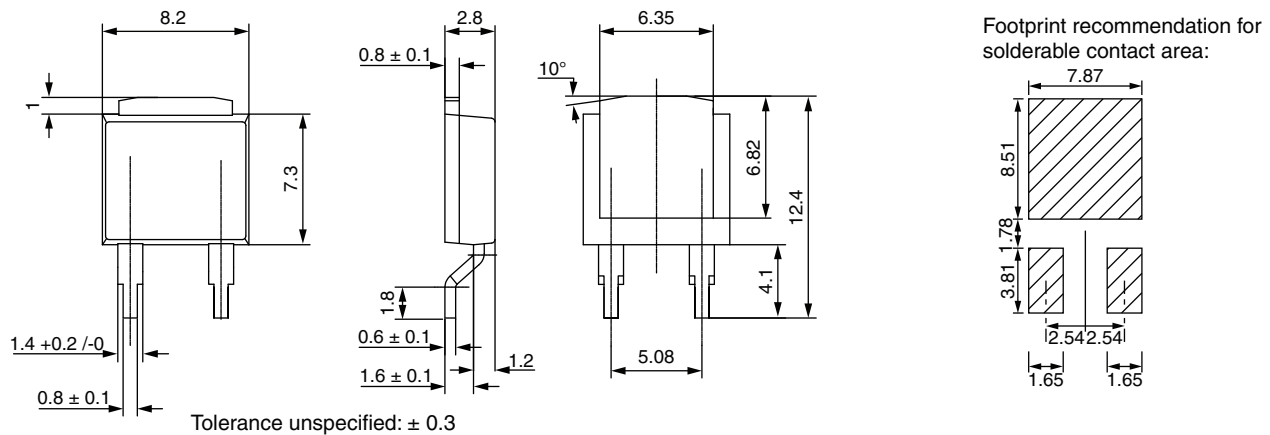
- AEC-Q200 qualified
- 35 W at 25 °C case temperature
- Surface mounted resistor - TO-252 (DPAK) style package
- Wide resistance range: 0.016 Ω to 700 kΩ
- Non inductive
- Resistor isolated from metal tab
- Solder reflow secure at 270 °C / 10 s, MSL = 1
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

LINKS TO ADDITIONAL RESOURCES



DIMENSIONS in millimeters



Notes

- For the assembly, we recommend the lead (Pb)-free thermal profile as per J-STD-020C
- Power dissipation is 4.5 W at an ambient temperature of 25 °C when mounted on a double sided copper board using FR4 HTG, 70 μm of copper, 39 mm x 30 mm x 1.6 mm, with thermal vias
- For other information about dissipation, see the Application Note 52027: "Thermal Management on SMD Thick Film Resistors (D2TO20, D2TO35, DTO25, DTO35)"

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	RESISTANCE RANGE Ω	RATED POWER $P_{25\text{ }^\circ\text{C}}$ W	LIMITING ELEMENT VOLTAGE U_L V	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	CRITICAL RESISTANCE Ω
DTO35	TO-252 (DPAK)	0.016 to 700K	35	500	1, 2, 5, 10	150	7.1K

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper, Ni under layer
Weight	2 g max.

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	-55 °C to +175 °C
Climatic Category	55 / 175 / 56
Flammability	IEC 60695-11-5 Application time: $t_a = 10$ s Burning duration: $t_b < 30$ s

ELECTRICAL SPECIFICATIONS

Tolerances	From 0.016 Ω to 0.047 Ω: ± 5 % and ± 10 % > 0.047 Ω to 0.1 Ω: ± 2 % to ± 10 % ≥ 0.11 Ω: ± 1 % to ± 10 %
Power Rating and Thermal Resistance	35 W at +25 °C case temperature $R_{TH(j-c)}$: 4.28 °C/W
Temperature Coefficient	See Special Feature table ± 150 ppm/°C
Dielectric Strength	1500 V_{RMS} - 1 min - 15 mA max. (between terminals and board)
Insulation Resistance	≥ 10 ⁴ MΩ
Inductance	≤ 0.1 μH



DIMENSIONS	
Standard Package	TO-252 style (DPAK)

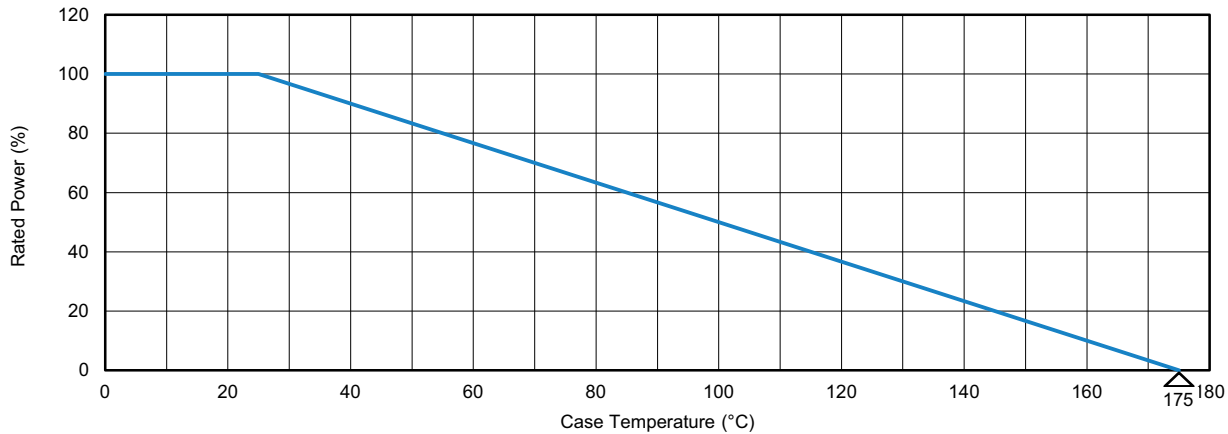
SPECIAL FEATURES			
Resistance Values	≥ 0.016	≥ 0.1	≥ 0.5
Requirement Temperature Coefficient (TCR) (-55 °C +175 °C) IEC 60115-1	± 900 ppm/°C	± 350 ppm/°C	± 150 ppm/°C

PERFORMANCE		
TESTS	CONDITIONS	REQUIREMENTS
Momentary Overload	IEC 60115-1 §4.13 1.6 Pr 5 s US < 1.5 UL	± (0.25 % + 0.005 Ω)
Load Life	IEC 60115-1 1000 h, 90/30 Pr at +25 °C	± (0.5 % + 0.005 Ω)
High Temperature Exposure	AEC-Q200 rev. D conditions: MIL-STD-202 method 108 1000 h, +175 °C, unpowered	± (0.5 % + 0.005 Ω)
Temperature Cycling	AEC-Q200 rev. D conditions: pre-conditioning 3 reflows according JESTD020D JESD22 method JA-104 1000 cycles, (-55 °C to +125 °C) dwell time 15 min	± (0.5 % + 0.005 Ω)
Biased Humidity	AEC-Q200 rev. D conditions: MIL-STD-202 method 103 1000 h, 85 °C, 85 % RH	± (0.5 % + 0.005 Ω)
Operational Life	AEC-Q200 rev. D conditions: pre-conditioning 3 reflows according JESTD020D MIL-STD-202 method 108 1000 h, 90/30, powered, +125 °C	± (0.5 % + 0.005 Ω)
ESD Human Body Model	AEC-Q200 rev. D conditions: AEC-Q200-002 25 kV _{AD}	± (0.5 % + 0.005 Ω)
Vibration	AEC-Q200 rev. D conditions: MIL-STD-202 method 204 20 g's for 20 min, 12 cycles test from 10 Hz to 2000 Hz	± (0.2 % + 0.005 Ω)
Mechanical Shock	AEC-Q200 rev. D conditions: MIL-STD-202 method 213 100 g's, 6 ms, 3.75 m/s 3 shocks/direction	± (0.2 % + 0.005 Ω)
Board Flex	AEC-Q200 rev. D conditions: AEC-Q200-005 bending 2 mm, 60 s	± (0.25 % + 0.01 Ω)
Terminal Strength	AEC-Q200 rev. D conditions: AEC-Q200-006 1.8 kgf, 60 s	± (0.25 % + 0.01 Ω)

ASSEMBLY SPECIFICATIONS		
For the assembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C		
TESTS	CONDITIONS	REQUIREMENTS
Resistance to Soldering Heat	AEC-Q200 rev. D MIL-STD-202 method 210 Solder bath method: 270 °C / 10 s	± (0.5 % + 0.005 Ω)
Moisture Sensitivity Level (MSL)	IPC / JEDEC® J-STD-020C 85 °C / 85 % RH / 168 h	Level: 1 + pass requirements of TCR overload and dielectric strength after MSL

POWER RATING

The temperature of the case should be maintained within the limits specified.



CHOICE OF THE BOARD

The user must choose the board according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 175 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)}} \quad (1)$$

P: Expressed in W

ΔT : Difference between maximum working temperature and room temperature

$R_{TH(j-c)}$: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: 4.28 °C/W.

$R_{TH(c-h)}$: Thermal resistance value measured between outer side of the resistor and upper side of the board. This is the thermal resistance of the solder layer.

$R_{TH(h-a)}$: Thermal resistance of the board.

Example:

$R_{TH(c-h)} + R_{TH(h-a)}$ for DTO35 power rating 3.5 W at ambient temperature +25 °C.

Thermal resistance $R_{TH(j-c)}$: 4.28 °C/W

Considering equation (1) we have:

$$\Delta T = 175 \text{ °C} - 25 \text{ °C} = 150 \text{ °C}$$

$$R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)} = \Delta T / P = 150 / 3.5 = 42.8 \text{ °C/W}$$

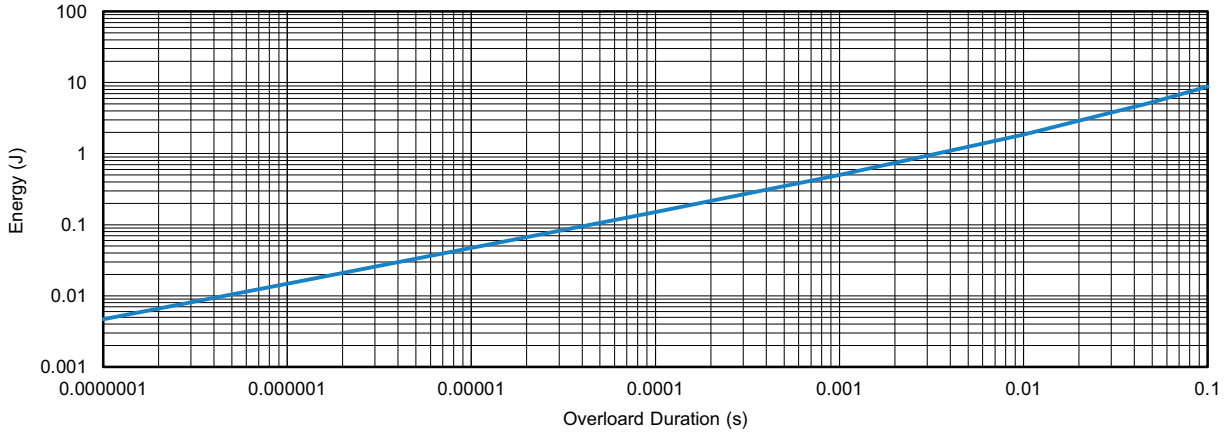
$$R_{TH(c-h)} + R_{TH(h-a)} = 42.8 \text{ °C/W} - 4.28 \text{ °C/W} = 38.52 \text{ °C/W}$$

ACCIDENTAL OVERLOAD

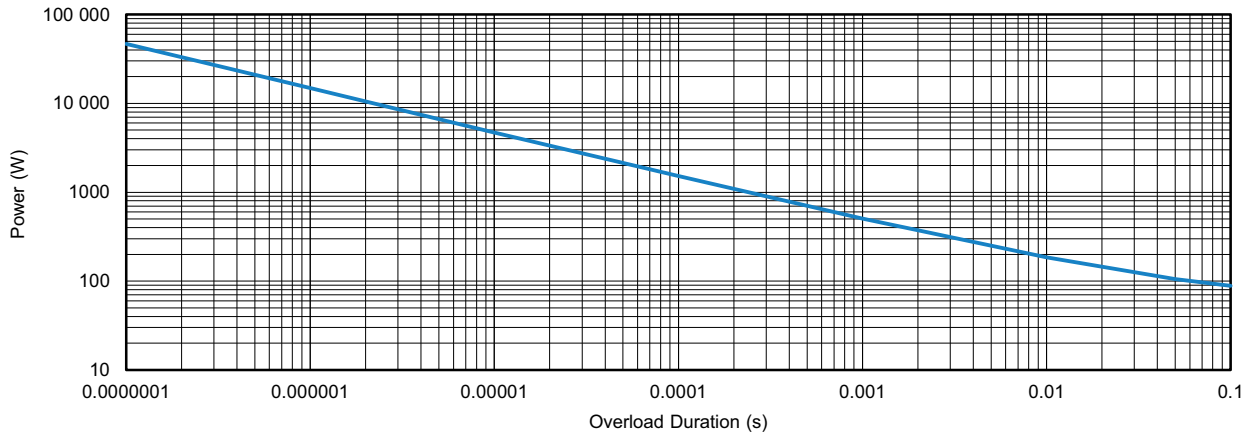
In any case the applied voltage must be lower than the maximum overload voltage of $U_s = 750 \text{ V}$. The values indicated on the graph below are applicable to resistors onto a board.



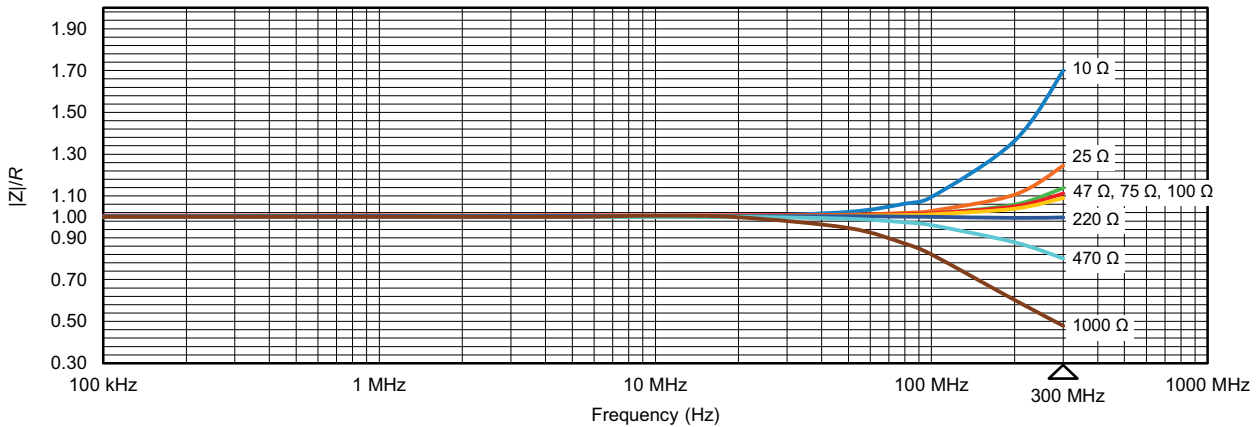
ENERGY CURVE



POWER CURVE

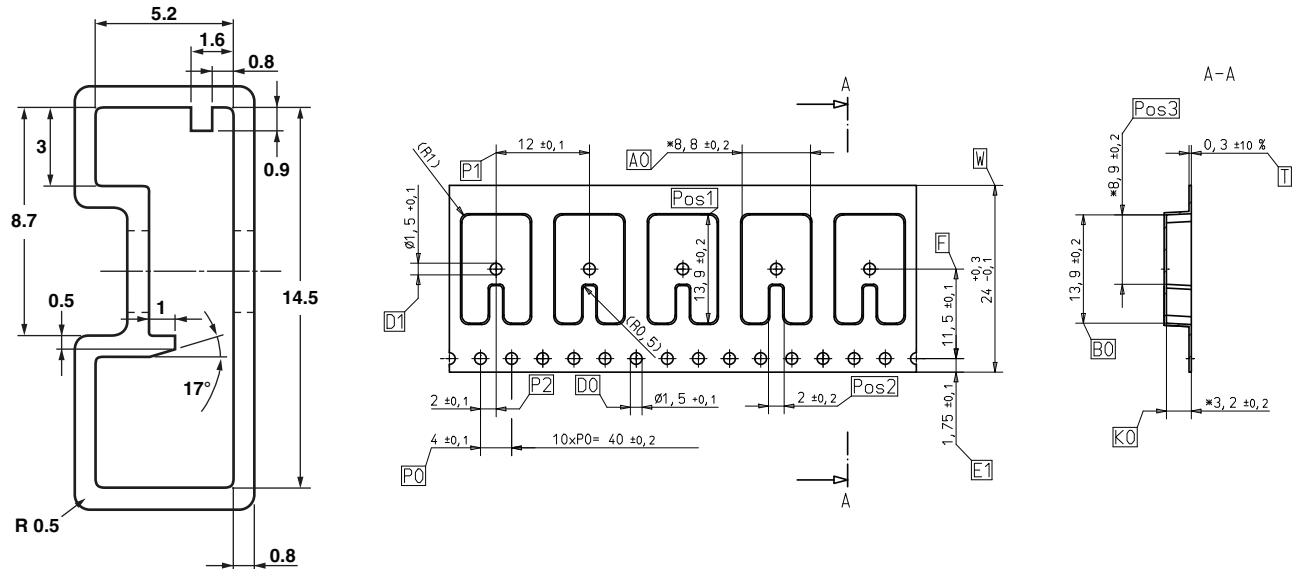


IMPEDANCE CURVE 10 Ω to 1 kΩ from 100 kHz to 300 MHz



PACKAGING

- Tube: max. 50 units per tube
- Reel: max. 500 units per reel


MARKING

 Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

ORDERING INFORMATION						
DTO	035	C	100 kΩ	$\pm 1\%$	XXX	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	LEAD (Pb)-FREE
				F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$	Optional on request: shape, etc	

SAP PART NUMBERING GUIDELINES															
D	T	O	0	3	5	C	1	0	0	0	2	F	R	E	3
GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE				TOLERANCE	PACKAGING	LEAD (Pb)-FREE						
DTO	035	C = surface mount	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. 48R70 = 48.7 Ω 48701 = 48 700 Ω 10002 = 100 000 Ω R0100 = 0.01 Ω R6800 = 0.68 Ω 27000 = 2700 Ω = 2.7 k Ω				F = 1 % G = 2 % J = 5 % K = 10 %	R = reel 500 pieces T = tube 50 pieces	E3 = pure tin						



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.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.