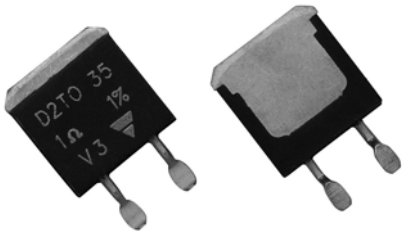
Surface Mount Power Resistor Thick Film Technology

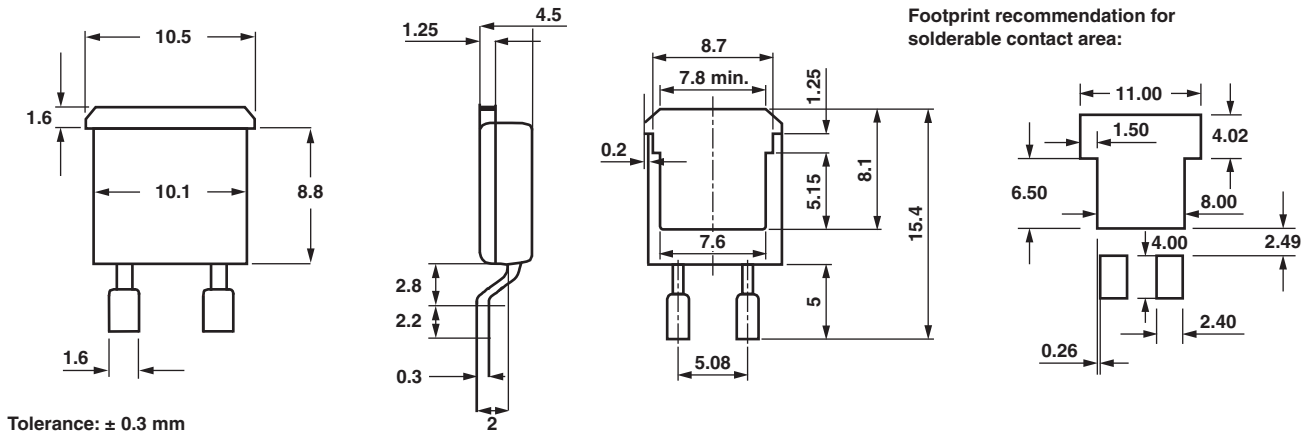


FEATURES

- **AEC-Q200 qualified**
- 35 W at 25 °C case temperature
- Surface mounted resistor - TO-263 (D^2PAK) style package
- Wide resistance range from 0.01 W to 550 kW
- Non inductive
- Resistor isolated from metal tab
- Solder reflow secure at 270 °C/10 s
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

DIMENSIONS in millimeters



Notes

- For the asssembly on board, we recommend the lead (Pb)-free thermal profile as per J-STD-020C
- Power dissipation is 3.3 W at an ambient temperature of 25 °C when mounted on a double sided copper board using FR4 standard, 70 µm of copper, 39 mm x 30 mm x 1.6 mm

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	RESISTANCE RANGE Ω	RATED POWER $P_{25\,°C}$ W	LIMITING ELEMENT VOLTAGE U_L V	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	CRITICAL RESISTANCE Ω
D2TO35	TO-263	0.01 to 550K	35	500	1, 2, 5, 10	150, 250, 700, 1100	7.14K

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2.2 g max.

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to 175 °C
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

TECHNICAL SPECIFICATIONS

Power Rating and Thermal Resistance of the Component	350 W at 25 °C (case temperature) $R_{TH\ (j-c)}$: 4.28 °C/W
Temperature Coefficient **Standard**	See Special Feature table ± 150 ppm/°C
Dielectric Strength IEC 60115-1	2000 V_{RMS} - 1 min - 10 mA max. (between terminals and board)
Insulation Resistance	≥ 10^6 MΩ
Inductance	≤ 0.1 µH

DIMENSIONS

Standard Package	TO-263 style (D^2PAK)

SPECIAL FEATURES				
Resistance Values	≥ 0.010	≥ 0.045	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Requirement Temperature Coefficient (TCR) (- 55 °C + 150 °C) IEC 60115-1	± 1100 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 ppm/°C

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	IEC 60115-1 §4.13 1.7 Pr 5 s for $R < 2\ \Omega$ 1.4 Pr 5 s for $R \geq 2\ \Omega$ US < 1.5 UL	± (0.25 % + 0.005 Ω)
Load Life	IEC 60115-1 1000 h, 90/30 Pr at + 25 °C	± (1 % + 0.005 Ω)
High Temperature Exposure	AEC-Q200 REV C conditions: MIL-STD-202 method 108 1000 h, + 175 °C, unpowered	± (0.25 % + 0.005 Ω)
Temperature Cycling	Pre-conditioning 3 reflows according JESTD020D IEC 60068-2-14 test Na 1000 cycles, - 55 °C, + 175 °C Dwell time - 15 min	± (0.5 % + 0.005 Ω)
Moisture Resistance	AEC-Q200 REV C conditions: MIL-STD-202 method 106 10 cycles, 24 h, unpowered	± (0.5 % + 0.005 Ω)
Biased Humidity	AEC-Q200 REV C conditions: MIL-STD-202 method 103 1000 h, 85 °C, 85% RH	± (1 % + 0.005 Ω)
Operational Life	AEC-Q200 REV C conditions: Pre-conditioning 3 reflows according JESTD020D MIL-STD-202 method 108 1000 h, 90/30, powered, + 125 °C	± (1 % + 0.005 Ω)
ESD Human Body Model	AEC-Q200 REV C conditions: AEC-Q200-002 25 kV_{AD}	± (0.5 % + 0.005 Ω)
Vibration	AEC-Q200 REV C conditions: MIL-STD-202 method 204 5 *g*'s for 20 min, 12 cycles test from 10 Hz to 2000 Hz	± (0.5 % + 0.005 Ω)
Mechanical Shock	AEC-Q200 REV C conditions: MIL-STD-202 method 213 100 *g*'s, 6 ms, 3.75 m/s 3 shocks/direction	± (0.5 % + 0.005 Ω)
Board Flex	AEC-Q200 REV C conditions: AEC-Q200-005 bending 2 mm, 60 s	± (0.25 % + 0.01 Ω)
Terminal Strength	AEC-Q200 REV C 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	IEC 60115-1 IEC 60068-2-58 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

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 exeed 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 or fluid cooling 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 measure 4.28 °C/W. 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 D2TO35 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:

$\Delta T = 175\ °C - 25\ °C = 150\ °C$

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

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

Single Pulse:

These informations are for a single pulse on a cold resistor at 25 °C (not already used for a dissipation) and for pulses of 100 ms maximum duration.

The formula used to calculate *E* is:

$$E = P \times t = \frac{U^2}{R} \times t$$

with:

E (J): Pulse energy

P (W): Pulse power

t (s): Pulse duration

U (V): Pulse voltage

R (W): Resistor

The energy calculated must be less: than that allowed by the graph.

Repetitive or Superimposed Pulses:

The following formula is used to calculate the “equivalent” energy of a repetitive pulse or the “equivalent energy” of a pulse on a resistor that is already dissipating power.

$$E_c = E \times \left(1 + \frac{P_a}{P_r}\right)$$

with:

E_c (J): Equivalent pulse energy

E (J): Known pulse energy

P_r: Resistor power rating

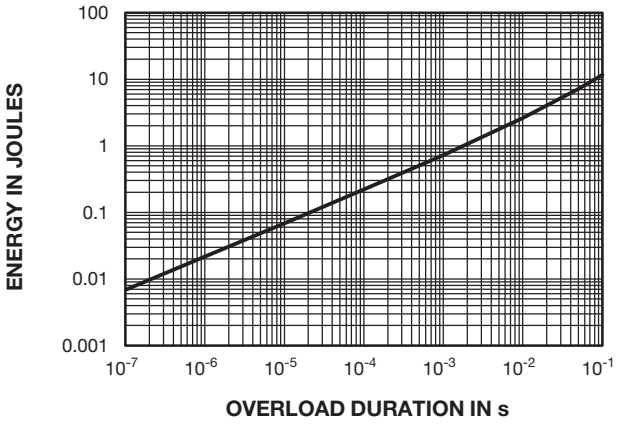
P_a: Mean power being dissipated

The energy calculated must be less than that allowed by the graph and the average power dissipated (P_a) must not exceed the continuous power of resistor.

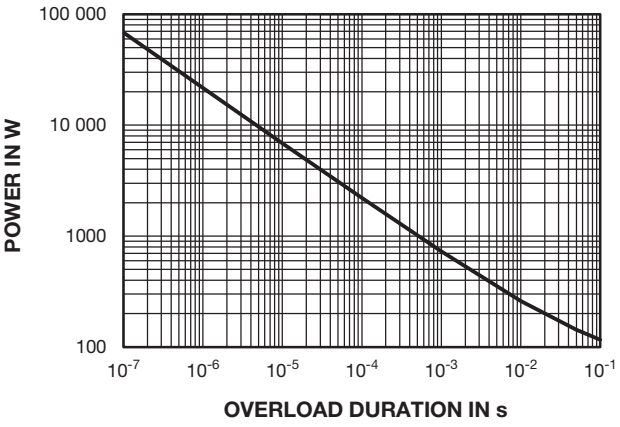
OVERLOADS

In any case the applied voltage must be lower than the maximum overload voltage of 750 V. The values indicated on the graph below are applicable to resistors in air or mounted onto a board.

ENERGY CURVE

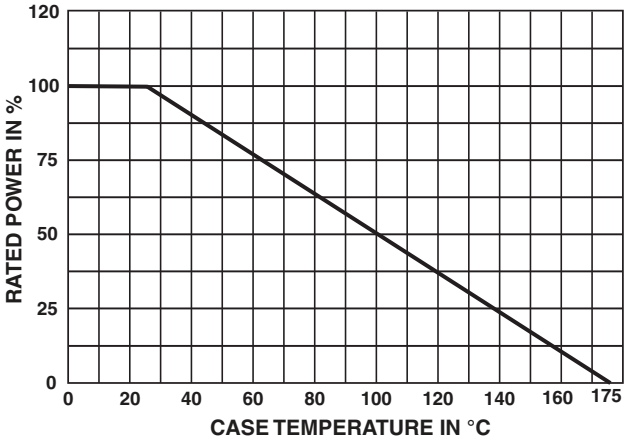


POWER CURVE



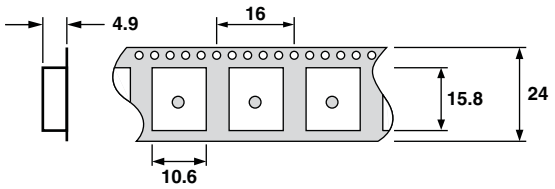
POWER RATING

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



PACKAGING

- Reel
- Tube
- Tape dimensions (mm) for reel:



MARKING

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

ORDERING INFORMATION

D2TO	35	C	100 kΩ	± 1 %	XXX	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	LEAD (Pb)-FREE
				F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 %	Optional on request: Shape, etc.	

SAP PART NUMBERING GUIDELINES

D	2	T	O	0	3	5	C	R	2	0	0	0	K	R	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
D2TO	**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 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**R** = Reel 500 pieces **T** = Tube 50 pieces	**E3** = Pure tin

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