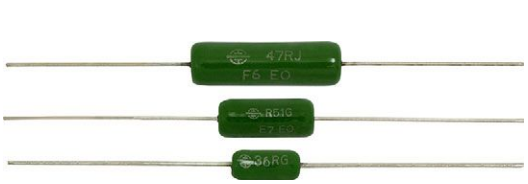
Axial Vitreous Leaded Wirewound Resistors with CECC Approval, Available with Established Reliability



FEATURES

- CECC 40201-801 approval options:
  - Version A, failure rate level E0
  - Version E, with established reliability, failure rate level E7
- High power dissipation in a small design
- Excellent pulse load capability
- Vitreous coating
- Non-flammable and enhanced humidity protection
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

The FDG, FDK and FDP resistors, with completely welded construction, are the perfect choice for high continuous power dissipation up to 11.5 W. The established reliability and failure rate level E0 and E7 is demonstrated within CECC qualification. The components of this series are well suited for harsh environments and exhibit a long lifetime. With their high pulse power capability, they are the ideal choice for inrush limiters. Typical applications include but are not limited to power supplies, voltage dividers, AC filters, and snubber resistors. Particular requirements can be submitted to a Vishay Draloric application engineer specifying peak voltage, pulse shape, pulse duration, and environmental conditions for review.

APPLICATIONS

- Inrush current limiter
- Power supplies
- Snubber resistor
- Filter resistor

TECHNICAL SPECIFICATION

TYPE	RATED DISSIPATION P_{25}	RATED DISSIPATION P_{70}	RESISTANCE RANGE (1)	RESISTANCE TOLERANCE	OPERATING VOLTAGE $U_{max.}$	TEMPERATURE COEFFICIENT
FDG	3.5 W	3.0 W	0.10 Ω to 10.0 kΩ	± 5 %	100 V	+100 ppm/K to +180 ppm/K
			0.10 Ω to 10.0 kΩ	± 2 %		
FDK	6.5 W	5.5 W	0.10 Ω to 39.0 kΩ	± 5 %	200 V	
			0.10 Ω to 22.0 kΩ	± 2 %		
FDP	11.5 W	10 W	0.15 Ω to 68.0 kΩ	± 5 %	350 V	
			0.15 Ω to 33.0 kΩ	± 2 %		

Notes

- The operating temperature range for these resistors is from -55 °C up to 350 °C
- The failure rate level E7 (10^{-7}/h, πQ = 0.1) corresponds to MIL Level R, is superior to level E6 (10^{-6}/h, πQ = 0.3) or level E5 (10^{-5}/h, πQ = 1) and thus may be used as a replacement

(1) Resistance values are to be selected for ± 5 % from the E12 series, and for ± 2 % from the E24 series

PACKAGING

TYPE	CODE	DESCRIPTION	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
FDG	4C	AC G73	500	Taped acc. IEC 60286-1, fan-folded in a box	73 mm	10 mm	324 mm x 101 mm x 49 mm
	F1	R1 R73	1000	Taped acc. IEC 60286-1, on a reel	73 mm	10 mm	Ø 271 mm x 108 mm
FDK	4B	AB G73	250	Taped acc. IEC 60286-1, fan-folded in a box	73 mm	10 mm	324 mm x 101 mm x 49 mm
	7B	AB G88	250		88 mm	10 mm	324 mm x 111 mm x 75 mm
	FC	RC R73	500	Taped acc. IEC 60286-1, on a reel	73 mm	10 mm	Ø 271 mm x 108 mm
	IC	RC R88	500		88 mm	10 mm	Ø 271 mm x 118 mm
FDP	LA	LA	100	Bulk	-	-	225 mm x 140 mm x 70 mm

Notes

- Width is the nominal spacing between tapes, with the nominal tape width on both sides being 6 mm, and pitch is the nominal standard spacing between components; tolerances apply according to IEC 60286-1
- On reels, the flanges are regular octagons with a span of 250 mm, and the arbor hole is Ø 20 mm

PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: FDPCEE031809JLA000

F	D	P	C	E	E	0	3	1	8	0	9	J	L	A	0	0	0

TYPE	VERSION	VARIANT	RESISTANCE	TOLERANCE	PACKAGING	SPECIAL
FDG **FDK** **FDP**	**CEE0** = CECC 40201-801, Version A **CEE7** = CECC 40201-801, Version E failure rate level E7	**3** = +100 ppm/K to +180 ppm/K	**3 digit value** **1 digit multiplier** MULTIPLIER **7** = $*10^{-3}$ **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$	**G** = ± 2 % **J** = ± 5 %	**4C** **F1** **4B** **7B** **FC** **IC** **LA**	**000** = standard **3 digit code** = customized version

PRODUCT DESCRIPTION: G206 18R 5 % LA CECC 40201-801S FDP E0

G206	18R	5 %	LA	CECC 40201-801S FDP E0
TYPE	RESISTANCE	TOLERANCE	PACKAGING	VERSION
G202 = FDG **G204** = FDK **G206** = FDP	**1R2** = 1.2 Ω **12K** = 12 kΩ	± **2 %** ± **5 %**	**AC G..** **R1 R..** **AB G..** **RC R..** **LA**	**CECC 40201-801S FDP E0** = Version A **CECC 40201-801S FDP E7** = Version E failure rate level E7

Note

- The products can be ordered using either the PRODUCT DESCRIPTION or the PART NUMBER

DESCRIPTION

Vitreous wirewound resistors are best suited for the use in demanding environmental conditions. Their rugged design and durable coatings enable these resistors to withstand extreme environmental stress. The vitreous coating is designed for high stability and a long lifetime in humid environments. The coating is resistant to all cleaning chemicals commonly used in the electronic industry.

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. The winding is done with specific materials on a specially developed fine ceramic body (Al_2O_3). The ceramic meets the highest requirements against mechanical resistance, thermal shocks, dielectric strength, and insulation resistance at high temperatures. With different diameters and turn spacings, a large ohmic value range can be offered. The glaze is fired layer by layer, several times, at a high temperature (> 600 °C). The resistors are marked with resistance and tolerance, and in addition the FDG, FDK and FDP are marked with the failure rate level. Product quality is verified by resistance measurement, performed on 100 % of the individual resistors.

Established reliability products within a package unit are from the same production lot and carry the same date code.

Resistance is measured on the lead wires at a distance of 6 mm from the resistor body. If a greater length of lead wire is used in the application, the user may need to consider the additional wire resistance, particularly with low resistance products.

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein [(1)]
- The Global Automotive Declarable Substance List (GADSL) [(2)]
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) [(3)] for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree. Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

ASSEMBLY

The resistors are axial leaded for soldering. The terminals of the resistors are completely lead (Pb)-free. The special tin plating used, provides compatibility with lead (Pb)-free and lead-containing soldering processes.

Special lead forms may be available on request, please inquire at ww1resistors@vishay.com.

These components are high dissipation power resistors, customers are advised to use a high melting point solder.

APPLICATION INFORMATION

The power dissipation of the resistor generates a temperature rise with respect to the ambient. The permissible dissipation is derated for temperatures above 70 °C, as shown in the derating diagram, in order to avoid overheating of the resistor. The heat dissipated from the resistor may affect adjacent components, hence proper clearance will be required in order to avoid overheating.

The resistive wire is hermetically encapsulated. All materials used are non-flammable and inorganic.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

RELATED PRODUCTS

For the related G200 product family, without CECC approval, see the datasheet:

- “G200 - Axial Vitreous Leaded Wirewound Resistors” www.vishay.com/doc?21002

In lower continuous power applications and less demanding environmental conditions the cement coated alternatives, like the AC series or the Z300 series, might be suitable, see the datasheets:

- “AC Series - Cemented Leaded Wirewound Resistors” www.vishay.com/doc?28730
- “Z300 - Industrial Axial Cemented Leaded Wirewound Resistors” www.vishay.com/doc?21007

For precision applications, there is the cement coated PAC series, see the datasheet:

- “PAC Series - Cemented Leaded Wirewound Precision Resistors” www.vishay.com/doc?28731

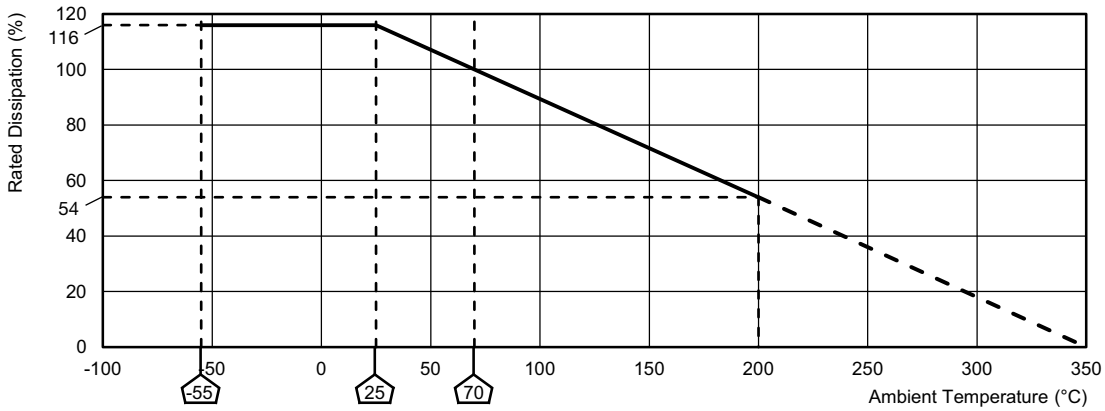
Notes

(1) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474

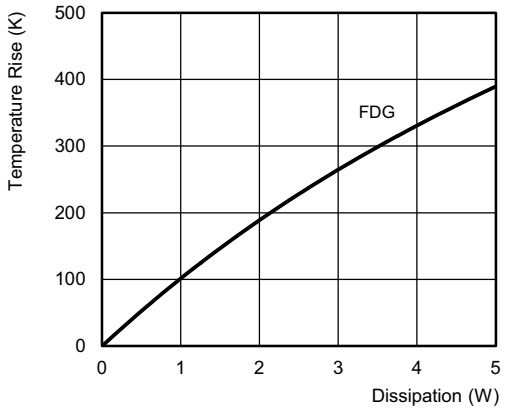
(2) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council, and available at www.gadsl.org

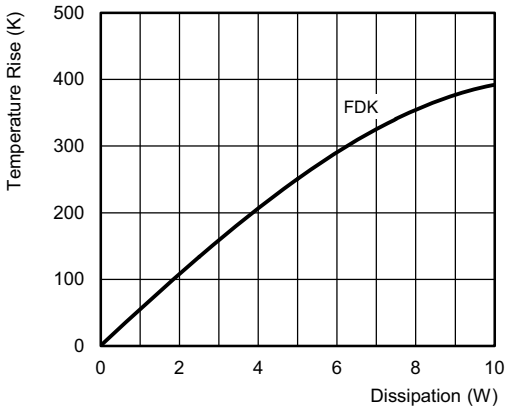
(3) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table

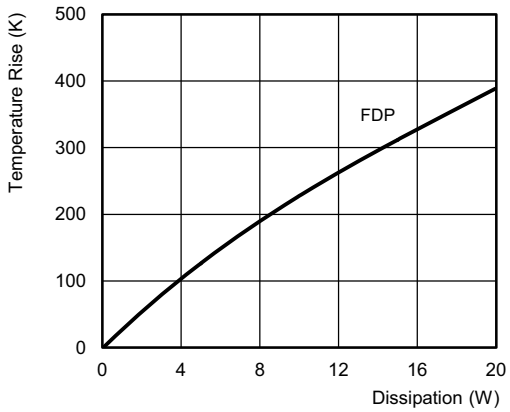
DERATING according to CECC 40201-801



TEMPERATURE RISE







The requirements stated in the Test Procedures And Requirements table are based on the required and permitted limits of CECC 40201-801. However, a number of improvements against those minimum requirements have been included. The testing temperatures LCT = -55 °C and UCT = 200 °C are established with the climatic category -55 / 200 / 56 as defined in CECC 40201-801.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD (1)	TEST	PROCEDURE		REQUIREMENTS PERMISSIBLE CHANGE (ΔR) STABILITY CLASS 5 OR BETTER
4.5	-	Resistance	-		± 2 %; ± 5 %
4.7	-	Voltage proof	**V-block-method; $U_{RMS} = U_{ins}$; 60 s**		No flashover or breakdown
			Type	**U_{ins}**	
			FDG	300 V	
			FDK	400 V	
			FDP	500 V	
4.8	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 200 / 20) °C		+100 ppm/K to +180 ppm/K
4.13	-	Short time overload	Overload voltage = $\sqrt{10}$ x rated voltage		± (0.5 % R + 0.05 Ω) no visible damage
			Type	**Duration**	
			FDG	5 s	
			FDK	6 s	
			FDP	10 s	
4.16	21 (Ua_1) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending and torsion		± (0.25 % R + 0.05 Ω) no visible damage
4.17	20 (Ta)	Solderability	Solder bath method; SnPb40; non-activated flux (235 ± 5) °C; (2 ± 0.2) s		Good tinning (≥ 95 % covered) no visible damage
			Solder bath method; SnAg3Cu0.5; non-activated flux; (245 ± 5) °C; (3 ± 0.3) s		
4.18	20 (Tb, Method 1A)	Resistance to soldering heat	Unmounted components; (260 ± 3) °C; (10 ± 1) s		± (0.25 % R + 0.05 Ω) no visible damage
4.19	14 (Na)	Rapid change of temperature	30 min at LCT = -55 °C 30 min at UCT = 200 °C 5 cycles		± (0.25 % R + 0.05 Ω) no visible damage
4.21	27 (Ea)	Shock	Acceleration: 981 m/s^2 Pulse duration: 11 ms Wave form: half sine 3 successive shocks to be applied in each perpendicular direction		± (0.25 % R + 0.05 Ω) no visible damage
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s^2; 6 h		± (0.25 % R + 0.05 Ω) no visible damage

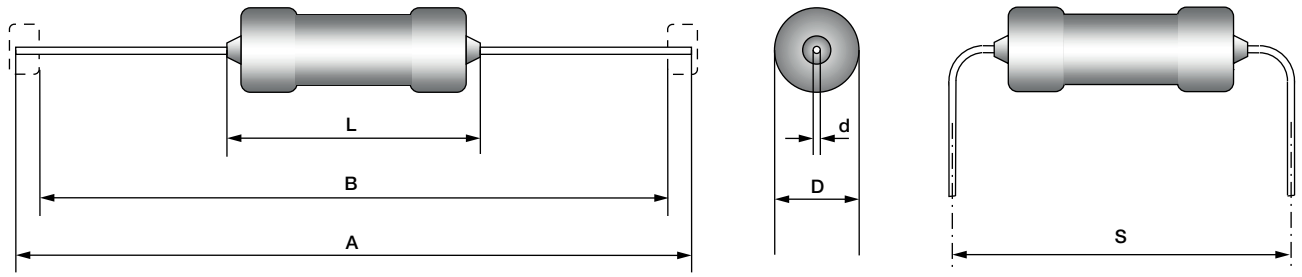
TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD (1)	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR) STABILITY CLASS 5 OR BETTER
4.23				
4.23.2	2 (Bb)	Climatic sequence	Dry heat 200 °C; 16 h	± (0.5 % R + 0.05 Ω)
4.23.3	30 (Db)		Damp heat, cyclic 55 °C; 24 h; 90 % to 100 % RH; 1 cycle	
4.23.4	1 (Ab)		Cold -55 °C; 2 h	
4.23.5	13 (M)		Low air pressure; 1.0 kPa; 2 h; 15 °C to 35 °C	
4.23.6	30 (Db)		Damp heat, cyclic 55 °C; 24 h; 95 % to 100 % RH; 5 cycles	
4.25.2	-	Endurance at room temperature	$P_{test} = 1.16 \times P_{70}$ $U_{test} = \sqrt{1.16 \times P_{70} \times R} \leq U_{max.}$ $t_{on} = 1.5$ h; $t_{off} = 0.5$ h	
			25 °C; 1000 h	± (3.0 % R + 0.05 Ω)
			25 °C; 8000 h	± (6.0 % R + 0.05 Ω)
4.25.3	-	Endurance at upper category temperature	$P_{test} = P_{cat} = 0.54 \times P_{70}$ $U_{test} = \sqrt{0.54 \times P_{70} \times R} \leq U_{max.}$ 200 °C; 1000 h	± (3.0 % R + 0.05 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.5 % R + 0.05 Ω)

Note

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents

DIMENSION AND MASS



TYPE	$L_{max.}$ (mm)	$D_{max.}$ (1) (mm)	d (mm)	B (mm)	A (mm)	$S_{min.}$ (2) (mm)	MASS (g)
FDG	13.0	6.0	0.8	73.0 ± 1.0	83.0 ± 0.3	17.5	1.0
FDK	20.0	8.0	0.8	73.0 ± 1.0	83.0 ± 0.3	25.0	2.2
				88.0 ± 1.0	98.0 ± 0.3		
FDP	32.5	10.5	0.8	-	107.0 ± 2.0	40.0	6.5

Notes

(1) The body diameter is 0.5 mm larger for resistance values ≤ 10 Ω

(2) Minimum pitch

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