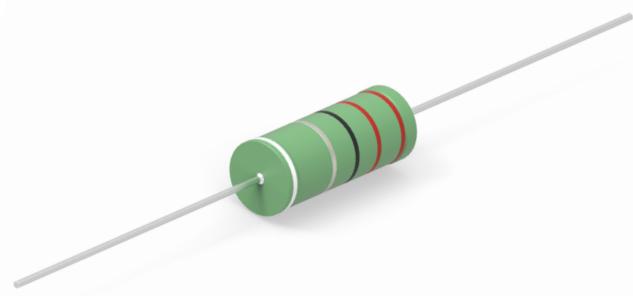


FUSIBLE WIRE WOUND FIXED RESISTOR

TYPE FWFU SERIES

INTRODUCTION

TE Connectivity (TE)'s Fusible Wire Wound Fixed (FWFU) Resistor are a special type of resistor that also act as a safety fuse. They allow current to flow normally but break the circuit when the current exceeds a safe level, protecting electronic devices from damage. These resistors are commonly used in power supplies, chargers, and household appliances to help prevent overheating and short circuits. Unlike traditional fuses, they provide some resistance before they "blow," making them useful for controlling inrush current.



FEATURES

- UL recognised (UL1412) : UL file no.
- Power up to 7 watts
- RoHS compliant with no exemptions
- Moisture sensitivity level-MSL1
- Flame resistant coating meets UL 94 VO requirements
- Fusing time up to 120s

APPLICATIONS

- LED lighting/LED Drivers
- EV chargers
- Power supply
- Test measurement equipment
- Surge protection and voltage divider
- Energy meter

ELECTRICAL CHARACTERISTICS

Size	Standard Size					Small Size					
	Type	FWFU 1W	FWFU 2W	FWFU 3W	FWFU 5W	FWFU 7W	FWFU 1WSS	FWFU 1WS	FWFU 2WS	FWFU 3WS	
Rated Power @70°C Watts		1	2	3	5	7	1	1	2	3	
Resistance tolerance	±5%										
Ohmic value Min (Ω)	R47					10R	R47				
Ohmic value Max (Ω)	240R					47R	-	240R			
Dielectric withstand Voltage	1000VAC										
Max working voltage	RCWV = $\sqrt{P \times R}$										
Max overload voltage	2.5 $\sqrt{P \times R}$										
Operating temperature	-55°C - 155°C										
Climatic category	55/155/42										
Net weight (mg)	630	990	1620	2590	3940	185	350	630	990		

Fusible Wire Wound Fixed Resistor

Type FWFU Series

POWER RATING

Resistors shall have a power rating based on continuous full load operation at an ambient temperature of 70°C. For temperature in excess of 70°C, the load shall be derated as shown on the derating curve.

VOLTAGE RATING

Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{(P \times R)}$$

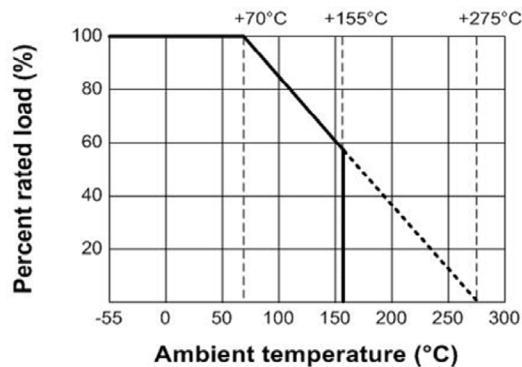
Where: $RCWV$ = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

P = Power Rating (watt)

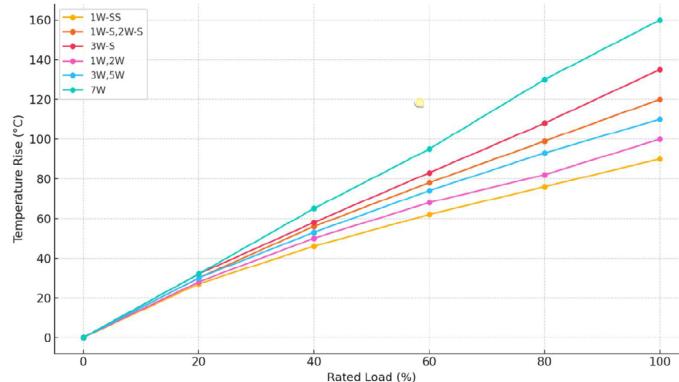
R = Nominal Resistance (ohm)

In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

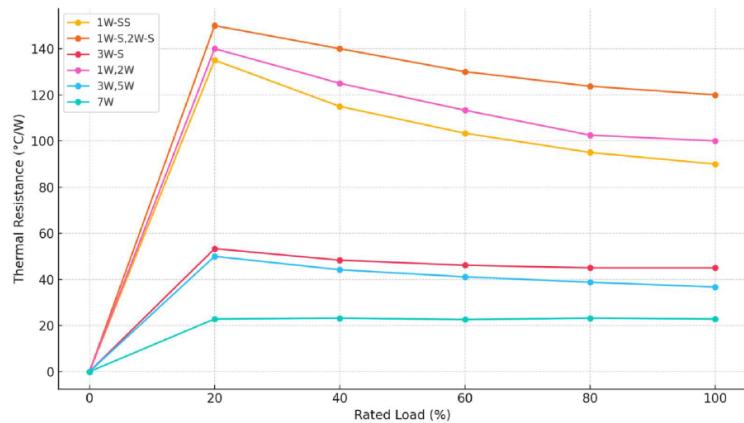
DERATING CURVE



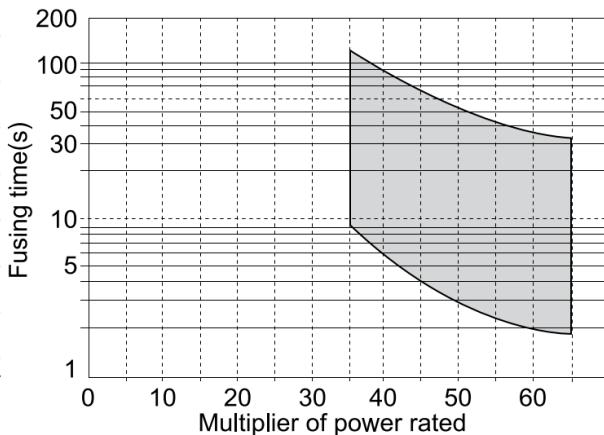
HEAT RISE CHART



THERMAL RESISTANCE



FUSING GRAPH

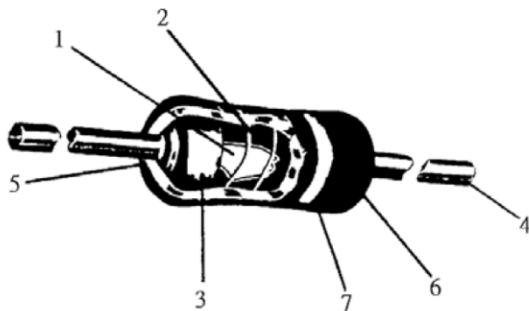


*Graphical data is provided for reference purposes only.

Fusible Wire Wound Fixed Resistor

Type FWFU Series

CONSTRUCTION



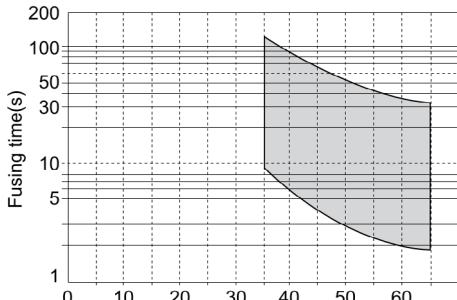
No.	Name	Material
1	Basic Body	Rod Type Ceramics
2	Resistance Wire	Resistance Wire Alloy
3	End Cap	Steel (tin plated iron surface)
4	Lead Wire	Annealed Copper wire with a tin matte finish
5	Connection	Lead wire to end cap attachment method: welded
6	Coating	Insulated and non-flame paint (colour: green)
7	Colour Code	Non-flame epoxy resin

PERFORMANCE CHARACTERISTICS

Characteristics	Limits	Test Methods (JIS C 5201-1)
DC. Resistance	Must be within the specified tolerance	The limit of error of measuring apparatus shall not exceed allowable range or 5% of the resistance tolerance (Sub-clause 4.5)
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	Resistors shall be clamped in the trough of a 90° metallic V-block or foil method use a metal foil shall be wrapped closely around the body of the resistor. After that shall be tested at AC potential respectively specified in the electrical characteristic, for 60 +10/-0 secs. (Sub-clause 4.7)
Temperature coefficient	<20Ω : ± 400 PPM/°C ≥20Ω : ± 300 PPM/°C	Natural resistance change per temp. degree centigrade. $\frac{R2-R1}{R1(t2-t1)} \times 10^6 \text{ (PPM/°C)}$ R1 : Resistance value at room temperature (t1) R2 : Resistance value at room temperature plus 100°C (t2) (Sub-clause 4.8)
Short time overload	Resistance change rate is ± (2% + 0.05Ω) Max. with no evidence of mechanical damage	Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. overload voltage, whichever is lesser for 5 seconds (Sub-clause 4.13)
Terminal strength	No evidence of mechanical damage	Direct load: Resistance to a 2.5kgs direct load for 10 secs. In the direction of the longitudinal axis of the terminal leads Twist test: Terminal leads shall be bent through 90° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations (Sub-clause 4.16)

Fusible Wire Wound Fixed Resistor

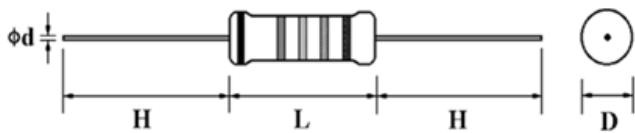
Type FWFU Series

Characteristics	Limits		Test Methods (JIS C 5201-1)															
Solderability	95% coverage Min.		<p>The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes.</p> <p>Test temp. of solder : $245^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Dwell time in solder : 2 ~ 3 seconds (Sub-clause 4.17)</p>															
Soldering temp. reference	<p>Electrical characteristics shall be satisfied. Without distinct deformation in appearance.</p> <p>(95% coverage Min.)</p>		<p>The leads immersed into solder bath to 3.2 to 4.8mm. from the body. Permanent resistance change shall be checked.</p> <p>Wave soldering condition: (2 cycles Max.) Pre-heat : $100\text{--}120^{\circ}\text{C}$, 30 ± 5 sec. Suggestion solder temp : $235\text{--}255^{\circ}\text{C}$, 10 sec. (Max.) Peak temp : 260°C</p> <p>Hand soldering condition: Hand soldering bit temp : $380\pm 10^{\circ}\text{C}$ Dwell time in solder : 3 +1/-0 sec.</p>															
Resistance to soldering heat	Resistance change rate is $\pm(1\% + 0.05\Omega)$ Max. with no evidence of mechanical damage		<p>Permanent resistance change when leads immersed to 3.2mm to 4.8mm from the body in $350^{\circ}\text{C} \pm 10^{\circ}\text{C}$ solder for 3 ± 0.5 seconds.(Sub-clause 4.18)</p>															
Temperature cycling	Resistance change rate is $\pm(2\% + 0.05\Omega)$ Max. with no evidence of mechanical damage		<p>Resistance change after continuous 100 cycles for duty shown below:</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$</td> <td>30 mins</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>10~15 mins</td> </tr> <tr> <td>3</td> <td>$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$</td> <td>30 mins</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>10~15 mins</td> </tr> </tbody> </table> <p>(Sub-clause 4.19)</p>	Step	Temperature	Time	1	$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$	30 mins	2	Room temp.	10~15 mins	3	$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$	30 mins	4	Room temp.	10~15 mins
Step	Temperature	Time																
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2	Room temp.	10~15 mins																
3	$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$	30 mins																
4	Room temp.	10~15 mins																
Load life in humidity	Resistance change rate is $\pm(5\% + 0.05\Omega)$ Max. with no evidence of mechanical damage		<p>Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity test chamber controlled at $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 90 to 95% relative humidity (Sub-clause 4.24.2.1)</p>															
Load life	Resistance change rate is $\pm(5\% + 0.05\Omega)$ Max. with no evidence of mechanical damage		<p>Permanent resistance change after 1,000 hours operating at RCWV with duty cycle of (1.5 hours "on", 0.5 "hour off") at $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ambient (Sub-clause 4.25.1)</p>															
Flammability	No ignition of the tissue paper or scorching of the pine wood board		<p>V-0 or V-1 are acceptable. Electrical test not required (UL 94 rating)</p>															
Fusing test	<p>Resistance should be opened (The resistance value is over than 50 times from before test value) follow fusing curve condition</p> <table border="1"> <thead> <tr> <th>Magnification of power</th> <th>Fusing</th> </tr> </thead> <tbody> <tr> <td>35 times</td> <td>120s (max)</td> </tr> </tbody> </table>		Magnification of power	Fusing	35 times	120s (max)	 <p>Fusing curve</p>											
Magnification of power	Fusing																	
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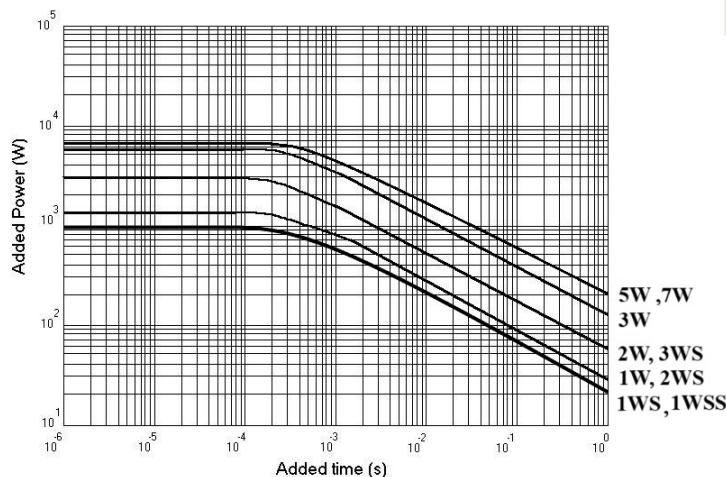
Fusible Wire Wound Fixed Resistor

Type FWFU Series

DIMENSIONS (Unit:mm)

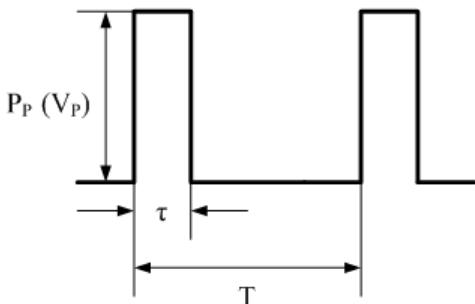


PULSE LIMIT POWER



Type	D (Max)	L (Max)	d ± 0.05	H ± 3
FWFU 1W	5.0	12.0	0.70	28
FWFU 2W	5.5	16.0	0.70	28
FWFU 3W	6.5	17.5	0.75	28
FWFU 5W	8.0	20.0	0.75	38
FWFU 7W	8.5	25.0	0.75	38
FWFU 1WSS	3.0	8.5	0.54	28
FWFU 1WS	4.3	9.0	0.6	28
FWFU 2WS	5.0	12.0	0.7	28
FWFU 3WS	5.5	16.0	0.7	28

PULSE CHARACTERISTICS (REPEAT)



Withstand pulse limit power is calculated by the next method.

$$P_p = K \cdot P \cdot T / \tau$$

$$V_p = \sqrt{(K \cdot P \cdot R \cdot T / \tau)}$$

Reference to the right about a fixed number of $V_{p \max}$

• $T > 1(s) \rightarrow T = 1(s)$

• $T / \tau > 100 \rightarrow T / \tau = 100$

• $P_p < P \rightarrow P$ stands for P_p ($V_p < V_R \rightarrow V_R$ stands for V_p)

• Added voltage $\leq V_{p \max}$

• P_p or V_p is referent value

Condition : Pulse added time = 1000h

Resistance change = ±5%

Room temperature

P_p : Pulse limit power (W)

V_p : Pulse limit voltage (V)

τ : Pulse continuous times (s)

T : Period (s)

V_R : Rated voltage (V)

P : Rated power (W)

R : Nominal resistance (Ω)

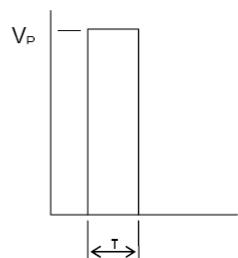
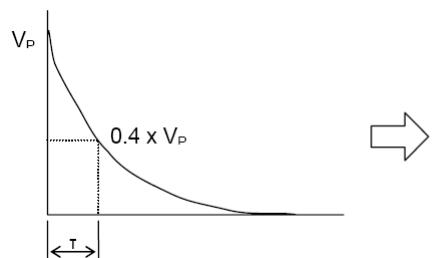
$V_{p \max}$: Max pulse limit voltage (V)

Type	Power	K	V_p max
FWFU	All power rate	0.70	500

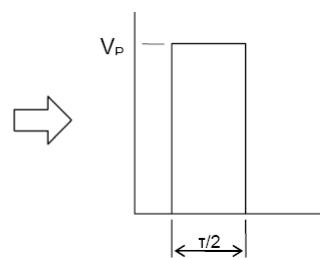
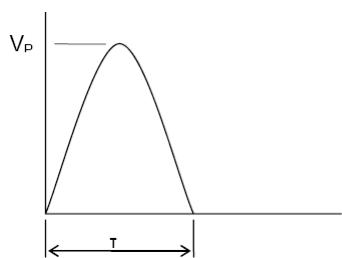
Fusible Wire Wound Fixed Resistor

Type FWFU Series

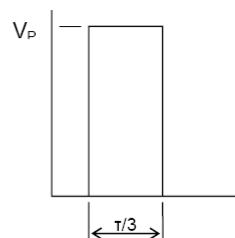
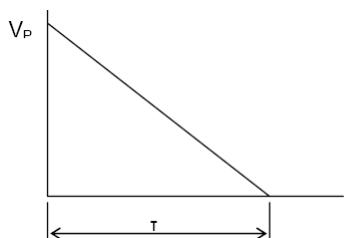
THE DISCHARGE WAVEFORM OF A CAPACITOR



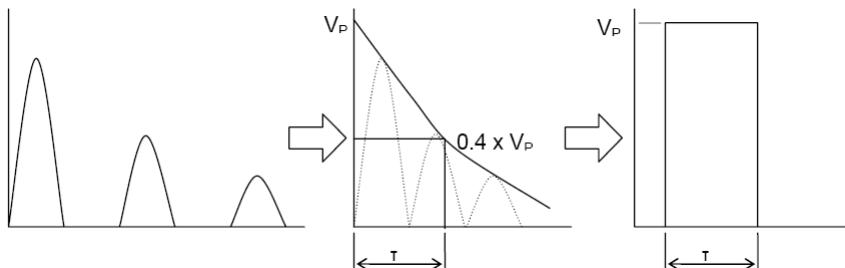
SINE CURVE



TRIANGULAR WAVE

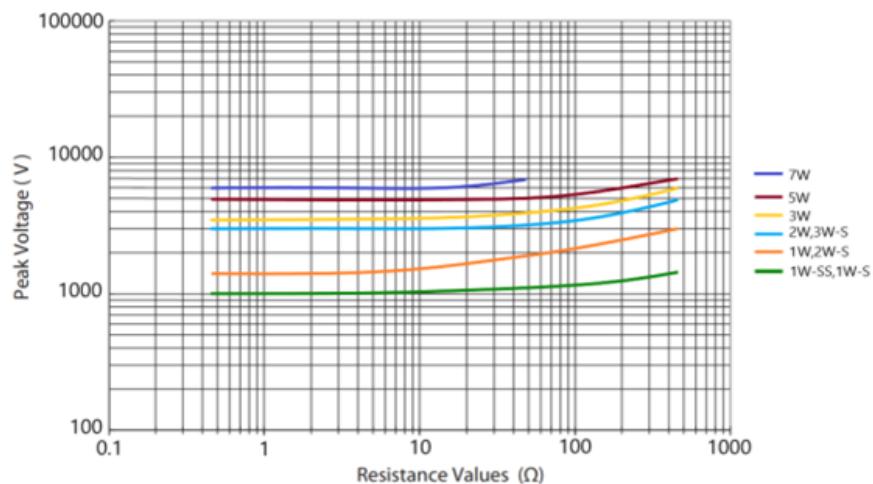


SPECIAL WAVE



1.2/50 μ S LIGHTNING SURGE

(IEC61000-4-5)

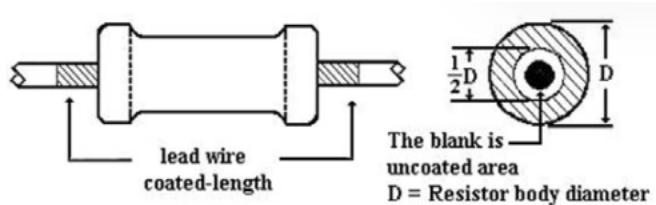


Fusible Wire Wound Fixed Resistor

Type FWFU Series

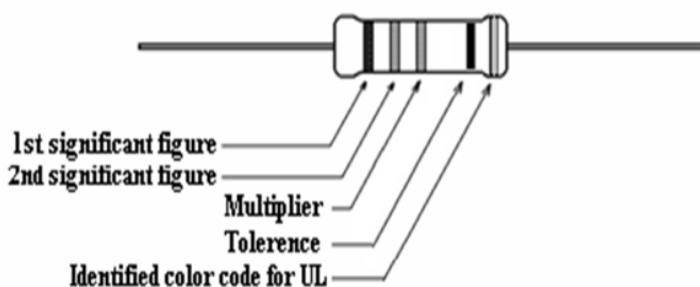
PAINTING METHOD

Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover. The extent should be within $\frac{1}{2}$ of cap diameter



MARKING

Resistors shall be marked with colour coding. Colours shall be in accordance with JIS C 0802



LABELS

Label shall be marked with the following items:

TYCO Pn	5-2176794-7
DESC	FWFU 5W $\pm 5\%$ 100 R
QTY	1000 Pcs.
LOT	5220228 RT008-04
REF	TEST RoHS 3 (2015/863/EU)
 DC : 2522 	

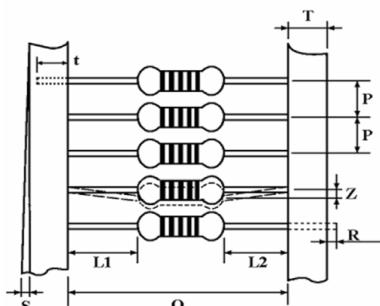
- (1) Type and style, resistance tolerance, nominal resistance
- (2) Quantity
- (3) Lot number

Fusible Wire Wound Fixed Resistor

Type FWFU Series

PACKAGING

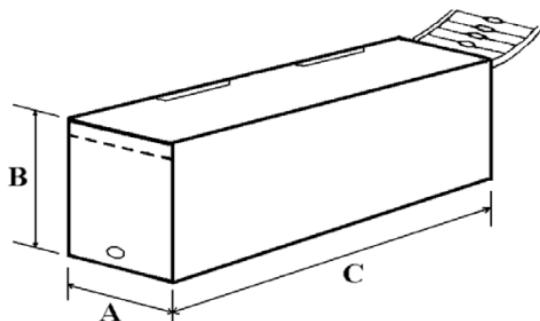
TAPING DIMENSIONS (mm)



Type	Style	O`	P	L1-L2	T	Z	R	t	S
FWFU 1W	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
FWFU 2W	PT-64	64 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
FWFU 3W	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	6 ± 1	0.5 Max.
FWFU 1WSS	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
FWFU 1WS	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
FWFU 2WS	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
FWFU 3WS	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	6 ± 1	0.5 Max.

TAPE IN BOX PACKAGING (mm)

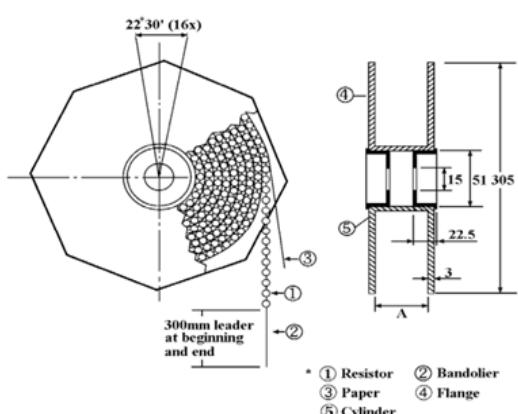
AMMO PACK



Type	Style	C ±5	A ±5	B ±5	Quantity Per Box (pcs)
FWFU 1W	PT-52	262	86	80	1,000
FWFU 2W	PT-64	262	92	108	1,000
FWFU 3W	PT-64	256	92	80	500
FWFU 1WSS	PT-52	260	85	70	1,000
FWFU 1WS	PT-52	262	92	106	1,000
FWFU 2WS	PT-52	262	86	80	1,000
FWFU 3WS	PT-64	262	92	108	1,000

TAPE ON REEL PACKAGING (mm)

(On request)

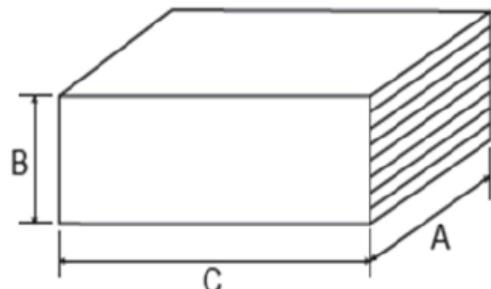


Type	Style	Across Flange (A)	Quantity Per Reel
FWFU 1W	PT-52	73 ± 2	2,500
FWFU 2W	PT-64	81 ± 5	1,000
FWFU 3W	PT-64	81 ± 5	500
FWFU 1WSS	PT-52	73 ± 2	2,500
FWFU 1WS	PT-52	73 ± 2	2,500
FWFU 2WS	PT-52	73 ± 2	2,500
FWFU 3WS	PT-64	81 ± 5	1000

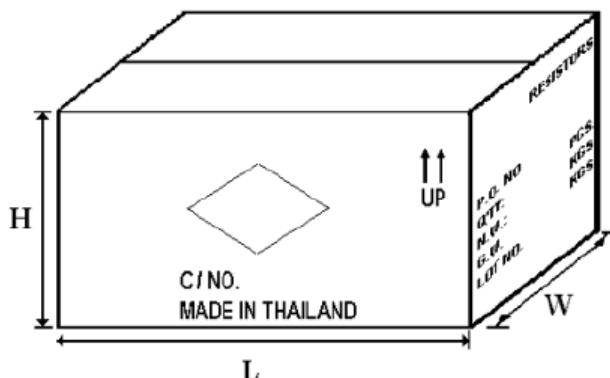
Fusible Wire Wound Fixed Resistor

Type FWFU Series

BOX PACKING (PLASTIC CASE) (mm)



BULK IN INNER BOX PACKING (PLASTIC CASE) (mm)



Type	C ± 5	A ± 5	B ± 5	Quantity Per Case/Box (pcs.)	L ± 5	W ± 5	H ± 5	Quantity Per Case/Box (pcs.)
FWFU 5W	36	20	8	100/1000	350	175	90	4,000
FWFU 7W	36	20	8	100/1000	350	175	90	4,000

ENVIRONMENTAL RELATED SUBSTANCE

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product. This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorfluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

STORAGE CONDITION

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and a relative humidity of 60%RH ± 10%RH, chemical and dust free atmosphere.

Even within the above guarantee periods, do not store these products in the following conditions, otherwise their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_2
2. In direct sunlight

ORDERING INFORMATION

Part Number	
FWFU 1W 6R8 J	
Common Part	
FWFU	Fusible Wire Wound Resistor UL Approved
Tolerance	
J	5%
Power Rating	
Standard Size	
1W	1W
2W	2W
3W	3W
5W	5W
7W	7W
Small Size (Available on demand)	
1WSS	1W
1WS	1W
2WS	2W
3WS	3W
Resistance Value	
R10	100 mohm (100mΩ)
1R0	1 ohm (1Ω)
10R	10 ohm (10Ω)
100R	100R (100Ω)

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