SF25F/W_Q, SF20F/W_Q, SF10F/W_Q, SF12F/W_Q, SF08F/W_Q, SF06F/W_Q, SF04F/W_Q.

±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05% .

TC15,TC10.

Anti-Sulfuration .

High Power&Precision Thin Film Chip Resistors

Size 2512, 2010, 1210, 1206, 0805, 0603, 0402

AEC - Q200 Compliant.

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RoHS COMPLIANT

Pb Pb-Free

*Contents in this sheet are subject to change without prior notice.

FEATURE

1. SMD metal film resistor

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2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR: 15 /10 ppm/K and below per customer request
4. Low current noise
5. RoHS compliant and lead free
6. AEC-Q200 compliant
7. Sulfuration resistant against ASTM B-809-95*

APPLICATION

- Automotive
- Medical equipment
- Measuring instrument
- Communication device
- Computer
- Printer

DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive layer that is applied to the top surface of the substrate. The composition of the resistive layer is adjusted to give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For environmental soldering issue, the outer layer of these end terminations is a Lead-free solder .

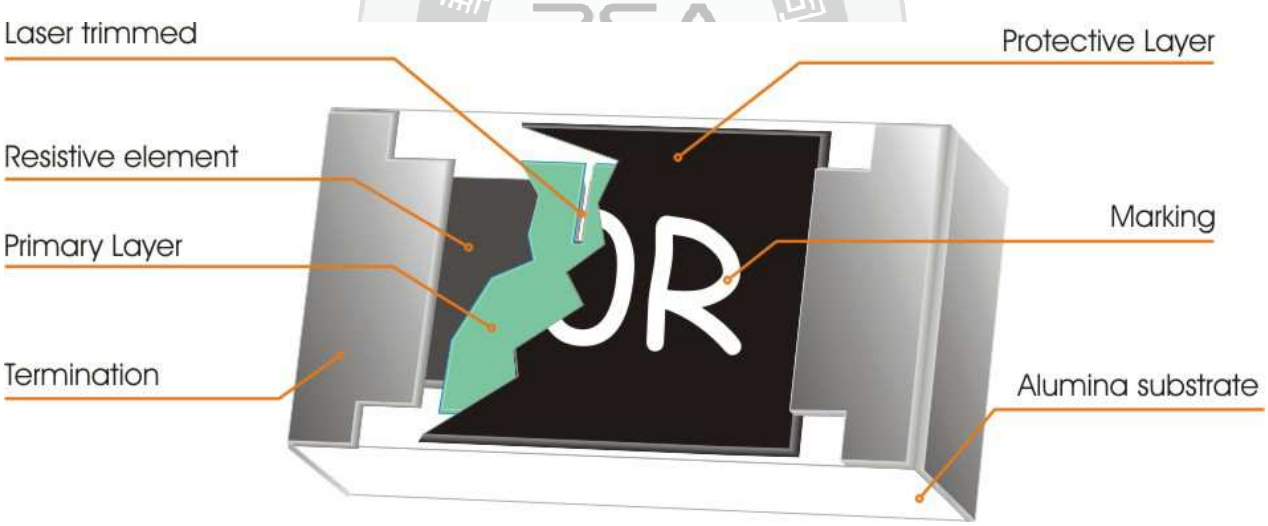


Fig 1. Construction of Chip-R SFxxF&W_Q

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QUICK REFERENCE DATA

Item	General Specification						
Series No.	SF25 F&W_Q	SF20 F&W _Q	SF10 F&W_Q	SF12 F&W_Q	SF08 F&W _Q	SF06 F&W _Q	SF04 F&W _Q
Size Code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±1.0%, ±0.5%, ±0.25%, ±0.1%, ±0.05%						
Resistance Range	10Ω ~ 1.5MΩ	10Ω ~ 900KΩ	10Ω ~ 400KΩ	10Ω ~ 300KΩ	10Ω ~ 200KΩ	10Ω ~ 100KΩ	10Ω ~ 20KΩ
TCR	±15 / 10 ppm/°C						
Max. Dissipation at T_{amb}=70°C	1W	3/4W	2/5W	1/4W	1/8W	1/10W	1/10W
Max. Operation Voltage	200V	200V	200V	200V	150V	75V	50V
Max. Overload Voltage	400V	400V	400V	400V	300V	150V	100V
Operating Temperature	- 55~ +155'C						

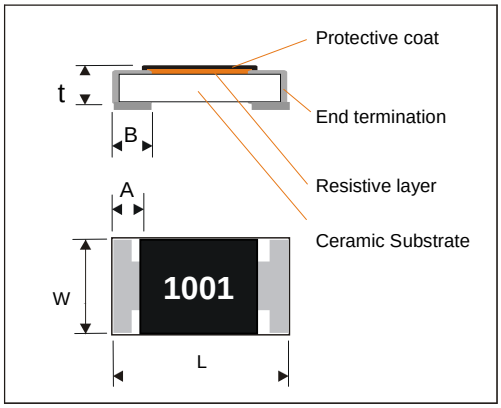
Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

   $RCWV = \sqrt{Rated\,Power \times Resistance\,Value}$ or Max. RCWV listed above, whichever is lower.
3. Tolerance ±0.01% is upon requested

DIMENSIONS:(unit:mm)

Type	SF25_Q	SF20_Q	SF10_Q	SF12_Q	SF08_Q	SF06_Q	SF04_Q
L	6.35 ± 0.10	5.00 ± 0.10	3.10 ± 0.10	3.05 ± 0.15	2.00 ± 0.10	1.55 ± 0.10	1.00 ± 0.10
W	3.20 ± 0.15	2.50 ± 0.15	2.60 ± 0.15	1.55 ± 0.15	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
A	0.60 ± 0.20	0.60 ± 0.20	0.50 ± 0.20	0.40 ± 0.20	0.25 ± 0.20	0.25 ± 0.15	0.30 ± 0.15
B	0.90 ± 0.25	0.60 ± 0.25	0.50 ± 0.20	0.40 ± 0.20	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10
t	0.55 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.10	0.45 ± 0.10	0.35 ± 0.05



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MARKING

- ***3-digits marking for 0603 size***

SFxxF/W has same marking rule as WRxx ±1%.

Nominal resistance	Description
1.E-24 series	As *0603 WR06X* ±5%.
2.E-96 series	The 1st two digit codes are referring to the CODE on the table, the 3rd code is the index of resistance value : Y=10^{-2}，X=10^{-1}，A=10^{0}，B=10^{1}，C=10^{2}，D=10^{3}，E=10^{4}，F=10^{5} EX : 17.8Ω=25X，178Ω=25A，1K78 =25B 17K8=25C， 178K=25D， 1M78=25E
3. Remark	There is no marking for the items are not under E-24 and E-96 series

CODE	R_value	CODE	R_value	CODE	R_Value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value
01	**100**	13	**133**	25	**178**	37	**237**	49	**316**	61	**422**	73	**562**	85	**750**
02	**102**	14	**137**	26	**182**	38	**243**	50	**324**	62	**432**	74	**576**	86	**768**
03	**105**	15	**140**	27	**187**	39	**249**	51	**332**	63	**442**	75	**590**	87	**787**
04	**107**	16	**143**	28	**191**	40	**255**	52	**340**	64	**453**	76	**604**	88	**806**
05	**110**	17	**147**	29	**196**	41	**261**	53	**348**	65	**464**	77	**619**	89	**825**
06	**113**	18	**150**	30	**200**	42	**267**	54	**357**	66	**475**	78	**634**	90	**845**
07	**115**	19	**154**	31	**205**	43	**274**	55	**365**	67	**487**	79	**649**	91	**866**
08	**118**	20	**158**	32	**210**	44	**280**	56	**374**	68	**499**	80	**665**	92	**887**
09	**121**	21	**162**	33	**215**	45	**287**	57	**383**	69	**511**	81	**681**	93	**909**
10	**124**	22	**165**	34	**221**	46	**294**	58	**392**	70	**523**	82	**698**	94	**931**
11	**127**	23	**169**	35	**226**	47	**301**	59	**402**	71	**536**	83	**715**	95	**953**
12	**130**	24	**174**	36	**232**	48	**309**	60	**412**	72	**549**	84	**732**	96	**976**

- ***4-digits marking for 2512, 2010, 1210, 1206, 0805 size***

For E24+E96, each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For values below 97Ω6 the R is used as a digit. For values of 100Ω or greater, the first 3 digits are significant, the fourth digit indicates the number of multiple to follow.

Example

RESISTANCE	100Ω	6800Ω	47000Ω
4-digits marking	1000	6801	4702

- ***No marking code for 0402 size***

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E192 & E24 series for resistors with a tolerance of ±1.0%, ±0.5%, ±0.25%, ±0.1%,±0.05%The values of the E24/E192 series are in accordance with “IEC publication 60063”.

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Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2

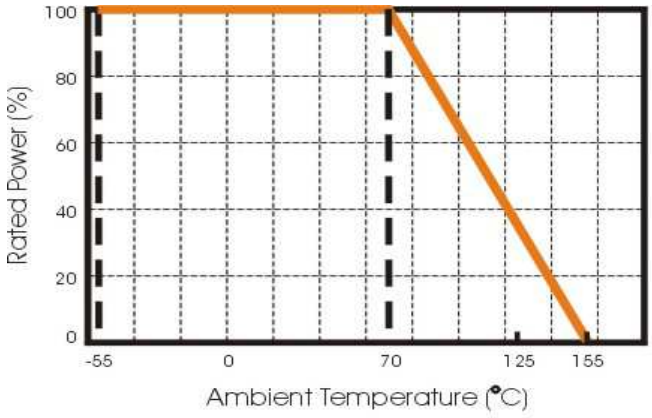


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

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SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds within lead-free solder bath. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering profile and condition that provide reliable joints without any damage are given in Fig 3. and Table 1.

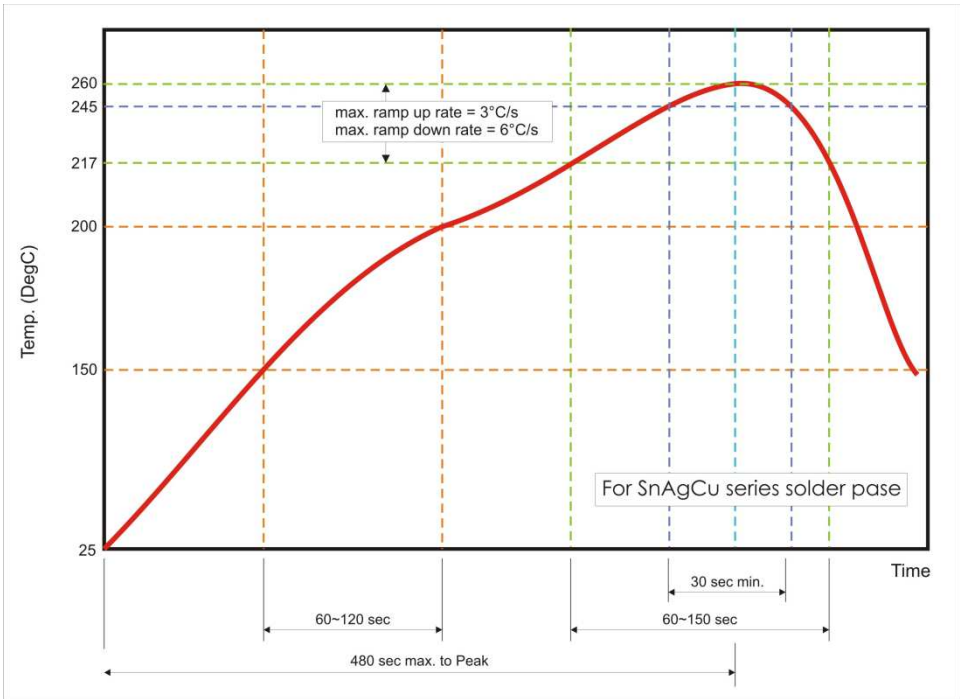


Fig. 3 Infrared soldering profile for Chip Resistors

Table 1. Infrared soldering condition for Chip Resistors

Temperature Condition	Exposure Time
Average ramp-up rate (217°C to 260°C)	Less than 3°C/second
Between 150 and 200°C	Between 60-120 seconds
> 217°C	Between 60-150 seconds
Peak Temperature	260ºC +0/-5°C
Time within 245°C	Min. 30 seconds
Ramp-down rate (Peak to 217°C)	Less than 6°C/second
Time from 25°C to Peak	No greater than 480 seconds

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CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

SF06	F/W	xxxx	B	T	L	Q
Size code SF25: 2512 SF20: 2010 SF10: 1210 SF12: 1206 SF08: 0805 SF06: 0603 SF04: 0402	**Type code** F: TCR = 15 ppm W: TCR = 10 ppm	**Resistance code** R is first code followed by 3 significant digits. 100Ω =1000 37.4KΩ =3742	**Tolerance** A : ±0.05% B : ±0.10% C : ±0.25% D : ±0.50% F : ±1.00%	**Packaging code** T : 7” Reel taping	**Termination code** L : lead free	**Special code** Q : AEC-Q200 compliant

1. Reeled tape packaging: 8mm width paper taping.
   5,000pcs/reel for SF10_Q, SF12_Q, SF08_Q, SF06_Q,
   10,000pcs/reel for SF04_Q;
2. Reeled tape packaging: 12mm width paper taping
   4,000pcs/reel for SF25_Q, SF20_Q.

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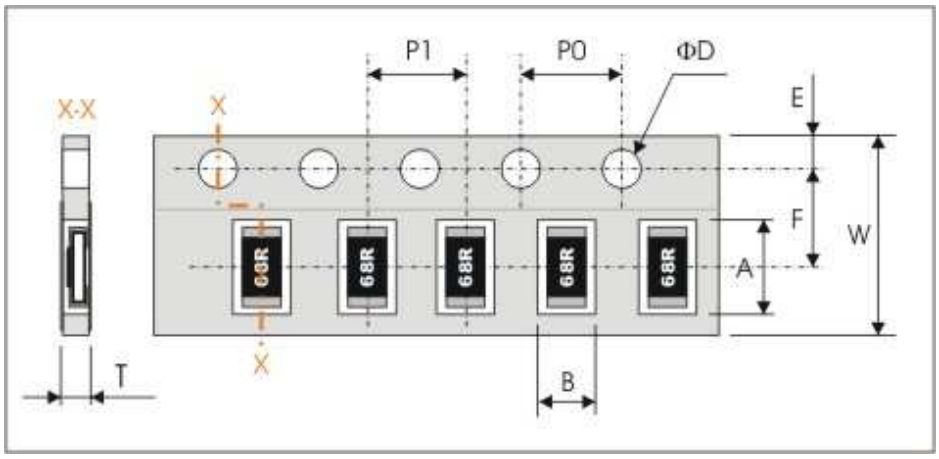
TEST AND REQUIREMENTS

TEST	PROCEDURE	REQUIREMENT
		Resistor
Electrical Characteristics **IEC 60115-1 4.8**	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/ C) t_1 : 20℃+5℃-1℃ R_1 : Resistance at reference temperature (20℃+5℃/-1 ℃) R_2 : Resistance at test temperature (-55℃ or +125℃)	Within the specified tolerance
Short time overload (S.T.O.L) **IEC60115-1 4.13**	Permanent resistance change after a 5second application of a voltage 2.5 times RCWV or the maximum overload voltage specified in the above list, whichever is less.	R/R max. ±(0.25%+0.05Ω)
Resistance to soldering heat(R.S.H) **MIL-STD-202 Method 210**	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260℃±5ºC	no visible damage R/R max. ±(0.25%+0.05Ω)
Solderability **IEC 60068-2-58**	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235℃±5℃	good tinning (>95% covered) no visible damage
Temperature cycling **MIL-STD-202 Method 107**	Test –55 to 125℃/ dwell time 30min/ Max transfer time 20sec 1000 cycles	no visible damage R/R max. ±(0.3%+0.05Ω)
Biased Humidity **MIL-STD-202 Method 103**	Test 1000 hours at 85℃/85%RH. 10% of operation power. Measurement at 24±4 hours after test conclusion.	R/R max. (0.5%+0.05Ω)
Operational Life **MIL-STD-202 -108**	1000 hours at 125±2℃, loaded with rated power cont inuously	R/R max. (0.5%+0.05Ω)
High Temperature Exposure **MIL-STD-202 -108**	1000 hours at 155℃, un-powered	R/R max. (0.3%+0.05Ω)
Mechanical Shock **MIL-STD-202 Method 213**	1/2 Sine Pulse / 100g Peak / Velocity 15.4ft/sec	R/R max. (0.25%+0.05Ω)
Vibration **MIL-STD-202 Method 204**	5 g's for 20 min , 12 cycles each of 3 orientations	R/R max. (0.1%+0.05Ω)
Terminal strength **AEC-Q200-006**	1 kg for 60 s	No broken
Board flex **AEC-Q200-005**	Bending 2mm for 60 sec	R/R max. (0.1%+0.05Ω)
Flower of Sulfur **ASTM-B-809-95*** *** Modified**	Sulfur 1000 hours, 105℃, unpowered	R/R max. (4%+0.05Ω)

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PACKAGING

Paper Tape specifications (unit :mm)

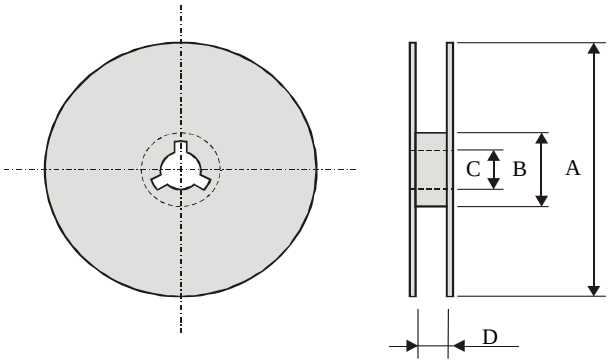


Series No.	Tape	A	B	W	F	E
SF25	Plastic	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
SF20	Plastic	5.50±0.20	2.80±0.20	12.00±0.30	5.50±0.10	1.75±0.10
SF10	Paper	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
SF12	Paper	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
SF08	Paper	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.20	1.75±0.10
SF06	Paper	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.20	1.75±0.10
SF04	Paper	1.20±0.10	0.7±0.10	8.00±0.30	3.50±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
SF25	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 1.2
SF20	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max 1.2
SF10	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.0
SF12	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.0
SF08	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.0
SF06	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.65±0.05
SF04	2.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.40±0.05

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Reel dimensions



SF25 , SF20

Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	14.0±0.5

SF12 ,

Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

SF10 , SF08 , SF06, SF04

Taping quantity

- Chip resistors 4,000 pcs per reel (SF25_Q, SF20_Q)
- Chip resistors 5,000 pcs per reel (SF10_Q, SF12_Q, SF08_Q, SF06_Q)
- Chip resistors 10,000 pcs per reel (SF04_Q)

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