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Lead Type Capacitors with Varistor Function VFC2 H

Murata Reference Specification [AEC-Q200]

1.Scope

This reference specification applies to Lead Type Capacitors With Varistor Function for Automotive Electronics based on AEC-Q200.

2.Part Numbering

 VF
 C
 2
 H
 R7
 1 D
 1 0 5
 K
 2
 K 1
 A

 ①
 ②
 ③
 ④
 ⑤
 ⑥
 ⑦
 ⑧
 ⑨
 ⑩

①Structure C: Capacitors with Varistor Function

②Style 2:2012Size

3Features

4 Temperature Characteristics

⑤Rated Voltage

⑥Capacitance

Marked three digits system.(Ex. 1.0pF→105)

7 Capacitance Tolerance

8 Varistor Voltage (1:22V, 2:27V, 3:33V, 4:47V, 5:68V, 6:82V)

9Lead Type

3.Rating

| Customer Part Number | Part Number | Capacitance value ,Tolerance | Temperature Characteistics | Rated Voltage (DC) | Varistor Voltage (V ₁ mA) | Voltage Ratio (V ₁ mA / V _{0.1} mA) | |
|-------------------------|-------------------|------------------------------|-------------------------------|--------------------------|--------------------------------------------|---------------------------------------------------------------|--|
| | VFC2HL81C474K1M1A | 470nF±10% | | | | 1.17max. | |
| | VFC2HL81C474K1K1B | 170111 21070 | | 16V | 22V | T. T. Tillax. | |
| | VFC2HL81C105K1M1A | 1.00/ | ±15% | 10 V | +5/-0V | 1.12max. | |
| | VFC2HL81C105K1K1B | 1.0uF±10% | (~125°C) | | | 1.1211148. | |
| | VFC2HL81D474K2M1A | 470nF±10% | +15%/-40% | | | 1.17max. | |
| | VFC2HL81D474K2K1B | 470HF±10% | (125°C~150°C) | 22V | 27V +5/-3V | 1.17IIIax. | |
| | VFC2HL81D105K2M1A | 10 5:100 | | | | 1.12max. | |
| | VFC2HL81D105K2K1B | 1.0uF±10% | | | | | |
| | VFC2HR71C474K1M1A | 470-51100/ | | | | 1.17max. | |
| | VFC2HR71C474K1K1B | 470nF±10% | | 16V | 22V +5/-0V | 1.17IIIax. | |
| | VFC2HR71C105K1M1A | 1.0 | | | | 1.12max. | |
| | VFC2HR71C105K1K1B | 1.0uF±10% | | | | 1.12IIIdX. | |
| | VFC2HR71D474K2M1A | 470 5:400/ | | | | 4.47 | |
| | VFC2HR71D474K2K1B | 470nF±10% | 1450/ | 00)/ | 27V | 1.17max. | |
| | VFC2HR71D105K2M1A | | ±15% | 22V | +5/-3V | | |
| | VFC2HR71D105K2K1B | 1.0uF±10% | | | | 1.12max. | |
| | VFC2HR71E474K3M1A | 470°E1100/ | | | | 1.12max. | |
| | VFC2HR71E474K3K1B | 470nF±10% | | 001/ | 33V | 1.12IIIdX. | |
| | VFC2HR71E105K3M1A | 1.0uF±10% | | 26V | +6/-0V | 1.10max. | |
| | VFC2HR71E105K3K1B | 1.0UF±10% | | | | 1.TUIIIax. | |

| Customer Part Number | Part Number | Capacitance value ,Tolerance | Temperature Characteistics | Rated Voltage (DC) | Varistor Voltage (V ₁ mA) | Voltage Ratio (V ₁ mA / V _{0.1} mA) | |
|-------------------------|-------------------|------------------------------|-------------------------------|--------------------------|--------------------------------------------|---------------------------------------------------------------|--|
| | VFC2HR71F474K4M1A | 470nF±10% | | 34V | 47V +7/-7V | 1.12max. | |
| | VFC2HR71F474K4K1B | 470HF±10% | | | | 1.12IIIax. | |
| | VFC2HR71F105K4M1A | 4.0 | | | | 1.10max. | |
| | VFC2HR71F105K4K1B | 1.0uF±10% | ±15% | | | 1.Tumax. | |
| | VFC2HR71H104K5M1A | 100nF±10% | | 56V | 68V | 1.07max. | |
| | VFC2HR71H104K5K1B | | | 30 V | +4/-6V | 1.07max. | |
| | VFC2HR71J104K6M1A | | | 65V | 82V | 1.06max. | |
| | VFC2HR71J104K6K1B | 100111 ±10% | | 03 V | +8/-8V | 1.00max. | |

■ Operating Temperature • Storage Temperature

-55~+150°C (VFC2HL8 Series) -55~+125°C (VFC2HR7 Series)

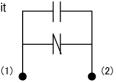
■ Insulation Resistance

 $1M\Omega$ min

■ Maximum Peak Current

200A (except VFC2HR71J104K6) 160A (for VFC2HR71J104K6)

Equivalent Circuit



■ Unit Mass (Typical value)

0.16g

4. Style and Dimensions

See item 10.

5.Marking

Capacitance : Marked three digits system. (105)

Capacitance Tolerance : Marked with code (K)
Varistor Voltage : Marked with code (2)
Trade Mark : Marked as

6.Testing Condition

<Unless otherwise specified> <In case of doubt>
Ordinary Temperature 15 to 35 °C
Temperature : 20+3

Atmospheric Pressure : 86 to 106 kPa

7. Electrical Performance

| No. | Item | Specification | | Test Method | | | | | | | | | |
|------|------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------|---------------------------|------------------|-----------------|----------------|-----------------|-----------------|----------------|
| 7.1 | Style and Dimension | Meet item 9. | | Visual Inspection and measured with Slide Calipers. | | | | | | | | | |
| 7.2. | Marking | Marking is able t easily. | o be read | Visual | Ins | pectio | n. | | | | | | |
| 7.3 | Capacitance and Tolerance | Meet item 3. | | Freque | olta/ | ige : 1 | ±0.2 | V(rms | , | | | | |
| 7.4 | Insulation Resistance(I.R.) | | | Test V | | | | | | suitab | ole re | sistor | · 1ΜΩ. |
| 7.5 | Varistor Voltage | | | Meası E | uring + | • . | ent : ` | 1 mA | A - | | | | |
| 7.6 | Resistance to Surge Current | Meet Table 1. Table 1 Appearance Varistor Voltage Change | No damaged. within ±10% | The s | Lig Su | CUTTE thtning rge nulator | | all be | appli- | ed tw | rice to | | n. |
| | | | | Wave Peak (find the notation of the notation o | curre or V | ent : 2 FC2H | 200A IR71J | 104K | | | nutes | inter | val) |
| 7.7 | Capacitance/ Varistor Temperature Characteristics | Change | No damaged. within ±15% (~125°C) within+15%/-40% (125°C~) | Capacispecific equilibiting The capacispecific step 4 Table | citan ied i oriun apac sha 3 | ice sh n Tab n. citance all be d | all be le 3 a e cha | meas ofter re | sured eachir | at ea | ich st e the | ep mal | |
| | | Varistor Voltage Change | within ±10% | Tei | ер тр. С) | 1 +20 ±2 | 2 -55 ±2 | -41 ±2 | 0 +2 | 20 +8 | | 6 125 ±2 | 7 +20 ±2 |
| | | | | Tei | ep mp. C) | 1 +20 ±2 | 2 -55 ±2 | 3 -40 ±2 | 4 +20 ±2 | 5 +85 ±2 | 6 +125 ±2 | 7 +150 ±2 | 8 +20 ±2 |

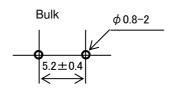


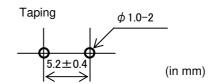
8. Q200 Requirement

8-1. Performance (based on Table 13 for Ferrite EMI SUPPRESSORS/FILTERS) AEC-Q200 Rev.D issued June. 1 2010

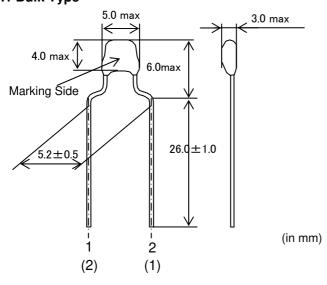
| | | AEC-Q200 | | | | |
|-----|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--|--|--|
| No. | | | Murata Specification / Deviation | | | |
| 3 | High Temperature Exposure | 1000hours at 125C Set for 24hours at room temperature, | Meet Table 4 after testing. Table 4 | | | |
| | (Storage) | then measured. Measurement at 24+/-2 hours after test conclusion. | Appearance No damaged. Capacitance within ± 10% Varistor Voltage Change within ± 10% | | | |
| 4 | Temperature | 1000cycles(-55C to 125C) | Meet Table 4 after testing. | | | |
| | Cycling | Measurement at 24±2 hours after test conclusion. | | | | |
| 5 | Destructive Physical Analysis | Per EIA469 No electrical tests | Not Applicable | | | |
| 7 | Biased Humidity | 1000hours 85C/85%RH. Apply Maximum rated Voltage. Measurement at 24+/-2 hours | Meet Table 4 after testing. | | | |
| 8 | Operational Life | after test conclusion. 1000hours at 125C Apply Maximum rated Voltage. | Meet Table 4 after testing. | | | |
| | | Measurement at 24+/-2 hours after test conclusion. | No. 1 | | | |
| 9 | External Visual | Visual inspection | No abnormalities | | | |
| 10 | Physical Dimension | Meet ITEM 10.1 (Style and Dimensions) | No defects | | | |
| 11 | Terminal | Per MIL-STD-202 Method 211 | Condition E: Not Applicable | | | |
| | Strength (Leaded) | Conditions:A,C | Lead wire should not cut off. Capacitor should not be broken. | | | |
| | Resistance to Solvents | Per MIL-STD-202 Method 215 | Not Applicable | | | |
| 13 | Mechanical Shock | Per MIL-STD-202 Method 213 Figure 1 of Method 213. Condition C(100g's/6ms/Half sine) Three times each 6 direction. | Meet Table 4 after testing. | | | |
| 14 | Vibration | 5g's for 20 minutes, 12cycles each of 3 oritentations Osscillation Frequency: 10-2000Hz. | Meet Table 4 after testing. | | | |
| 15 | Resistance to Soldering Heat | No heating. 260C +/-5 degree C Immersion time 10s | Meet Table 4 after testing. | | | |
| 17 | ESD | Per AEC-Q200-002 | Meet Table 4 after testing. ESD Rank: Refer to Item 3. Rating. | | | |
| 18 | Solderbility | Per J-STD-002 Method A | Along the circumference of terminal shall be covered with new solder at least 90%. | | | |
| | Electrical Characterization | Measured :Capacitance | No defects | | | |
| | Flammability | Per UL-94 | Not Applicable | | | |
| 21 | Board Flex | Per AEC Q200-005 | Not Applicable | | | |
| 30 | Electrical Transient Conduction | Per ISO-7637-2 | Not Applicable | | | |

9.Mounting Hole





10.Style and Dimension 10.1 Bulk Type



10.2 Taping Type

(All symbols in the illustrations below are described in Table 5.)

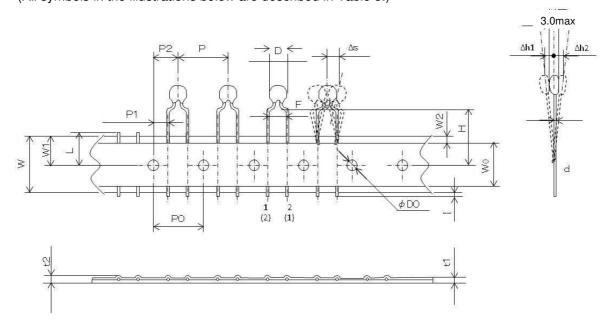


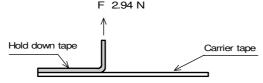
Table 5

| Code | Description | Dimensions | Remark |
|----------------|--------------------------------------------------------|--------------------------------------------|---------------------------------------------|
| Р | Pitch of Component | 12.7 | Product Inclination ΔS Determines Crossing |
| P ₀ | Pitch of Sprocket Hole | 12.7±0.2 | |
| P1 | Length from Hole Center to Lead | 3.85±0.7 | |
| P2 | Length from Hole Center to Component Center | 6.35±1.3 | Shift In Tape In Direction of Feed |
| D | Width of Body | 5.0 max. | |
| ΔS | Deviation along tape, Left or Right | 0±1.0 | |
| W | Carrier Tape Width | 18.0±0.5 | |
| W1 | Position of Sprocket Hole | 9.0± ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° | Tape Widthwise Shift |
| 1 | Protrusion Length | +0.5 ~ -1.0 | |
| D ₀ | Diameter of Sprocket Hole | φ 4.0±0.1 | |
| d | Lead Diameter | φ 0.48 | |
| t1 | Total Tape Thickness | 0.6±0.3 | Includes Thickness of |
| t2 | Total Thickness, Tape and Lead Wire | 1.5 max. | Bonding Tape |
| ∆h1 | Deviation across Tape,front | 1.0 max. | |
| ∆h2 | Deviation across Tape,rear | 1.0 max. | |
| L | Portion to Cut in Case of Defect | 11.0± ⁰ _{1.0} | |
| W 0 | Hold Down Tape Width | 12.0±0.5 | |
| W2 | Hold Down Tape Position | 1.5±1.5 | |
| Н | Lead length between sprocket hole and forming position | 18.5±1.0 | |
| F | Lead Spacing | $5.0\pm^{0.8}_{0.2}$ | |

(in mm)

11.Taping

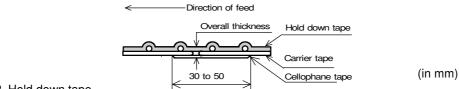
- 11.1 (1) A maximum of 0.3% of the components quantity per reel or Ammo pack may be missing without consecutive missing components.
 - (2) The adhesive power of the tape shall have over 2.94N at the following condition.



- (3) Splicing method of tape
 - 1. Carrier tape

Carrier tape shall be spliced by cellophane tape.

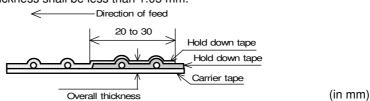
Overall thickness shall be less than 1.05 mm.



2. Hold down tape

Hold down tape shall be spliced with overlapping.

Overall thickness shall be less than 1.05 mm.



3. Both carrier tape and hold down tape

Both tapes shall be cut zigzag and spliced with splicing tape.



12. Packing

12.1 Packing quantity

Minimun Packing Form and Quantity

| Terminal Configuration | A Unit Quantity | Packing Form | | |
|------------------------|-----------------|------------------|--|--|
| Bulk | 250 pcs. | In a plastic bag | | |
| Taping | 2000 pcs. | In an Ammo pack | | |

^{*} A quantity in a container is depending on a quantity of an order.

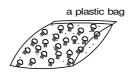
12.2 Packing Form

(1)Bulk

<A plastic bag pack>

1. Products are packed into a plastic bag.

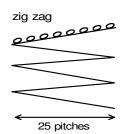
2. The plastic bags are put into a container (corrugated cardboard box) depending on a quantity of an order.





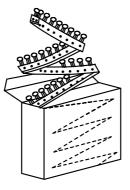
(2) Taping

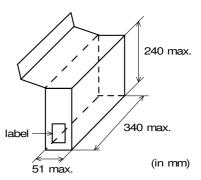
- · An ammo pack
- 1. Folding the tape per 25 pitches, products are packed into an ammo package so that each product of each layer wound zigzag is put on top of one another.
- 2. The dimensions of the ammo package are as follows.
- 3. The ammo packages are put into a container (corrugated cardboard box) depending on a quantity of an order.
- 4. Not less than 3 consecutive of component shall be missing on both edge of tape.



The unloading direction: Right The hold down tape: Upper

The product body: Left along the unloading direction







13. Marking on package

13.1 Unit Package

Bulk : Marked on a plastic bag.

Taping: Marked on a label stuck on a reel.

Marking on a unit package consists of:

Customer part number, MURATA part number, Inspection number(*1), RoHS marking(*2), Quantity, etc

*1) « Expression of Inspection No. » 0000

(1) Factory Code (2) Date

First digit Second digit : Year / Last digit of year

: Month / Jan. to Sep. \rightarrow 1 to 9, Oct. to Dec. \rightarrow O,N,D

Third, Fourth digit: Day

(3) Serial No.

 $ROHS - \underline{Y}(\underline{\triangle})$ *2) « Expression of RoHS marking »

- (1) RoHS regulation conformity parts.
- (2) MURATA classification number

13.2 Container

Marking on the label sticked on a container consists of :

Customer name Purchasing Order Number, Customer Part Number, MURATA part number,

RoHS marking (*2), Quantity, etc

14. 🗥 Caution

14.1 Mounting holes

Mounting holes should be designed as specified in this specifications.

Or different design from this specifications may cause cracks in ceramics which may lead to smoking / firing.

14.2 Lead Type Capacitors with Varistor Function

Products should not be applied for the absorption of surges which have large energy (ex. lighting surges, switching surges) because it is designed for the absorption of motor surges.

14.3 Caution for the product angle adjust work

Take care not to apply any mechanical stress to product body at the lead terminal bending process for product angle adjustment after insertion.

14.4 Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

(1) Aircraft equipment (7) Traffic signal equipment

(2) Aerospace equipment (8) Disaster prevention / crime prevention equipment

(3) Undersea equipment (9) Data-processing equipment

(4) Power plant control equipment (10) Applications of similar complexity and /or reliability requirements

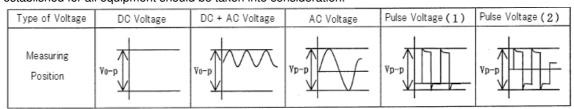
(5) Medical equipment to the applications listed in the above

(6) Transportation equipment (vehicles, trains, ships, etc.)

14.5 Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the V0-p which contains DC bias within the rated voltage range. When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

When DC-rated capacitors are to be used in input circuits from commercial power source (AC filter), be sure to use Safety Recognized Capacitors because various regulations on withstand voltage or impulse withstand established for all equipment should be taken into consideration.





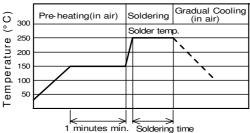
15. Notice

15.1 Soldering

(1) Use rosin-based flux. Do not use strong acidic flux with halide content exceeding 0.2(wt)% (chlorine conversion value).

Use Sn-3.0Ag-0.5Cu solder

(2) Standard flow soldering profile.



| Solder | Soldering | | |
|-------------|-----------|--|--|
| temperature | time | | |
| 250~260 °C | 4∼6s | | |

- (3) Resistance to soldering iron goes in the following condition that tip temperature is 350 °C max. and soldering time is 5 s max.
- (4) Products and the leads should not be subject to any mechanical stress during soldering process. (and also while subject to the equivalent high temperature.)
- (5) When the outer coating is hot (over 100 degreescentigrade) after soldering, it becomes soft and fragile, so please be careful not to give it mechanical stress.

15.2 Cleaning Conditions

Do not clean after soldering.

15.3 Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor with varistor function below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a highfrequency current, pulse current or similar current, it may have self-generated heat due to dielectric loss. In the case of " X7R char. Capacitors," applied voltage load should be such that self-generated heat is within 20 °C under the condition where the capacitor is subjected at an atmosphere temperature of 25 °C. When measuring, use a thermocouple of small thermal capacity -K of Ø0.1mm under conditions where the capacitor is not affected by radiant heat from other components or wind from surroundings. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.

15.4 Operating Environment

- (1) Do not use products in corrosive gases such as chlorine gas, acid or sulfide gas.
- (2) Do not use products in the environment where water, oil or organic solvents may adhere to products.
- (3) Do not adhere any resin to products, coat nor mold products with any resin (including adhesive)to prevent mechanical and chemical stress on products.

15.5 Vibration and impact

Do not expose a capacitor with varistor function or its leads to excessive shock or vibration during use.

15.6 Capacitance change of capacitor

Tenperature Charastristics: X7R

In case Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. Please contact us if you use a capacitor with varistor function in a circuit that needs a tight (narrow) capacitance tolerance (e.g., a time-constant circuit).

Spec No. JEWE243B-9101C-01



P10/10

15.7 Storage and handling requirements

(1) Storage period

Use the products within 12 months after delivered.

Solderability should be checked if this period is exceeded.

(2) Storage environment condition

To prevent products quality deterioration, storage conditions should be controlled as follows;

- 1. Temperature: -10 to 40 degrees centigrade
- 2. Humidity : 15 to 85% relative humidity
- 3. Products should be stored without sudden changes in temperature and humidity.

Don't keep products in corrosive gases such as sulfur, chlorine gas or acid,

or it may cause oxidization of lead terminals resulting in poor solderability.

- 4. Products should be stored on the palette for the prevention of the influencefrom humidity, dust and so on.
- 5. Products should be stored in the warehouse without heat shock, vibration, direct sunlight and so on.
- (3) Handling Conditions

Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

16. /!\ Note

- (1)Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
- (2) You are requested not to use our product deviating from the reference specifications.
- (3)The contents of this reference specification are subject to change without advance notice. Please approve our product specifications or transact the approval sheet for product specifications before ordering.