

## AC Line Rated Ceramic Disc Capacitors

### Class X1, 440 V<sub>AC</sub>, Class Y2, 300 V<sub>AC</sub>



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

#### FEATURES

- Complying with IEC 60384-14 4<sup>th</sup> edition
- High reliability
- Vertical (inline) kinked or straight leads
- Singlelayer AC disc safety capacitors
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

#### APPLICATIONS

- X1, Y2 according to IEC 60384-14.4
- Across-the-line
- Line by-pass
- Antenna coupling

#### DESIGN

The capacitor consists of a ceramic disc which is silver plated on both sides. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors may be supplied with vertical (inline) kinked leads having a lead spacing of 5.0 mm, 7.5 mm, 10.0 mm, or 12.5 mm. Encapsulation is made of flame retardant epoxy resin in accordance with UL 94 V-0.

#### CAPACITANCE RANGE

10 pF to 0.01  $\mu$ F

#### RATED VOLTAGE U<sub>R</sub>

IEC 60384-14 and UL60384-14:

(X1): 440 V<sub>AC</sub>, 50 Hz

(Y2): 300 V<sub>AC</sub>, 50 Hz

#### TEST VOLTAGE

Component test (100 %):

2600 V<sub>AC</sub>, 50 Hz, 2 s

(2600 V<sub>AC</sub> for LS 7.5 mm and above)

(2200 V<sub>AC</sub> for LS 5.0 mm)

Random sampling test (destructive test):

2600 V<sub>AC</sub>, 50 Hz, 60 s

Voltage proof of coating (destructive test):

2600 V<sub>AC</sub>, 50 Hz, 60 s

#### INSULATION RESISTANCE

$\geq 10\,000\,M\Omega$

#### CAPACITANCE TOLERANCE

$\pm 20\%$  (code M);  $\pm 10\%$  (code K)

#### DISSIPATION FACTOR

Class 1: max. 0.5 % (1 MHz)

Class 2: max. 2.5 % (1 kHz)

#### QUICK REFERENCE DATA

| DESCRIPTION                | VALUE  |     |               |     |
|----------------------------|--------|-----|---------------|-----|
| Ceramic Class              | 1      |     | 2             |     |
| Ceramic Dielectric         | N750   |     | Y5S, Y5U, Y5V |     |
| Voltage (V <sub>AC</sub> ) | 300    | 440 | 300           | 440 |
| Min. Capacitance (pF)      | 10     |     | 68            |     |
| Max. Capacitance (pF)      | 47     |     | 10 000        |     |
| Mounting                   | Radial |     |               |     |

#### OPERATING TEMPERATURE RANGE

-40 °C to +125 °C

#### TEMPERATURE CHARACTERISTICS

Class 1: N750 (U2J)

Class 2: Y5S, Y5U, Y5V

#### SECTIONAL SPECIFICATIONS

Climatic category (according to EN 60058-1)

Class 1 and class 2: 40/125/21

#### COATING

According to UL 94 V-0

Epoxy resin, isolating, flame retardant

#### APPROVALS

IEC 60384-14.4

UL 60384-14

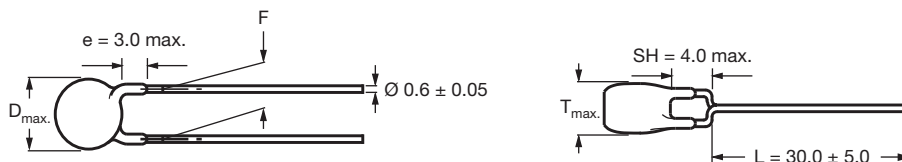
DIN EN 60384-14

CSA E60384-1:03, CSA E60384-14:09

CQC11-471112

#### PACKAGING

Bulk, tape and reel, taped ammpack

**DIMENSIONS** in millimeters


Capacitors with 5.0 mm, 7.5 mm, 10 mm, or 12.5 mm lead spacing.  
Coating extension e valid for straight leads only.

**TECHNICAL DATA**

| CAPACITANCE<br>C (pF)      | CAPACITANCE<br>TOLERANCE<br>(%) | BODY<br>DIAMETER<br>D <sub>max.</sub> (mm) | BODY<br>THICKNESS<br>T <sub>max.</sub> (mm) | LEAD SPACING <sup>(1)</sup><br>F (mm) ± 1 mm | PART NUMBER                               |
|----------------------------|---------------------------------|--------------------------------------------|---------------------------------------------|----------------------------------------------|-------------------------------------------|
|                            |                                 |                                            |                                             |                                              | MISSING DIGITS SEE<br>ORDERING CODE BELOW |
| U2J (N750)                 |                                 |                                            |                                             |                                              |                                           |
| 10                         | ± 10                            | 7.5                                        | 5.0                                         | 5.0, 7.5, 10.0, or 12.5                      | VY2100K29U2JS6###                         |
| 15                         |                                 |                                            |                                             |                                              | VY2150K29U2JS6###                         |
| 22                         |                                 |                                            |                                             |                                              | VY2220K29U2JS6###                         |
| 33                         |                                 |                                            |                                             |                                              | VY2330K29U2JS6###                         |
| 47                         |                                 |                                            |                                             |                                              | VY2470K29U2JS6###                         |
| Y5S (2C3)                  |                                 |                                            |                                             |                                              |                                           |
| 68                         | ± 10                            | 7.5                                        | 5.0                                         | 5.0, 7.5, 10.0, or 12.5                      | VY2680K29Y5SS6###                         |
| 100                        |                                 |                                            |                                             |                                              | VY2101K29Y5SS6###                         |
| 150                        |                                 |                                            |                                             |                                              | VY2151K29Y5SS6###                         |
| 220                        |                                 |                                            |                                             |                                              | VY2221K29Y5SS6###                         |
| 330                        |                                 |                                            |                                             |                                              | VY2331K29Y5SS6###                         |
| 470                        |                                 |                                            |                                             |                                              | VY2471K29Y5SS6###                         |
| Y5U (2E3)                  |                                 |                                            |                                             |                                              |                                           |
| 680                        | ± 20                            | 7.5                                        | 5.0                                         | 5.0, 7.5, 10.0, or 12.5                      | VY2681M29Y5US6###                         |
| 1000                       |                                 |                                            |                                             |                                              | VY2102M29Y5US6###                         |
| 1500                       |                                 | 8.0                                        |                                             |                                              | VY2152M31Y5US6###                         |
| 2200                       |                                 | 9.0                                        |                                             |                                              | VY2222M35Y5US6###                         |
| 3300                       |                                 | 10.5                                       |                                             |                                              | VY2332M41Y5US6###                         |
| 3900                       |                                 | 11.0                                       |                                             |                                              | VY2392M43Y5US6###                         |
| 4700                       |                                 | 12.5                                       |                                             |                                              | VY2472M49Y5US6###                         |
| 6800                       |                                 | 14.5                                       | 7.5, 10.0, or 12.5                          | VY2682M59Y5US63##                            |                                           |
| 10 000                     |                                 | 16.0                                       | VY2103M63Y5US63##                           |                                              |                                           |
| Y5V (2F3) MINI SIZE SERIES |                                 |                                            |                                             |                                              |                                           |
| 1000                       | ± 20                            | 7.5                                        | 5.0                                         | 5.0, 7.5, 10.0,<br>or 12.5                   | VY2102M29Y5VS6###                         |
| 1500                       |                                 | 7.5                                        |                                             |                                              | VY2152M29Y5VS6###                         |
| 2200                       |                                 | 8.0                                        |                                             |                                              | VY2222M31Y5VS6###                         |
| 3300                       |                                 | 9.0                                        |                                             |                                              | VY2332M35Y5VS6###                         |
| 3900                       |                                 | 10.0                                       |                                             |                                              | VY2392M39Y5VS6###                         |
| 4700                       |                                 | 10.5                                       |                                             |                                              | VY2472M41Y5VS6###                         |
| 6800                       |                                 | 12.0                                       |                                             |                                              | VY2682M47Y5VS6###                         |
| 10 000                     |                                 | 15.0                                       |                                             |                                              | VY2103M59Y5VS6###                         |

**Note**

<sup>(1)</sup> Straight leads are available on request

| ORDERING CODE |                                            |                    |                |           |                                    |                            |                    |                                                     |                                         |                                            |
|---------------|--------------------------------------------|--------------------|----------------|-----------|------------------------------------|----------------------------|--------------------|-----------------------------------------------------|-----------------------------------------|--------------------------------------------|
| ###           | 15 <sup>th</sup> to 17 <sup>th</sup> digit | Lead configuration |                |           | Available configurations see below |                            |                    |                                                     |                                         |                                            |
| Example       | VY2                                        | 221                | K              | 29        | Y5S                                | S                          | 6                  | U                                                   | V                                       | 7                                          |
|               | Series                                     | Capacitance value  | Tolerance code | Size code | Temperature coefficient            | Rated voltage              | Lead wire diameter | Packaging / lead length                             | Lead style                              | Lead spacing                               |
|               |                                            |                    |                |           |                                    | S =<br>X1/Y2<br>300 V (AC) |                    | 3 = bulk<br>T = tape<br>and reel<br>U =<br>ammopack | L =<br>straight<br>V = inline<br>kinked | 5 = 5.0<br>7 = 7.5<br>0 = 10.0<br>X = 12.5 |

### LEADSPACING 5.0 mm AND 7.5 mm

| PACKAGING |                                         |                      |      |      |
|-----------|-----------------------------------------|----------------------|------|------|
| SIZE CODE | BODY DIAMETER<br>D <sub>max.</sub> (mm) | PACKAGING QUANTITIES |      |      |
|           |                                         | BULK                 | REEL | AMMO |
| 29 to 49  | 12.5                                    | 1000                 | 1000 | 1000 |
| 59 to 63  | 16.0                                    | 500                  | -    | -    |

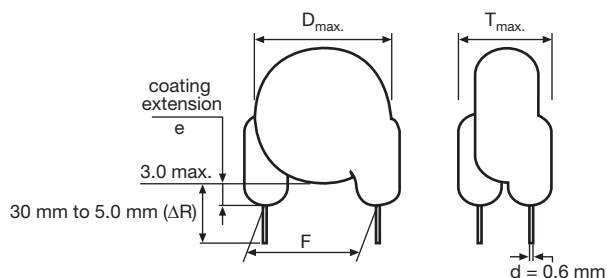
### LEADSPACING 10.0 mm AND 12.5 mm

| PACKAGING          |           |                                         |                      |      |      |
|--------------------|-----------|-----------------------------------------|----------------------|------|------|
| CAPACITANCE VALUE  | SIZE CODE | BODY DIAMETER<br>D <sub>max.</sub> (mm) | PACKAGING QUANTITIES |      |      |
|                    |           |                                         | BULK                 | REEL | AMMO |
| 10 pF to 4700 pF   | 29 to 49  | 12.5                                    | 1000                 | 500  | 750  |
| 6800 pF to 0.01 µF | 59 to 63  | 16.0                                    | 500                  | 500  | 750  |

#### Note

- The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel in ammopack.

### STRAIGHT LEADS



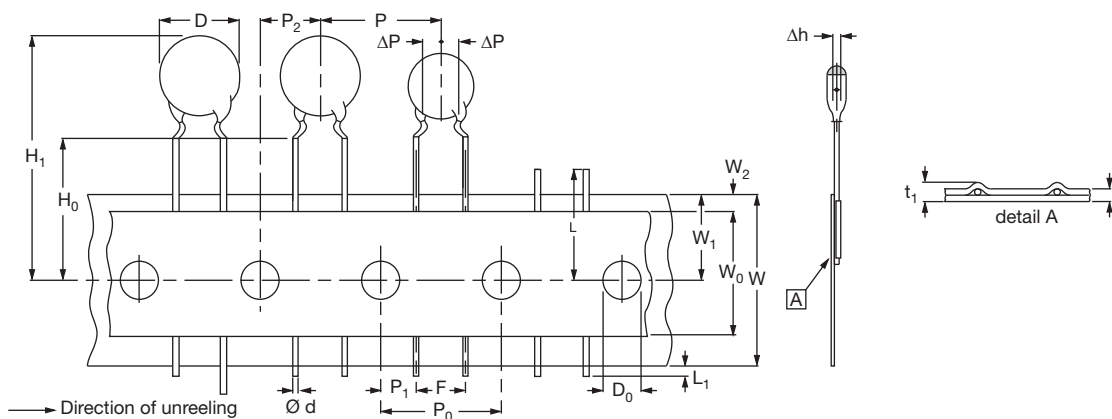


Fig. 1 - Kinked capacitors on tape, lead spacing 5.0 mm (0.2") and 7.5 mm (0.3")

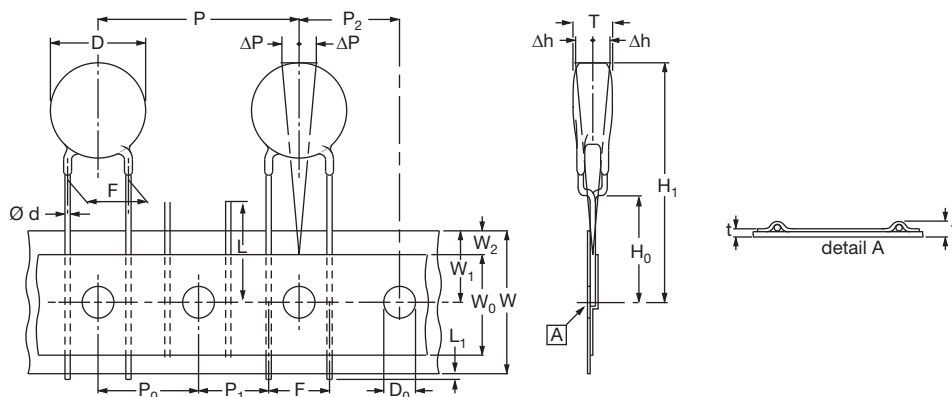


Fig. 2 - Inline kink (V) leaded capacitors on tape, lead spacing 10 mm (0.40")

| DIMENSION OF TAPE             |                                              |                   |                   |                    |
|-------------------------------|----------------------------------------------|-------------------|-------------------|--------------------|
| SYMBOL                        | PARAMETER                                    | DIMENSIONS (mm)   |                   |                    |
|                               |                                              | FIG. 1 (5 mm)     | FIG. 1 (7.5 mm)   | FIG. 2 (10 mm)     |
| D <sup>(1)</sup>              | Body diameter                                | 11.0 max.         | 14.0 max.         | 16.0 max.          |
| d                             | Lead diameter                                | 0.6 ± 0.05        | 0.6 ± 0.05        | 0.6 ± 0.05         |
| P                             | Pitch of component                           | 12.7 ± 1          | 15.0 ± 1          | 25.4 ± 1           |
| P <sub>0</sub> <sup>(2)</sup> | Pitch of sprocket hole                       | 12.7 ± 0.3        | 15.0 ± 0.3        | 12.7 ± 0.3         |
| P <sub>1</sub> <sup>(3)</sup> | Distance, hole center to lead                | 3.85 ± 0.7        | 3.75 ± 0.7        | 7.7 ± 1.0          |
| P <sub>2</sub> <sup>(3)</sup> | Distance, hole to center of component        | 6.35 ± 1.3        | 7.5 ± 1.5         | 12.7 ± 1.5         |
| F                             | Lead spacing                                 | 5.0 (+ 0.6/- 0.4) | 7.5 (+ 0.6/- 0.4) | 10.0 (+ 0.6/- 0.4) |
| Δh                            | Average deviation across tape                | ± 1.0 max.        | ± 1.0 max.        | ± 1.0 max.         |
| ΔP                            | Average deviation in direction of reeling    | ± 1.0 max.        | ± 1.0 max.        | ± 1.0 max.         |
| W                             | Carrier tape width                           | 18.0 + 1/- 0.5    | 18.0 + 1/- 0.5    | 18.0 + 1/- 0.5     |
| W <sub>0</sub>                | Hold-down tape width                         | 5.0 min.          | 5.0 min.          | 5.0 min.           |
| W <sub>1</sub>                | Position of sprocket hole                    | 9.0 + 0.75/- 0.5  | 9.0 + 0.75/- 0.5  | 9.0 + 0.75/- 0.5   |
| W <sub>2</sub>                | Distance of hold-down tape                   | 3.0 max.          | 3.0 max.          | 3.0 max.           |
| H <sub>1</sub>                | Maximum component height                     | 32                | 40                | 40                 |
| H <sub>0</sub>                | Height to seating plane (for kinked leads)   | 16.0 ± 0.5        | 16.0 ± 0.5        | 16.0 ± 0.5         |
| H <sub>0</sub>                | Height to seating plane (for straight leads) | 20.0 ± 0.5        | 20.0 ± 0.5        | 20.0 ± 0.5         |
| L                             | Length of cut leads                          | 11.0 max.         | 11.0 max.         | 11.0 max.          |
| L <sub>1</sub>                | Length of lead protrusion                    | 1.0 max.          | 1.0 max.          | 1.0 max.           |
| D <sub>0</sub>                | Diameter of sprocket hole                    | 4.0 ± 0.2         | 4.0 ± 0.2         | 4.0 ± 0.2          |
| t                             | Total tape thickness                         | 0.9 max.          | 0.9 max.          | 0.9 max.           |
| t <sub>1</sub>                | Maximum thickness of tape and wires          | 1.5 max.          | 1.5 max.          | 1.5 max.           |

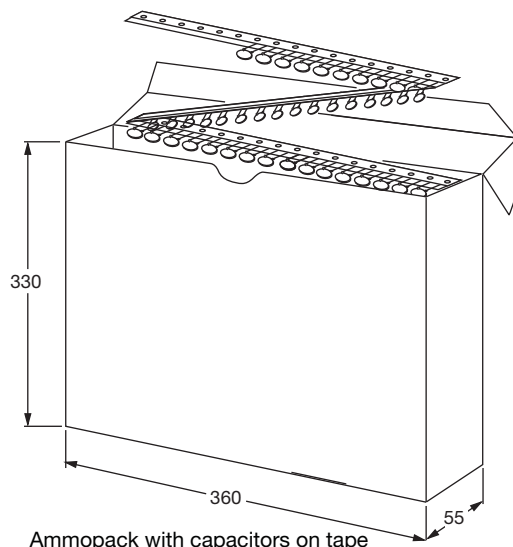
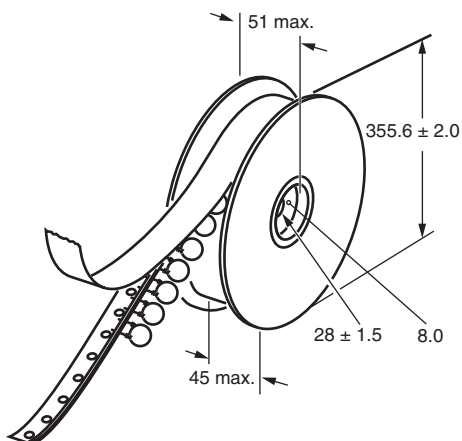
**Notes**
<sup>(1)</sup> See "Technical Data" table

<sup>(2)</sup> Cumulative pitch error: ± ≤ 1 mm/20 pitches

<sup>(3)</sup> Obliquity maximum 3°



**REEL AND TAPE DATA** in millimeters



Ammopack with capacitors on tape

**APPROVALS**

IEC 60384-14.4 - Safety tests

This approval together with CB test certificate substitutes all national approvals.

**CB Certificate**

|                                    |             |                |                     |
|------------------------------------|-------------|----------------|---------------------|
| Y2-capacitor: CB test certificate: | US-26163-UL | 10 pF to 10 nF | 300 V <sub>AC</sub> |
| X1-capacitor: CB test certificate: | US-26163-UL | 10 pF to 10 nF | 440 V <sub>AC</sub> |



**VDE**

|                                   |          |                |                     |
|-----------------------------------|----------|----------------|---------------------|
| Y2-capacitor: VDE marks approval: | 40009669 | 10 pF to 10 nF | 300 V <sub>AC</sub> |
| X1-capacitor: VDE marks approval: | 40009669 | 10 pF to 10 nF | 440 V <sub>AC</sub> |



DIN EN 60384-14 VDE 0565-1-1:2006-04 - Safety tests

**Underwriters Laboratories Inc. / Canadian Standards Association**

|                                    |         |                |                     |
|------------------------------------|---------|----------------|---------------------|
| Y2-capacitor: UL-test certificate: | E183844 | 10 pF to 10 nF | 300 V <sub>AC</sub> |
| X1-capacitor: UL-test certificate: | E183844 | 10 pF to 10 nF | 440 V <sub>AC</sub> |



UL 60384-14.1, CSA E60384-1:03 2<sup>nd</sup> edition, CSA E60384-14:09 2<sup>nd</sup> edition

Across-the-line, antenna-coupling, and line-by-pass component

**CQC**

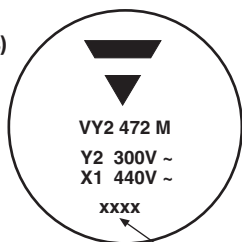
|                                     |                |                |                     |
|-------------------------------------|----------------|----------------|---------------------|
| Y2-capacitor: CQC test certificate: | CQC05001012316 | 10 pF to 10 nF | 300 V <sub>AC</sub> |
| X1-capacitor: CQC test certificate: | CQC05001012316 | 10 pF to 10 nF | 440 V <sub>AC</sub> |



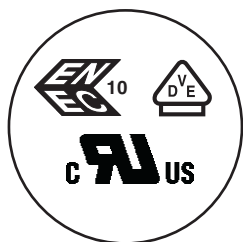


## MARKING

Sample  
(2 sides)



Front



Back



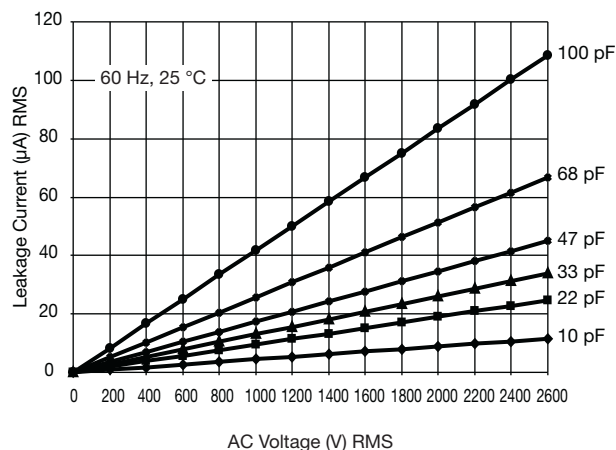
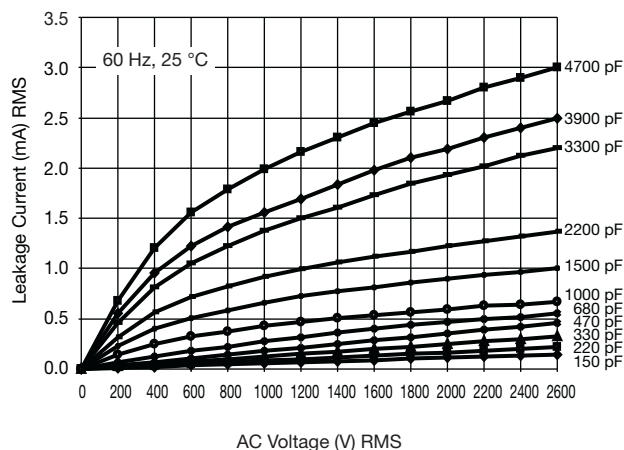
PN: VY2331K29Y5SS6UV7  
QTY: 1000  
PO:  
SO:

Lot1: 14Z549306  
Lot2:  
Batch: 200601CN  
Region: 9520  
Ser.No: 0601H72383



2/5

## LEAKAGE CURRENT VS. VOLTAGE (Typical)



### Note

- The capacitors meet the essential requirements of EIA 198. Unless stated otherwise all electrical values apply at an ambient temperature of  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ , at normal atmospheric conditions.

## RELATED DOCUMENTS

|                      |                                                                        |
|----------------------|------------------------------------------------------------------------|
| General Information  | <a href="http://www.vishay.com/doc?28536">www.vishay.com/doc?28536</a> |
| CB Test Certificate  | <a href="http://www.vishay.com/doc?22254">www.vishay.com/doc?22254</a> |
| VDE Marks Approval   | <a href="http://www.vishay.com/doc?22256">www.vishay.com/doc?22256</a> |
| UL Test Certificate  | <a href="http://www.vishay.com/doc?22253">www.vishay.com/doc?22253</a> |
| CQC Test Certificate | <a href="http://www.vishay.com/doc?22255">www.vishay.com/doc?22255</a> |

## SAMPLE KITS

|                                    |                                                                        |
|------------------------------------|------------------------------------------------------------------------|
| Part Number (VY2 Sample Kit)       | VY21-KIT-HF                                                            |
| Link (VY2 Sample Kit)              | <a href="http://www.vishay.com/doc?28554">www.vishay.com/doc?28554</a> |
| Part Number (VY2...Y5V Sample Kit) | VY2-KIT-MS                                                             |
| Link (VY2...Y5V Sample Kit)        | <a href="http://www.vishay.com/doc?28562">www.vishay.com/doc?28562</a> |



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