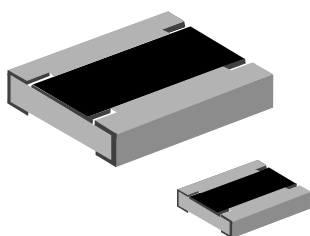


# Long Side Termination Thick Film Chip Resistors



## FEATURES

- Enhanced power rating
- Long side terminations
- Enhanced thermo cycling performance in 0406 size
- Pure tin solder contacts on Ni barrier layer, provides compatibility with lead (Pb)-free and lead containing soldering processes
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## STANDARD ELECTRICAL SPECIFICATIONS

| STANDARD ELECTRICAL SPECIFICATIONS |                |                  |                         |                                                             |                                                                                 |             |                           |          |
|------------------------------------|----------------|------------------|-------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------|-------------|---------------------------|----------|
| MODEL                              | CASE SIZE INCH | CASE SIZE METRIC | POWER RATING $P_{70}$ W | LIMITING ELEMENT VOLTAGE $U_{max.}$ AC <sub>RMS</sub> /DC V | TEMPERATURE COEFFICIENT ppm/K                                                   | TOLERANCE % | RESISTANCE RANGE $\Omega$ | SERIES   |
| RCL0406 e3                         | 0406           | RR 1016M         | 0.25                    | 50                                                          | $\pm 100$                                                                       | $\pm 1$     | 1 to 1M                   | E24; E96 |
|                                    |                |                  |                         |                                                             | $\pm 200$                                                                       | $\pm 5$     |                           | E24      |
|                                    |                |                  |                         |                                                             | Zero-Ohm-Resistor: $R_{max.} = 10 \text{ m}\Omega$ , $I_{max.}$ at 70°C = 4.0 A |             |                           |          |
| RCL0612 e3                         | 0612           | RR 1632M         | 0.5                     | 75                                                          | $\pm 100$                                                                       | $\pm 1$     | 1 to 1M                   | E24; E96 |
|                                    |                |                  |                         |                                                             | $\pm 200$                                                                       | $\pm 5$     |                           | E24      |
|                                    |                |                  |                         |                                                             | Zero-Ohm-Resistor: $R_{max.} = 10 \text{ m}\Omega$ , $I_{max.}$ at 70°C = 6.0 A |             |                           |          |
| RCL1218 e3                         | 1218           | RR 3246M         | 1.0                     | 200                                                         | $\pm 100$                                                                       | $\pm 1$     | 1 to 2.2M                 | E24; E96 |
|                                    |                |                  |                         |                                                             | $\pm 200$                                                                       | $\pm 5$     |                           | E24      |
|                                    |                |                  |                         |                                                             | Zero-Ohm-Resistor: $R_{max.} = 20 \text{ m}\Omega$ , $I_{max.}$ at 70°C = 7.0 A |             |                           |          |
| RCL1225 e3                         | 1225           | RR 3263M         | 2.0 <sup>(1)</sup>      | 200                                                         | $\pm 100$                                                                       | $\pm 1$     | 1 to 1M                   | E24; E96 |
|                                    |                |                  |                         |                                                             | $\pm 200$                                                                       | $\pm 5$     |                           | E24      |
|                                    |                |                  |                         |                                                             | Zero-Ohm-Resistor: $R_{max.} = 10 \text{ m}\Omega$ , $I_{max.}$ at 70°C = 12 A  |             |                           |          |

## Notes

- These resistors do not feature a lifetime limitation when operated within the limits of rated dissipation, permissible operating voltage and permissible film temperature. However, the resistance typically increases due to the resistor's film temperature over operating time, generally known as drift. The drift may exceed the stability requirements of an individual application circuit and thereby limits the functional lifetime.
- Marking and packaging: See datasheet "Surface Mount Resistor Marking" ([www.vishay.com/doc?20020](http://www.vishay.com/doc?20020)). No marking for 0406 size.
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material.
- <sup>(1)</sup> Specified power rating requires dedicated mounting conditions to achieve the required thermal resistance.

## TECHNICAL SPECIFICATIONS

| PARAMETER                                    | UNIT             | RCL0406     | RCL0612 | RCL1218 | RCL1225            |
|----------------------------------------------|------------------|-------------|---------|---------|--------------------|
| Rated Dissipation at $P_{70}$ <sup>(2)</sup> | W                | 0.25        | 0.5     | 1.0     | 2.0 <sup>(3)</sup> |
| Operating Voltage $U_{max.}$ AC RMS/DC       | V                | 50          | 75      | 200     | 200                |
| Insulation Voltage $U_{ins}$ (1 min)         | V                | 100         | 100     | 300     | 300                |
| Insulation Resistance                        | $\Omega$         | $> 10^9$    |         |         |                    |
| Operating Temperature Range                  | $^\circ\text{C}$ | -55 to +155 |         |         |                    |
| Weight                                       | mg               | 3.5         | 11      | 29.5    | 55                 |

## Notes

- <sup>(2)</sup> The power dissipation on the resistors generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of  $155^\circ\text{C}$  is not exceeded.
- <sup>(3)</sup> Specified power rating requires dedicated mounting conditions to achieve the required thermal resistance.

**PART NUMBER AND PRODUCT DESCRIPTION**
**PART NUMBER: RCL061210K0FKEA**

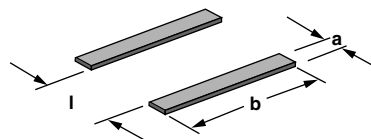
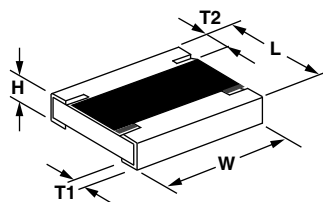
|                                          |          |                                                                        |          |                                              |          |                                                          |          |                            |          |          |          |          |          |          |
|------------------------------------------|----------|------------------------------------------------------------------------|----------|----------------------------------------------|----------|----------------------------------------------------------|----------|----------------------------|----------|----------|----------|----------|----------|----------|
| <b>R</b>                                 | <b>C</b> | <b>L</b>                                                               | <b>0</b> | <b>6</b>                                     | <b>1</b> | <b>2</b>                                                 | <b>1</b> | <b>0</b>                   | <b>K</b> | <b>0</b> | <b>F</b> | <b>K</b> | <b>E</b> | <b>A</b> |
| <b>MODEL</b>                             |          | <b>RESISTANCE</b>                                                      |          | <b>TOLERANCE</b>                             |          | <b>TCR</b>                                               |          | <b>PACKAGING</b>           |          |          |          |          |          |          |
| RCL0406<br>RCL0612<br>RCL1218<br>RCL1225 |          | R = decimal<br>K = thousand<br>M = million<br>0000 = 0 $\Omega$ Jumper |          | F = $\pm 1\%$<br>J = $\pm 5\%$<br>Z = jumper |          | K = $\pm 100$ ppm/K<br>N = $\pm 200$ ppm/K<br>0 = jumper |          | EA<br>EB<br>EC<br>EK<br>EG |          |          |          |          |          |          |

**PRODUCT DESCRIPTION: RCL0612 100 10K 1 % ET1 e3**

|                                          |                                    |                                                                               |                        |                                 |                                        |
|------------------------------------------|------------------------------------|-------------------------------------------------------------------------------|------------------------|---------------------------------|----------------------------------------|
| <b>RCL0612</b>                           | <b>100</b>                         | <b>10K</b>                                                                    | <b>1 %</b>             | <b>ET1</b>                      | <b>e3</b>                              |
| <b>MODEL</b>                             | <b>TCR</b>                         | <b>RESISTANCE</b>                                                             | <b>TOLERANCE</b>       | <b>PACKAGING</b>                | <b>LEAD (Pb)-FREE</b>                  |
| RCL0406<br>RCL0612<br>RCL1218<br>RCL1225 | $\pm 100$ ppm/K<br>$\pm 200$ ppm/K | 10R = 10 $\Omega$<br>10K = 10 k $\Omega$<br>1M = 1 M $\Omega$<br>0R0 = jumper | $\pm 1\%$<br>$\pm 5\%$ | ET1<br>ET5<br>ET6<br>ET9<br>E67 | e3 = pure tin<br>termination<br>finish |

**PACKAGING**

| MODEL   | CODE     | QUANTITY | CARRIER TAPE                                   | WIDTH | PITCH | REEL DIAMETER |
|---------|----------|----------|------------------------------------------------|-------|-------|---------------|
| RCL0406 | EA = ET1 | 5000     | Paper tape acc. to<br>IEC 60068-3<br>Type I    | 8 mm  | 4 mm  | 180 mm/7"     |
|         | EB = ET5 | 10 000   |                                                |       |       | 285 mm/11.25" |
|         | EC = ET6 | 20 000   |                                                |       |       | 330 mm/13"    |
| RCL0612 | EA = ET1 | 5000     |                                                | 8 mm  | 4 mm  | 180 mm/7"     |
|         | EB = ET5 | 10 000   |                                                |       |       | 285 mm/11.25" |
|         | EC = ET6 | 20 000   |                                                |       |       | 330 mm/13"    |
| RCL1218 | EK = ET9 | 4000     | Blister tape acc. to<br>IEC 60068-3<br>Type II | 12 mm | 4 mm  | 180 mm/7"     |
| RCL1225 | EG = E67 | 2000     |                                                | 12 mm | 8 mm  | 180 mm/7"     |

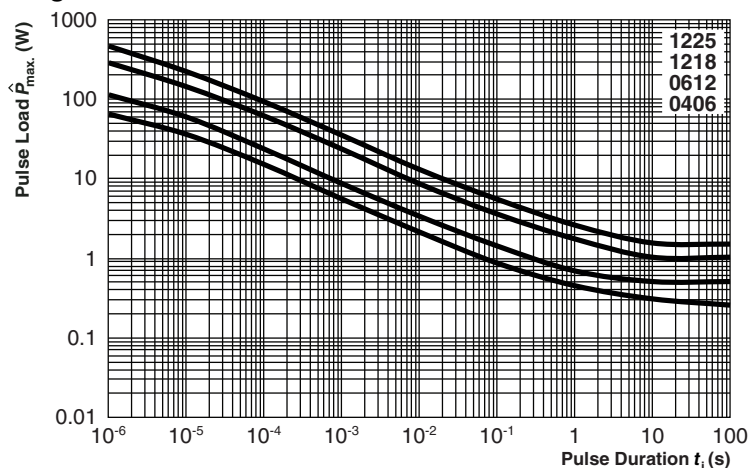
**DIMENSIONS** in millimeters


| SIZE |        | DIMENSIONS             |                |                 |                        |                 | SOLDER PAD DIMENSIONS |      |      |                |     |      |
|------|--------|------------------------|----------------|-----------------|------------------------|-----------------|-----------------------|------|------|----------------|-----|------|
|      |        |                        |                |                 |                        |                 | REFLOW SOLDERING      |      |      | WAVE SOLDERING |     |      |
| INCH | METRIC | L                      | W              | H               | T1                     | T2              | a                     | b    | l    | a              | b   | l    |
| 0406 | 1016   | 1.0 $\pm$ 0.1          | 1.6 $\pm$ 0.1  | 0.35 $\pm$ 0.1  | 0.2 $^{+0.10}_{-0.15}$ | 0.2 $\pm$ 0.1   | 0.55                  | 1.75 | 0.35 | 0.75           | 1.8 | 0.35 |
| 0612 | 1608   | 1.6 $\pm$ 0.2          | 3.2 $\pm$ 0.2  | 0.55 $\pm$ 0.1  | 0.35 $\pm$ 0.15        | 0.25 $\pm$ 0.15 | 0.6                   | 3.2  | 1.0  | 1.1            | 3.2 | 1.0  |
| 1218 | 3246   | 3.2 $^{+0.10}_{-0.20}$ | 4.6 $\pm$ 0.15 | 0.55 $\pm$ 0.05 | 0.45 $\pm$ 0.2         | 0.4 $\pm$ 0.2   | 1.1                   | 4.9  | 1.9  | 1.25           | 4.8 | 1.9  |
| 1225 | 3263   | 3.2 $\pm$ 0.2          | 6.3 $\pm$ 0.2  | 0.70 $\pm$ 0.10 | 0.8 $\pm$ 0.2          | 0.4 $\pm$ 0.2   | 1.9                   | 7.6  | 1.2  | 1.9            | 7.6 | 1.2  |

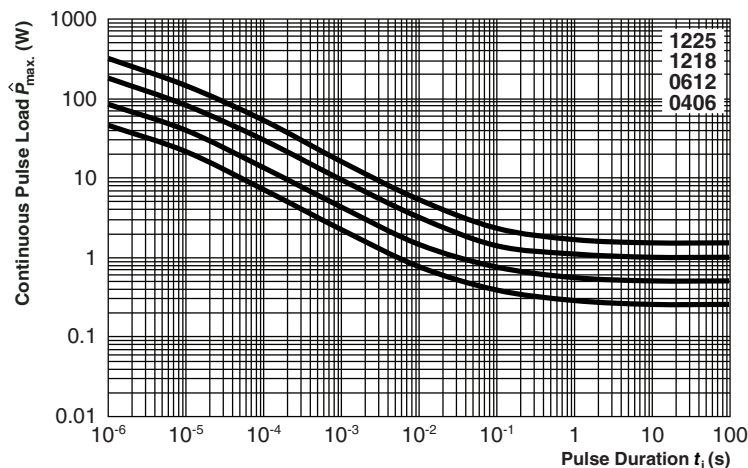


## FUNCTIONAL PERFORMANCE

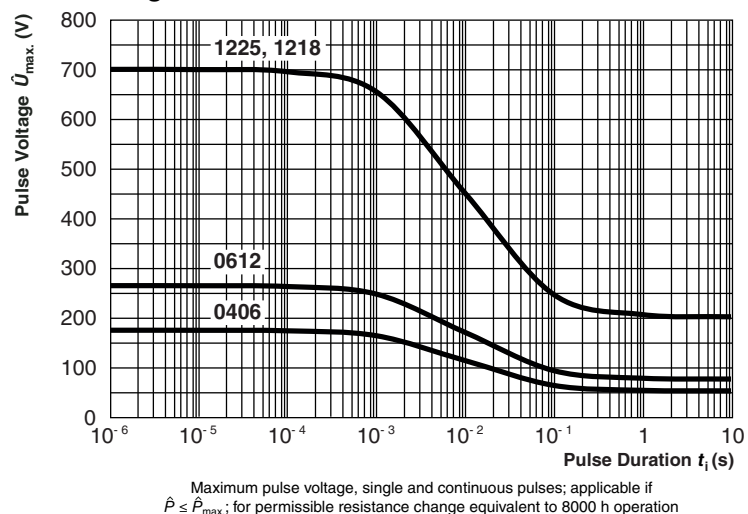
### Single Pulse

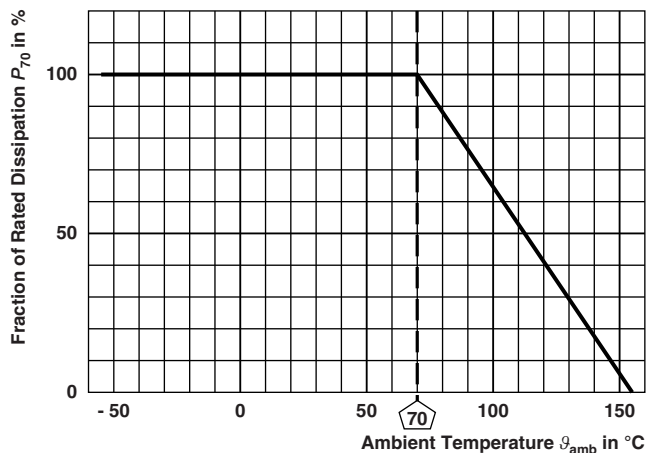


### Continuous Pulse



### Pulse Voltage



**Derating**

**TEST PROCEDURES AND REQUIREMENTS**

| EN 60115-1<br>CLAUSE | IEC<br>60068-2<br>TEST<br>METHOD | TEST                           | PROCEDURE                                                                                           | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R$ )                                      |                                                                |
|----------------------|----------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------|
|                      |                                  |                                | Stability for product types:                                                                        | <b>STABILITY CLASS 2 OR BETTER</b>                                                     |                                                                |
|                      |                                  |                                | <b>RCL e3</b>                                                                                       | 1 $\Omega$ to 2.2 M $\Omega$                                                           |                                                                |
| 4.5                  | -                                | Resistance                     | -                                                                                                   | $\pm 1 \%$                                                                             | $\pm 5 \%$                                                     |
| 4.7                  | -                                | Voltage proof                  | $U = 1.4 \times U_{ins}$ ; 60 s                                                                     | No flashover or breakdown                                                              |                                                                |
| 4.13                 | -                                | Short time overload            | $U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$ ;<br>Duration acc. to style          | $\pm (0.25 \% R + 0.05 \Omega)$                                                        | $\pm (0.5 \% R + 0.05 \Omega)$                                 |
| 4.17.2               | 58 (Td)                          | Solderability                  | Solder bath method;<br>Sn60Pb40<br>non-activated flux;<br>(235 $\pm$ 5) °C<br>(2 $\pm$ 0.2) s       | Good tinning ( $\geq 95 \%$ covered)<br>no visible damage                              |                                                                |
|                      |                                  |                                | Solder bath method;<br>Sn96.5Ag3Cu0.5<br>non-activated flux;<br>(245 $\pm$ 5) °C<br>(3 $\pm$ 0.3) s | Good tinning ( $\geq 95 \%$ covered)<br>no visible damage                              |                                                                |
| 4.8.4.2              | -                                | Temperature<br>coefficient     | (20/-55/20) °C and<br>(20/125/20) °C                                                                | $\pm 100$ ppm/K                                                                        | $\pm 200$ ppm/K                                                |
| 4.32                 | 21 ( $U_{u3}$ )                  | Shear<br>(adhesion)            | 45 N                                                                                                | No visible damage                                                                      |                                                                |
| 4.33                 | 21 ( $U_{u1}$ )                  | Substrate bending              | Depth 2 mm;<br>3 times                                                                              | No visible damage, no open circuit in bent position<br>$\pm (0.25 \% R + 0.05 \Omega)$ |                                                                |
| 4.19                 | 14 (Na)                          | Rapid change of<br>temperature | 30 min at -55 °C;<br>30 min at 125 °C<br>5 cycles<br>1000 cycles                                    | $\pm (0.25 \% R + 0.05 \Omega)$<br>$\pm (1 \% R + 0.05 \Omega)$                        | $\pm (0.5 \% R + 0.05 \Omega)$<br>$\pm (1 \% R + 0.05 \Omega)$ |

| TEST PROCEDURES AND REQUIREMENTS |                                  |                                                            |                                                                                                             |                                                                |                                                            |
|----------------------------------|----------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------|
| EN 60115-1<br>CLAUSE             | IEC<br>60068-2<br>TEST<br>METHOD | TEST                                                       | PROCEDURE                                                                                                   | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R$ )              |                                                            |
|                                  |                                  |                                                            | Stability for product types:                                                                                | <b>STABILITY CLASS 2 OR BETTER</b>                             |                                                            |
|                                  |                                  |                                                            | <b>RCL e3</b>                                                                                               | 1 $\Omega$ to 2.2 M $\Omega$                                   |                                                            |
| 4.23                             | -                                | Climatic sequence:                                         | -                                                                                                           | $\pm (1 \% R + 0.05 \Omega)$                                   | $\pm (2 \% R + 0.1 \Omega)$                                |
| 4.23.2                           | 2 (Ba)                           | Dry heat                                                   | 125 °C; 16 h                                                                                                |                                                                |                                                            |
| 4.23.3                           | 30 (Db)                          | Damp heat, cyclic                                          | 55 °C; $\geq 90 \% RH$ ;<br>24 h; 1 cycle                                                                   |                                                                |                                                            |
| 4.23.4                           | 1 (Aa)                           | Cold                                                       | - 55 °C; 2 h                                                                                                |                                                                |                                                            |
| 4.23.5                           | 13 (M)                           | Low air pressure                                           | 1 kPa; (25 $\pm$ 10) °C; 1 h                                                                                |                                                                |                                                            |
| 4.23.6                           | 30 (Db)                          | Damp heat, cyclic                                          | 55 °C; $\geq 90 \% RH$ ;<br>24 h; 5 cycles                                                                  |                                                                |                                                            |
| 4.23.7                           | -                                | DC load                                                    | $U = \sqrt{P_{70} \times R}$                                                                                |                                                                |                                                            |
| 4.25.1                           | -                                | Endurance at 70 °C                                         | $U = \sqrt{P_{70} \times R} \leq U_{max.}$ ;<br>1.5 h on; 0.5 h off;<br>70 °C; 1000 h<br>70 °C; 8000 h      | $\pm (0.5 \% R + 0.05 \Omega)$<br>$\pm (1 \% R + 0.05 \Omega)$ | $\pm (2 \% R + 0.1 \Omega)$<br>$\pm (4 \% R + 0.1 \Omega)$ |
| 4.18.2                           | 58 (Td)                          | Resistance to soldering heat                               | Solder bath method<br>(260 $\pm$ 5) °C;<br>(10 $\pm$ 1) s                                                   | $\pm (0.25 \% R + 0.05 \Omega)$                                | $\pm (0.5 \% R + 0.05 \Omega)$                             |
| 4.35                             | -                                | Flamability, needle flame test                             | IEC 60695-11-5;<br>10 s                                                                                     | No burning after 30 s                                          |                                                            |
| 4.24                             | 78 (Cab)                         | Damp heat, steady state                                    | (40 $\pm$ 2) °C;<br>(93 $\pm$ 3) % RH;<br>56 days                                                           | $\pm (1 \% R + 0.05 \Omega)$                                   |                                                            |
| 4.25.3                           | -                                | Endurance at upper category temperature                    | 155 °C, 1000 h                                                                                              | $\pm (1 \% R + 0.05 \Omega)$                                   | $\pm (2 \% R + 0.1 \Omega)$                                |
| 4.40                             | -                                | Electrostatic discharge (human body model)                 | IEC 61340-3-1;<br>3 pos. + 3 neg. discharges;<br>ESD voltage: 1000 V                                        | $\pm (1 \% R + 0.05 \Omega)$                                   |                                                            |
| 4.29                             | 45 (XA)                          | Component solvent resistance                               | Isopropyl alcohol;<br>50 °C; method 2                                                                       | No visible damage                                              |                                                            |
| 4.30                             | 45 (XA)                          | Solvent resistance of marking                              | Isopropyl alcohol;<br>50 °C; method 1,<br>toothbrush                                                        | Marking legible,<br>no visible damage                          |                                                            |
| 4.22                             | 6 (Fc)                           | Vibration, endurance by sweeping                           | f = 10 Hz to 2000 Hz;<br>x, y, z $\leq$ 1.5 mm;<br>A $\leq$ 200 m/s <sup>2</sup> ;<br>10 sweeps per axis    | $\pm (0.25 \% R + 0.05 \Omega)$                                | $\pm (0.5 \% R + 0.05 \Omega)$                             |
| 4.37                             | -                                | Periodic electric overload                                 | $U = \sqrt{15 \times P_{70} \times R}$<br>$\leq 2 \times U_{max.}$ ;<br>0.1 s on; 2.5 s off;<br>1000 cycles | $\pm (1 \% R + 0.05 \Omega)$                                   |                                                            |
| 4.27                             | -                                | Single pulse high voltage overload, 10 $\mu$ s/700 $\mu$ s | $\hat{U} = 10 \times \sqrt{P_{70} \times R}$<br>$\leq 2 \times U_{max.}$ ;<br>10 pulses                     | $\pm (1 \% R + 0.05 \Omega)$                                   |                                                            |

All tests are carried out in accordance with the following specifications:

- EN 60115-1, generic specification
- EN 140400, sectional specification
- EN 140401-802, detail specification
- IEC 60068-2, environmental test procedures

Packaging of components is done in paper tapes according to IEC 60286-3.



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