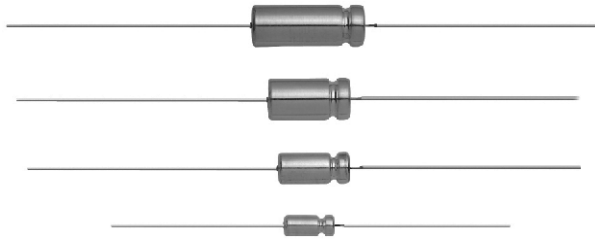


Wet Tantalum Capacitors Sintered Anode TANTALEX® Capacitors for Operation to +125 °C, Elastomer-Sealed



FEATURES

- Axial through-hole terminations: standard tin / lead (SnPb), 100 % tin (RoHS-compliant) available
- Vishay Sprague model 109D tubular elastomer-sealed, sintered anode TANTALEX® capacitors fill the basic requirements for applications where a superior quality, reliable design for industrial, automotive and telecommunications application is desired.
- Model 109D capacitors are the commercial equivalents of Tansitor style WC, UWC, Mallory-NACC style TLS, TLH and the military style CL64 and CL65, designed to meet the performance requirements of military specification MIL-DTL-3965.
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS*
Available

HALOGEN

FREE

GREEN

(5-2008)

Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

PERFORMANCE CHARACTERISTICS

Operating Temperature: -55 °C to +85 °C
(to +125 °C with voltage derating)

Capacitance Tolerance: at 120 Hz, +25 °C.
± 20 % standard. ± 10 %, ± 5 % available as special.

DC Leakage Current (DCL max.):
at +25 °C, +85 °C, +125 °C: leakage current shall not exceed the values listed in the Standard Ratings tables.

Life Test: capacitors are capable of withstanding a 2000 h life test at a temperature of +85 °C or +125 °C at the applicable DC working voltage.

Following the life test:

1. DCL shall not exceed the initial requirements or 1 µA, whichever is greater.
2. The ESR shall meet the initial requirement.
3. Change in capacitance shall not exceed 10 % from the initial measurement. For capacitors with voltage ratings of 15 V_{DC} and below, change in capacitance shall not exceed + 10 %, - 25 % from the initial measurement.

| ORDERING INFORMATION | | | | | | |
|----------------------|---|--|---|----------------------------------|---|---|
| 109D | 207 | X0 | 006 | C | 0 | E3 |
| MODEL | CAPACITANCE | CAPACITANCE TOLERANCE | DC VOLTAGE RATING AT +85 °C | CASE CODE | STYLE NUMBER | RoHS-COMPLIANT |
| | This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow | X0 = ± 20 % X9 = ± 10 % X5 = ± 5 % special order | This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V) | See Ratings and Case Codes table | 0 = no outer sleeve Standard 2 = outer plastic film insulation | E3 = 100 % tin termination (RoHS-compliant) Blank = SnPb termination (standard design) |

Note

- Packaging: the use of formed plastic trays for packaging these axial lead components is standard. Tape and reel is not available due to the unit weight.

DIMENSIONS in inches [millimeters]


| CASE CODE | BARE TUBE | | WITH PLASTIC-FILM INSULATING SLEEVE | | LEAD LENGTH |
|------------------|-----------------------------|---|-------------------------------------|---------------|------------------------------|
| | D | L | D Max. | L Max. | |
| C | 0.188 ± 0.016 [4.78 ± 0.41] | 0.453 + 0.031 / - 0.016 [11.51 + 0.79 / - 0.41] | 0.219 [5.56] | 0.608 [15.45] | 1.500 ± 0.250 [38.10 ± 6.35] |
| F | 0.281 ± 0.016 [7.14 ± 0.41] | 0.641 + 0.031 / - 0.016 [16.28 + 0.79 / - 0.41] | 0.312 [7.92] | 0.796 [20.22] | 2.250 ± 0.250 [57.15 ± 6.35] |
| T | 0.375 ± 0.016 [9.53 ± 0.41] | 0.766 + 0.031 / - 0.016 [19.46 + 0.79 / - 0.41] | 0.406 [10.31] | 0.921 [23.40] | 2.250 ± 0.250 [57.15 ± 6.35] |
| K ⁽¹⁾ | 0.375 ± 0.016 [9.53 ± 0.41] | 1.062 + 0.031 / - 0.016 [26.97 + 0.79 / - 0.41] | 0.406 [10.31] | 1.217 [30.91] | 2.250 ± 0.250 [57.15 ± 6.35] |

Note
⁽¹⁾ Replaces previous W case

RATINGS AND CASE CODES (Standard)

| μF | 6 V | 8 V | 10 V | 15 V | 20 V | 25 V | 30 V | 35 V | 50 V | 60 V | 75 V | 100 V | 125 V |
|-----|-----|-----|------|------|------|------|------|------|------|------|------|-------|-------|
| 1.7 | | | | | | | | | | | | | C |
| 2.5 | | | | | | | | | | | | C | |
| 3.0 | | | | | | | | | | | | C | |
| 3.5 | | | | | | | | | | | C | | |
| 3.6 | | | | | | | | | | | | | C |
| 4.0 | | | | | | | | | | C | | | |
| 4.5 | | | | | | | | | C | | | | |
| 4.7 | | | | | | | | | | | | C | |
| 5.0 | | | | | | | | | C | | | | |
| 6.8 | | | | | | | | | | | C | | |
| 7.0 | | | | | | | C | | | | | | |
| 8.0 | | | | | | | C | | | | | | |
| 8.2 | | | | | | | | | | C | | | |
| 9.0 | | | | | | | | | | | | | F |
| 10 | | | | | | C | | | C | | | F | |
| 11 | | | | | | | | | | | | F | |
| 13 | | | | | | | | | | | F | | |
| 14 | | | | | | | | | | | | | F |
| 15 | | | | C | | | C | | | | F | | |
| 18 | | | | | | | | | | | | | T |
| 20 | | | C | | | | | | | F | | | |
| 22 | | C | | | | C | | | F | | | F | |
| 25 | | C | | | | | | | F | | | | T |
| 27 | | | | | C | C | | | | | | | |
| 30 | C | | | | | | | | | | | T | |
| 33 | | | | C | | | | | | | F | | |
| 39 | | | | | | | | | | F | | | |
| 40 | | | | | | | F | | | | T | | |
| 43 | | | | | | | | | | | | T | |
| 47 | | | C | | | | | | F | | | | |
| 50 | | | | | | F | | | | T | | | |
| 56 | | C | | | | | | | | | T | | K |
| 60 | | | | | | | | | T | | | | |



| RATINGS AND CASE CODES (Standard) | | | | | | | | | | | | | |
|-----------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|-------|-------|
| µF | 6 V | 8 V | 10 V | 15 V | 20 V | 25 V | 30 V | 35 V | 50 V | 60 V | 75 V | 100 V | 125 V |
| 68 | C | | | | | | F | F | | T | | | |
| 70 | | | | F | | | | | | | | | |
| 82 | | | | | | | | | T | | | | |
| 86 | | | | | | | | | | | | K | |
| 100 | | | F | | | F/T | T | | | | | | |
| 110 | | | | | | | | | | | K | | |
| 120 | | | | F | | | | T | | | | | |
| 140 | F | | | | | | | | | K | | | |
| 150 | | | | | | | T | | | | | | |
| 160 | | | | | | | | | K | | | | |
| 170 | | | | T | | | | | | | | | |
| 180 | | | F | | | T | | | | | | | |
| 220 | | F | | | T | | | | | | | | |
| 250 | | | T | | | | | | | | | | |
| 270 | F | | | T | | | | K | | | | | |
| 290 | T | T | | | | | | | | | | | |
| 300 | | | | | | | K | | | | | | |
| 330 | T | | | | | | | | | | | | |
| 350 | | | | | | K | | | | | | | |
| 390 | | | T | | | | | | | | | | |
| 430 | | T | | | | | | | | | | | |
| 540 | | | | K | | | | | | | | | |
| 560 | T | | | | | | | | | | | | |
| 750 | | | K | | | | | | | | | | |
| 850 | | K | | | | | | | | | | | |
| 1200 | K | | | | | | | | | | | | |

| RATINGS AND CASE CODES (Extended) | | | | | | | | | | | | | |
|-----------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|-------|-------|
| µF | 6 V | 8 V | 10 V | 15 V | 20 V | 25 V | 30 V | 35 V | 50 V | 60 V | 75 V | 100 V | 125 V |
| 2.0 | | | | | | | | | | | | C | |
| 6.8 | | | | | | | | | | | | | C |
| 8.2 | | | | | | | | | | | | C | |
| 10 | | | | | | | | | | | | C | |
| 12 | | | | | | | | | | | C | | |
| 15 | | | | | | | | | | | C | | |
| 18 | | | | | | | | | | C | | | |
| 22 | | | | | | | | | C | | C | | |
| 27 | | | | | | | | | | C | | | F |
| 33 | | | | | | | | C | C | | | F | |
| 39 | | | | | | | C | | | | | F | T |
| 47 | | | | | | C | C | C | | | F | | T |
| 56 | | | | | C | | C | | | | F | T | K |
| 68 | | | | C | | C | | | | F | | T | |
| 82 | | | | C | C | | | | F | | F | | K |
| 86 | | | | | | | | | | | | K | |
| 100 | | | C | C | | | | | | F | | | |
| 110 | | | | | | | | | | | T | | |
| 120 | | | C | | | | | F | F | | | K | |
| 140 | C | | | | | | | | | T | | | |
| 150 | | | C | | | | F | | | | | | |
| 160 | | | | | | | | | T | | | | |



| RATINGS AND CASE CODES (Extended) | | | | | | | | | | | | | |
|-----------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|-------|-------|
| μF | 6 V | 8 V | 10 V | 15 V | 20 V | 25 V | 30 V | 35 V | 50 V | 60 V | 75 V | 100 V | 125 V |
| 180 | | C | | | | F | F | | | | T | | |
| 200 | | | | | | | | | | | T | | |
| 220 | | | | | F | | F | T | | T | K | | |
| 250 | | | | | | | | | T | | | | |
| 270 | | | | F | | F | | | T | K | K | | |
| 330 | | | | F | F | | T | | K | | | | |
| 350 | | | | | | T | | | | | | | |
| 390 | | | F | F | | | T | T | | | | | |
| 470 | | F | F | | | | T | K | | | | | |
| 510 | | | | T | | | | | | | | | |
| 540 | | | | T | | | | | | | | | |
| 560 | | | F | | | T | K | | | | | | |
| 680 | | F | | | | K | | | | | | | |
| 750 | | | | | | K | | | | | | | |
| 820 | F | | | T/K | | | | | | | | | |
| 1000 | | | T | K | | | | | | | | | |
| 1200 | | | T/K | | | | | | | | | | |
| 1500 | T | | K | | | | | | | | | | |
| 1800 | | K | | | | | | | | | | | |
| 2200 | K | | | | | | | | | | | | |

| STANDARD RATINGS | | | | | | | | | | | |
|---|-----------|-----------------|-------------------------|-------------------------|------------------|-------------------|--------------------------------|--------|---------|-------------------------------|--|
| CAPACITANCE (μF) | CASE CODE | PART NUMBER (1) | MAX. ESR | MAX. IMP. | MAX. DCL (μA) AT | | MAX. CAPACITANCE CHANGE (%) AT | | | MAX. RMS | |
| | | | AT +25 °C 120 Hz (Ω) | AT -55 °C 120 Hz (Ω) | +25 °C | +85 °C +125 °C | -55 °C | +85 °C | +125 °C | RIPPLE CURRENT 120 Hz (mA) | |
| 6 V_{DC} AT +85 °C; 7 V_{DC} AT +125 °C | | | | | | | | | | | |
| 30 | C | 109D306X0006C0 | 4.2 | 100 | 1.0 | 2.0 | -40 | +10.5 | +12 | 140 | |
| 68 | C | 109D686X0006C0 | 4.0 | 60 | 1.0 | 2.0 | -40 | +14 | +16 | 160 | |
| 140 | F | 109D147X0006F0 | 2.0 | 40 | 1.0 | 3.0 | -40 | +14 | +16 | 330 | |
| 270 | F | 109D277X0006F0 | 4.0 | 25 | 1.0 | 7.0 | -44 | +17.5 | +20 | 270 | |
| 290 | T | 109D297X0006T0 | 2.0 | 24 | 2.0 | 7.0 | -70 | +20 | +20 | 410 | |
| 330 | T | 109D337X0006T0 | 2.1 | 20 | 2.0 | 7.9 | -44 | +14 | +16 | 410 | |
| 560 | T | 109D567X0006T0 | 3.0 | 25 | 2.0 | 13 | -64 | +17.5 | +20 | 340 | |
| 1200 | K | 109D128X0006K0 | 1.6 | 20 | 3.0 | 14 | -80 | +25 | +25 | 530 | |
| 8 V_{DC} AT +85 °C; 5 V_{DC} AT +125 °C | | | | | | | | | | | |
| 22 | C | 109D226X0008C0 | 6.0 | 115 | 1.0 | 2.0 | -40 | +10.5 | +12 | 130 | |
| 25 | C | 109D256X0008C0 | 4.2 | 100 | 1.0 | 2.0 | -40 | +10.5 | +12 | 140 | |
| 56 | C | 109D566X0008C0 | 4.0 | 59 | 1.0 | 2.0 | -40 | +14 | +16 | 160 | |
| 220 | F | 109D227X0008F0 | 4.0 | 30 | 1.0 | 7.0 | -44 | +17.5 | +20 | 270 | |
| 290 | T | 109D297X0008T0 | 2.0 | 24 | 2.0 | 9.5 | -70 | +20 | +20 | 410 | |
| 430 | T | 109D437X0008T0 | 3.2 | 25 | 2.0 | 14 | -64 | +17.5 | +20 | 410 | |
| 850 | K | 109D857X0008K0 | 1.0 | 22 | 4.0 | 16 | -80 | +25 | +25 | 670 | |
| 10 V_{DC} AT +85 °C; 7 V_{DC} AT +125 °C | | | | | | | | | | | |
| 20 | C | 109D206X0010C0 | 5.0 | 175 | 1.0 | 2.0 | -32 | +10.5 | +12 | 140 | |
| 47 | C | 109D476X0010C0 | 5.0 | 100 | 1.0 | 2.0 | -36 | +14 | +16 | 160 | |
| 100 | F | 109D107X0010F0 | 2.1 | 60 | 1.0 | 4.0 | -36 | +14 | +16 | 270 | |
| 180 | F | 109D187X0010F0 | 4.0 | 40 | 1.0 | 7.0 | -36 | +14 | +16 | 270 | |
| 250 | T | 109D257X0010T0 | 2.0 | 30 | 2.0 | 10 | -40 | +14 | +16 | 410 | |
| 390 | T | 109D397X0010T0 | 3.0 | 25 | 2.0 | 16 | -64 | +17.5 | +20 | 340 | |
| 750 | K | 109D757X0010T0 | 1.0 | 23 | 4.0 | 16 | -80 | +25 | +25 | 670 | |

Note

(1) Part numbers shown are for units with ± 20 % capacitance tolerance and uninsulated capacitors. For ± 10 % units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



| STANDARD RATINGS | | | | | | | | | | |
|--|--------------|----------------------------|-------------------------------------|-------------------------------------|-------------------------|------------------------------------|-------------------------|--------|---------|---|
| CAPACITANCE (μ F) | CASE CODE | PART NUMBER ⁽¹⁾ | MAX. ESR | MAX. IMP. | MAX. DCL | | MAX. CAPACITANCE | | | MAX. RMS RIPPLE CURRENT 120 Hz (mA) |
| | | | AT +25 °C 120 Hz (Ω) | AT -55 °C 120 Hz (Ω) | (μ A) AT +25 °C | (μ A) AT +85 °C +125 °C | CHANGE (%) AT -55 °C | +85 °C | +125 °C | |
| 15 V_{DC} AT +85 °C; 10 V_{DC} AT +125 °C | | | | | | | | | | |
| 15 | C | 109D156X0015C0 | 6.0 | 155 | 1.0 | 2.0 | -24 | +10.5 | +12 | 130 |
| 33 | C | 109D336X0015C0 | 5.0 | 90 | 1.0 | 2.0 | -28 | +14 | +16 | 160 |
| 70 | F | 109D706X0015F0 | 3.6 | 75 | 1.0 | 4.0 | -28 | +14 | +16 | 270 |
| 120 | F | 109D127X0015F0 | 4.0 | 50 | 1.0 | 7.0 | -28 | +17.5 | +20 | 270 |
| 270 | T | 109D277X0015T0 | 3.0 | 30 | 2.0 | 16 | -56 | +17.5 | +20 | 340 |
| 540 | K | 109D547X0015K0 | 1.2 | 23 | 6.0 | 24 | -80 | +25 | +25 | 610 |
| 20 V_{DC} AT +85 °C; 13 V_{DC} AT +125 °C | | | | | | | | | | |
| 27 | C | 109D276X0020C0 | 5.0 | 100 | 1.0 | 2.0 | -20 | +11 | +14 | 160 |
| 220 | T | 109D227X0020T0 | 4.0 | 3 | 2.0 | 16 | -48 | +13 | +15 | 410 |
| 25 V_{DC} AT +85 °C; 15 V_{DC} AT +125 °C | | | | | | | | | | |
| 10 | C | 109D106X0025C0 | 6.0 | 220 | 1.0 | 2.0 | -16 | +8 | +9 | 130 |
| 22 | C | 109D226X0025C0 | 5.0 | 140 | 1.0 | 3.0 | -20 | +10.5 | +12 | 160 |
| 50 | F | 109D506X0025F0 | 4.0 | 70 | 1.0 | 5.0 | -28 | +13 | +15 | 270 |
| 100 | F | 109D107X0025F0 | 4.0 | 50 | 1.0 | 10 | -28 | +13 | +15 | 270 |
| 100 | T | 109D107X0025T0 | 4.0 | 45 | 2.0 | 10 | -48 | +13 | +15 | 410 |
| 180 | T | 109D187X0025T0 | 4.0 | 32 | 2.0 | 18 | -48 | +13 | +15 | 340 |
| 350 | K | 109D357X0025K0 | 1.3 | 24 | 7.0 | 28 | -70 | +25 | +25 | 580 |
| 30 V_{DC} AT +85 °C; 20 V_{DC} AT +125 °C | | | | | | | | | | |
| 7.0 | C | 109D705X0030C0 | 8.0 | 275 | 1.0 | 2.0 | -16 | +8 | +12 | 110 |
| 8.0 | C | 109D805X0030C0 | 7.5 | 275 | 1.0 | 2.0 | -16 | +8 | +12 | 130 |
| 15 | C | 109D156X0030C0 | 8.0 | 175 | 1.0 | 2.0 | -20 | +10.5 | +12 | 160 |
| 40 | F | 109D406X0030F0 | 4.0 | 65 | 1.0 | 5.0 | -24 | +10.5 | +12 | 270 |
| 68 | F | 109D686X0030F0 | 6.0 | 60 | 1.0 | 8.0 | -24 | +13 | +15 | 270 |
| 100 | T | 109D107X0030T0 | 6.0 | 40 | 2.0 | 12 | -28 | +10.5 | +12 | 410 |
| 150 | T | 109D157X0030T0 | 4.1 | 35 | 2.0 | 18 | -48 | +13 | +15 | 340 |
| 300 | K | 109D307X0030K0 | 1.6 | 25 | 8.0 | 32 | -60 | +25 | +25 | 550 |
| 35 V_{DC} AT +85 °C; 22 V_{DC} AT +125 °C | | | | | | | | | | |
| 68 | F | 109D686X0035F0 | 6.0 | 60 | 1.0 | 8 | -24 | +12 | +15 | 270 |
| 120 | T | 109D127X0035T0 | 4.0 | 38 | 2.0 | 16 | -30 | +13 | +15 | 410 |
| 270 | K | 109D277X0035K0 | 2.2 | 23 | 8.0 | 32 | -45 | +20 | +25 | 500 |
| 50 V_{DC} AT +85 °C; 30 V_{DC} AT +125 °C | | | | | | | | | | |
| 4.5 | C | 109D455X0050C0 | 9.0 | 400 | 1.0 | 2.0 | -16 | +5 | +6 | 110 |
| 5.0 | C | 109D505X0050C0 | 9.0 | 400 | 1.0 | 2.0 | -16 | +5 | +6 | 130 |
| 10 | C | 109D106X0050C0 | 8.0 | 250 | 1.0 | 2.0 | -24 | +8 | +9 | 160 |
| 22 | F | 109D226X0050F0 | 7.0 | 95 | 1.0 | 4.0 | -20 | +10.5 | +12 | 230 |
| 25 | F | 109D256X0050F0 | 6.0 | 95 | 1.0 | 5.0 | -20 | +10.5 | +12 | 270 |
| 47 | F | 109D476X0050F0 | 6.0 | 70 | 1.0 | 9.0 | -28 | +13 | +15 | 270 |
| 60 | T | 109D606X0050T0 | 3.0 | 45 | 2.0 | 12 | -16 | +10.5 | +12 | 410 |
| 82 | T | 109D826X0050T0 | 4.0 | 45 | 2.0 | 16 | -32 | +13 | +15 | 340 |
| 160 | K | 109D167X0050K0 | 2.2 | 27 | 8.0 | 32 | -50 | +25 | +25 | 460 |

Note

⁽¹⁾ Part numbers shown are for units with $\pm 20\%$ capacitance tolerance and uninsulated capacitors. For $\pm 10\%$ units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



| STANDARD RATINGS | | | | | | | | | | |
|---|--------------|----------------------------|-------------------------------------|-------------------------------------|-------------------------|-------------------|--|-------|-----|---|
| CAPACITANCE (μ F) | CASE CODE | PART NUMBER ⁽¹⁾ | MAX. ESR | MAX. IMP. | MAX. DCL | | MAX. CAPACITANCE | | | MAX. RMS RIPPLE CURRENT 120 Hz (mA) |
| | | | AT +25 °C 120 Hz (Ω) | AT -55 °C 120 Hz (Ω) | (μ A) AT +25 °C | +85 °C +125 °C | CHANGE (%) AT -55 °C +85 °C +125 °C | | | |
| 60 V_{DC} AT +85 °C; 40 V_{DC} AT +125 °C | | | | | | | | | | |
| 4.0 | C | 109D405X0060C0 | 10.0 | 550 | 1.0 | 2.0 | -16 | +5 | +6 | 110 |
| 8.2 | C | 109D825X0060C0 | 8.0 | 275 | 1.0 | 2.0 | -24 | +8 | +9 | 140 |
| 20 | F | 109D206X0060F0 | 5.0 | 105 | 1.0 | 5.0 | -16 | +10.5 | +12 | 270 |
| 39 | F | 109D396X0060F0 | 7.0 | 90 | 1.0 | 9.0 | -28 | +10.5 | +12 | 230 |
| 50 | T | 109D506X0060T0 | 4.0 | 50 | 2.0 | 12 | -16 | +10.5 | +12 | 410 |
| 68 | T | 109D686X0060T0 | 6.0 | 50 | 2.0 | 16 | -32 | +10.5 | +12 | 340 |
| 140 | K | 109D147X0060K0 | 2.4 | 28 | 8.0 | 32 | -40 | +20 | +20 | 430 |
| 75 V_{DC} AT +85 °C; 50 V_{DC} AT +125 °C | | | | | | | | | | |
| 3.5 | C | 109D355X0075C0 | 10.0 | 650 | 1.0 | 2.0 | -16 | +5 | +6 | 110 |
| 6.8 | C | 109D685X0075C0 | 8.0 | 300 | 1.0 | 2.0 | -20 | +8 | +9 | 140 |
| 13 | F | 109D136X0075F0 | 6.0 | 160 | 1.0 | 4.0 | -16 | +8 | +9 | 190 |
| 15 | F | 109D156X0075F0 | 6.5 | 150 | 1.0 | 5.0 | -16 | +8 | +9 | 270 |
| 33 | F | 109D336X0075F0 | 7.0 | 90 | 1.0 | 10 | -24 | +10.5 | +15 | 230 |
| 40 | T | 109D406X0075T0 | 5.0 | 60 | 2.0 | 12 | -16 | +10.5 | +12 | 410 |
| 56 | T | 109D566X0075T0 | 6.0 | 60 | 2.0 | 17 | -28 | +10.5 | +15 | 300 |
| 110 | K | 109D117X0075K0 | 3.1 | 29 | 9.0 | 36 | -35 | +20 | +20 | 400 |
| 100 V_{DC} AT +85 °C; 65 V_{DC} AT +125 °C | | | | | | | | | | |
| 2.5 | C | 109D255X0100C0 | 26.5 | 950 | 1.0 | 2.0 | -16 | +7 | +8 | 100 |
| 3.0 | C | 109D305X0100C0 | 10.0 | 800 | 1.0 | 2.0 | -16 | +7 | +8 | 110 |
| 4.7 | C | 109D475X0100C0 | 10.0 | 500 | 1.0 | 2.0 | -16 | +7 | +8 | 130 |
| 10 | F | 109D106X0100F0 | 6.0 | 215 | 1.0 | 4.0 | -16 | +7 | +8 | 190 |
| 11 | F | 109D116X0100F0 | 6.0 | 200 | 1.0 | 4.0 | -16 | +7 | +8 | 230 |
| 22 | F | 109D226X0100F0 | 7.0 | 100 | 1.0 | 9.0 | -16 | +7 | +8 | 230 |
| 30 | T | 109D306X0100T0 | 4.0 | 80 | 2.0 | 12 | -16 | +7 | +8 | 340 |
| 43 | T | 109D436X0100T0 | 6.0 | 70 | 2.0 | 17 | -20 | +7 | +8 | 300 |
| 86 | K | 109D866X0100K0 | 3.1 | 30 | 9.0 | 36 | -25 | +15 | +15 | 400 |
| 125 V_{DC} AT +85 °C; 85 V_{DC} AT +125 °C | | | | | | | | | | |
| 1.7 | C | 109D175X0125C0 | 54.6 | 1250 | 1.0 | 2.0 | -16 | +7 | +8 | 100 |
| 3.6 | C | 109D365X0125C0 | 15.0 | 600 | 1.0 | 2.0 | -16 | +7 | +8 | 110 |
| 9.0 | F | 109D905X0125F0 | 15.0 | 240 | 1.0 | 5.0 | -16 | +7 | +8 | 210 |
| 14 | F | 109D146X0125F0 | 12.0 | 167 | 1.0 | 7.0 | -16 | +7 | +8 | 190 |
| 18 | T | 109D186X0125T0 | 11.0 | 129 | 2.0 | 9.0 | -16 | +7 | +8 | 340 |
| 25 | T | 109D256X0125T0 | 10.0 | 93 | 2.0 | 13 | -16 | +7 | +8 | 260 |
| 56 | K | 109D566X0125K0 | 4.1 | 3.2 | 10 | 40 | -25 | +15 | +15 | 400 |

Note

⁽¹⁾ Part numbers shown are for units with $\pm 20\%$ capacitance tolerance and uninsulated capacitors. For $\pm 10\%$ units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



| EXTENDED RATINGS | | | | | | | | | | |
|--|--------------|----------------------------|--------------|--------------|---------------|---------|------------------|--------|---------|----------|
| CAPACITANCE (μ F) | CASE CODE | PART NUMBER ⁽¹⁾ | MAX. ESR | MAX. IMP. | MAX. DCL | | MAX. CAPACITANCE | | | MAX. RMS |
| | | | AT +25 °C | AT -55 °C | (μ A) AT | | CHANGE (%) AT | | | RIPPLE |
| | | | 120 Hz | 120 Hz | +25 °C | +85 °C | -55 °C | +85 °C | +125 °C | CURRENT |
| | | | (Ω) | (Ω) | | +125 °C | | | | 120 Hz |
| | | | | | | | | | | (mA) |
| 6 V_{DC} AT +85 °C; 7 V_{DC} AT +125 °C | | | | | | | | | | |
| 140 | C | 109D147X0006C2 | 3.0 | 54 | 2.0 | 9.0 | -45 | +13 | +16 | 160 |
| 820 | F | 109D827X0006F0 | 2.5 | 18 | 3.0 | 14 | -88 | +16 | +20 | 300 |
| 1500 | T | 109D158X0006T0 | 1.5 | 18 | 5.0 | 20 | -90 | +20 | +25 | 480 |
| 2200 | K | 109D228X0006K0 | 1.0 | 13 | 6.0 | 24 | -90 | +25 | +30 | 670 |
| 8 V_{DC} AT +85 °C; 5 V_{DC} AT +125 °C | | | | | | | | | | |
| 180 | C | 109D187X0008C0 | 3.0 | 45 | 2.0 | 9.0 | -60 | +13 | +16 | 180 |
| 470 | F | 109D477X0008F0 | 2.5 | 25 | 3.0 | 14 | -75 | +16 | +20 | 300 |
| 680 | F | 109D687X0008F0 | 2.5 | 22 | 3.0 | 14 | -90 | +16 | +20 | 300 |
| 1800 | K | 109D188X0008K0 | 1.0 | 14 | 7.0 | 25 | -60 | +20 | +30 | 670 |
| 10 V_{DC} AT +85 °C; 7 V_{DC} AT +125 °C | | | | | | | | | | |
| 100 | C | 109D107X0010C0 | 3.0 | 60 | 2.0 | 9.0 | -50 | +13 | +16 | 160 |
| 120 | C | 109D127X0010C0 | 4.0 | 60 | 2.0 | 9.0 | -45 | +13 | +16 | 160 |
| 150 | C | 109D477X0010F0 | 3.0 | 54 | 2.0 | 9.0 | -55 | +13 | +16 | 180 |
| 390 | F | 109D397X0010F0 | 2.5 | 30 | 3.0 | 16 | -70 | +16 | +20 | 300 |
| 470 | F | 109D477X0010F0 | 2.5 | 30 | 3.0 | 16 | -65 | +16 | +20 | 300 |
| 560 | F | 109D567X0010F0 | 2.5 | 27 | 3.0 | 16 | -77 | +16 | +20 | 300 |
| 1000 | T | 109D108X0010T0 | 1.5 | 20 | 5.0 | 20 | -75 | +20 | +25 | 480 |
| 1200 | K | 109D128X0010K0 | 1.0 | 18 | 7.0 | 25 | -75 | +30 | +30 | 670 |
| 1200 | T | 109D128X0010T0 | 1.5 | 18 | 5.0 | 20 | -88 | +20 | +25 | 480 |
| 1500 | K | 109D158X0010K0 | 1.0 | 15 | 7.0 | 25 | -88 | +25 | +30 | 670 |
| 15 V_{DC} AT +85 °C; 10 V_{DC} AT +125 °C | | | | | | | | | | |
| 68 | C | 109D686X0015C0 | 4.0 | 80 | 2.0 | 9.0 | -40 | +13 | +16 | 140 |
| 82 | C | 109D826X0015C0 | 4.0 | 80 | 2.0 | 9.0 | -38 | +13 | +16 | 160 |
| 100 | C | 109D107X0015C0 | 4.0 | 72 | 2.0 | 9.0 | -44 | +13 | +16 | 160 |
| 270 | F | 109D277X0015F0 | 2.5 | 35 | 3.0 | 16 | -60 | +16 | +20 | 300 |
| 330 | F | 109D337X0015F0 | 2.5 | 35 | 3.0 | 16 | -60 | +16 | +20 | 300 |
| 390 | F | 109D397X0015F0 | 2.5 | 31 | 3.0 | 16 | -66 | +16 | +20 | 300 |
| 510 | T | 109D517X0015T0 | 1.8 | 25 | 6.0 | 24 | -65 | +20 | +25 | 340 |
| 540 | T | 109D547X0015T0 | 1.8 | 22 | 6.0 | 24 | -77 | +20 | +25 | 440 |
| 820 | T | 109D827X0015T0 | 1.8 | 22 | 6.0 | 24 | -77 | +20 | +25 | 440 |
| 820 | K | 109D827X0015K0 | 1.2 | 20 | 8.0 | 32 | -70 | +30 | +30 | 610 |
| 1000 | K | 109D108X0015K0 | 1.2 | 17 | 8.0 | 32 | -77 | +25 | +30 | 610 |
| 20 V_{DC} AT +85 °C; 13 V_{DC} AT +125 °C | | | | | | | | | | |
| 56 | C | 109D566X0020C0 | 4.3 | 90 | 2.0 | 9.0 | -38 | +13 | +16 | 140 |
| 82 | C | 109D826X0020C0 | 4.3 | 81 | 2.0 | 9.0 | -43 | +13 | +16 | 160 |
| 220 | F | 109D227X0020F0 | 2.7 | 35 | 3.0 | 16 | -60 | +16 | +20 | 300 |
| 330 | F | 109D337X0020F0 | 2.7 | 31 | 3.0 | 16 | -66 | +16 | +20 | 300 |
| 25 V_{DC} AT +85 °C; 15 V_{DC} AT +125 °C | | | | | | | | | | |
| 47 | C | 109D476X0025C0 | 4.3 | 100 | 2.0 | 9.0 | -35 | +12 | +15 | 140 |
| 68 | C | 109D686X0025C0 | 4.3 | 90 | 2.0 | 9.0 | -40 | +12 | +15 | 160 |
| 180 | F | 109D187X0025F0 | 2.7 | 37 | 3.0 | 16 | -55 | +13 | +16 | 300 |
| 270 | F | 109D277X0025F0 | 2.7 | 33 | 3.0 | 16 | -62 | +13 | +16 | 300 |
| 350 | T | 109D357X0025T0 | 1.8 | 27 | 7.0 | 28 | -60 | +20 | +25 | 440 |
| 560 | T | 109D567X0025T0 | 1.8 | 24 | 7.0 | 28 | -72 | +20 | +25 | 440 |
| 680 | K | 109D687X0025K0 | 1.2 | 19 | 8.0 | 32 | -72 | +25 | +30 | 610 |
| 750 | K | 109D757X0025K2 | 1.0 | 18 | 8.0 | 29 | -60 | +25 | +25 | 610 |

Note

(1) Part numbers shown are for units with \pm 20 % capacitance tolerance and uninsulated capacitors. For \pm 10 % units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



| EXTENDED RATINGS | | | | | | | | | | |
|--|--------------|-----------------|--------------|--------------|----------|---------|------------------|--------|---------|----------|
| CAPACITANCE (μ F) | CASE CODE | PART NUMBER (1) | MAX. ESR | MAX. IMP. | MAX. DCL | | MAX. CAPACITANCE | | | MAX. RMS |
| | | | AT +25 °C | AT -55 °C | (μA) AT | | CHANGE (%) AT | | | RIPPLE |
| | | | 120 Hz | 120 Hz | +25 °C | +85 °C | -55 °C | +85 °C | +125 °C | CURRENT |
| | | | (Ω) | (Ω) | | +125 °C | | | | 120 Hz |
| | | | | | | | | | | (mA) |
| 30 V_{DC} AT +85 °C; 20 V_{DC} AT +125 °C | | | | | | | | | | |
| 39 | C | 109D396X0030C0 | 5.2 | 110 | 2.0 | 9.0 | -28 | +10 | +12 | 140 |
| 47 | C | 109D476X0030C0 | 5.2 | 100 | 2.0 | 9.0 | -30 | +10 | +12 | 140 |
| 56 | C | 109D566X0030C0 | 5.2 | 100 | 2.0 | 9.0 | -38 | +12 | +15 | 140 |
| 150 | F | 109D157X0030F0 | 2.5 | 40 | 3.0 | 9.0 | -40 | +12 | +15 | 300 |
| 180 | F | 109D187X0030F0 | 2.5 | 40 | 3.0 | 16 | -45 | +13 | +16 | 300 |
| 220 | F | 109D227X0030F0 | 2.5 | 36 | 3.0 | 16 | -60 | +13 | +16 | 300 |
| 330 | T | 109D337X0030T0 | 1.8 | 28 | 8.0 | 16 | -45 | +20 | +25 | 440 |
| 390 | T | 109D397X0030T0 | 1.8 | 28 | 8.0 | 32 | -50 | +20 | +25 | 440 |
| 470 | T | 109D477X0030T0 | 1.8 | 25 | 8.0 | 32 | -65 | +20 | +25 | 550 |
| 560 | K | 109D567X0030K0 | 1.3 | 20 | 9.0 | 32 | -65 | +25 | +30 | 590 |
| 35 V_{DC} AT +85 °C; 22 V_{DC} AT +125 °C | | | | | | | | | | |
| 33 | C | 109D336X0035C0 | 5.2 | 130 | 2.0 | 9.0 | -30 | +10 | +12 | 140 |
| 47 | C | 109D476X0035C0 | 5.2 | 115 | 2.0 | 9.0 | -35 | +10 | +12 | 140 |
| 120 | F | 109D127X0035F0 | 2.5 | 45 | 3.0 | 16 | -45 | +13 | +16 | 300 |
| 220 | T | 109D227X0035T0 | 1.8 | 30 | 8.0 | 32 | -45 | +20 | +25 | 440 |
| 390 | T | 109D337X0035T0 | 1.8 | 27 | 8.0 | 32 | -58 | +20 | +25 | 440 |
| 470 | K | 109D477X0035T0 | 1.3 | 21 | 9.0 | 36 | -58 | +25 | +30 | 590 |
| 50 V_{DC} AT +85 °C; 30 V_{DC} AT +125 °C | | | | | | | | | | |
| 22 | C | 109D226X0050C0 | 5.0 | 150 | 2.0 | 9.0 | -24 | +10 | +12 | 140 |
| 33 | C | 109D336X0050C0 | 5.0 | 135 | 2.0 | 9.0 | -29 | +10 | +12 | 140 |
| 82 | F | 109D826X0050F0 | 2.5 | 55 | 4.0 | 24 | -35 | +10 | +15 | 300 |
| 120 | F | 109D127X0050F0 | 2.5 | 49 | 4.0 | 24 | -42 | +12 | +15 | 300 |
| 160 | T | 109D167X0050T0 | 1.8 | 32 | 6.0 | 32 | -35 | +20 | +25 | 420 |
| 250 | T | 109D257X0050T0 | 1.8 | 29 | 8.0 | 32 | -40 | +20 | +25 | 440 |
| 270 | T | 109D277X0050T0 | 1.8 | 29 | 8.0 | 32 | -46 | +20 | +25 | 440 |
| 330 | K | 109D337X0050K0 | 1.5 | 22 | 9.0 | 36 | -46 | +25 | +30 | 550 |
| 60 V_{DC} AT +85 °C; 40 V_{DC} AT +125 °C | | | | | | | | | | |
| 18 | C | 109D186X0060C0 | 5.0 | 160 | 3.0 | 12 | -20 | +10 | +12 | 140 |
| 27 | C | 109D276X0060C0 | 5.0 | 144 | 3.0 | 12 | -24 | +10 | +12 | 140 |
| 68 | F | 109D686X0060F0 | 3.0 | 60 | 3.0 | 20 | -30 | +12 | +15 | 270 |
| 100 | F | 109D107X0060F0 | 2.5 | 54 | 4.0 | 20 | -36 | +12 | +15 | 300 |
| 140 | T | 109D147X0060T0 | 2.0 | 32 | 8.0 | 32 | -30 | +16 | +20 | 420 |
| 220 | T | 109D227X0060T0 | 1.8 | 29 | 8.0 | 32 | -40 | +16 | +20 | 440 |
| 270 | K | 109D277X0060K0 | 1.5 | 23 | 9.0 | 36 | -45 | +20 | +25 | 550 |
| 75 V_{DC} AT +85 °C; 50 V_{DC} AT +125 °C | | | | | | | | | | |
| 12 | C | 109D126X0075C0 | 5.0 | 175 | 2.0 | 12 | -12 | +8 | +10 | 140 |
| 15 | C | 109D156X0075C0 | 5.0 | 160 | 2.0 | 12 | -14 | +10 | +12 | 140 |
| 22 | C | 109D226X0075C0 | 5.0 | 157 | 3.0 | 12 | -19 | +10 | +12 | 140 |
| 47 | F | 109D476X0075F0 | 3.0 | 75 | 4.0 | 24 | -18 | +10 | +12 | 270 |
| 56 | F | 109D566X0075F0 | 3.0 | 70 | 4.0 | 24 | -20 | +12 | +15 | 270 |
| 82 | F | 109D826X0075F0 | 2.5 | 63 | 4.0 | 24 | -30 | +12 | +15 | 300 |
| 110 | T | 109D117X0075T0 | 2.0 | 33 | 9.0 | 36 | -25 | +16 | +20 | 420 |
| 180 | T | 109D187X0075T0 | 1.8 | 30 | 9.0 | 36 | -35 | +16 | +20 | 440 |
| 200 | T | 109D207X0075T0 | 1.8 | 29 | 8.0 | 32 | -40 | +20 | +25 | 440 |
| 220 | K | 109D227X0075K0 | 2.2 | 24 | 10 | 40 | -40 | +20 | +25 | 450 |
| 270 | K | 109D277X0075K2 | 1.3 | 24 | 10 | 40 | -40 | +20 | +25 | 450 |

Note

(1) Part numbers shown are for units with $\pm 20\%$ capacitance tolerance and uninsulated capacitors. For $\pm 10\%$ units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



| EXTENDED RATINGS | | | | | | | | | | |
|---|--------------|-----------------|-------------------------------------|-------------------------------------|-------------------------|------------------------------------|-------------------------|--------|---------|---|
| CAPACITANCE (μ F) | CASE CODE | PART NUMBER (1) | MAX. ESR | MAX. IMP. | MAX. DCL | | MAX. CAPACITANCE | | | MAX. RMS RIPPLE CURRENT 120 Hz (mA) |
| | | | AT +25 °C 120 Hz (Ω) | AT -55 °C 120 Hz (Ω) | (μ A) AT +25 °C | (μ A) AT +85 °C +125 °C | CHANGE (%) AT -55 °C | +85 °C | +125 °C | |
| 100 V_{DC} AT +85 °C; 65 V_{DC} AT +125 °C | | | | | | | | | | |
| 2.0 | C | 109D205X0100C0 | 14.0 | 870 | 3.0 | 12 | -20 | +12 | +12 | 100 |
| 8.2 | C | 109D825X0100C0 | 6.0 | 250 | 3.0 | 12 | -12 | +12 | +12 | 130 |
| 10 | C | 109D106X0100C0 | 6.0 | 200 | 3.0 | 12 | -17 | +10 | +12 | 130 |
| 33 | F | 109D336X0100F0 | 3.5 | 85 | 4.0 | 24 | -18 | +15 | +15 | 250 |
| 39 | F | 109D396X0100F0 | 3.5 | 80 | 5.0 | 24 | -20 | +12 | +15 | 250 |
| 56 | T | 109D566X0100T0 | 2.2 | 45 | 9.0 | 36 | -20 | +15 | +15 | 400 |
| 68 | T | 109D686X0100T0 | 2.2 | 40 | 10 | 40 | -30 | +14 | +16 | 400 |
| 86 | K | 109D866X0100K0 | 3.2 | 30 | 10 | 40 | -25 | +15 | +15 | 370 |
| 120 | K | 109D127X0100K0 | 2.8 | 30 | 12 | 48 | -35 | +15 | +17 | 440 |
| 125 V_{DC} AT +85 °C; 85 V_{DC} AT +125 °C | | | | | | | | | | |
| 6.8 | C | 109D685X0125C0 | 11.7 | 300 | 3.0 | 12 | -14 | +10 | +12 | 130 |
| 27 | F | 109D276X0125F0 | 3.5 | 90 | 5.0 | 24 | -18 | +12 | +15 | 250 |
| 39 | T | 109D396X0125T0 | 2.2 | 60 | 10 | 40 | -16 | +14 | +16 | 400 |
| 47 | T | 109D476X0125T0 | 2.2 | 50 | 10 | 40 | -26 | +14 | +16 | 400 |
| 56 | K | 109D566X0125K0 | 4.1 | 32 | 10 | 40 | -25 | +15 | +15 | 330 |
| 82 | K | 109D826X0125K0 | 2.8 | 32 | 12 | 48 | -30 | +15 | +17 | 440 |

Note

(1) Part numbers shown are for units with $\pm 20\%$ capacitance tolerance and uninsulated capacitors. For $\pm 10\%$ units, change the digit following the letter "X" from "0" to "9". For units with outer plastic-film insulation, substitute "2" for "0" at the end of the part number. For RoHS-compliant add "E3".



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: org@lifeelectronics.ru