

Aluminum Capacitors 105 °C, Miniature, Radial Lead


FEATURES

- Improved SMPS output capacitors
- Highest ripple current ratings per case size
- High CV
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



| QUICK REFERENCE DATA | |
|---|--|
| DESCRIPTION | VALUE |
| Nominal case size Ø D x L in inches [mm] | 0.394 x 0.472 [10.0 x 12.0] to 0.709 x 1.575 [18.0 x 40.0] |
| Operating temperature | -55 °C to +105 °C |
| Rated capacitance range, C _R | 33 µF to 6800 µF |
| Tolerance on C _R | ± 20 % |
| Rated voltage range, U _R | 6.3 WV _{DC} to 63 WV _{DC} |
| Termination | 2 and 3 radial leads and axial mount. |
| Life validation test at 105 °C | 4000 h (≥ 0.512" [13.0] diameter): 3000 h (0.394" [10.0] diameter): ΔCAP ≤ 20 % (6.3 WV _{DC} to 25 WV _{DC}), ≤ 15 % (40 WV _{DC} to 63 WV _{DC}) from initial measurement. ΔESR ≤ 1.3 x initial specified limit. ΔDCL ≤ 2 x initial specified limit. |
| Shelf life at 105 °C | 1000 h: ΔCAP ≤ 20 % (6.3 WV _{DC} to 25 WV _{DC}), ≤ 15 % (40 WV _{DC} to 63 WV _{DC}) from initial measurements. ΔESR ≤ 1.3 x initial specified limit. |
| DC leakage current | I = 0.01 CV (2 min charge time) I = 0.03 CV (1 min charge time) I in µA, C in µF, V in Volts |

| RIPPLE CURRENT MULTIPLIERS | | | | | |
|----------------------------|----------|-------------|------------|-----------|-------------|
| TEMPERATURE | | | | | |
| AMBIENT TEMPERATURE | | MULTIPLIERS | | | |
| +105 °C | | 1.0 | | | |
| +85 °C | | 2.2 | | | |
| +75 °C | | 2.7 | | | |
| ≤ +65 °C | | 3.0 | | | |
| FREQUENCY (Hz) | | | | | |
| WV _{DC} | 50 TO 60 | 100 TO 120 | 300 TO 400 | 1K TO 19K | 20K TO 200K |
| 6.3 to 63 | 0.60 | 0.70 | 0.75 | 0.82 | 1.0 |

| LOW TEMPERATURE PERFORMANCE | | | | |
|---|---------------|--------------|--------------|--------------|
| CAPACITANCE RATIO C ^{-55 °C} / C ^{+25 °C} MINIMUM AT 120 Hz | | | | |
| MAXIMUM CAPACITANCE CHANGE | VOLTAGE | MULTIPLIER | | |
| | 6.3 V to 16 V | 0.75 | | |
| 25 V to 63 V | 0.85 | | | |
| MAXIMUM IMPEDANCE CHANGE | VOLTAGE | MULTIPLIER | | |
| | 6.3 V to 16 V | 2.0 | | |
| 25 V to 63 V | 1.5 | | | |
| ESL (TYPICAL VALUES AT 1 MHz TO 10 MHz) | | | | |
| NOMINAL DIAMETER | 0.394 [10.0] | 0.512 [13.0] | 0.630 [16.0] | 0.709 [18.0] |
| TYPICAL ESL (nH) | 4.0 | 7.0 | 10.0 | 12.0 |

BULK SPECIFICATIONS in millimeters

TERMINAL CODE C

TERMINAL CODE D

TERMINAL CODE J (1)

TERMINAL CODE O (2)

Notes

- ⊕ Positive terminal
- ⊖ Negative terminal
- Ⓝ No charge potential
- (1) Available for 12.5 mm, 16 mm, and 18 mm diameter units
- (2) Available for 12.5 mm, 16 mm, and 18 mm diameter units with epoxy end-seal

| DIMENSIONS in inches [millimeters] | | | | | | | | | | |
|---|--------------|--------------|----------------|--------------|----------------|--------------|------------------|------------------|---------------|-----|
| CASE CODE | NOMINAL | | STYLES 2 AND 4 | | STYLES 3 AND 5 | | LEAD SPACING | | LEAD DIAMETER | |
| | D | L | D (max.) | L (max.) | D (max.) | L (max.) | S ± 0.024 [0.60] | T ± 0.020 [0.50] | NOMINAL | AWG |
| CC | 0.394 [10.0] | 0.512 [13.0] | 0.413 [10.5] | 0.563 [14.3] | 0.413 [10.5] | 0.630 [16.0] | 0.197 [5.0] | n/a | 0.025 [0.63] | 22 |
| CD | 0.394 [10.0] | 0.630 [16.0] | 0.413 [10.5] | 0.669 [17.0] | 0.413 [10.5] | 0.740 [18.8] | 0.197 [5.0] | n/a | 0.025 [0.63] | 22 |
| CG | 0.394 [10.0] | 0.787 [20.0] | 0.413 [10.5] | 0.846 [21.5] | 0.413 [10.5] | 0.906 [23.0] | 0.197 [5.0] | n/a | 0.025 [0.63] | 22 |
| DG | 0.492 [12.5] | 0.787 [20.0] | 0.512 [13.0] | 0.846 [21.5] | 0.512 [13.0] | 0.906 [23.0] | 0.197 [5.0] | 0.098 [2.5] | 0.032 [0.81] | 20 |
| DK | 0.492 [12.5] | 0.984 [25.0] | 0.512 [13.0] | 1.043 [26.5] | 0.512 [13.0] | 1.142 [29.0] | 0.197 [5.0] | 0.098 [2.5] | 0.032 [0.81] | 20 |
| DM | 0.492 [12.5] | 1.043 [26.5] | 0.512 [13.0] | 1.102 [28.0] | 0.512 [13.0] | 1.161 [29.5] | 0.197 [5.0] | 0.098 [2.5] | 0.032 [0.81] | 20 |
| DT | 0.492 [12.5] | 1.319 [33.5] | 0.512 [13.0] | 1.346 [34.2] | 0.512 [13.0] | 1.417 [36.0] | 0.197 [5.0] | 0.098 [2.5] | 0.032 [0.81] | 20 |
| DS | 0.492 [12.5] | 1.673 [42.5] | 0.512 [13.0] | 1.720 [43.7] | 0.512 [13.0] | 1.791 [45.5] | 0.197 [5.0] | 0.098 [2.5] | 0.032 [0.81] | 20 |
| EK | 0.630 [16.0] | 0.984 [25.0] | 0.650 [16.5] | 1.031 [26.2] | 0.650 [16.5] | 1.098 [27.9] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |
| EN | 0.630 [16.0] | 1.260 [32.0] | 0.650 [16.5] | 1.319 [33.5] | 0.650 [16.5] | 1.417 [36.0] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |
| ER | 0.630 [16.0] | 1.417 [36.0] | 0.650 [16.5] | 1.476 [37.5] | 0.650 [16.5] | 1.575 [40.0] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |
| EU | 0.630 [16.0] | 1.575 [40.0] | 0.650 [16.5] | 1.642 [41.7] | 0.650 [16.5] | 1.669 [42.4] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |
| FR | 0.709 [18.0] | 1.417 [36.0] | 0.728 [18.5] | 1.476 [37.5] | 0.728 [18.5] | 1.575 [40.0] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |
| FV | 0.709 [18.0] | 1.575 [40.0] | 0.728 [18.5] | 1.653 [42.0] | 0.728 [18.5] | 1.693 [43.0] | 0.295 [7.5] | 0.150 [3.8] | 0.032 [0.81] | 20 |

TAPE AND REEL, SPECIFICATIONS TO EIA-468D in inches [millimeters]

Formed Leads


| DIMENSIONS in inches [millimeters] AND PACKAGING QUANTITIES | | |
|---|-----------------------|----------------------|
| CASE SIZE | F LEAD SPACING | STD. QTY/REEL |
| 0.236 x 0.453 [6.0 x 11.0] | 0.197 [5.0] | 800 |
| 0.315 x 0.472 [8.0 x 12.0] | 0.197 [5.0] | 700 |

Unformed (Straight) Leads


| DIMENSIONS in inches [millimeters] AND PACKAGING QUANTITIES | | |
|---|----------------------------|----------------------|
| CASE SIZE | F LEAD SPACING | STD. QTY/REEL |
| 0.236 x 0.453 [6.0 x 11.0] | 0.098 [2.5] | 800 |
| 0.315 x 0.472 [8.0 x 12.0] | 0.140 ⁽¹⁾ [3.5] | 700 |
| 0.394 x 0.512 [10.0 x 13.0] | 0.197 [5.0] | 500 |
| 0.394 x 0.630 [10.0 x 16.0] | 0.197 [5.0] | 500 |
| 0.394 x 0.787 [10.0 x 20.0] | 0.197 [5.0] | 500 |

Note
⁽³⁾ Available as special order.



| DIMENSIONS in inches [millimeters] | | | | | |
|--|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|
| ITEM | CASE SIZE (DIAMETER x LENGTH) | | | | |
| | 0.236 x 0.433 [6.0 x 11.0] | 0.315 x 0.472 [8.0 x 12.0] | 0.394 x 0.512 [10.0 x 13.0] | 0.394 x 0.630 [10.0 x 16.0] | 0.394 x 0.787 [10.0 x 20.0] |
| d - Lead-wire diameter | 0.025 [0.63] | 0.025 [0.63] | 0.025 [0.63] | 0.025 [0.63] | 0.025 [0.63] |
| P - Pitch of component | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] |
| P ₀ - Feed hole pitch | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] | 0.500 [12.7] |
| F - Lead-to-lead distance | 0.197 [5.0] | 0.197 [5.0] | 0.197 [5.0] | 0.197 [5.0] | 0.197 [5.0] |
| K - Clinch height | 0.098 [2.5] | 0.157 [4.0] | n/a | n/a | n/a |
| H - Height of component from tape center | 0.728 [18.5] | 0.787 [20.0] | 0.906 [23.0] | 0.906 [23.0] | 0.906 [23.0] |
| H ₀ - Lead-wire clinch height | 0.630 [16.0] | 0.630 [16.0] | n/a | n/a | n/a |
| W - Tape width | 0.709 [18.0] | 0.709 [18.0] | 0.709 [18.0] | 0.709 [18.0] | 0.709 [18.0] |
| W ₀ - Hold down tape width | 0.591 [15.0] | 0.591 [15.0] | 0.591 [15.0] | 0.591 [15.0] | 0.591 [15.0] |
| D ₀ - Feed hole diameter | 0.157 [4.0] | 0.157 [4.0] | 0.157 [4.0] | 0.157 [4.0] | 0.157 [4.0] |
| t - Total tape thickness | 0.028 [0.7] | 0.028 [0.7] | 0.028 [0.7] | 0.028 [0.7] | 0.028 [0.7] |
| L ₁ - Maximum lead protrusion | 0.118 [3.0] | 0.118 [3.0] | 0.118 [3.0] | 0.118 [3.0] | 0.118 [3.0] |

Note

- Terminal code "I" = tape and reel. Terminal code "+" = tape and ammo.
Positive leader is standard. Negative leader is available by special order.

ORDERING EXAMPLE

Electrolytic capacitor 678D series: 678D 108 M 6R3 DG 3 D

| DESCRIPTION | |
|-------------|---|
| CODE | EXPLANATION |
| 678D | Product type |
| 108 | Capacitance value (1000 µF) |
| M | Tolerance (M = ± 20 %) |
| 6R3 | Voltage rating at 105 °C (6R3 = 6.3 V) |
| DG | Can size (see Dimensions table) |
| 3 | Sleeve and sealing (3 = P.V.C. sleeve w/epoxy end seal) |
| D | Terminal code / packaging (D = bulk; straight leads) |

Note

- For lead (Pb)-free / RoHS compliant products add suffix "E3" to part number.
Example: 678D108M6R3DG3DE3

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | |
|---|-----------------|-----------------------------|---------------------------|--------|--|---|
| CAPACITANCE (µF) | PART NUMBER | NOMINAL CASE SIZE D x L | MAX. ESR AT +25 °C (Ω) | | MAX. RIPPLE AT +105 °C (A) 20 kHz to 100 kHz | MAX. IMPEDANCE AT +25 °C (Ω) 100 kHz |
| | | | 20 Hz | 20 kHz | | |
| 6.3 WV_{DC} at 105 °C, SURGE = 9 V | | | | | | |
| 330.0 | 678D337M6R3CC3D | 0.394 x 0.512 [10.0 x 13.0] | 0.540 | 0.213 | 0.36 | 0.213 |
| 470.0 | 678D477M6R3CD3D | 0.394 x 0.630 [10.0 x 16.0] | 0.340 | 0.133 | 0.49 | 0.132 |
| 1000.0 | 678D108M6R3DG3D | 0.492 x 0.787 [12.5 x 20.0] | 0.200 | 0.071 | 0.83 | 0.070 |
| 2200.0 | 678D228M6R3EK3D | 0.630 x 0.984 [16.0 x 25.0] | 0.110 | 0.041 | 1.36 | 0.045 |
| 3300.0 | 678D338M6R3DS3D | 0.492 x 1.673 [12.5 x 42.5] | 0.067 | 0.031 | 1.67 | 0.032 |
| 4700.0 | 678D478M6R3FR3D | 0.709 x 1.417 [18.0 x 36.0] | 0.066 | 0.029 | 2.02 | 0.031 |
| 10 WV_{DC} AT 105 °C, SURGE = 13 V | | | | | | |
| 330.0 | 678D337M010CD3D | 0.394 x 0.630 [10.0 x 16.0] | 0.350 | 0.135 | 0.46 | 0.134 |
| 470.0 | 678D477M010CG3D | 0.394 x 0.787 [10.0 x 20.0] | 0.235 | 0.092 | 0.63 | 0.090 |
| 1000.0 | 678D108M010DM3D | 0.492 x 1.043 [12.5 x 26.5] | 0.120 | 0.062 | 0.98 | 0.061 |
| 2200.0 | 678D228M010EK3D | 0.630 x 0.984 [16.0 x 25.0] | 0.115 | 0.042 | 1.52 | 0.046 |
| 3300.0 | 678D338M010EN3D | 0.630 x 1.260 [16.0 x 32.0] | 0.085 | 0.038 | 1.56 | 0.041 |
| 4700.0 | 678D487M010FR3D | 0.709 x 1.417 [18.0 x 36.0] | 0.070 | 0.031 | 1.97 | 0.033 |



| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | |
|---|-----------------|-----------------------------|------------------------------------|--------|--|--|
| CAPACITANCE (μ F) | PART NUMBER | NOMINAL CASE SIZE D x L | MAX. ESR AT +25 °C (Ω) | | MAX. RIPPLE AT +105 °C (A) 20 kHz to 100 kHz | MAX. IMPEDANCE AT +25 °C (Ω) 100 kHz |
| | | | 20 Hz | 20 kHz | | |
| 16 WV_{DC} AT 105 °C, SURGE = 20 V | | | | | | |
| 220.0 | 678D227M016CC3D | 0.394 x 0.512 [10.0 x 13.0] | 0.585 | 0.217 | 0.40 | 0.217 |
| 330.0 | 678D337M016CD3D | 0.394 x 0.630 [10.0 x 16.0] | 0.370 | 0.137 | 0.52 | 0.136 |
| 470.0 | 678D477M016CG3D | 0.394 x 0.787 [10.0 x 20.0] | 0.250 | 0.098 | 0.70 | 0.094 |
| 1000.0 | 678D108M016DM3D | 0.492 x 1.043 [12.5 x 26.5] | 0.130 | 0.066 | 1.00 | 0.065 |
| 2200.0 | 678D228M016ER3D | 0.630 x 1.417 [16.0 x 36.0] | 0.074 | 0.032 | 1.78 | 0.034 |
| 3300.0 | 678D338M016FR3D | 0.709 x 1.417 [18.0 x 36.0] | 0.074 | 0.032 | 1.94 | 0.034 |
| 20 WV_{DC} AT 105 °C, SURGE = 30 V | | | | | | |
| 220.0 | 678D227M020CD3D | 0.394 x 0.630 [10.0 x 16.0] | 0.380 | 0.150 | 0.41 | 0.148 |
| 330.0 | 678D337M020CG3D | 0.394 x 0.787 [10.0 x 20.0] | 0.270 | 0.100 | 0.61 | 0.098 |
| 470.0 | 678D477M020DG3D | 0.492 x 0.787 [12.5 x 20.0] | 0.250 | 0.077 | 0.45 | 0.075 |
| 1000.0 | 678D108M020DT3D | 0.492 x 1.280 [12.5 x 33.5] | 0.115 | 0.048 | 0.78 | 0.045 |
| 2200.0 | 678D228M020ER3D | 0.630 x 1.417 [16.0 x 36.0] | 0.077 | 0.032 | 1.80 | 0.034 |
| 3300.0 | 678D338M020FV3D | 0.709 x 1.575 [18.0 x 40.0] | 0.061 | 0.026 | 2.25 | 0.028 |
| 25 WV_{DC} AT 105 °C, SURGE = 35 V | | | | | | |
| 100.0 | 678D107M025CC3D | 0.394 x 0.512 [10.0 x 13.0] | 0.700 | 0.250 | 0.32 | 0.250 |
| 220.0 | 678D227M025CG3D | 0.394 x 0.787 [10.0 x 20.0] | 0.300 | 0.105 | 0.59 | 0.100 |
| 330.0 | 678D337M025DG3D | 0.492 x 0.787 [12.5 x 20.0] | 0.270 | 0.078 | 0.79 | 0.076 |
| 470.0 | 678D477M025DM3D | 0.492 x 1.043 [12.5 x 26.5] | 0.160 | 0.067 | 0.97 | 0.068 |
| 1000.0 | 678D108M025DS3D | 0.492 x 1.673 [12.5 x 42.5] | 0.090 | 0.034 | 1.60 | 0.036 |
| 2200.0 | 678D228M025FV3D | 0.709 x 1.575 [18.0 x 40.0] | 0.062 | 0.026 | 2.22 | 0.028 |
| 40 WV_{DC} AT 105 °C, SURGE = 55 V | | | | | | |
| 47.0 | 678D476M040CC3D | 0.394 x 0.512 [10.0 x 13.0] | 0.950 | 0.265 | 0.28 | 0.265 |
| 100.0 | 678D107M040CD3D | 0.394 x 0.630 [10.0 x 16.0] | 0.580 | 0.165 | 0.38 | 0.165 |
| 330.0 | 678D337M040DM3D | 0.492 x 1.043 [12.5 x 26.5] | 0.200 | 0.068 | 0.93 | 0.070 |
| 470.0 | 678D477M040EK3D | 0.630 x 0.984 [16.0 x 25.0] | 0.133 | 0.046 | 1.28 | 0.050 |
| 1000.0 | 678D108M040ER3D | 0.630 x 1.417 [16.0 x 36.0] | 0.080 | 0.033 | 1.76 | 0.035 |
| 50 WV_{DC} AT 105 °C, SURGE = 75 V | | | | | | |
| 47.0 | 678D476M050CC3D | 0.394 x 0.512 [10.0 x 13.0] | 1.250 | 0.275 | 0.28 | 0.275 |
| 100.0 | 678D107M050CG3D | 0.394 x 0.787 [10.0 x 20.0] | 0.520 | 0.115 | 0.57 | 0.112 |
| 220.0 | 678D227M050DM3D | 0.472 x 1.043 [12.5 x 26.5] | 0.240 | 0.069 | 0.93 | 0.071 |
| 330.0 | 678D337M050EK3D | 0.630 x 0.984 [16.0 x 25.0] | 0.150 | 0.048 | 1.26 | 0.052 |
| 470.0 | 678D477M050DS3D | 0.492 x 1.673 [12.5 x 42.5] | 0.110 | 0.036 | 1.55 | 0.039 |
| 1000.0 | 678D108M050FV3D | 0.709 x 1.575 [18.0 x 40.0] | 0.077 | 0.028 | 2.15 | 0.032 |
| 63 WV_{DC} AT 105 °C, SURGE = 80 V | | | | | | |
| 33.0 | 678D336M063CC3D | 0.394 x 0.512 [10.0 x 13.0] | 1.600 | 0.288 | 0.27 | 0.288 |
| 47.0 | 678D476M063CD3D | 0.394 x 0.630 [10.0 x 16.0] | 1.000 | 0.180 | 0.37 | 0.180 |
| 100.0 | 678D107M063DG3D | 0.492 x 0.787 [12.5 x 20.0] | 0.450 | 0.093 | 0.72 | 0.090 |
| 220.0 | 678D227M063DT3D | 0.492 x 1.280 [12.5 x 33.5] | 0.160 | 0.055 | 1.10 | 0.054 |
| 220.0 | 678D227M063EK3D | 0.630 x 0.984 [16.0 x 25.0] | 0.170 | 0.050 | 1.23 | 0.054 |
| 330.0 | 678D337M063DS3D | 0.492 x 1.673 [12.5 x 42.5] | 0.130 | 0.038 | 1.51 | 0.040 |
| 470.0 | 678D477M063ER3D | 0.630 x 1.417 [16.0 x 36.0] | 0.120 | 0.035 | 1.70 | 0.038 |

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.



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