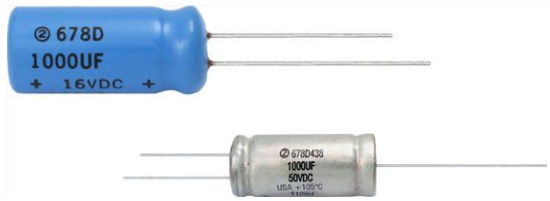
Aluminum Capacitors
105 °C, Miniature, Radial Lead



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

Pb-free Available

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

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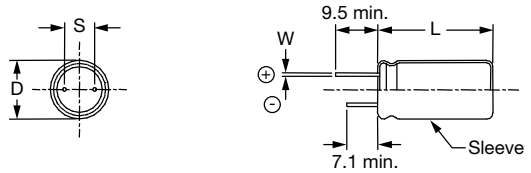
BULK SPECIFICATIONS in millimeters

TERMINAL CODE C



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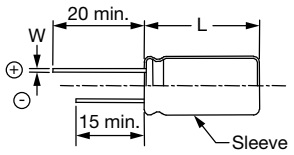

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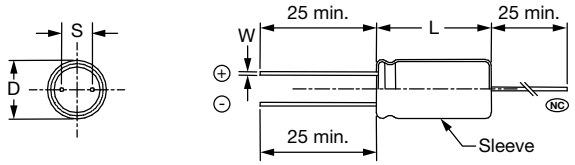

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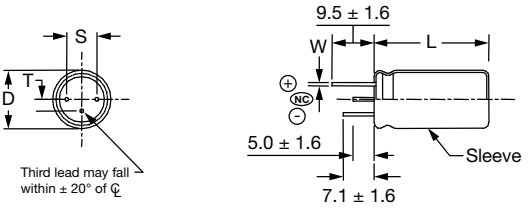

Notes

⊕ Positive terminal
⊖ Negative terminal
NC No charge potential

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

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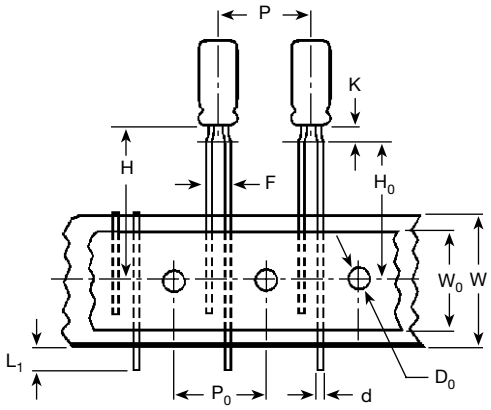
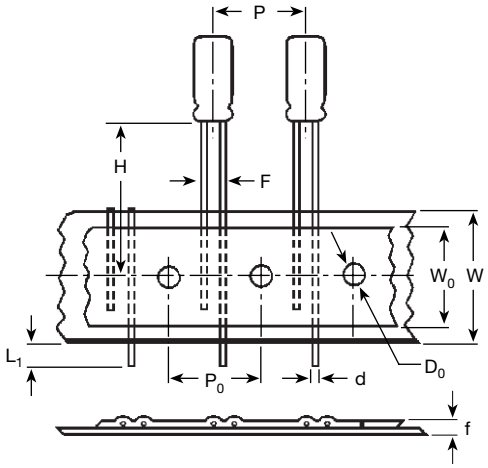
TAPE AND REEL, SPECIFICATIONS TO EIA-468D in inches [millimeters]

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

(1) Available as special order.

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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 (mΩ)		MAX. RIPPLE AT + 105 °C (A)	MAX. IMPEDANCE AT + 25 °C (mΩ) 100 Hz
			20 Hz	20 kHz	20 kHz to 100 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 (1)	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

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ELECTRICAL DATA AND ORDERING INFORMATION

CAPACITANCE (µF)	PART NUMBER	NOMINAL CASE SIZE D x L	MAX. ESR AT + 25 °C (mΩ)		MAX. RIPPLE AT + 105 °C (A)	MAX. IMPEDANCE AT + 25 °C (mΩ) 100 Hz
			20 Hz	20 kHz	20 kHz to 100 kHz	
16 WV_{DC} AT 105 °C, SURGE = 20 V						
220.0 (1)	678D227M016CC3D	0.394 x 0.512 [10.0 x 13.0]	0.585	0.217	0.40	0.217
330.0 (1)	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 (1)	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 (1)	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 (1)	678D337M025DG3D	0.492 x 0.787 [12.5 x 20.0]	0.270	0.078	0.79	0.076
470.0 (1)	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 (1)	678D107M040CD3D	0.394 x 0.630 [10.0 x 16.0]	0.580	0.165	0.38	0.165
330.0 (1)	678D337M040DM3D	0.492 x 1.043 [12.5 x 26.5]	0.200	0.068	0.93	0.070
470.0 (1)	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 (1)	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 (1)	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

Note

(1) These values are normally stocked.

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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.