

# +105°C Miniature Radial Lead, Aluminum Capacitors

## Features-

- Wide Temperature Range
- Improved SMPS Output Capacitors
- Optional 3<sup>rd</sup> Lead On Diameters  $\geq 12.5\text{mm}$

## General Specifications-

### Operating Temperature:

-55 to +105°C

### Voltage Range:

6.3 – 63 VDC

### Capacitance Range:

39 $\mu\text{F}$  to 10,000 $\mu\text{F}$

### Capacitance Tolerance:

$\pm 20\%$  (Std.)

### Case Size Range:

10.0 X 13.0mm – 18.0 X 40.0mm

### Termination:

2 or 3 Lead Radial And Axial Mount.

### Life Validation Test:

4,000hrs @ +105°C ( $\geq 13.0\text{mm}$  dia.):

3,000hrs @ +105°C (10.0mm):

$\Delta \text{CAP} \leq 20\%$  From initial measurement.

$\Delta \text{ESR} \leq 1.3\text{X}$  From initial specified limit.

$\Delta \text{DCL} \leq$  Initial specified limit.

### Shelf Test: 500hrs @ +105°C

$\Delta \text{CAP} \leq 10\%$  From initial measurement.

( $\leq 20\%$  for 6.3 – 25VDC)

$\Delta \text{ESR} \leq 1.3\text{X}$  From initial specified limit.

$\Delta \text{DCL} \leq 2\text{X}$  Initial specified limit.

### DC Leakage Current: (After 2 min. charge)

$I = 0.01\text{CV}$

Where: I is in  $\mu\text{A}$ , C is in  $\mu\text{F}$ , V is in Volts



## Ripple Current Multipliers:

Temperature:

Ambient Temp.	Multiplier
+105°C	0.50
+95°C	0.77
+85°C	1.00
+75°C	1.25
$\leq +65^\circ\text{C}$	1.34

Frequency (Hz):

VDC	50-60	100-120	300-400	1k-19k	20k-200k
6.3-63	0.60	0.70	0.75	0.80	1.00

## Low Temperature Performance:

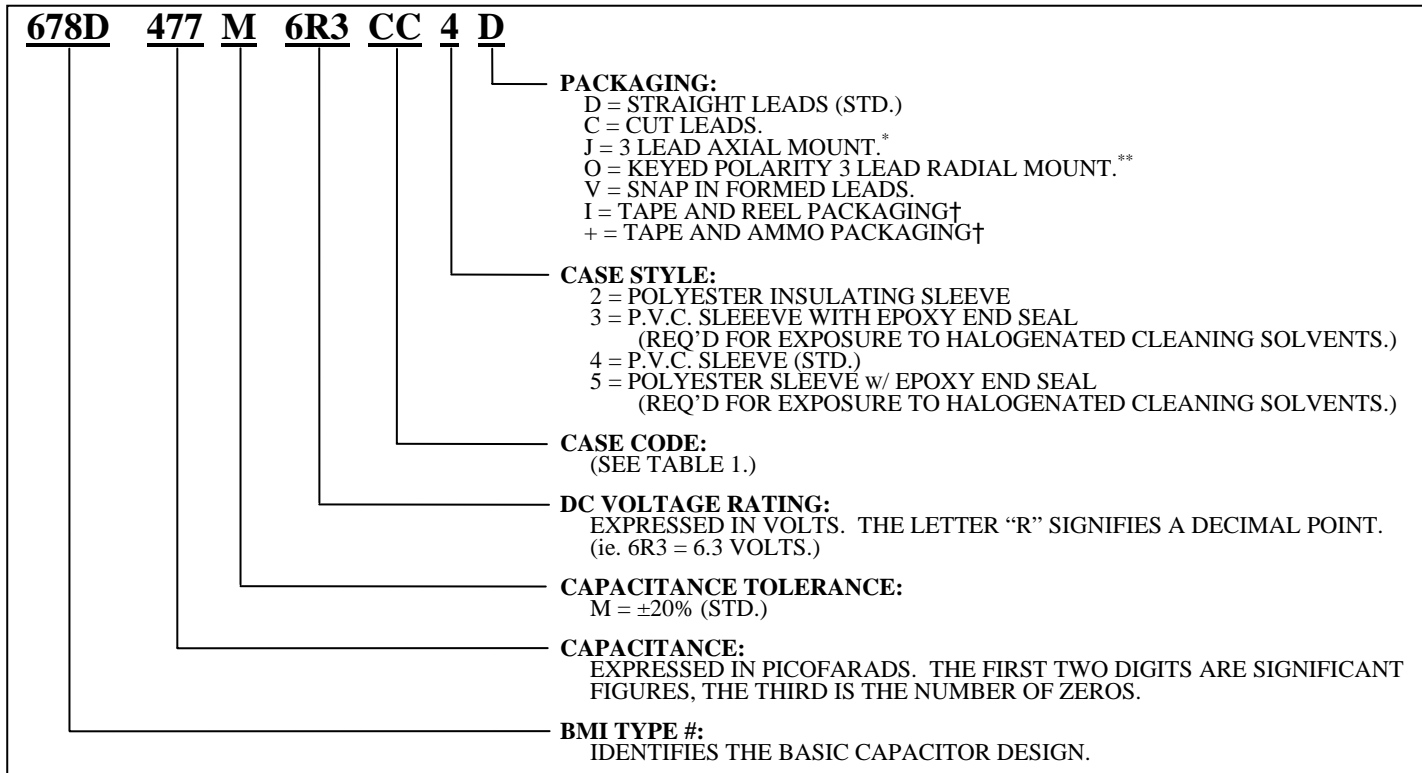
**Capacitance Ratio  $C^{-55^\circ\text{C}}/C^{+25^\circ\text{C}}$  min. @ 120Hz.**

Max.	Voltage (VDC)	Multiplier
Capacitance	6.3 – 16	0.75
Change	25 – 63	0.85

**Impedance Ratio  $Z^{-55^\circ\text{C}}/Z^{+25^\circ\text{C}}$  min. @ 120Hz**

Max.	Voltage (VDC)	Multiplier
Impedance	6.3 – 16	2.50
Change	25 – 63	1.50

## PART NUMBER BREAK-DOWN:



\*Available for 12.5, 16, and 18mm dia. units.

\*\*Available for 12.5, 16, and 18mm dia. units with epoxy end-seal.

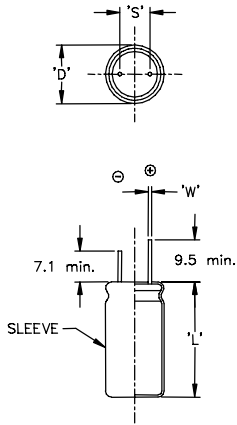
†Available for 10 mm dia. units.

### Table 1. Case Dimensions mm(in.)

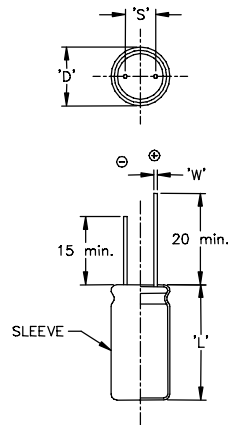
CASE CODE	NOMINAL		STYLES 2 & 4		STYLES 3 & 5 (w/EPOXY)		LEAD SPACING		WIRE GAUGE 'W'
	'D'	'L'	'D' MAX.	'L' MAX.	'D' MAX.	'L' MAX.	S ± 0.6	T ± 0.5	
CC	10.0 (0.394)	13.0 (0.512)	10.5 (0.413)	14.3 (0.563)	10.5 (0.413)	16.0 (0.630)	5.0 (0.197)	N/A	No. 22 AWG (0.025)
CD	10.0 (0.394)	16.0 (0.630)	10.5 (0.413)	17.0 (0.669)	10.5 (0.413)	18.8 (0.740)	5.0 (0.197)	N/A	No. 22 AWG (0.025)
CG	10.0 (0.394)	20.0 (0.787)	10.5 (0.413)	21.5 (0.846)	10.5 (0.413)	23.0 (0.906)	5.0 (0.197)	N/A	No. 22 AWG (0.025)
DG	12.5 (0.492)	20.0 (0.787)	13.0 (0.512)	21.2 (0.835)	13.0 (0.512)	23.0 (0.906)	5.0 (0.197)	2.5 (0.098)	No. 20 AWG (0.032)
DK	12.5 (0.492)	25.0 (0.984)	13.0 (0.512)	26.2 (1.031)	13.0 (0.512)	29.0 (1.142)	5.0 (0.197)	2.5 (0.098)	No. 20 AWG (0.032)
DM	12.5 (0.492)	26.5 (1.043)	13.0 (0.512)	28.0 (1.102)	13.0 (0.512)	29.5 (1.161)	5.0 (0.197)	2.5 (0.098)	No. 20 AWG (0.032)
DT	12.5 (0.492)	33.5 (1.319)	13.0 (0.512)	34.2 (1.347)	13.0 (0.512)	36.0 (1.417)	5.0 (0.197)	2.5 (0.098)	No. 20 AWG (0.032)
DS	12.5 (0.492)	42.5 (1.673)	13.0 (0.512)	43.7 (1.721)	13.0 (0.512)	45.5 (1.791)	5.0 (0.197)	2.5 (0.098)	No. 20 AWG (0.032)
EK	16.0 (0.630)	25.0 (0.984)	16.5 (0.650)	26.2 (1.032)	16.5 (0.650)	27.9 (1.098)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)
EN	16.0 (0.630)	32.0 (1.260)	16.5 (0.650)	33.5 (1.319)	16.5 (0.650)	36.0 (1.417)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)
ER	16.0 (0.630)	36.0 (1.417)	16.5 (0.650)	37.5 (1.476)	16.5 (0.650)	40.0 (1.575)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)
EU	16.0 (0.630)	40.0 (1.575)	16.5 (0.650)	41.7 (1.642)	16.5 (0.650)	42.4 (1.669)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)
FR	18.0 (0.709)	36.0 (1.417)	18.5 (0.728)	37.5 (1.476)	18.5 (0.728)	40.0 (1.575)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)
FV	18.0 (0.709)	40.0 (1.575)	18.5 (0.728)	41.7 (1.642)	18.5 (0.728)	42.4 (1.669)	7.5 (0.295)	3.8 (0.150)	No. 20 AWG (0.032)

Radial-Leaded Capacitor Dimensions

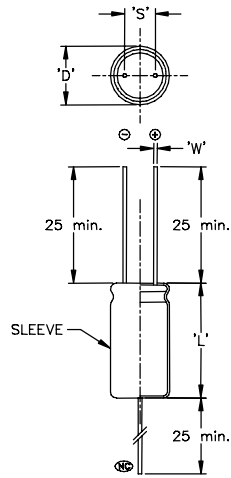
TERMINAL CODE C



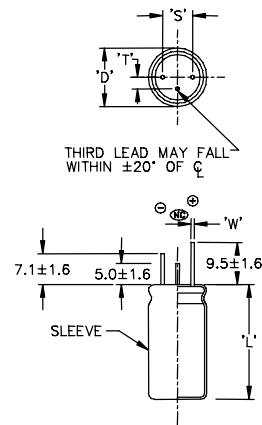
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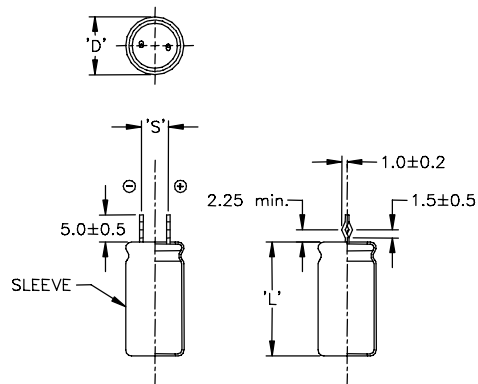
TERMINAL CODE J



TERMINAL CODE O



TERMINAL CODE V  
10 - 18 mm Dia.



Dimensions in mm

⊕ Positive Lead ⊖ Negative Lead (NC) No Charge Potential

## STANDARD RATINGS FOR TYPE 678D

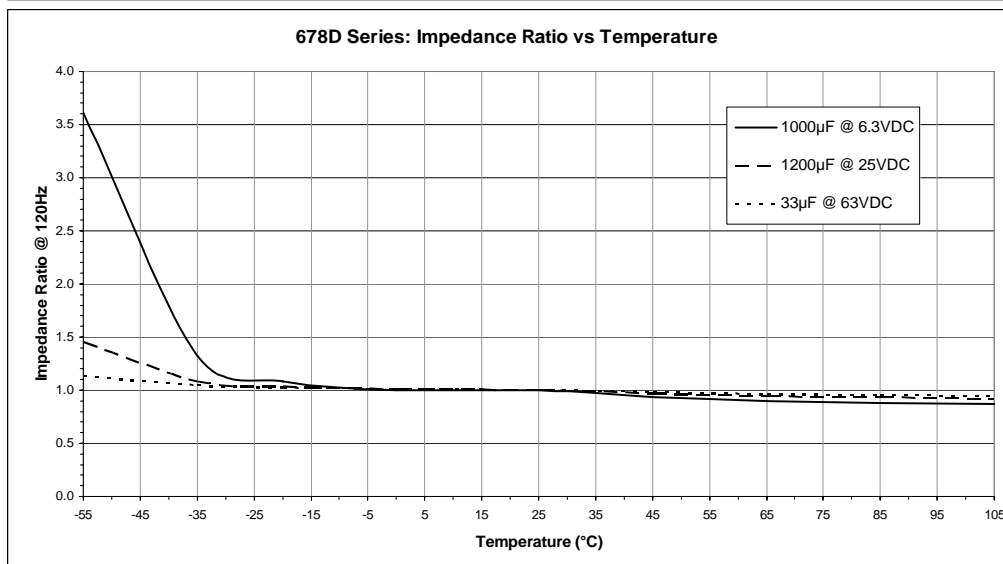
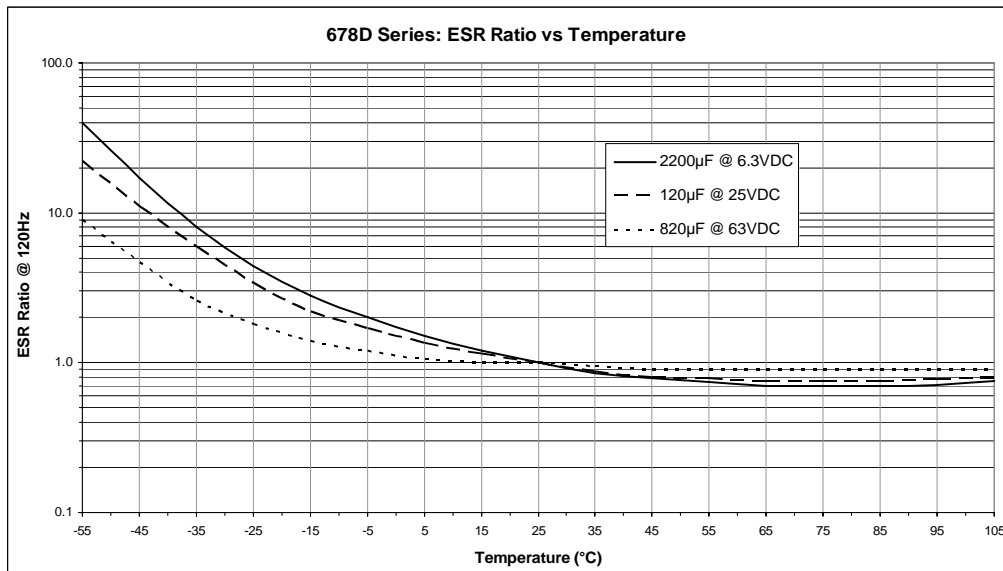
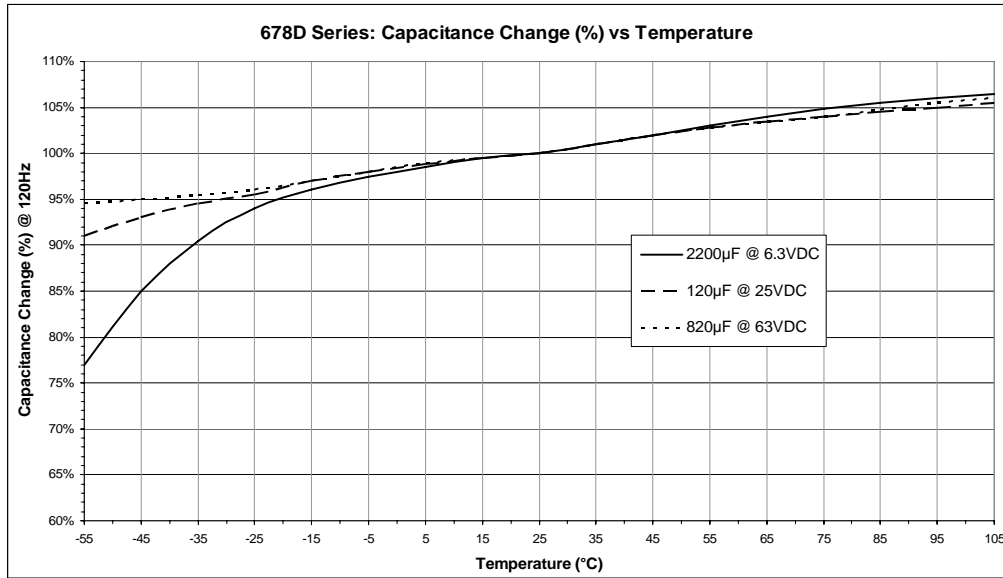
Rated Capacitance ( $\mu\text{F}$ )	Catalog Number	Nominal Case Size D x L (mm)	Maximum	Maximum	Maximum	Maximum
			ESR +25°C 120Hz ( $\Omega$ )	ESR +25°C 20-40kHz ( $\Omega$ )	Ripple Current +85°C 20-100kHz ( $\text{A}_{\text{rms}}$ )	Z +25°C 100kHz ( $\Omega$ )
<b>6.3 VOLTS DC WORKING; 8 VOLTS DC SURGE</b>						
470	678D477M6R3CC4D	10.0 x 13.0	0.540	0.213	0.80	0.213
680	678D687M6R3CD4D	10.0 x 16.0	0.340	0.133	1.09	0.132
1,000	678D108M6R3CG4D	10.0 x 20.0	0.230	0.090	1.45	0.093
1,500	678D158M6R3DG4D	12.5 x 20.0	0.200	0.071	1.85	0.070
2,200	678D228M6R3DM4D	12.5 x 26.5	0.110	0.060	1.63	0.059
3,300	678D338M6R3DT4D	12.5 x 33.5	0.091	0.057	2.30	0.056
3,900	678D398M6R3EK4D	16.0 x 25.0	0.110	0.041	3.04	0.045
4,700	678D478M6R3DS4D	12.5 x 42.5	0.067	0.031	3.74	0.032
5,600	678D568M6R3EN4D	16.0 x 32.0	0.078	0.037	3.53	0.040
6,800	678D688M6R3ER4D	16.0 x 36.0	0.069	0.034	3.67	0.037
8,200	678D828M6R3EU4D	16.0 x 40.0	0.059	0.031	4.18	0.034
8,200	678D828M6R3FR4D	18.0 x 36.0	0.066	0.029	4.52	0.031
10,000	678D109M6R3FV4D	18.0 x 40.0	0.054	0.024	5.21	0.026
<b>10 VOLTS DC WORKING; 12 VOLTS DC SURGE</b>						
330	678D337M010CC4D	10.0 x 13.0	0.550	0.215	0.80	0.215
560	678D567M010CD4D	10.0 x 16.0	0.350	0.135	1.03	0.134
820	678D827M010CG4D	10.0 x 20.0	0.235	0.092	1.41	0.090
1,000	678D108M010DG4D	12.5 x 20.0	0.215	0.077	1.79	0.079
1,500	678D158M010DK4D	12.5 x 25.0	0.200	0.064	1.90	0.062
1,800	678D188M010DM4D	12.5 x 26.5	0.120	0.062	2.19	0.061
2,700	678D278M010DT4D	12.5 x 33.5	0.111	0.059	2.28	0.060
2,700	678D278M010EK4D	16.0 x 25.0	0.115	0.042	3.40	0.046
3,300	678D338M010DS4D	12.5 x 42.5	0.075	0.032	3.69	0.033
4,700	678D478M010EN4D	16.0 x 32.0	0.085	0.038	3.49	0.041
5,600	678D568M010ER4D	16.0 x 36.0	0.078	0.033	3.62	0.036
6,800	678D688M010FR4D	18.0 x 36.0	0.070	0.031	4.41	0.033
8,200	678D828M010FV4D	18.0 x 40.0	0.060	0.026	5.01	0.028
<b>16 VOLTS DC WORKING; 20 VOLTS DC SURGE</b>						
220	678D227M016CC4D	10.0 x 13.0	0.585	0.217	0.89	0.217
390	678D397M016CD4D	10.0 x 16.0	0.370	0.137	1.16	0.136
560	678D567M016CG4D	10.0 x 20.0	0.250	0.098	1.56	0.094
820	678D827M016DG4D	12.5 x 20.0	0.215	0.085	1.79	0.085
1,200	678D128M016DM4D	12.5 x 26.5	0.130	0.066	2.24	0.065
1,800	678D188M016DT4D	12.5 x 33.5	0.121	0.055	2.77	0.054
2,200	678D228M016EK4D	16.0 x 25.0	0.120	0.042	3.02	0.046
2,700	678D278M016DS4D	12.5 x 42.5	0.080	0.032	3.67	0.034
3,300	678D338M016EN4D	16.0 x 32.0	0.078	0.032	3.78	0.034
3,900	678D398M016ER4D	16.0 x 36.0	0.074	0.032	3.98	0.034
4,700	678D478M016FR4D	18.0 x 36.0	0.074	0.032	4.34	0.034
5,600	678D568M016FV4D	18.0 x 40.0	0.061	0.026	4.99	0.028
<b>25 VOLTS DC WORKING; 35 VOLTS DC SURGE</b>						
120	678D127M025CC4D	10.0 x 13.0	0.700	0.250	0.71	0.250
220	678D227M025CD4D	10.0 x 16.0	0.489	0.187	1.00	0.186
330	678D337M025CG4D	10.0 x 20.0	0.300	0.105	1.32	0.100
390	678D397M025DG4D	12.5 x 20.0	0.265	0.092	1.54	0.092
560	678D567M025DK4D	12.5 x 25.0	0.193	0.075	1.79	0.076
680	678D687M025DM4D	12.5 x 26.5	0.160	0.067	2.17	0.068
1,000	678D108M025DT4D	12.5 x 33.5	0.151	0.056	2.68	0.058

## STANDARD RATINGS FOR TYPE 678D

Rated Capacitance ( $\mu$ F)	Catalog Number	Nominal Case Size D x L (mm)	Maximum	Maximum	Maximum	Maximum
			ESR +25°C 120Hz ( $\Omega$ )	ESR +25°C 20-40kHz ( $\Omega$ )	Ripple Current +85°C 20-100kHz (A <sub>rms</sub> )	Z +25°C 100kHz ( $\Omega$ )
<b>25 VOLTS DC WORKING; 35 VOLTS DC SURGE</b>						
1,200	678D128M025EK4D	16.0 x 25.0	0.123	0.045	2.93	0.047
1,200	678D128M025DS4D	12.5 x 42.5	0.090	0.034	3.58	0.036
1,500	678D158M025EN4D	16.0 x 32.0	0.095	0.039	3.44	0.041
1,800	678D188M025ER4D	16.0 x 36.0	0.074	0.032	3.98	0.034
2,200	678D228M025EU4D	16.0 x 40.0	0.072	0.031	4.14	0.033
2,200	678D228M025FR4D	18.0 x 36.0	0.070	0.030	4.34	0.032
2,700	678D278M025FV4D	18.0 x 40.0	0.062	0.026	4.97	0.028
<b>35 VOLTS DC WORKING; 50 VOLTS DC SURGE</b>						
82	678D826M035CC4D	10.0 x 13.0	0.950	0.265	0.62	0.265
150	678D157M035CD4D	10.0 x 16.0	0.580	0.165	0.85	0.165
220	678D227M035CG4D	10.0 x 20.0	0.250	0.098	1.56	0.094
270	678D277M035DG4D	12.5 x 20.0	0.248	0.094	1.61	0.093
390	678D387M035DK4D	12.5 x 25.0	0.233	0.089	1.72	0.090
470	678D477M035DM4D	12.5 x 26.5	0.200	0.068	2.08	0.070
680	678D687M035DT4D	12.5 x 33.5	0.190	0.059	2.46	0.059
820	678D827M035EK4D	16.0 x 25.0	0.133	0.046	2.86	0.050
820	678D827M035DS4D	12.5 x 42.5	0.093	0.035	3.51	0.037
1,200	678D128M035EN4D	16.0 x 32.0	0.099	0.041	3.71	0.042
1,500	678D158M035ER4D	16.0 x 36.0	0.080	0.033	3.94	0.035
1,800	678D188M035FR4D	18.0 x 36.0	0.079	0.033	4.25	0.034
<b>50 VOLTS DC WORKING; 75 VOLTS DC SURGE</b>						
39	678D396M050CC4D	10.0 x 13.0	1.250	0.275	0.62	0.275
68	678D686M050CD4D	10.0 x 16.0	0.933	0.178	0.76	0.179
100	678D107M050CG4D	10.0 x 20.0	0.520	0.115	1.27	0.112
120	678D127M050DG4D	12.5 x 20.0	0.390	0.139	1.34	0.141
180	678D187M050DK4D	12.5 x 25.0	0.261	0.090	1.61	0.092
220	678D227M050DM4D	12.5 x 26.5	0.240	0.069	2.08	0.071
330	678D337M050DT4D	12.5 x 33.5	0.219	0.063	2.24	0.066
390	678D397M050EK4D	16.0 x 25.0	0.150	0.048	2.82	0.052
470	678D477M050DS4D	12.5 x 42.5	0.110	0.036	3.47	0.039
560	678D567M050EN4D	16.0 x 32.0	0.118	0.041	3.36	0.043
680	678D687M050ER4D	16.0 x 36.0	0.102	0.040	3.69	0.042
820	678D827M050EU4D	16.0 x 40.0	0.094	0.038	3.80	0.040
820	678D827M050FR4D	18.0 x 36.0	0.089	0.036	4.07	0.038
1,000	678D108M050FV4D	18.0 x 40.0	0.077	0.028	4.81	0.032
<b>63 VOLTS DC WORKING; 80 VOLTS DC SURGE</b>						
39	678D396M063CC4D	10.0 x 13.0	1.600	0.288	0.60	0.288
56	678D566M063CD4D	10.0 x 16.0	1.000	0.180	0.82	0.180
82	678D826M063CG4D	10.0 x 20.0	0.611	0.120	1.34	0.120
120	678D127M063DG4D	12.5 x 20.0	0.450	0.093	1.61	0.090
180	678D187M063DK4D	12.5 x 25.0	0.298	0.090	1.83	0.091
270	678D277M063DT4D	12.5 x 33.5	0.160	0.055	2.46	0.054
330	678D337M063EK4D	16.0 x 25.0	0.170	0.050	2.75	0.054
390	678D397M063DS4D	12.5 x 42.5	0.130	0.038	3.38	0.040
470	678D477M063EN4D	16.0 x 32.0	0.140	0.043	3.29	0.045
560	678D567M063ER4D	16.0 x 36.0	0.120	0.035	3.80	0.038
680	678D687M063EU4D	16.0 x 40.0	0.113	0.032	3.87	0.035
680	678D687M063FR4D	18.0 x 36.0	0.102	0.029	4.18	0.032
820	678D827M063FV4D	18.0 x 40.0	0.090	0.029	4.74	0.033

## 678D TYPICAL PERFORMANCE PROFILES

### TEMPERATURE CHARACTERISTICS



## 678D TYPICAL PERFORMANCE PROFILES

### FREQUENCY CHARACTERISTICS

