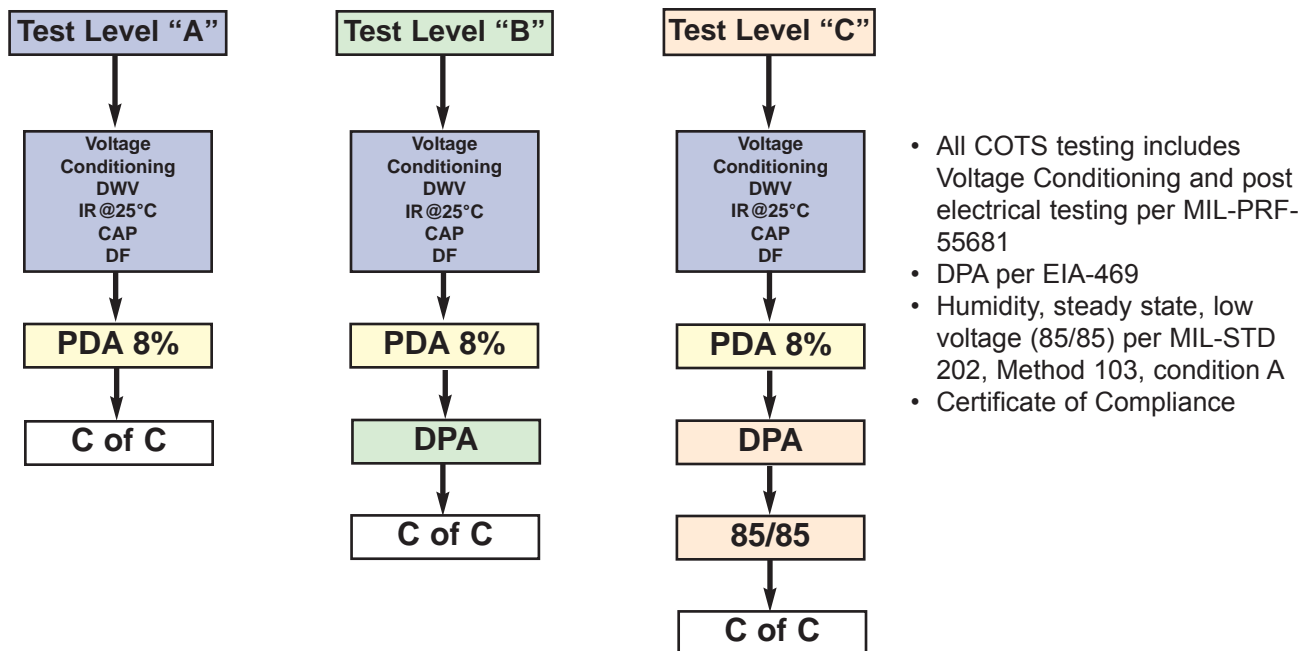


## Ceramic Commercial-Off-The-Shelf Surface Mount Capacitors (COTS)

KEMET is a qualified supplier of various military and high reliability specifications. The COTS program is an extension of KEMET's knowledge of high reliability test regimes and requirements. KEMET has for years supplied product that has been "up-screened" by working with customer drawings and imposing the design and test requirements specified. The COTS program will offer the same high quality and reliability components "up-screened" to the ordered test level at a lower cost to the customer. It eliminates the need for customer specific drawings used to achieve the reliability level required for customer applications. The tests and inspections imposed by the COTS program have been selected to provide the accelerated conditioning and 100% screening to eliminate infant mortal failures from the population.

All COTS testing includes Voltage Conditioning and post electrical testing per MIL-PRF-55681, paragraph 4.8.3.1, Standard voltage conditioning. For enhanced reliability, KEMET also provides the following test options and conformance certification.

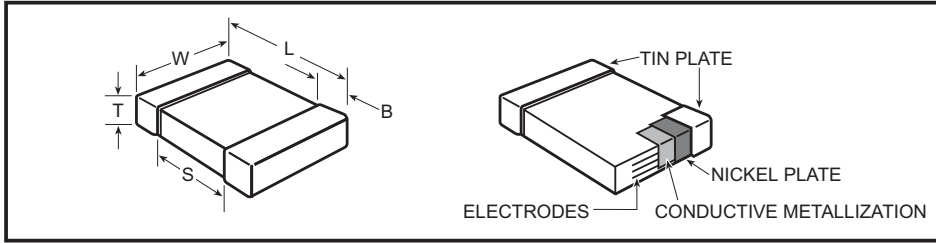


KEMET COTS MLCC surface mount capacitors are available in standard EIA case sizes from 0402 to 2225 and standard capacitance values in X7R and C0G dielectrics. Voltage ratings range from 6.3V to 200V. To order the COTS part number use a T in the 6th digit of the part number in conjunction with the desired test level A, B, or C in the 13th digit. A Tin/Lead termination option is also available with COTS by using a L in the 14th digit of the part number. For additional dielectrics and voltage ratings please contact the factory or local Sales personnel.

### Applications

- Military Products
- Space Quality Products
- High Reliability Electronics

## Outline Drawing

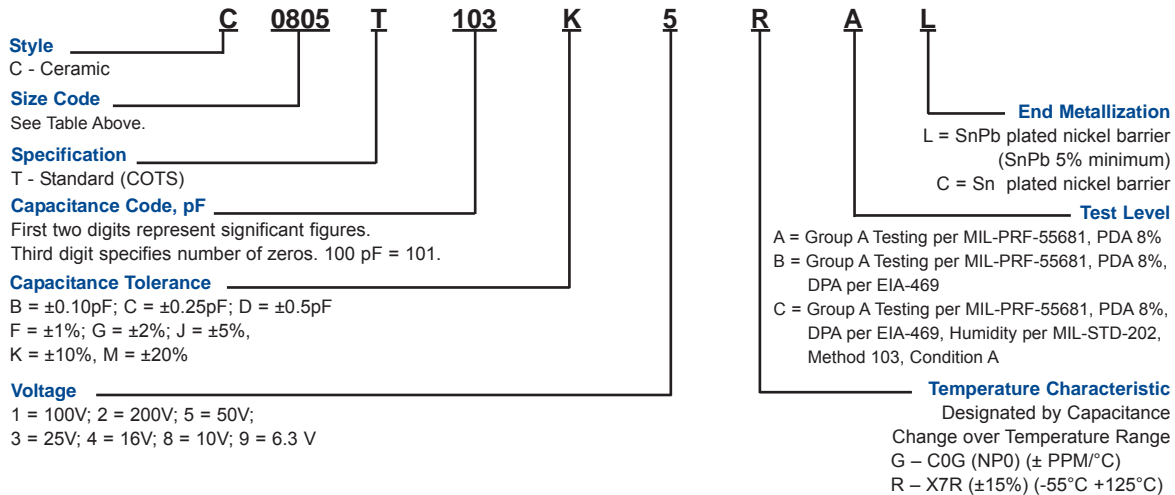


**Table 1 – Dimensions - Millimeters (Inches)**

Metric Code	EIA Size Code	L - Length	W - Width	B - Bandwidth	Band Separation
1005	0402	1.0 (.04) ± .05 (.002)	0.5 (.02) ± .05 (.002)	0.20 (0.008) -0.40 (0.016)	0.3 (.012)
1608	0603	1.6 (.063) ± 0.15 (.006)	0.8 (.032) ± 0.15 (.006)	0.35 (.014) ± 0.15 (.006)	0.7 (.028)
2012	0805	2.0 (0.079) ± 0.2 (0.008)	1.2 (0.049) ± 0.2 (0.008)	0.5 (0.02) ± 0.25 (0.010)	0.75 (0.030)
3216	1206	3.2 (0.126) ± 0.2 (0.008)	1.6 (0.063) ± 0.2 (0.008)	0.5 (0.02) ± 0.25 (0.010)	N/A
3225	1210	3.2 (0.126) ± 0.2 (0.008)	2.5 (0.098) ± 0.2 (0.008)	0.5 (0.02) ± 0.25 (0.010)	N/A
4532	1812	4.5 (0.177) ± 0.3 (0.012)	3.2 (0.126) ± 0.3 (0.012)	0.6 (0.024) ± 0.35 (0.014)	N/A
4564	1825	4.5 (0.177) ± 0.3 (0.012)	6.4 (0.250) ± 0.4 (0.016)	0.6 (0.024) ± 0.35 (0.014)	N/A
5650	2220	5.6 (.220) ± 0.4 (.016)	5.0 (.197) ± 0.4 (.016)	0.6 (0.024) ± .35 (0.014)	N/A
5664	2225	5.6 (.220) ± 0.4 (.016)	6.3 (.248) ± 0.4 (.016)	0.6 (0.024) ± .35 (0.014)	N/A

Note: For thickness dimensions, see Tables 2 and 3.

## Capacitor Ordering Information



## General Performance Characteristics & Electrical Parameters

<b>EIA Case Sizes</b>	0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225
<b>Capacitance Range</b>	0.5pF – 22.0μF
<b>Test Parameters</b>	Capacitance and Dissipation Factor measured at: C0G – 1kHz and 1 Vrms if capacitance 1000pF and 1MHz and 1 Vrms if capacitance ≤1000pF. X7R – 1kHz and 1 Vrms if capacitance ≤10μF and 120Hz and 0.5 Vrms if capacitance >10μF.
<b>Operating Temperature Range</b>	-55°C to +125°C, with no bias capacitance shift limited to ±15% over that range
<b>Capacitance Tolerances</b>	B = ±.10pF; C = ± 0.25pF; D = ±0.5pF; F = ±1%; G = ±2%; J = ±5%, K = ±10%, M = ±20%
<b>Aging Rate</b>	C0G – 0% maximum; X7R –2.0% maximum % capacitance loss/decade hour
<b>Voltage Rating</b>	6.3; 10; 16; 25; 50; 100; 200 Volts
<b>25°C IR @ Rated Voltage</b>	1000MΩ–μF or 100GΩ, whichever is less
<b>Dielectric Strength (DWV)</b>	2.5 times rated DC voltage

### Marking

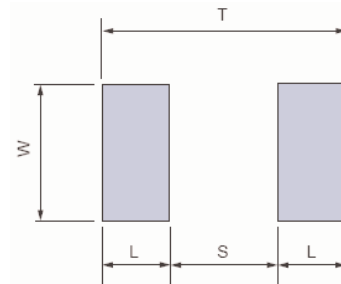
These chips are supplied unmarked. If required, they can be laser-marked as an extra cost option. Details on the marking format are included in KEMET Surface Mount Catalog F3102.

### Soldering Process

The 0402 size is suitable for solder reflow only. The 0603, 0805 and 1206 sizes are suitable for either reflow or wave soldering. Sizes 1210 and larger should be limited to reflow soldering only.

### Recommended Solder Pad Dimensions

Chip Size	T - Total Length		S - Separation		W - Pad Width		L - Pad Length	
	mm	in.	mm	in.	mm	in.	mm	in.
0402	2.14	0.084	0.28	0.011	0.74	0.029	0.93	0.037
0603	2.78	0.109	0.68	0.027	1.08	0.043	1.05	0.041
0805	3.30	0.130	0.70	0.028	1.60	0.063	1.30	0.051
1206	4.50	0.177	1.50	0.059	2.00	0.079	1.50	0.059
1210	4.50	0.177	1.50	0.059	2.90	0.114	1.50	0.059
1812	5.90	0.232	2.30	0.091	3.70	0.146	1.80	0.071
1825	5.90	0.232	2.30	0.091	6.90	0.272	1.80	0.071
2220	7.00	0.275	3.30	0.13	5.50	0.216	1.85	0.073
2225	7.00	0.275	3.30	0.13	6.80	0.268	1.85	0.073





**Table 2- C0G Dielectric Capacitance Values**

Cap pF	Cap Code	Cap Tol.	C1210*			C1812*			C1825*			C2220			C2225			
			50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	
10	100	D	J,K,M	FB	FB	FB												
12	120	D	J,K,M	FB	FB	FB												
15	150	D	G,J,K,M	FB	FB	FB												
18	180	D	G,J,K,M	FB	FB	FB												
22	220	D	G,J,K,M	FB	FB	FB												
27	270	D,F,G,J,K,M	F	FB	FB	FB												
33	330	D,F,G,J,K,M	F	FB	FB	FB												
39	390	D,F,G,J,K,M	F	FB	FB	FB												
47	470	D,F,G,J,K,M	F	FB	FB	FB												
56	560	F,G,J,K,M	F	FB	FB	FB												
68	680	F,G,J,K,M	F	FB	FB	FB												
82	820	F,G,J,K,M	F	FB	FB	FB												
100	101	F,G,J,K,M	F	FB	FB	FB												
120	121	F,G,J,K,M	F	FB	FB	FB												
150	131	F,G,J,K,M	F	FB	FB	FB												
180	181	F,G,J,K,M	F	FB	FB	FB												
220	221	F,G,J,K,M	F	FB	FB	FB												
270	271	F,G,J,K,M	F	FB	FB	FB												
330	331	F,G,J,K,M	F	FB	FB	FB												
390	391	F,G,J,K,M	F	FB	FB	FB												
470	471	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
560	561	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
680	681	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
820	821	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
1000	102	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
1200	122	F,G,J,K,M	F	FB	FB	FB	GB	GB	GB									
1500	152	F,G,J,K,M	F	FB	FE	FE	GB	GB	GB									
1800	182	F,G,J,K,M	F	FB	FE	FE	GB	GB	GB									
2200	222	F,G,J,K,M	F	FB	FC	FC	GB	GB	GB									
2700	272	F,G,J,K,M	F	FB	FC	FC	GB	GB	GB									
3300	332	F,G,J,K,M	F	FB	FF	FF	GB	GB	GB									
3900	392	F,G,J,K,M	F	FB	FF	FF	GB	GB	GB	HB	HB	HB						
4700	472	F,G,J,K,M	FF	FF	FF	FF	GB	GB	GD	HB	HB	HB				KB	KB	KB
5600	562	F,G,J,K,M	F	FB	FF	FF	GB	GB	GH	HB	HB	HB				KB	KB	KB
6800	682	F,G,J,K,M	F	FB	FG	FG	GB	GB	GJ	HB	HB	HB	JB	JB		KB	KB	KB
8200	822	F,G,J,K,M	FC	FC	FC	FC	GB	GB		HB	HB	HB	JB	JB		KB	KB	KB
10000	103	F,G,J,K,M	FF	FF	FF	FF	GB	GD		HB	HB	HE	JB	JB		KB	KB	KB
12000	123	F,G,J,K,M	FG	FG	FG	FG	GB	GD		HB	HB	HE	JB	JB		KB	KB	KB
15000	153	F,G,J,K,M								HB	HB		JB	JB		KB	KB	KE
18000	183	F,G,J,K,M								HB	HB		JB	JB		KB	KB	
22000	223	F,G,J,K,M								HB	HE		JB	JB		KB	KB	
27000	273	F,G,J,K,M								HB	HE		JB	JB		KB	KB	
33000	333	F,G,J,K,M														KB	KB	

\* EIA preferred chip sizes

See Thickness Code Table on page 7 for ceramic chip thickness dimensions.



**Table 3- X7R Dielectric Capacitance Values**

Cap pF	Cap Code	Cap Tol.	C1210*							C1812*			C1825*			C2220			C2225			
			6.3V	10V	16V	25V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	
2,200	222	K,M,J	FB	FB	FB	FB	FB	FB	FB													
2,700	272	K,M,J	FB	FB	FB	FB	FB	FB	FB													
3,300	332	K,M,J	FB	FB	FB	FB	FB	FB	FB													
3,900	392	K,M,J	FB	FB	FB	FB	FB	FB	FB													
4,700	472	K,M,J	FB	FB	FB	FB	FB	FB	FB													
5,600	562	K,M,J	FB	FB	FB	FB	FB	FB	FB													
6,800	682	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
8,200	822	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
10,000	103	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
12,000	123	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
15,000	153	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
18,000	183	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB										
22,000	223	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB							
27,000	273	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB							
33,000	333	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB							
39,000	393	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB							
47,000	473	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB					KC	KC	KC
56,000	563	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB					KC	KC	KC
68,000	683	K,M,J	FB	FB	FB	FB	FB	FB	FB	GB	GB	GB	HB	HB	HB					KC	KC	KC
82,000	823	K,M,J	FB	FB	FB	FB	FB	FC	FC	GB	GB	GB	HB	HB	HB					KC	KC	KC
100,000	104	K,M,J	FB	FB	FB	FB	FB	FD	FD	GB	GB	GB	HB	HB	HB					KC	KC	KC
120,000	124	K,M,J	FB	FB	FB	FB	FB	FD	FD	GB	GB	GB	HB	HB	HB					KC	KC	KC
150,000	154	K,M,J	FC	FC	FC	FC	FC	FD	FD	GB	GB	GE	HB	HB	HB					KC	KC	KC
180,000	184	K,M,J	FC	FC	FC	FC	FC	FD	FD	GB	GB	GG	HB	HB	HB					KC	KC	KC
220,000	224	K,M,J	FC	FC	FC	FC	FC	FD	FD	GB	GB	HB	HB	HB						KC	KC	KC
270,000	274	K,M,J	FC	FC	FC	FC	FC#	FD#	FD#	GB	GH	HB	HB	HB	JC	JC	JC			KB	KC	KC
330,000	334	K,M,J	FD	FD	FD	FD	FD#	FD#	FD#	GB	GH	HB	HB	HB	JC	JC	JC			KB	KC	KC
390,000	394	K,M,J	FD	FD	FD	FD	FD#	FD#	FD#	GB	GG	HB	HB	HD	JC	JC	JC			KB	KC	KC
470,000	474	K,M,J	FD	FD	FD	FD	FD#	FD#	FD#	GB	GG	HB	HB	HD	JC	JC	JC			KB	KC	KD
560,000	564	K,M,J	FD	FD	FD	FD	FD#	FD#	FD#	GC	GG	HB	HD	HD	JC	JC	JC			KB	KC	
680,000	684	K,M,J	FD	FD	FD	FD	FD#	FD#	FD#	GC	GG	HB	HD	HD	JC	JD	JD			KB	KC	
820,000	824	K,M,J	FF	FF	FF	FF	FF#	FF#	FF#	GE	GG	HB	HD	HD	JC	JF	JF			KB	KC	
1,000,000	105	K,M,J	FH	FH	FH	FH	FH#	FH#	FH#	GE	GG	HB	HD	HD	JC	JF	JF			KB	KD	
1,200,000	125	K,M,J	FH	FH	FH	FH	FH#	FH#	FH#			HB	HD	HD	JC	JF	JF			KB		
1,500,000	155	K,M,J	FH	FH	FH	FH	FH#	FH#	FH#			HB	HD	HD	JC	JF	JF			KC		
1,800,000	185	K,M,J	FH	FH	FH	FH	FH#	FH#	FH#			HD	HD	HD	JD	JD	JD			KD		
2,200,000	225	K,M,J	FJ	FJ	FJ	FJ	FJ#	FJ#	FJ#			HF	HD	HD	JF	JF	JF			KD		
2,270,000	275	K,M,J	FG	FG	FG	FG	FG#	FG#	FG#													
3,300,000	335	K,M,J	FG	FG	FG	FG	FG#	FG#	FG#													
3,900,000	395	K,M,J	FH	FH	FH	FH	FH#	FH#	FH#													
4,700,000	475	K,M,J	FJ	FJ	FJ	FJ	FJ#	FJ#	FJ#													
5,600,000	565	K,M,J																				
6,800,000	685	K,M,J																				
8,200,000	825	K,M,J																				
10,000,000	106	K,M,J																				
12,000,000	126	K,M,J																				
15,000,000	156	K,M,J																				
18,000,000	186	K,M,J																				
22,000,000	226	K,M,J																				

\* EIA preferred chip sizes  
 # X7R Dielectric - Extended Range Values or Voltages-Cap and DF measured @ 0.5 Vrms.  
 See Thickness Code Table on page 7 for ceramic chip thickness dimensions.

**Thickness Code Reference Chart**  
**Packaging Quantity Based on Finished Chip Thickness Specifications**

Thickness Code	Chip Size	Chip Thickness Range (mm)	Qty per Reel 7" Plastic	Qty per Reel 13" Plastic	Qty per Reel 7" Paper	Qty per Reel 13" Paper	Qty per Bulk Cassette
AA	0201	.30 ± .03	N/A	N/A	15,000	N/A	N/A
BB	0402	.50 ± .05	N/A	N/A	10,000	50,000	50,000
CB	0603	.80 ± .07	N/A	N/A	4,000	10,000	15,000
CC	0603	.80 ± .10	N/A	N/A	4,000	10,000	N/A
CD	0603	.80 ± .15	N/A	N/A	4,000	10,000	N/A
DB	0805	.60 ± .10	N/A	N/A	N/A	N/A	10,000
DC	0805	.78 ± .10	4,000	10,000	4,000	10,000	N/A
DD	0805	.90 ± .10	4,000	10,000	N/A	N/A	N/A
DE	0805	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
DF	0805	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
DG	0805	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
DH	0805	1.25 ± .20	2,500	10,000	N/A	N/A	N/A
DJ	0805	1.25 ± .20	3,000	10,000	N/A	N/A	N/A
EB	1206	.78 ± .10	4,000	10,000	4,000	10,000	N/A
EC	1206	.90 ± .10	4,000	10,000	N/A	N/A	N/A
ED	1206	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
EE	1206	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
EF	1206	1.20 ± .15	2,500	10,000	N/A	N/A	N/A
EG	1206	1.60 ± .15	2,000	8,000	N/A	N/A	N/A
EH	1206	1.60 ± .20	2,000	8,000	N/A	N/A	N/A
EJ	1206	1.70 ± .20	2,000	8,000	N/A	N/A	N/A
EK	1206	.80 ± .10	2,000	8,000	N/A	N/A	N/A
EL	1206	1.15 ± .15	2,000	8,000	N/A	N/A	N/A
EM	1206	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
EN	1206	0.95 ± .10	4,000	10,000	N/A	N/A	N/A
FB	1210	.78 ± .10	4,000	10,000	N/A	N/A	N/A
FC	1210	.90 ± .10	4,000	10,000	N/A	N/A	N/A
FD	1210	.95 ± .10	4,000	10,000	N/A	N/A	N/A
FE	1210	1.00 ± .10	2,500	10,000	N/A	N/A	N/A
FF	1210	1.10 ± .10	2,500	10,000	N/A	N/A	N/A
FG	1210	1.25 ± .15	2,500	10,000	N/A	N/A	N/A
FH	1210	1.55 ± .15	2,000	8,000	N/A	N/A	N/A
FJ	1210	1.85 ± .20	2,000	8,000	N/A	N/A	N/A
FK	1210	2.10 ± .20	2,000	8,000	N/A	N/A	N/A
FL	1210	1.40 ± .15	2,000	8,000	N/A	N/A	N/A
FM	1210	1.70 ± .20	2,000	8,000	N/A	N/A	N/A
FN	1210	1.85 ± .20	2,000	8,000	N/A	N/A	N/A
FO	1210	1.50 ± .20	2,000	8,000	N/A	N/A	N/A
FP	1210	1.60 ± .20	2,000	8,000	N/A	N/A	N/A
GB	1812	1.00 ± .10	1,000	4,000	N/A	N/A	N/A
GC	1812	1.10 ± .10	1,000	4,000	N/A	N/A	N/A
GD	1812	1.25 ± .15	1,000	4,000	N/A	N/A	N/A
GE	1812	1.30 ± .10	1,000	4,000	N/A	N/A	N/A
GF	1812	1.50 ± .10	1,000	4,000	N/A	N/A	N/A
GG	1812	1.55 ± .10	1,000	4,000	N/A	N/A	N/A
GH	1812	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
GJ	1812	1.70 ± .15	1,000	4,000	N/A	N/A	N/A
GK	1812	1.60 ± .20	1,000	4,000	N/A	N/A	N/A
GL	1812	1.90 ± .20	1,000	4,000	N/A	N/A	N/A
GM	1812	2.00 ± .20	1,000	4,000	N/A	N/A	N/A
HB	1825	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
HC	1825	1.15 ± .15	1,000	4,000	N/A	N/A	N/A
HD	1825	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
HE	1825	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
HF	1825	1.50 ± .15	1,000	4,000	N/A	N/A	N/A
JB	2220	1.00 ± .15	1,000	4,000	N/A	N/A	N/A
JC	2220	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
JD	2220	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
JE	2220	1.40 ± .15	1,000	4,000	N/A	N/A	N/A
JF	2220	1.50 ± .15	1,000	4,000	N/A	N/A	N/A
KB	2225	1.00 ± .15	1,000	4,000	N/A	N/A	N/A
KC	2225	1.10 ± .15	1,000	4,000	N/A	N/A	N/A
KD	2225	1.30 ± .15	1,000	4,000	N/A	N/A	N/A
KE	2225	1.40 ± .15	1,000	4,000	N/A	N/A	N/A