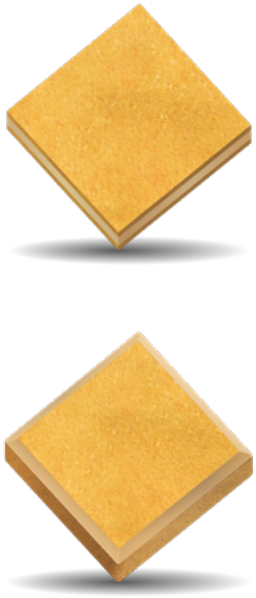
GENERAL INFORMATION

Maxi and Maxi+ are both KYOCERA AVX proprietary intergranular barrier layer dielectric formulations. Both use SrTiO3 as their major constituent and have dielectric constants exceeding 20,000 and 30,000 respectively. Grain boundary barrier layer (GBBL) capacitors have been well discussed in various literature sources and, while simple in principle, their resulting electrical properties are dependent on a complex combination of materials and process technology.

KYOCERA AVX's Maxi & Maxi+ dielectrics have the distinctive properties that are ideal for extremely broadband by-pass capacitors. This built-in feature gives these products a unique disspersive effect that is illustrated in the accompanying curves. KYOCERA AVX's ability to control the prerequisite relationships between materials and process has resulted in dielectrics that make these Single Layer Ceramics especially well suited for applications requiring high frequency performance well into the millimeter band.

These GBBL dielectrics are also available in low loss versions that are comparable to conventional barium titanate based dielectrics. Performance is likewise similar in that these materials exhibit a very pronounced dip at their resonant frequency. These designs are excellent choices for applications requiring the combined attributes of very small size and precise cut-off frequencies. Additional information on these high Q products may be obtained by contacting the factory or your local KYOCERA AVX representative.

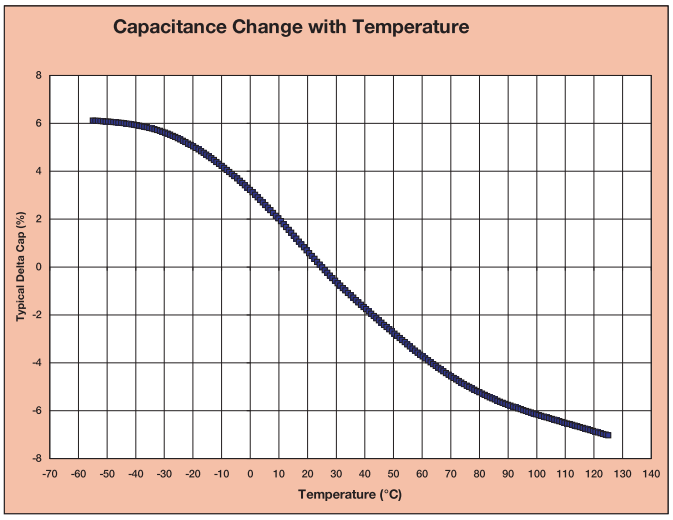
All Maxi & Maxi+ dielectrics exhibit X7R temperature performance of ±15% from −55°C to +125°C. Electrical characteristics, as outlined in MIL-C-49464, will meet those specified for Class II dielectrics, rather than the less stringent Class IV, which typically describes GBBL dielectrics.

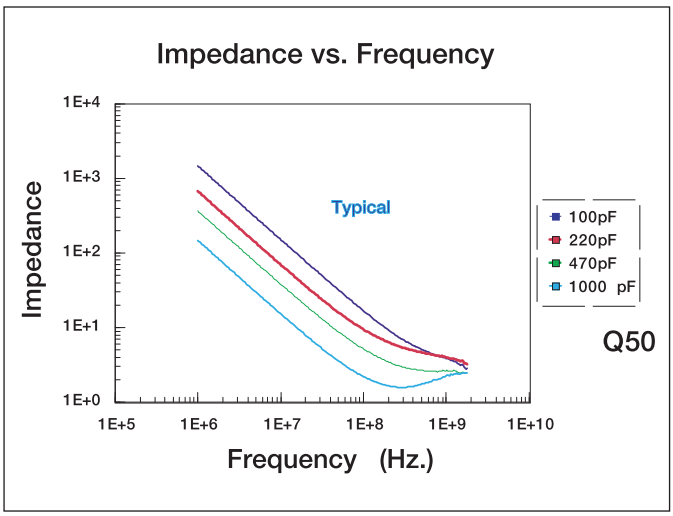


Sample kits are available

MAXI KIT Catalog # KITSLCK20KSAMPL includes 10 each: GH0158101MA6N, GH0258221MA6N, GH0258471MA6N, GH0358102MA6N, GH0458182MA6N

MAXI+ KIT Catalog # KITSLCK30KSAMPL includes 10 each: GH0159331MA6N, GH0259751MA6N, GH0359152MA6N, GH0459302MA6N, GH0559602MA6N





Microwave SLCs

GH/GB Series – SLC's With & Without Borders

Maxi & Maxi+ X7R Dielectrics

DIMENSIONS: inches (millimeters)

Case Size		GH01		GH02		GH03		GH04		GH05		GH06	
(L & W) Length & Width		0.015 ± 0.005 (0.381 ± 0.127)		0.025 ± 0.005 (0.635 ± 0.127)		0.035 ± 0.005 (0.889 ± 0.127)		0.050 ± 0.010 (1.270 ± 0.254)		0.070 ± 0.010 (1.780 ± 0.254)		0.090 ± 0.010 (0.2.29 ± 0.254)	
(T) Thickness		0.007 ± 0.002 (0.178 ± 0.051)											
		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)	
Dielectric	K	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Z	5000 - 18000	50	200	60	470	230	800	460	2000	900	3000	1500	4700
Maxi	20,000	68	330	330	750	750	1200	1200	2700	2700	4700	4700	8200
Maxi +	30,000	330	390	390	1000	1000	1800	1800	3300	3300	6800	6800	10000

Case Size		GB01		GB02		GB03		GB04		GB05		GB06	
(L & W) Length & Width		0.015 ± 0.005 (0.381 ± 0.127)		0.025 ± 0.005 (0.635 ± 0.127)		0.035 ± 0.005 (0.889 ± 0.127)		0.050 ± 0.010 (1.270 ± 0.254)		0.070 ± 0.010 (1.780 ± 0.254)		0.090 ± 0.010 (0.2.29 ± 0.254)	
(T) Thickness		0.007 ± 0.002 (0.178 ± 0.051)											
(B) Border		0.002 ± 0.001 (0.051 ± 0.025)											
		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)		Cap (pF)	
Dielectric	K	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Z	5000 - 18000	45	200	50	470	200	800	430	2000	840	3000	1400	4700
Maxi	20,000	51	220	220	560	560	1000	1000	2200	2200	4700	4700	8200
Maxi +	30,000	220	330	330	820	820	1500	1500	2700	2700	6800	6800	10000

HOW TO ORDER

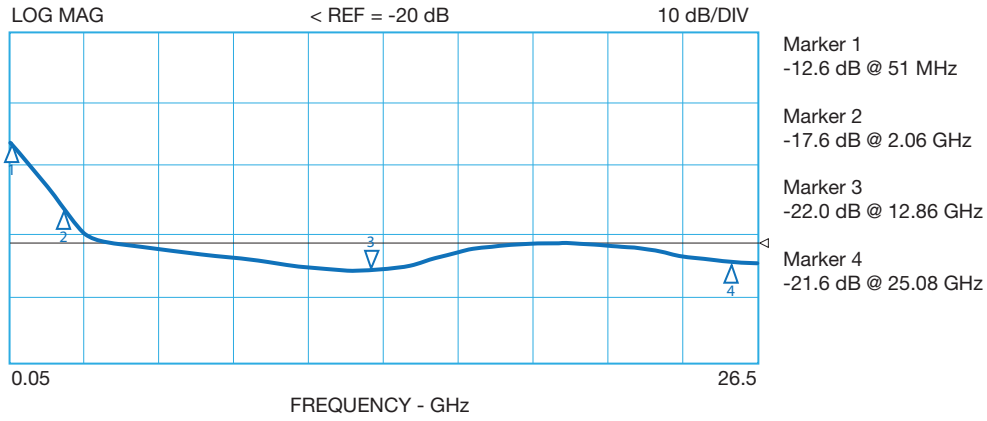
GH	02	5	8	102	M	A	6N
Type Code GH = w/o borders GB = w/ borders	**Case Size** 01 02 03 04 05 06	**Working Voltage Code*** 5 = 50 VDC	**Dielectric Code** Z = Z Dielectric (k = 2.5k - 18k) 8 = Maxi (k = 20,000) 9 = Maxi+ (k = 30,000)	**Capacitance Value** EIA Cap Code in pF	**Capacitance Tolerance** K = ±10% M = ±20% Z = +80% -20%	**Termination Code** **A = Au** (100 µ-in min) over Ti/W (1000 Å nom) also available **N = Ti/W-Ni-Au**	**Packaging Code** 6N = Waffle Pack

*Other Voltages available. Contact Factory for details.

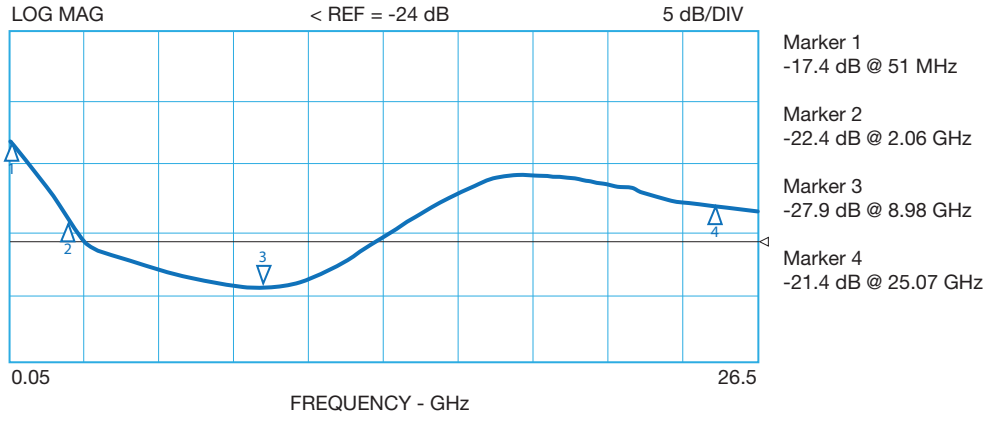
RoHS COMPLIANT

PERFORMANCE CURVES
S21 FORWARD TRANSMISSION

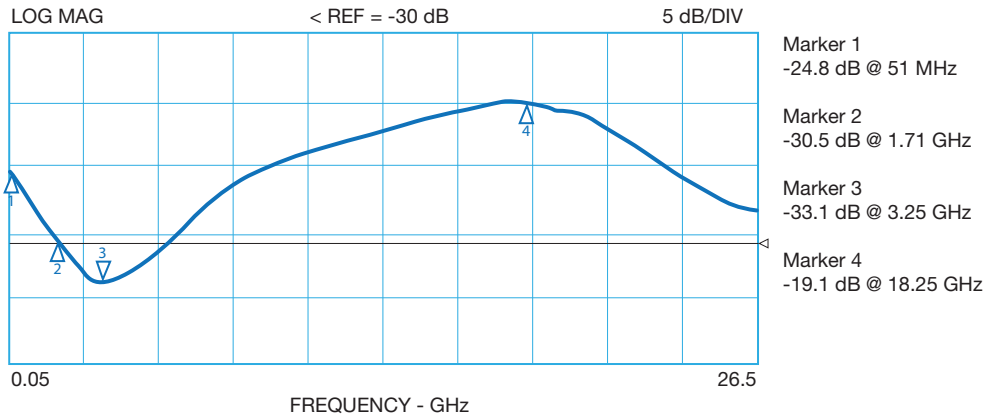
Capacitance = 220 pF Q = 50 @ 1 MHz
Size: L = .017" W = .017" T = .007"



Capacitance = 470 pF Q = 50 @ 1 MHz
Size: L = .024" W = .024" T = .007"

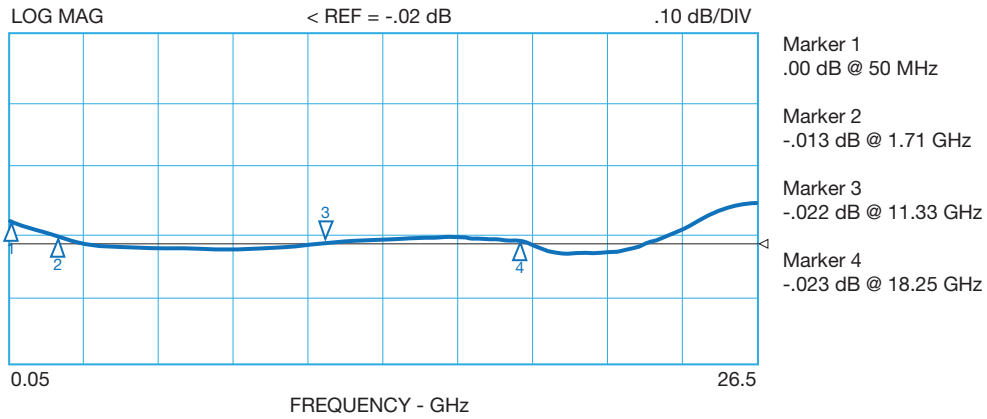


Capacitance = 1000 pF Q = 50 @ 1 MHz
Size: L = .035" W = .035" T = .007"

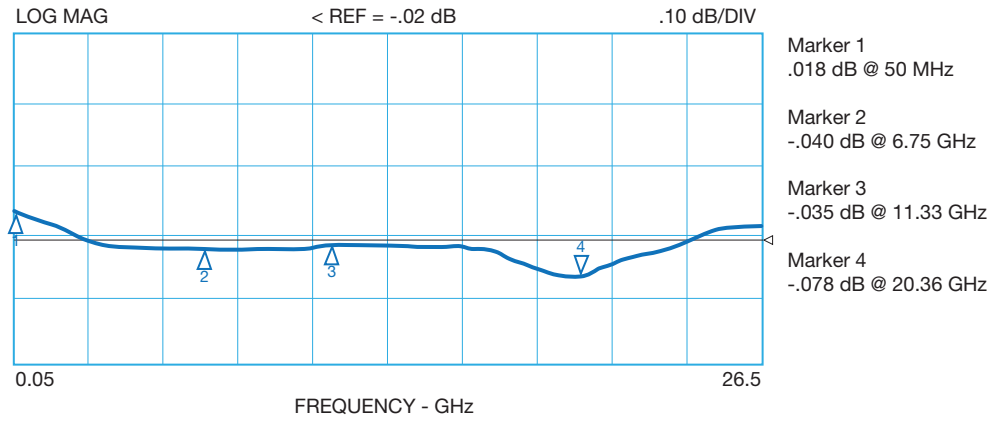


PERFORMANCE CURVES
S21 INSERTION LOSS

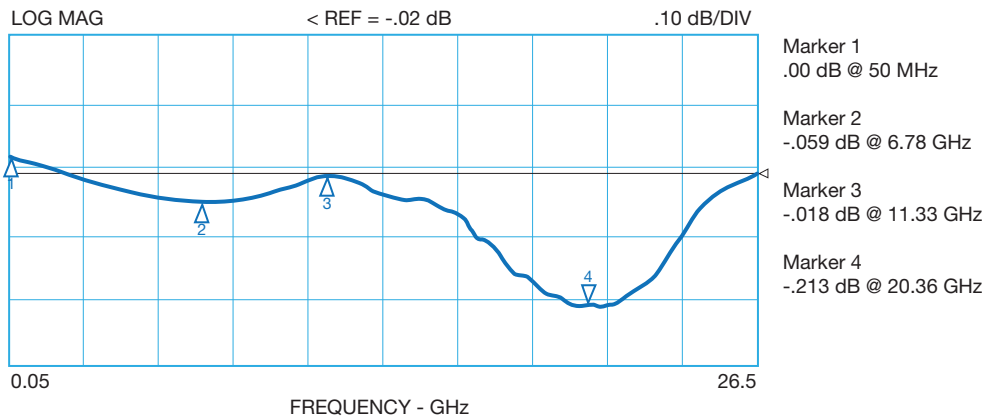
Capacitance = 220 pF Q = 50 @ 1 MHz
Size: L = .017" W = .017" T = .007"



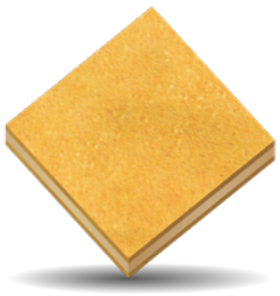
Capacitance = 470 pF Q = 50 @ 1 MHz
Size: L = .024" W = .024" T = .007"



Capacitance = 1000 pF Q = 50 @ 1 MHz
Size: L = .035" W = .035" T = .007"



Microwave SLCs
GH Series – SLC's Without Borders
NP0, Temp Compensating & X7R Dielectrics



GENERAL INFORMATION

In addition to the standard SLC products shown below, KYOCERA AVX is now able to offer bordered versions in these same dielectric families as detailed on the opposing page utilizing micron resolution photolithography and etching processes.

With borders precisely defined, these parts will be beneficial in those applications that require enhanced visual definition during placement and wire bonding. Additionally, bordered devices have proven effective in reducing susceptibility to conductive epoxy electrode bridging.

Custom designs to meet stringent circuit trace width matching requirements are available upon request.

GH SERIES: SINGLE LAYER CAPACITORS WITHOUT BORDERS
NP0, TEMPERATURE COMPENSATING & X7R DIELECTRICS

	GH16			GH18			GH26			GH35		
(L) Length / (W) Width	0.015±0.003 (0.381±0.076)			0.018±0.003 (0.457±0.076)			0.025±0.005 (0.635±0.127)			0.035±0.005 (0.889±0.127)		
(T) Thickness	0.0045-0.012 (0.114-0.305)											
	Cap (pF)			Cap (pF)			Cap (pF)			Cap (pF)		
Dielectric	Min	Max	Tol	Min	Max	Tol	Min	Max	Tol	Min	Max	Tol
A	0.06	0.2	A	0.08	0.2	A	0.2	0.4	A,B	0.4	0.9	A,B,C
1	0.2	0.5	A,B	0.2	0.5	A,B	0.4	1	A,B,C	0.7	2	A,B,C,D
2	0.3	1	B,C	0.4	1.1	A,B,C,D	0.8	2	B,C,D	1.5	3.9	B,C,D
3	0.6	2	C,D	0.8	2.2	B,C,D	1.5	4.3	C,D	3	8.2	C,D
5	0.7	2.7	C,D	1	2.7	C,D	2	5.6	C,D	3.9	11	D,J,K,M
4	0.8	3	C,D	1.2	3.6	C,D	2.4	6.8	C,D	4.7	13	D,J,K,M
7	1.5	5.6	D,K,M	2.2	6.2	D,J,K,M	4.3	12	D,J,K,M	8.2	22	J,K,M
Y	2.7	10	K,M	4.3	11	D,J,K,M	7.5	22	J,K,M	15	43	J,K,M
6	2.7	10	K,M	4.3	11	D,J,K,M	7.5	22	J,K,M	15	43	J,K,M
J	4.7	18	K,M	6.8	18	J,K,M	13	36	J,K,M	27	75	J,K,M
F	8.2	33	K,M	13	36	J,K,M	24	68	J,K,M	47	130	J,K,M
C	18	55	K,M	30	75	J,K,M	56	150	J,K,M	110	250	J,K,M
G	27	91	M	39	100	M	75	200	M	150	390	M
K	36	130	M	56	130	M	110	270	M	220	510	M
L	62	220	M	91	20	M	180	510	M	390	1000	M

	GH50			GH70			GH90		
(L) Length / (W) Width	0.050±0.010 (1.27±0.254)			0.070±0.010 (1.78±0.254)			0.090±0.010 (2.29±0.254)		
(T) Thickness	0.0045-0.012 (0.114-0.305)								
	Cap (pF)			Cap (pF)			Cap (pF)		
Dielectric	Min	Max	Tol	Min	Max	Tol	Min	Max	Tol
A	0.6	2	A,B,C	1.3	3.8	A,B,C	2.2	5.6	A,B,C
1	1.5	4.7	B,C,D	3	8.2	B,C,D	5.1	13	C,D
2	2.7	9.1	C,D	6.2	16	D,G,J,K,M	10	25	G,J,K,M
3	5.6	20	D,G,J,K,M	12	36	G,J,K,M	22	56	G,J,K,M
5	6.8	24	D,G,J,K,M	15	43	G,J,K,M	27	68	G,J,K,M
4	8.2	30	G,J,K,M	20	55	G,J,K,M	33	82	G,J,K,M
7	15	51	G,J,K,M	33	91	G,J,K,M	56	150	G,J,K,M
Y	27	100	G,J,K,M	62	180	G,J,K,M	110	270	G,J,K,M
6	27	100	G,J,K,M	62	180	G,J,K,M	110	270	G,J,K,M
J	47	160	J,K,M	100	300	J,K,M	180	470	J,K,M
F	82	300	J,K,M	220	550	J,K,M	330	820	J,K,M
C	180	600	J,K,M	430	1000	J,K,M	750	1700	J,K,M
G	240	910	M	560	1600	M	1000	2400	M
K	360	1200	M	910	2200	M	1500	3300	M
L	620	2200	M	1500	3900	M	2400	6200	M

DIMENSIONS: inches (millimeters)

HOW TO ORDER

GH	16	5	A	6R8	M	N	6N
Type Code GH = w/o borders	**Case Code**	**Working Voltage Code** 5 = 50WVDC 1 = 100WVDC	**Dielectric Code** See Table	**Capacitance Value** EIA Cap Code in pF. First two digits = significant figures or "R" for decimal place. Third digit = number of zeros or after "R" significant figures.	**Capacitance Tolerance** A = ±0.05pF B = ±0.1pF C = ±0.25pF D = ±0.5pF G = ±2% J = ±5% K = ±10% M = ±20%	**Termination Code** **N = Ti/W-Ni-Au** Au (100µ-in min) over Ni (1500Å nom) over Ti/W (500Å nom) **A = TiW-Au**	**Packaging Code** 6N = Waffle Pack

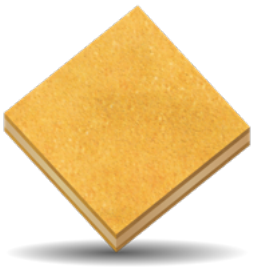
RoHS COMPLIANT

TABLE I - Dielectric Codes, Types & Product Styles

Dielectric Type & Code		Dielectric Constant	Temperature Coefficient	Temperature Range	Min Q at 1MHz	Max. DF (%)*		IR (Min) 25°C
						1 MHz	1 kHz	
NPO	A	14	+90±30PPM/°C	-55°C to +125°C	10,000	0.01	N/A	10^5 Mohms
	1	31	0±30PPM/°C		660	0.15	N/A	
	2**	60	0±30PPM/°C		660	0.15	N/A	
Temp Comp	3	130	-750±200PPM/°C	-55°C to +125°C	660	0.15	N/A	10^5 Mohms
	5	165	-1500±500PPM/°C		400	0.25	N/A	
	4	200	±7.5% (non-linear)		400	0.25	N/A	
	7	420	-2000±500PPM/°C		200	0.70	0.30	
	Y	650	-4700±1500PPM/°C		400	0.30	0.30	
	6	650	±10% (non-linear)		60	1.50	1.50	
X7R	J	1,100	+5% to -15% (non-linear)	-55°C to +125°C	40	2.50	2.00	10^5 Mohms
	F	2,000	±15% (non-linear)		40	2.50	2.00	
	C	4,000	±15%		25	4.00***	2.00***	
	G	6,000	+10% to -75% max. change (non-linear)		40	2.50	2.00	
	K	9,000	0% to -92% max. change (non-linear)		25	6.00	2.00	
	L	16,000	0/-92%		30	3.50	2.00	
X7S	Z	5,000-18,000	±22%	-55°C to +125°C	30	NA	2.5	10^4 Mohms
X7R	8	20,000	±15%	-55°C to +125°C	30	NA	2.5	10^4 Mohms
	9	30,000	±15%					
	0	60,000	±15%					

*Capacitance & DF are measured at 1MHz for values ≤100pF and 1 KHz for capacitance values >100pF
**NOTE: Code 2 DIELECTRIC IS NOT RoHS COMPLIANT
***DF for the GP, GM, and the GA series with C dielectric is 6.5%

GH SERIES



GB SERIES

GP SERIES

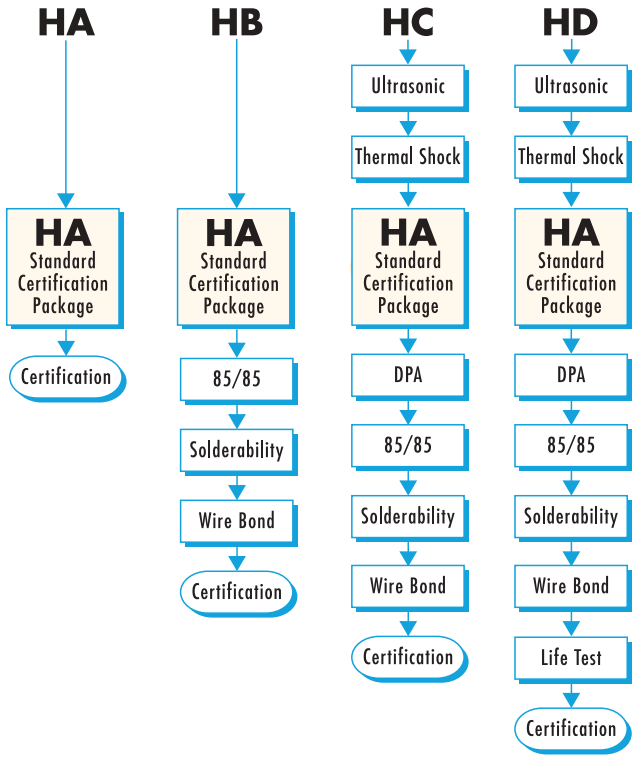
GN SERIES

TABLE II

MIL Reference	Parameter	Method or Paragraph
MIL-STD-883	Bond Strength	2011.7
MIL-STD-883	Shear Strength	2019
MIL-PRF-49464	Thermal Shock	4.8.3
MIL-PRF-49464	Voltage Conditioning	4.8.3
MIL-PRF-49464	Temperatue Coefficient	4.8.10
MIL-STD-202	Low Voltage Humidity	103 A
MIL-STD-202	Life Test	108

COTS

Commercial Off The Shelf



High Reliability Certification Program

The COTS Program provides a cost efficient approach to qualifying standard products for enhanced reliability applications. This flexible program offers standard screening packages with options to support specifics of customer-driven program requirements.

Applications:

- **Ruggedized Commercial**

(Medical, Industrial, Telecommunications)

- **Military**

(Ground, Naval, Airborne)

- **Space/Satellite**

Availability:

Contact KYOCERA AVX for more information regarding which parts are eligible for high reliability screening and any custom options.

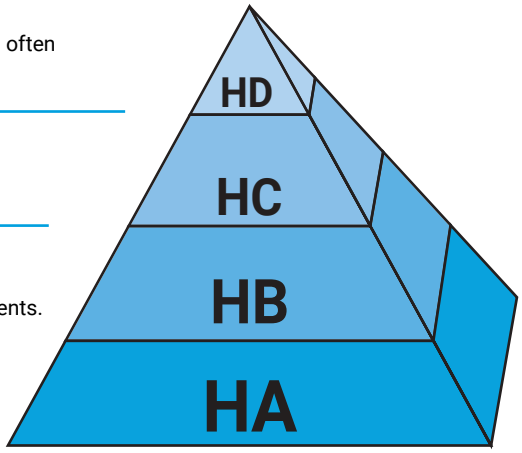
COTS Screening Options

HD: Highest Screening Level
The highest screening option adds life testing as an assurance in mission critical applications and is often used as an alternative in space qualified applications.

HC: Airborne Applications
Often used in airborne applications, this profile closely models the military specifications.

HB: Additional Sample Testing
Built upon our standard HA Screening, this program provides additional sample testing to certify the termination for attachment integrity and the ability to survive and perform in high humidity environments.

HA: Standard Upscreen Package
KYOCERA AVX's Standard Hi Rel certification screening profile is typically used as a lower cost means to certify product reliability. HA screening is used throughout the industry in ground based military applications as well as stringent commercial applications.



P/N Prefix				Evaluation Operation	Sample Size
HA	HB	HC	HD		
		X	X	Ultrasonic Screening†	100%
		X	X	Thermal Shock (5 Cycles for HC and 20 Cycles for HD)	100%
X	X	X	X	Standard Hi-Rel Certification Package (HA)	100%
		X	X	Destructive Physical Analysis	see table*
	X	X	X	85/85 (Low Voltage Moisture Humidity)	13 units*
	X	X	X	Solderability (Solderable or Solder Coated Only)	5 units*
	X	X	X	Wire Bond Test (Gold Terminated Chips Only)	13 units*
			X	Life Test (2000)	25 units*

DPA Sample Table	
Lot Size	Sample
1 - 500	14
501 - 10,000	32
10,001 - 35,000	50
35,001 and up	80

* Additional sample units required that have passed the 100% testing along with the deliverable (flight) quantity.
† Ultrasonic Screening does not apply to SLC products.