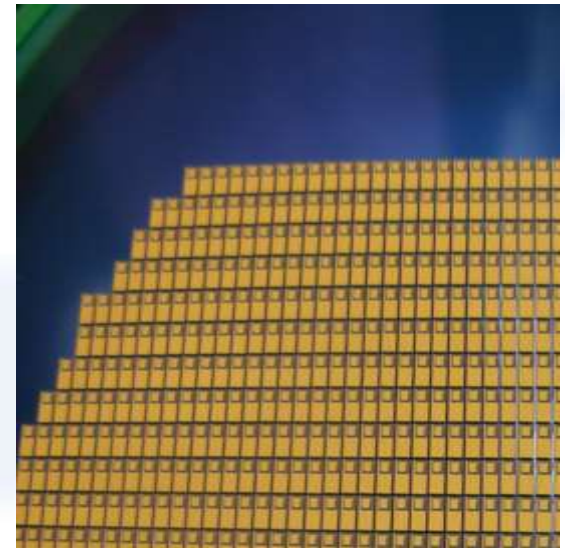
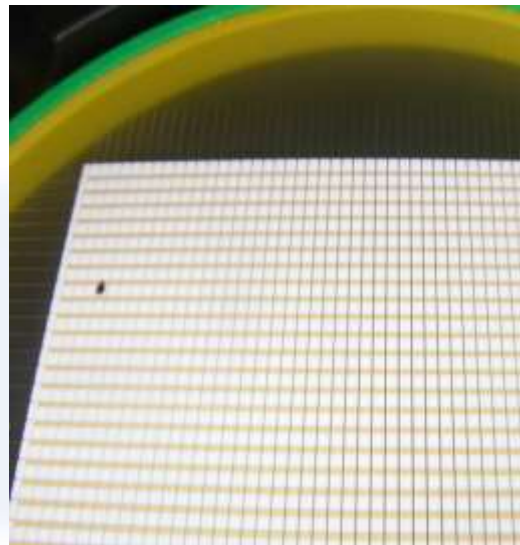


High-K Ceramic Substrates/Shims/Standoffs/Heat Sinks



Part Number Identification

Product Code H – Plates/Substrates							
Product Code	Case Size	Material Code	Thickness Code	Tolerance Code	Surface Finish Code	Metallization Code or Drawing number	Test Level Code (N/A if Drawing)
H	10	CG	250	D	Z	N	X

Product Code S – Shims/Standoffs/Heatsinks						
Product Code	Width (Mils)	Material Code	Thickness Code	Tolerance Code	Surface Finish Code	DLI Outline Drawing Number Reference
S	22	CG	250	D	Z	00000

Biggest question asked is “what is the difference between a plate and a substrate?” The answer is, nothing really. In industry these are interchangeable terms, but we had them defined as different product lines. The intent for differentiating them was that our standard sizes would be called plates and the custom sizes would be called substrates. We decided to change our product line definitions to be less confusing.

Plates and substrates are now interchangeable terms and will use our product code “H”. These are larger (1”x1” or larger) and will consist of a variety of standard catalog sizes. If a custom size/metallization or other is needed, then a DLI drawing number will be used.

Shims/Standoffs/Heatsinks will continue to use our product code “S”. These are ALL custom parts and will therefore ALWAYS need a DLI drawing number in the part number as shown above. These will be smaller (less than 1” square) and will have a 2-digit width code that works the same way as our Di-Caps case size code. So a 15 mil wide part will have the code “15”, and a part that is 100-199 mils wide uses the code “01”.

Part Number Identification

Case Size Definitions for Plates and Substrates

Case Size	Width (Inches)	Length (Inches)
10	1.000	1.000
15	1.000	1.500
20	2.000	2.000
25	2.500	2.500
30	3.000	3.000
40	4.000	4.000

Tolerance: $\pm 0.050"$

Custom sizes are available. Please contact us for more information.

Thickness Tolerance Codes

Code	Tolerance	Condition
D	± 0.0005	Machined or Polished
E	± 0.001	As-Fired $\leq 0.010"$ Thick
J	$\pm 5\%$	Minimum Thickness: As-Fired - $0.025"$ Lapped or Polished - $0.010"$
K	$\pm 10\%$	As-Fired $\geq 0.010"$ Thick

Thickness Options

Thickness Code Definition

A three digit number representing the thickness in **xx.x** mils.

Examples: Code 100 = $0.010"$
Code 155 = $0.0155"$
Code 250 = $0.025"$

Please consult with Applications Support for thicknesses $< .010"$

Comment about the thickness tolerance:

AS-FIRED, the standard tolerance for plates 10 mils thick or thinner will be ± 1 mil ("E" tolerance).

The standard tolerance for plates thicker than 10 mils will be $\pm 10\%$ ("K" tolerance)

Case Size Definitions for Shims/Standoffs/Heatsinks

Width Code (mils)	Inches
10	0.01
15	0.015
80	0.08
01	.100 to .199
09	.900 to .999

Surface Finish Codes

Code	Roughness R_a	Material Process
X	$< 50 \mu$ in.	As-Fired
Y	$< 20 \mu$ in.	Machined
Z	$< 5 \mu$ in.	Polished
S	Customer Defined	Customer Drawing/Spec. Required!



Material and Properties

Substrate Material	Dielectric Constant (Tolerance)	Typical Loss Tangent	Coefficient of Thermal Expansion (ppm/°K)	Temperature Coefficient of Capacitance (ppm/°C)	Surface Finish (m-inch)	Application
Fused Quartz (SiO ₂) QZ	3.82 @ 1MHz	0.000015 @ 1 MHz 0.00033 @ 24 GHz	0.55	—	<0.1	Suitable for microwave and millimeter wave frequency applications. Low loss. Thermal Conductivity: 1.38 W/m-°K.
Aluminum Nitride (AlN) AG	8.6 (± 0.35) @ 1MHz	0.001	4.6	—	As Fired <20 Polished <2	Suitable for circuits requiring high power dissipation. RF and microwave circuit applications. Thermal Conductivity: 170 W/m-°K or 200W/ m-°K.
96% Alumina (Al ₂ O ₃) PJ	9.5 (± 1) @ 1 MHz	0.0004	6.4 - 8.2	—	As Fired <4 Polished <1	General circuit applications. Compatible with Si and GaAs chip technology. Thermal Conductivity: 26 W/m-°K.
99.6% Alumina (Al ₂ O ₃) PI	9.9 (± 0.15) @ 1MHz	0.0001	6.5 - 7.5	P120 ± 30	Polished <5	General circuit applications. Compatible with Si and GaAs chip technology. Thermal Conductivity: 27 W/m-°K.
PG	13.3 (± 0.5)	0.0005	7.6	P22 ± 30	Polished <5	Replacement for Alumina - improved temperature stability.
AH	20.5 (± 0.5)	0.0002	9.6	P90 ± 20	Polished <5	Suitable for circuit miniaturization. RF and microwave circuit applications.
NA	23 (± 1)	0.0003	10.1	0 ± 15	Polished <5	Suitable for circuit miniaturization. RF and microwave circuit applications.
CF	25.7 (± 1)	0.0003	9.0	0 ± 15	Polished <5	Excellent temperature stability. Suitable for circuit miniaturization. RF and microwave circuit applications.
CD	38 (± 1)	0.0005	5.8	N20 ± 15	Polished <5	Suitable for circuit miniaturization. RF and microwave circuit applications.
CG	67.1 (± 1)	0.0009	9.0	0 ± 30	Polished <5 Lapped <20	Excellent temperature stability. Suitable for circuit miniaturization. RF and microwave circuit applications.
NP	85 (± 10%)	0.0008	—	N750 ± 200	Polished <5	Suitable for circuit miniaturization. RF and microwave circuit applications. Microwave power transistor matching; eg. GaN, SiC
NR	152 (± 5%)	0.0006	10.0	N1500 ± 500	Polished <5	
NS	300 (± 10%)	0.005	—	N2400 ± 500	Polished <5	
NU	600 (± 10%)	0.015	—	N3700 ± 1000	Polished <5	

As Fired - Natural state
Lapped - Remove Anomalies
Polished - Fine line geometries

Surface Finish

Surface Finish	PN Code	Material	Surface Roughness (Ra)	Thickness Tolerance	Application/Benefits
As-Fired	X	PG, AH, NA, CF, CD, CG, NP, NR, NS, NU, BU, BV	<50 micro-inch	±0.001 inch	Custom capacitors, circuit minaturization
		PI (Al ₂ O ₃)	≤3 micro-inch	±0.001 inch	Thin Film circuits not requiring precision photolithography or thickness tolerance. For filters, typically utilize multiple variants.
		AG (AlN)	<20 micro-inch	±0.001 inch	Heat sink circuits without resistors
Lapped	Y	PG, AH, NA, CF, CD, CG, NP, NR, NS, NU	<20 micro-inch	±0.0005 inch	More uniform finish and tighter thickness tolerance than As-Fired
		PI (Al ₂ O ₃)	10 micro-inch nominal		
		AG (AlN)	25 micro-inch nominal		
Polished	Z	PG, AH, NA, CF, CD, CG, NP, NR, NS, NU	<5 micro-inch	±0.0005 inch	Resistor grade, best photo lithography precision and thickness tolerance.
		PI (Al ₂ O ₃)	<1 micro-inch	±0.0005 inch	
		AG (AlN)	<2 micro-inch	±0.0005 inch	

Note: Custom thickness tolerance may be available; please consult factory

Metal Systems

Metal Systems

Metalization System	Application	Component Attachment Method	Typical Thickness Range	Comments	Max Temp. °C
S19 Tantalum Nitride (TaN) Titanium Tungsten (TiW) Gold (Au)	Standard Thin Film Metal System for Conductors with Resistor Layer	Au/Sn, Au/Si, Au/Ge - Eutectic Epoxy	TaN: 12 to 200 Ω/□ TiW: 300 to 500 Å Au: 5 to 300 μ"	Not recommended for Tin/Lead Solder Attach - Maintain Gold 5-20 μ" for Solder Attach. Compatible with Wire bonding - Maintain Gold ≥100 μ" for Wire bonding.	380
S5 Titanium Tungsten (TiW) Gold (Au)	Standard Thin Film Metal System for Conductors	Au/Sn, Au/Si, Au/Ge - Eutectic Epoxy	TiW: 300 to 500 Å Au: 5 to 300 μ"		425
Tantalum Nitride (TaN) Titanium Tungsten (TiW) Gold (Au) Copper (Cu) Nickel (Ni) Gold (Au)	High Current & Low Loss With or without TaN Resistor Layer	Au/Sn, Au/Si, Au/Ge - Eutectic Sn/Pb Epoxy	TaN: 12 to 200 Ω/□ TiW: 300 to 500 Å Au: 5 to 10 μ" Cu: 150 to 600 μ" Ni: 40 to 100 μ" Au: 5 to 300 μ"	Compatible with Tin/Lead Solder Attach - Maintain Gold 5-20 μ" for Solder Attach. When repeated soldering is required for repairs. Compatible with Wire bonding - Maintain Gold ≥100 μ" for Wire bonding.	350
S10 Tantalum Nitride (TaN) Titanium Tungsten (TiW) Gold (Au) Nickel (Ni) Gold (Au)	High Current & Low Loss With or without TaN Resistor Layer	Au/Sn, Au/Si, Au/Ge - Eutectic Sn/Pb Epoxy	TaN: 12 to 200 Ω/□ TiW: 300 to 500 Å Au: 5 to 300 μ" NiV: 40 to 100 μ" Au: 5 to 70 μ"		350
Tantalum Nitride (TaN) Titanium Tungsten (TiW) Gold (Au) Nickel (Ni) Gold Tin (AuSn)	With or without TaN Resistor Layer For selective Gold/Tin Attach and Wire bond locations	Au/Sn	TaN: 12 to 200 Ω/□ TiW: 300 to 500 Å Au: 5 to 100 μ" NiV: 40 to 100 μ" AuSn: 100 to 350 μ"	Eliminates solder preform. Direct die attach to pad. (Au/Sn)	280
S2 Titanium Tungsten (TiW) Nickel (Ni) Gold Tin (AuSn)	For Gold/Tin Solder Systems Without TaN Resistor Layer	Au/Sn	TiW: 300 to 500 Å NiV: 40 to 100 μ" AuSn: 100 to 350 μ"		280
S7 Titanium Tungsten (TiW) Platinum (Pt) Gold (Au)		Au/Sn, Au/Si, Au/Ge - Eutectic Sn/Pb Epoxy	TiW: 300 to 500 Å Pt: 6-10 μ" Au: 5 to 300 μ"	Compatible with Tin/Lead Solder Attach - Maintain Gold 5-20 μ" for Solder Attach. When repeated soldering is required for repairs.	>400
S1 Titanium Tungsten (TiW) Nickel (Ni) Gold (Au)		Sn/Pb Epoxy	TiW: 300 to 500 Å NiV: 40 to 100 μ" Au: 5 to 300 μ"	Compatible with Wire bonding - Maintain Gold ≥100 μ" for Wire bonding.	350

Note: Titanium can be substituted depending on substrate composition. Custom Metalizations and thicknesses are available upon request. Nickel Vanadium may be substituted for Nickel in some applications; contact applications engineering for details.

Substrate Material and Properties



Standard substrate thicknesses are in 5 and 10 mil thick increments but can be custom to 0.1 mil. Polished and lapped surfaces are available to $\pm 0.0005''$ tolerance where As-Fired materials are accurate to $\pm 0.001''$. Alternative surface finish may also be available, please consult the factory for more options.

As-Fired tolerance accurate to 1 mil, or 10% (whichever is larger)
1 mil tolerance is for plates that are under 10 mils thick
standard tolerance for plates thicker than 10 mils is 10% instead

Metallization Codes

Metallization Codes (2 sided metalization unless otherwise stated)

Code	Description
X	No Metallization (Not available for CG, CF, and CD)
M	300 Angstroms TiW, 100 μ in. min. Au
N	300 Angstroms TiW, 50 μ in. min. NiV, 100 μ in. min. Au
P	75 μ in. min. Nickel, 100 μ in. min. Au
L	Top 50 Ohms/sq. TaN, 300 Angstroms TiW, 100 μ in. min. Au Bottom Side 300 Angstroms TiW, 100 μ in. min. Au
T	300 Angstroms min. TiW, 50 μ in. min. NiV, 100 μ in. min. Au-Sn
D	Customer Defined, Customer Drawing/Spec. Required!



Test Level Codes

Test Code	Test/Inspection	Sample Size	Description
X	Visual mechanical	100%	Verify that the required area is available and continous. (Broken corners allowable).
K	Visual mechanical	100%	Verify that the required area is available and continous. (Broken corners allowable).
	Dielectric Measurement	10% of Lot	K and Loss Tangent.
D	Customer Defined		Customer Drawing/Spec. Required!

Note: For custom devices a DLI outline drawing may be issued. For these cases the part number will end in a five digit drawing number representing the appropriate drawing. Example: H20P1250DZ#####
Custom designs available with Laser Drilling