THERMALWORKS

STABLCOR PRESENTATION

WHAT IS STABLCOR?

STABLCOR is a Laminate technology for:

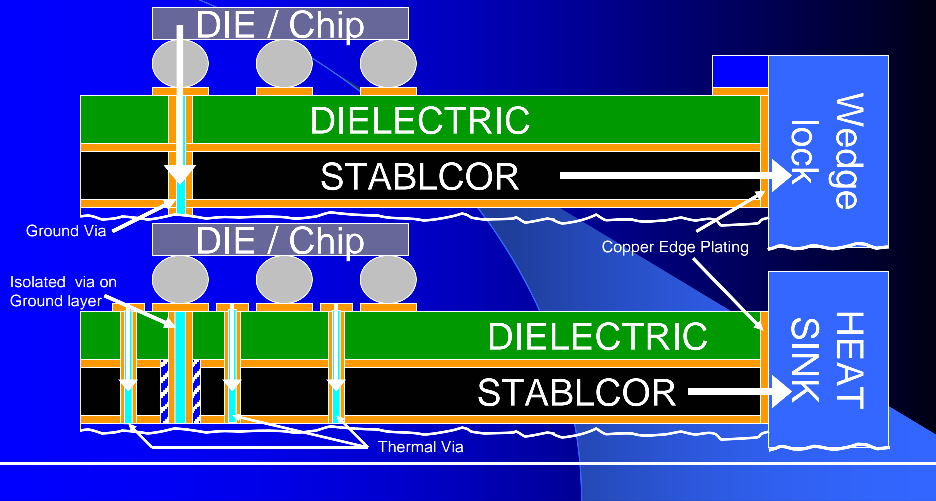
- PCBs
- Substrates

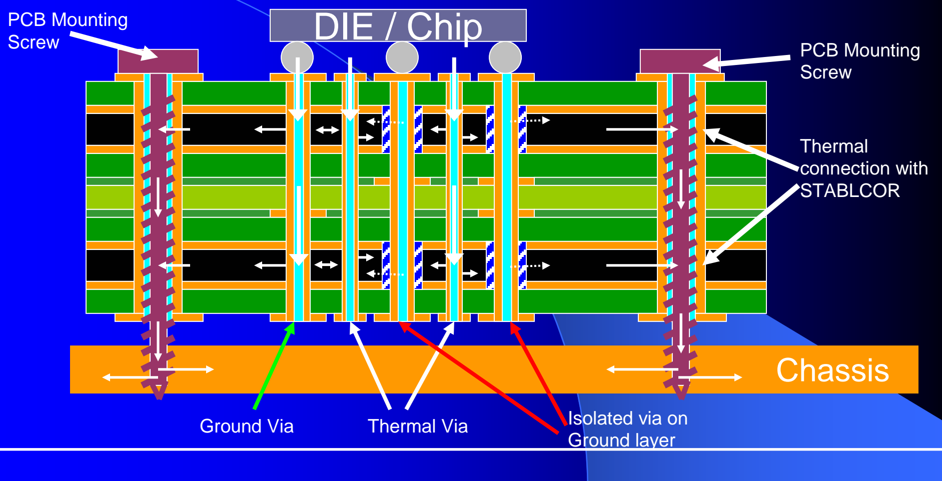
WHAT IS STABLCOR LAMINATE?

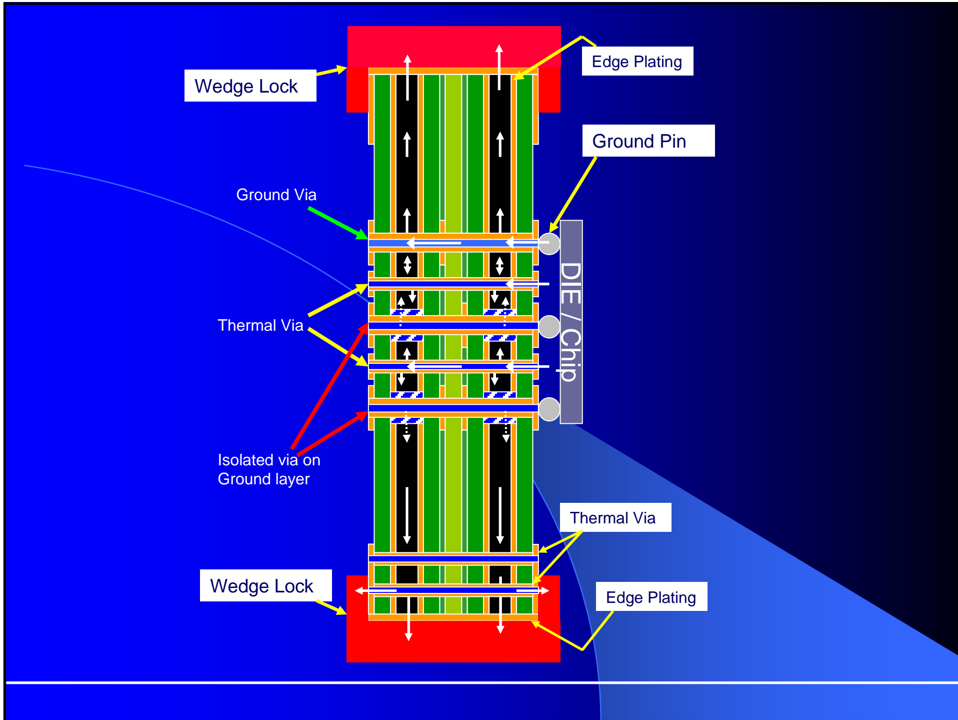
- ❑ STABLCOR Laminate is:
  - ❑ Thermally & Electrically Conductive Composite Material
    - ❑ In-plane Thermal Conductivity
    - ❑ Used as a plane layer
  - ❑ Only available in C-stage (Cured)
  - ❑ Standard size is 18”x24” sheets.

STABLCOR LAMINATE ENABLES

- ❑ To reduce the junction temperature of components
- ❑ To tailor the co-efficient of thermal expansion (CTE)
- ❑ To increase the stiffness
  - ❑ eliminates mechanical reinforcements or stiffeners
  - ❑ increases assembly yield in high I/O components
  - ❑ reduces thermal fatigue & warpage
  - ❑ increases shock and vibe reliability
- ❑ all of the above benefits at no weight premium

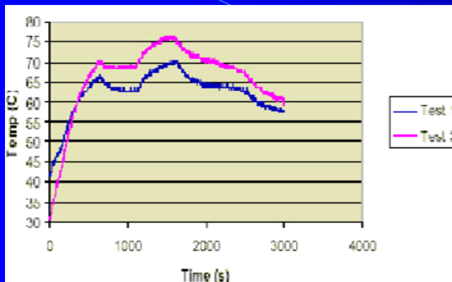

STABLCOR PCB THERMAL PATH
THERMAL PATH FROM STABLCOR PCB TO WEDGE LOCK OR HEAT SINK VIA COPPER PLATED EDGE.
DIE / Chip
DIELECTRIC
STABLCOR
Wedge lock
Ground Via
DIE / Chip
Copper Edge Plating
Isolated via on Ground layer
DIELECTRIC
STABLCOR
HEAT SINK
Thermal Via


STABLCOR PCB THERMAL PATH
THERMAL PATH FROM STABLCOR PCB TO FRAME OR CHASIS VIA THERMALLY CONDUCTIVE MOUNTING SCREW.
PCB Mounting Screw
DIE / Chip
PCB Mounting Screw
Thermal connection with STABLCOR
Chassis
Ground Via
Thermal Via
Isolated via on Ground layer



STABLCOR vs. FR-4

APPLIED MATERIALS TEST REPORT



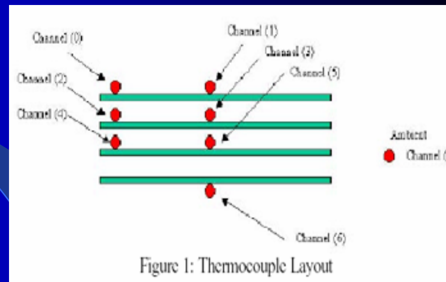
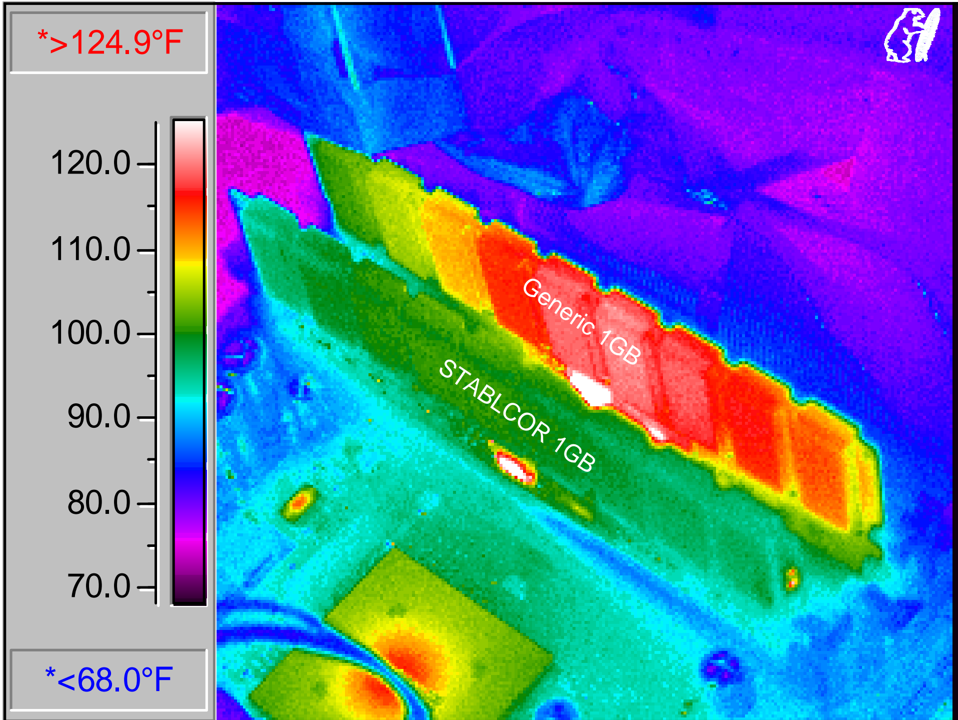
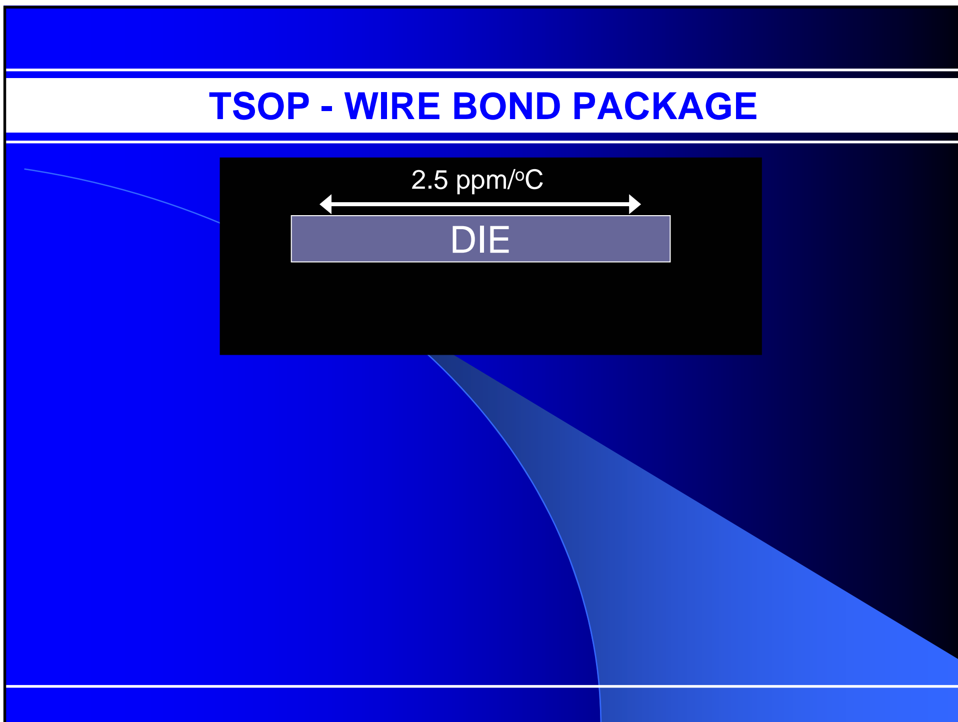


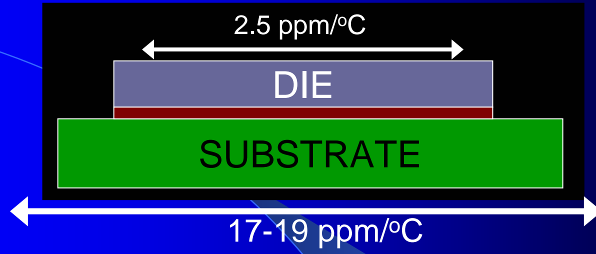
Figure 1: Thermocouple Layout

The data shows a (5.921° C) or a (9.66° F) change in temperature between Test 1 and 3. This is a significant change. Additionally the ramp rate of the temperature increases is much less on the STABLCOR™ modules. Secondly the ramp rate for cooling is higher on the STABLCOR™ modules and this means that the STABLCOR™ modules heat up slower and cool down faster.

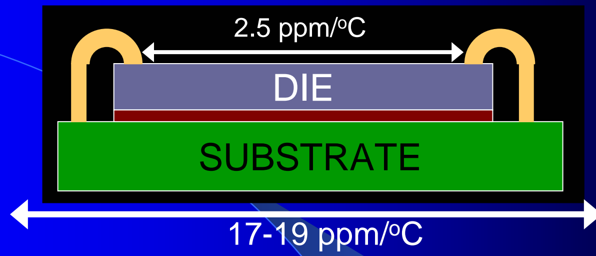

*>124.9°F
120.0
110.0
100.0
90.0
80.0
70.0
*<68.0°F
Generic 1GB
STABLCOR 1GB

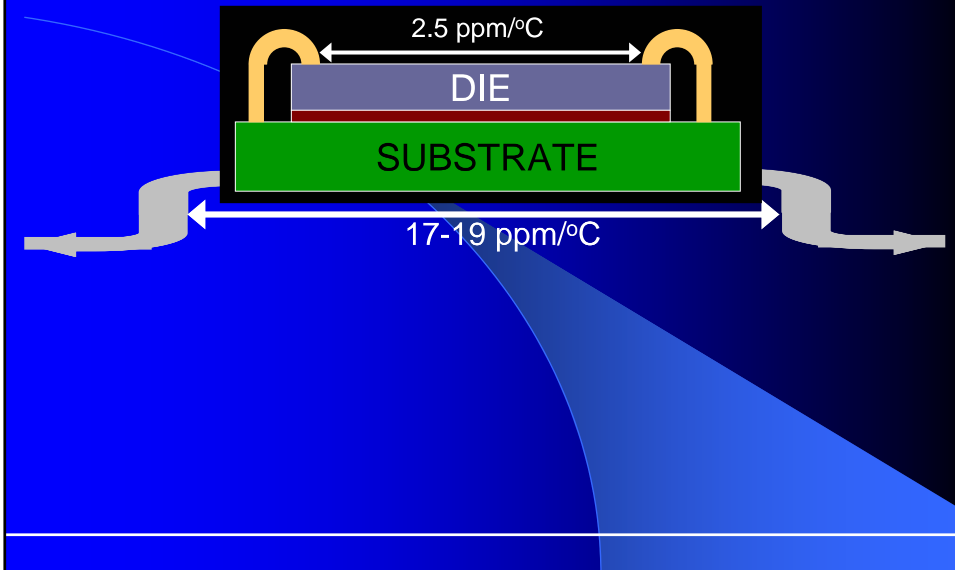

TSOP - WIRE BOND PACKAGE
2.5 ppm/°C
DIE

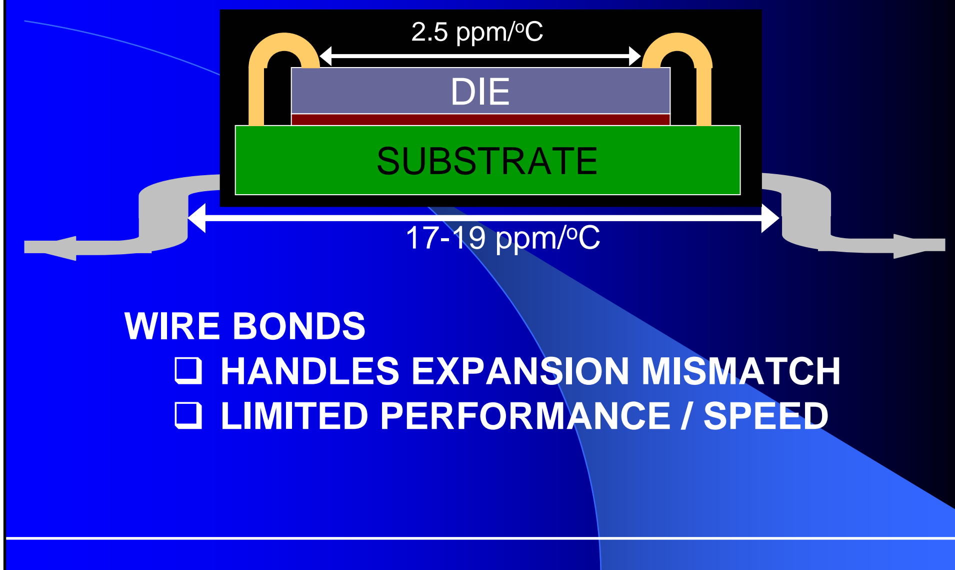
TSOP - WIRE BOND PACKAGE

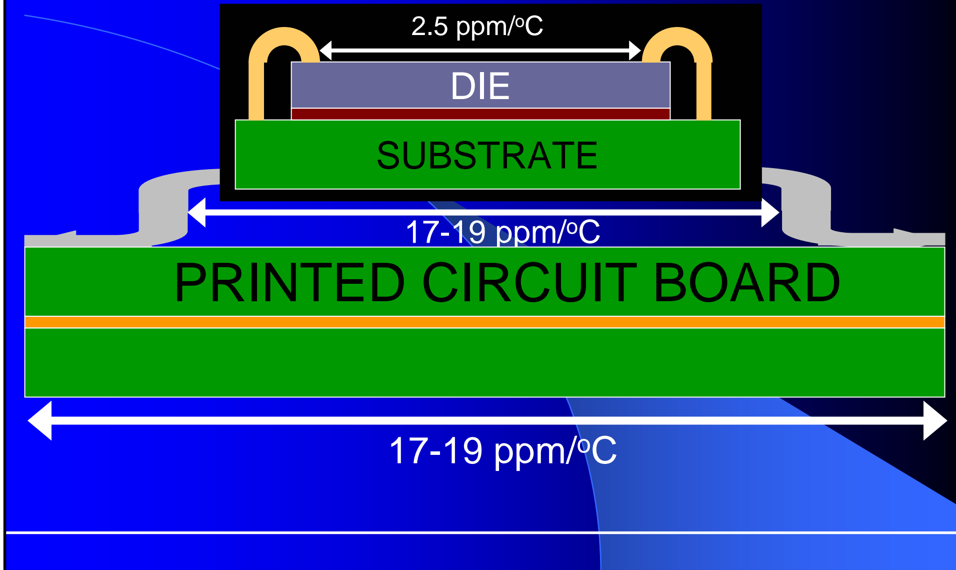


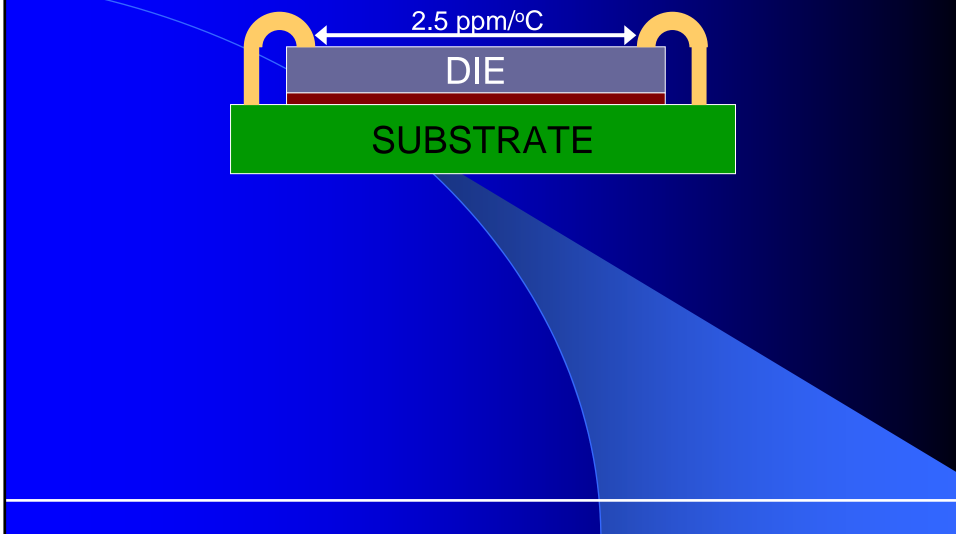
TSOP - WIRE BOND PACKAGE

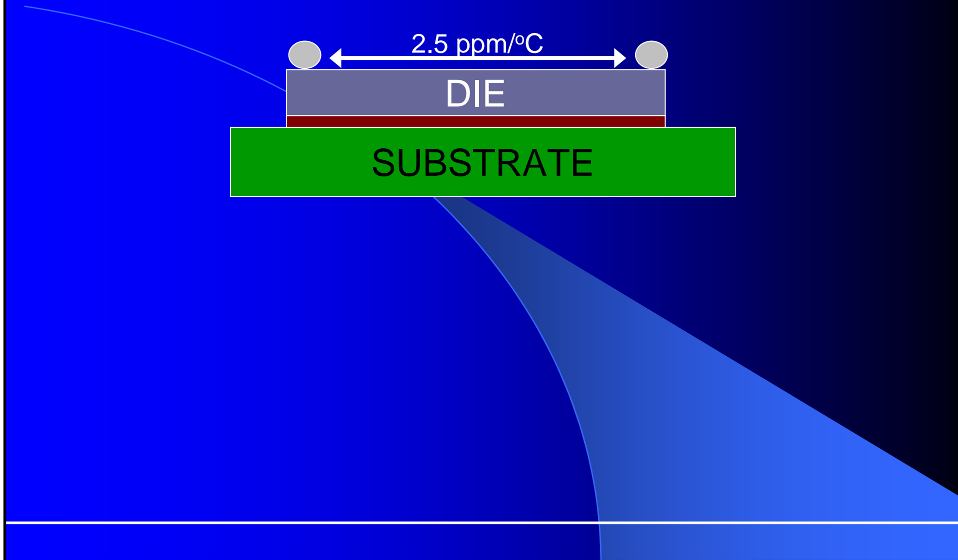


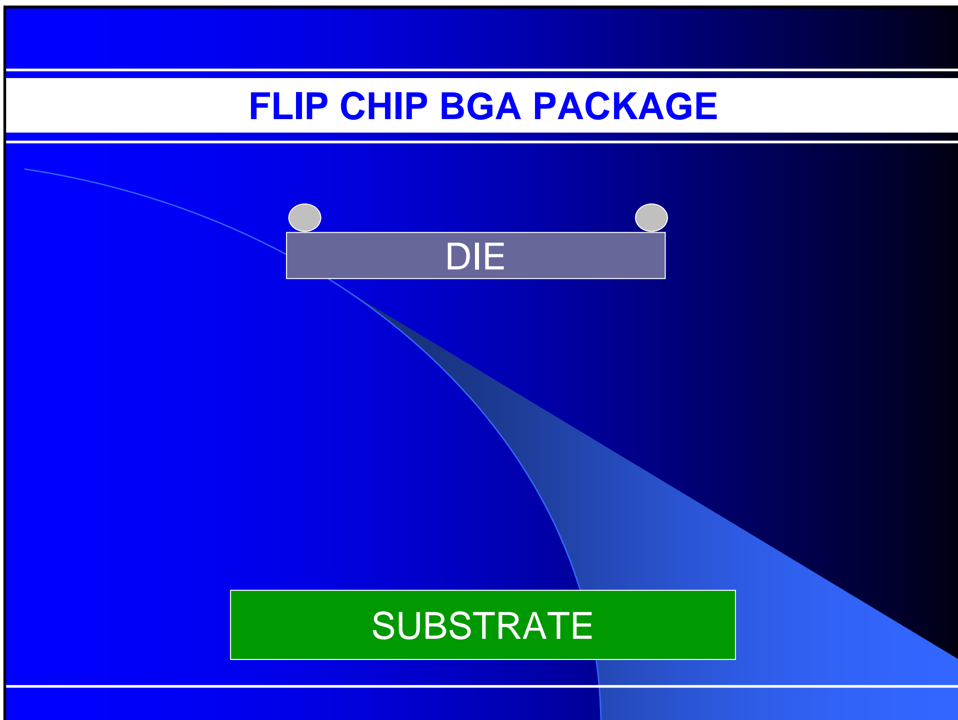

TSOP - WIRE BOND PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE
17-19 ppm/°C

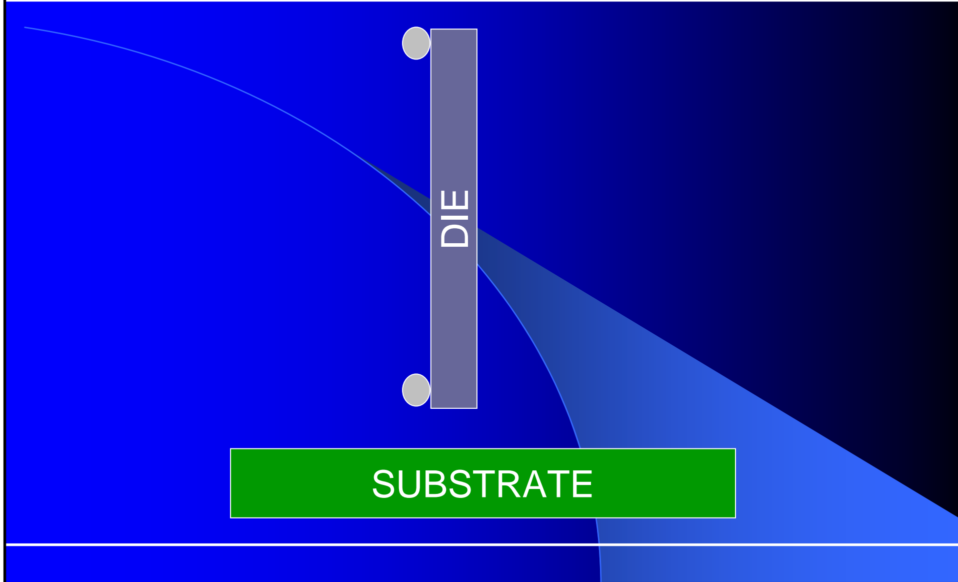

TSOP - WIRE BOND PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE
17-19 ppm/°C
WIRE BONDS
❑ HANDLES EXPANSION MISMATCH
❑ LIMITED PERFORMANCE / SPEED

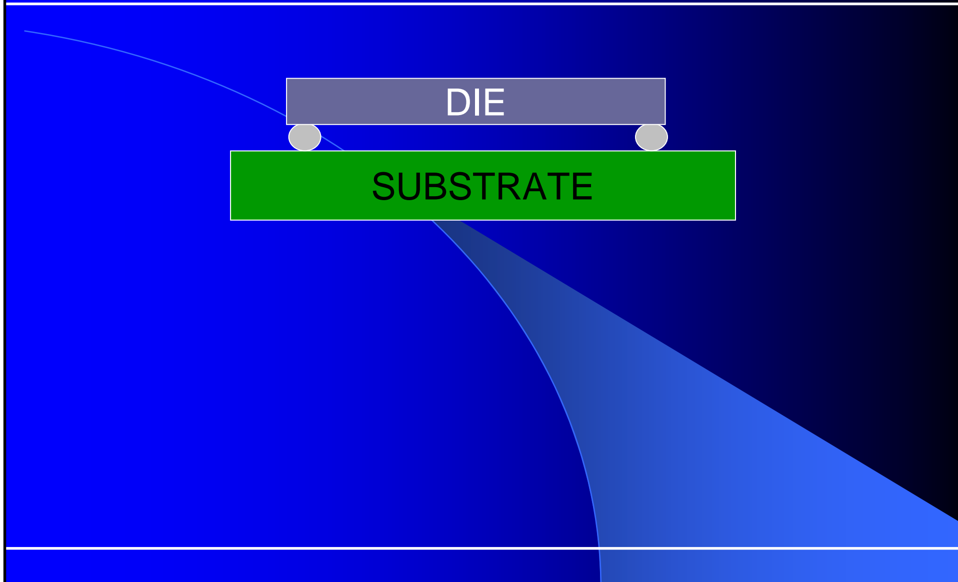

TSOP - WIRE BOND PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE
17-19 ppm/°C
PRINTED CIRCUIT BOARD
17-19 ppm/°C

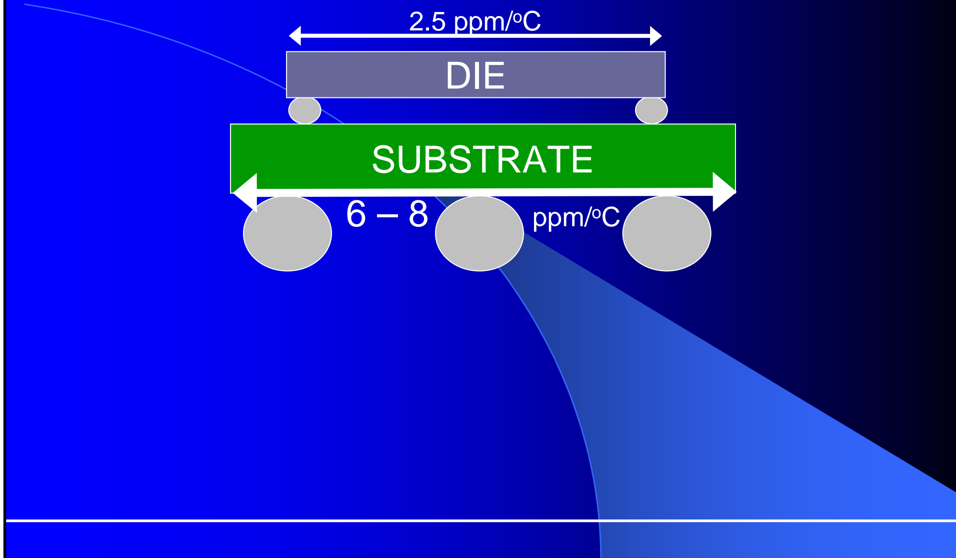

WIRE BOND PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE

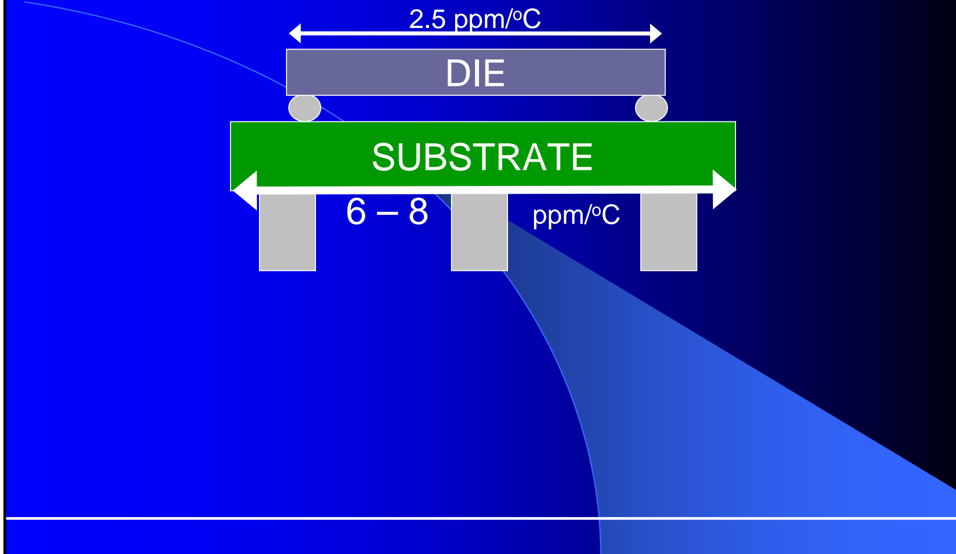

FLIP CHIP BGA PACKAGE
2.5 ppm/ºC
DIE
SUBSTRATE

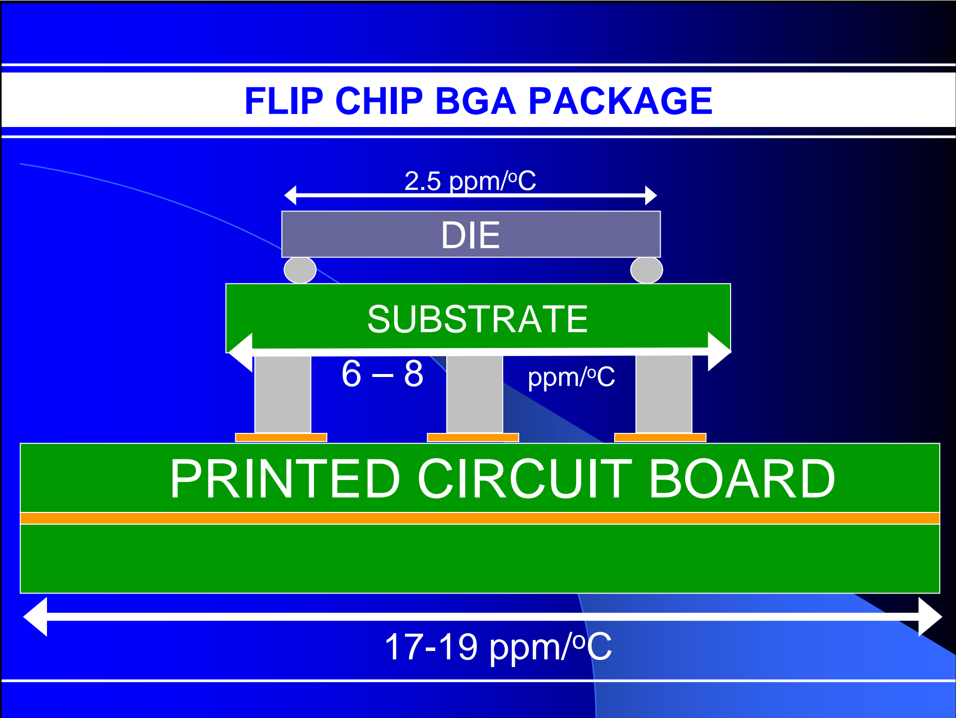

FLIP CHIP BGA PACKAGE
DIE
SUBSTRATE

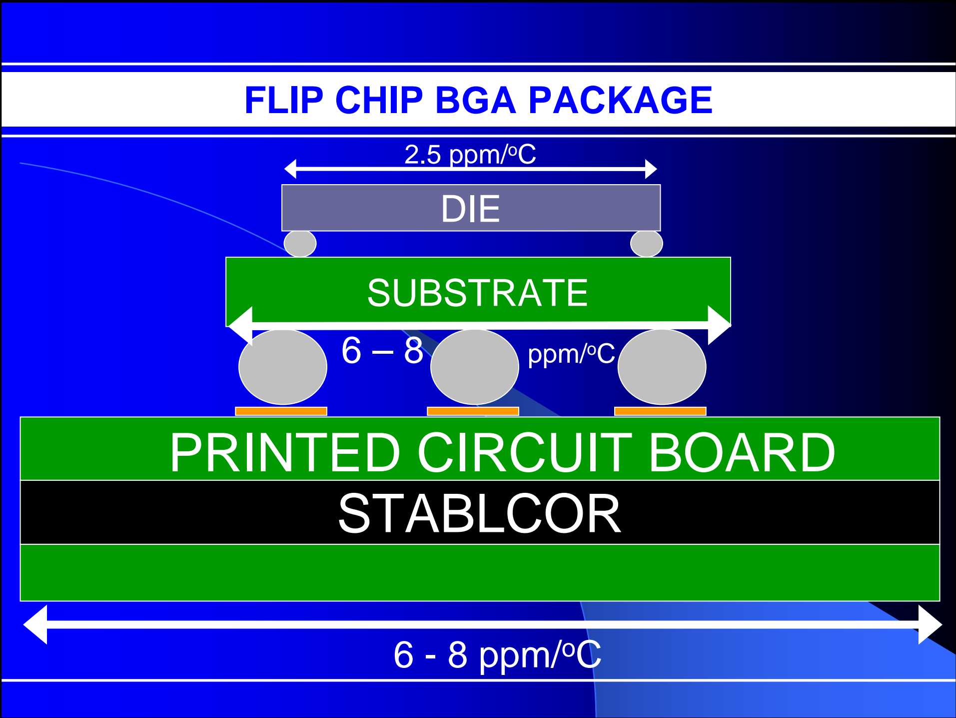

FLIP CHIP BGA PACKAGE
DIE
SUBSTRATE

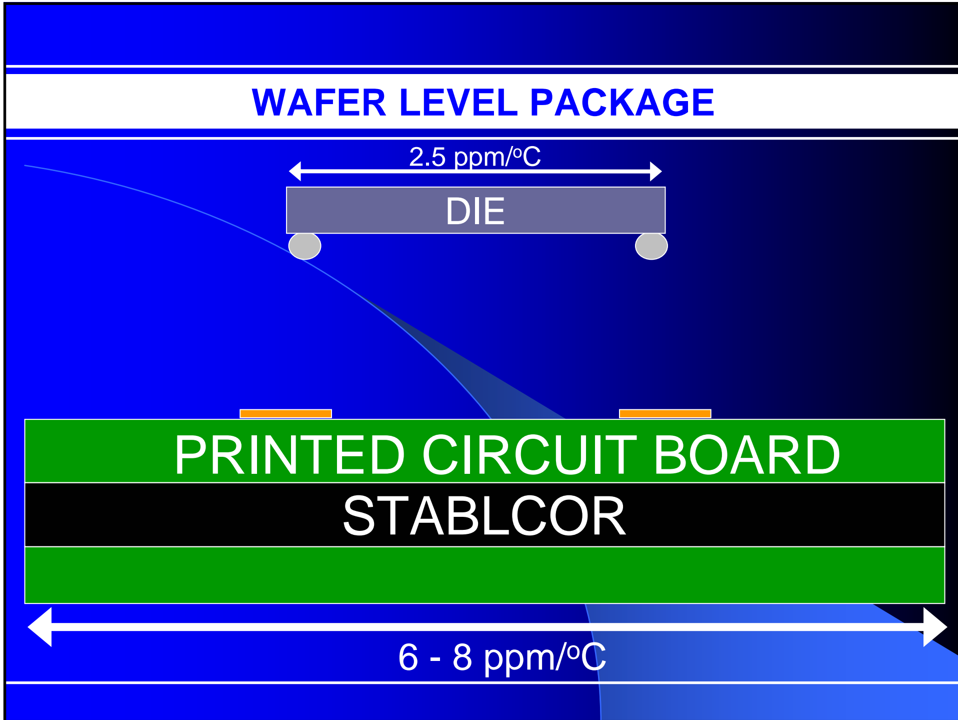

FLIP CHIP BGA PACKAGE
DIE
SUBSTRATE

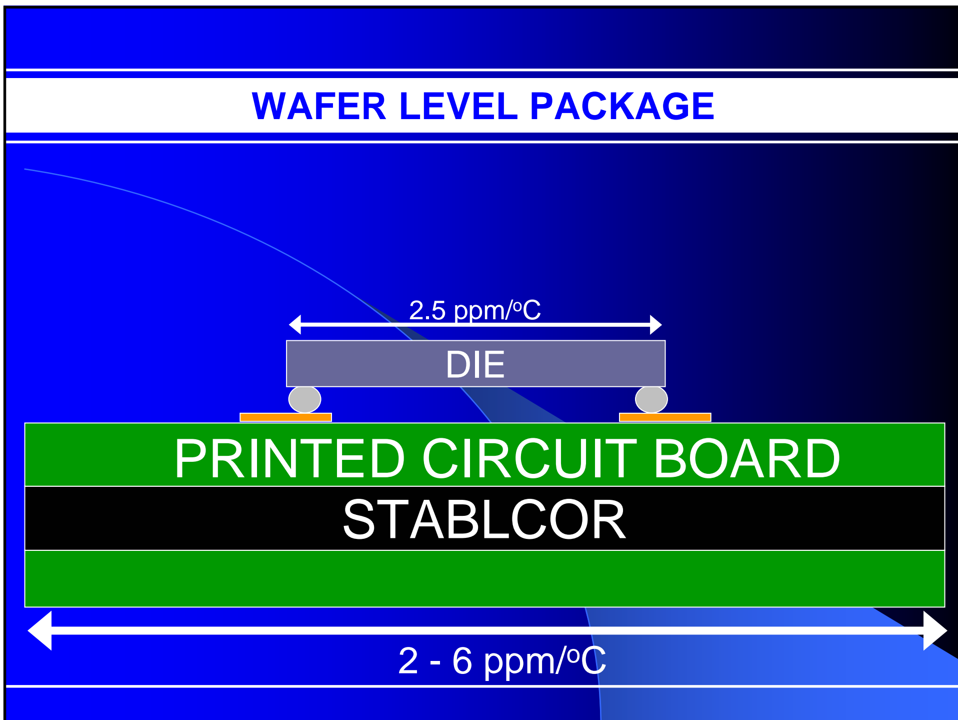

FLIP CHIP BGA PACKAGE
2.5 ppm/ºC
DIE
SUBSTRATE
6 – 8
ppm/ºC


FLIP CHIP BGA PACKAGE
2.5 ppm/ºC
DIE
SUBSTRATE
6 – 8
ppm/ºC

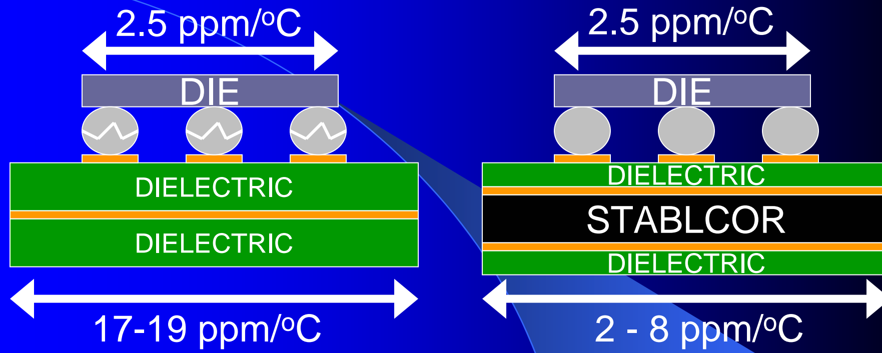

FLIP CHIP BGA PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE
6 – 8
ppm/°C
PRINTED CIRCUIT BOARD
17-19 ppm/°C


FLIP CHIP BGA PACKAGE
2.5 ppm/°C
DIE
SUBSTRATE
6 – 8
ppm/°C
PRINTED CIRCUIT BOARD
STABLCOR
6 - 8 ppm/°C


WAFER LEVEL PACKAGE
2.5 ppm/°C
DIE
PRINTED CIRCUIT BOARD
STABLCOR
6 - 8 ppm/°C

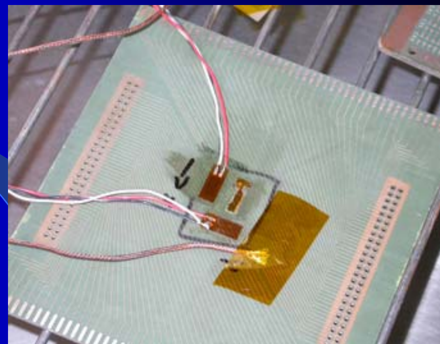

WAFER LEVEL PACKAGE
2.5 ppm/°C
DIE
PRINTED CIRCUIT BOARD
STABLCOR
2 - 6 ppm/°C

CO-EFFICIENT OF THERMAL EXPANSION



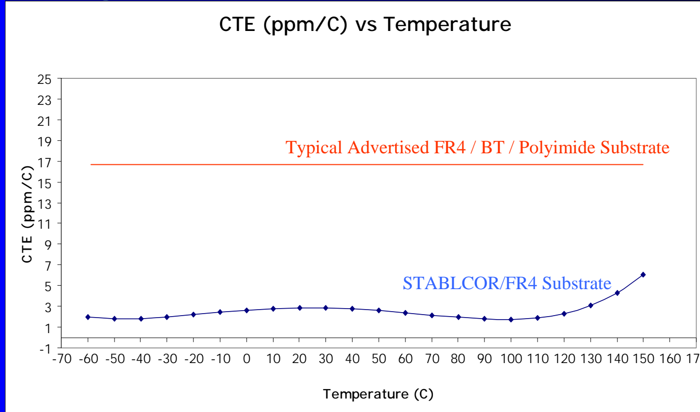
STABLCOR SUBSTRATE CTE REPORT

CTE Test				
FC 400				
Temp(C) - J1.0	Strain X	CTE	Strain Y	CTE
-47.8	-231		-153	
-23.2	-165	2.68	-105	1.95
0.7	-103	2.59	-60	1.88
24.5	0	4.33	0	2.52
49.4	9	0.36	32	1.29
73	65	2.37	75	1.82
96.5	119	2.30	119	1.87
121.3	170	2.06	165	1.85
144.7	218	2.05	203	1.62
CTE Overall		2.29		1.85
Correlation		0.993		0.999



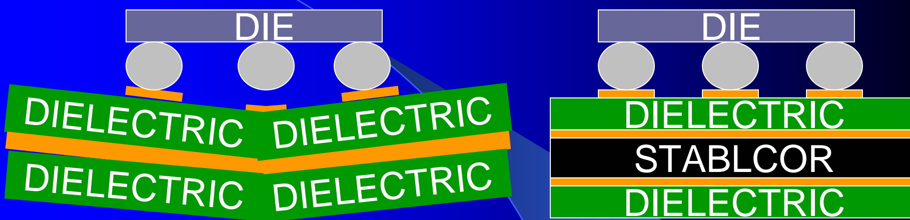
CTE VARIATION WITH TEMPERATURE (-60 to 150C)

STABLCOR/FR4 Substrate



Temp (C)	CTE (ppm/C)
-60	1.95
-50	1.79
-40	1.83
-30	1.98
-20	2.19
-10	2.42
0	2.63
10	2.78
20	2.86
30	2.85
40	2.77
50	2.61
60	2.40
70	2.17
80	1.95
90	1.79
100	1.75
110	1.89
120	2.31
130	3.07
140	4.27
150	6.03
Average	2.56

STIFFNESS & WARPAGE



BENEFITS OF STIFFNESS

- INCREASED YIELDS IN ASSEMBLY PROCESS
- PREVENTS WARPAGE
- HIGHER SHOCK & VIBRATION FREQUENCY
- REDUCES MECHANICAL REINFORCEMENTS

WEIGHT

Material (Laminate)	Density gm/cm3
FR4	1.80
Polyimide	1.70
STABLCOR™	1.85
Aluminum	2.7
Copper	8.92
CIC	9.9

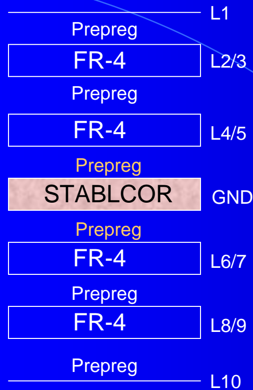
STABLCOR FAMILY OF PRODUCTS

RAW MATERIAL	THERMAL CONDUCTIVITY (W/m*K)	CTE (ppm/C)	DENSITY (g/cm3)	TENSILE MODULUS (msi)	DIELECTRIC CONSTANT (Dk)
ST600	620.0	-1.15	2.20	130.0	13.36
ST325	325.0	-1.15	2.17	114.0	13.36
ST10	8.0	-1.10	1.76	34.0	13.36
FR4	0.3	17.00	1.80	2.4	4.50
POLYIMIDE	0.3	17.00	1.70	3.0	4.20
COPPER	385.0	17.00	8.92	12.0	N/A
ALUMINUM	240.0	24.00	2.70	10.2	N/A
CIC	108.0	4.00	9.90	19.0	N/A

Stablcor values represents data of raw fibers

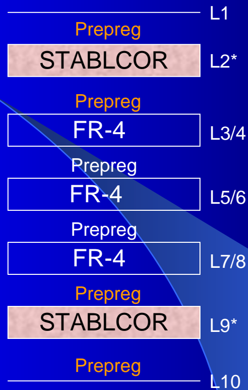
Ex.: STABLCOR STACK-UP FOR 10-LAYER PCB

(<0.035”) PCB/Substrate



1-CORE

(<0.093”) PCB



2-CORE

(>0.093”) PCB

3-CORE

* Must be a Plane layer. Preferred Ground layer.

NF= electrically Non-Functional layer.

STABLCOR THERMAL SIMULATION SOFTWARE

1. Harvard Thermal Inc. (TAS PCB Software)

   Dave Rosato
   Ph: (978) 772-3800
   dave@harvardthermal.com
   Harvard, Mass 01451

2. Fluent Inc. (Icepak Software)

   Dan Scharpf
   Ph: (603) 643-2600 x 617
   dfs@fluent.com
   New Hampshire 03766

3. Flomerics (Flotherm Software)

   Sherman Ikemoto
   Ph: (512) 420-9273 x 203
   Sherman.Ikemoto@flowmerics.com
   Vista, California 92083

STABLCOR = INCREASED RELIABILITY

Operates Cooler

- ❑ PCB acts as a Heat Sink
- ❑ Reduces Thermal Stress on Components

Matching CTE Between PCB's and packages

- ❑ More Reliable Solder Connections
- ❑ Allows for a Wafer Level Package (WLP)
  - ❑ Thinner profile module
  - ❑ Allows for increased airflow
  - ❑ Allows for increased performance

Stiffness

- ❑ Prevents Warpage
- ❑ Increased Yields for Component Placement

All Above Benefits at almost no weight premium