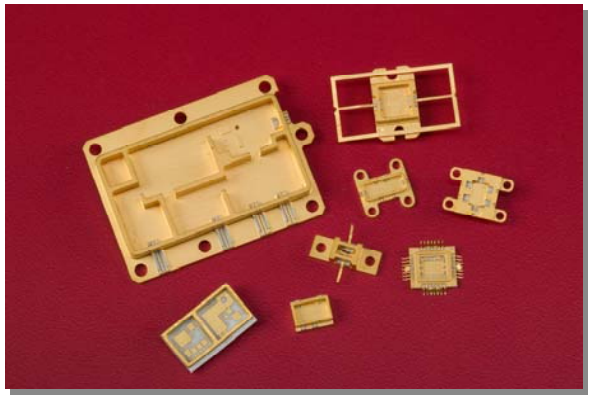
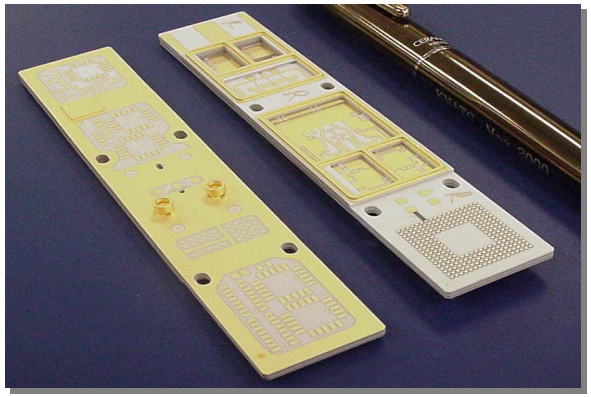
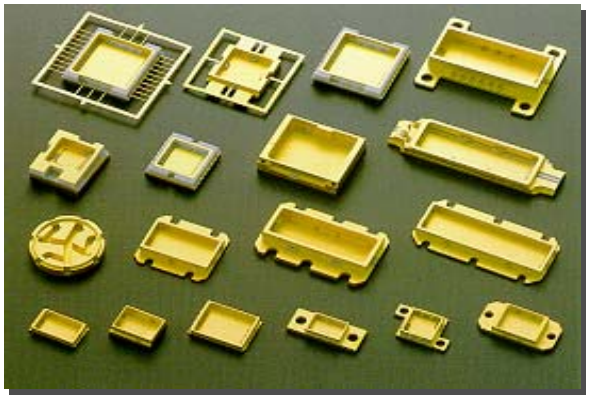


KYOCERA

KYOCERA America, Inc.





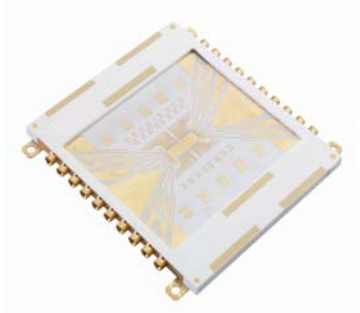
8611 Balboa Ave., San Diego, CA 92123 **http://americas.kyocera.com/kai/semiparts** **(800) 468-2957** **e-mail: kaicorp@kyocera.com**

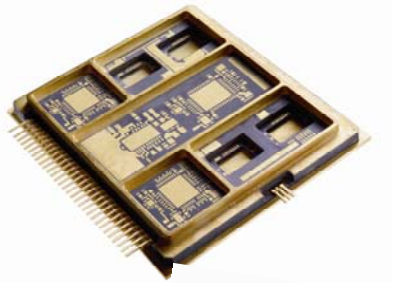
KYOCERA America, Inc.

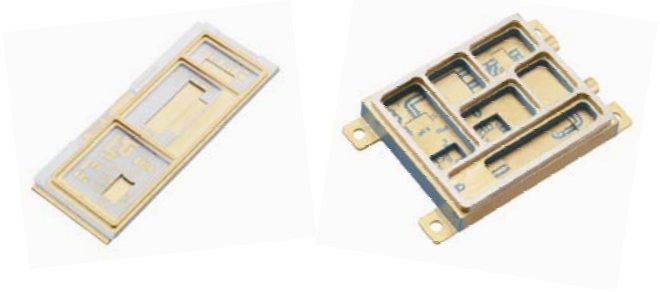
Semiconductor Packaging and Assembly Services

Kyocera America, Inc. (KAI) has been manufacturing ceramic IC packages and modules in San Diego since 1971. KAI's features listed below, provide a total package solution to customers.

- Advanced ceramic package manufacturing
  - HTCC (High Temp. Co-fired Ceramic)
  - LTCC (Low Temp. Co-fired Ceramic)
  - Post-fired BeO, Al_2O_3
- Ceramic package design
- Electrical design, simulation, & modeling
- Thermo-mechanical design and analysis
- Contract assembly services
- Strong customer support team
- Manufacturing in Mexico







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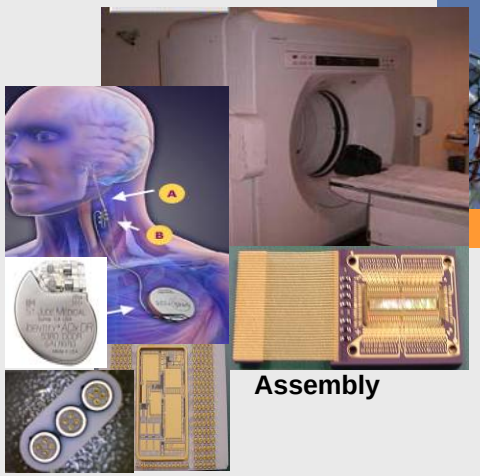
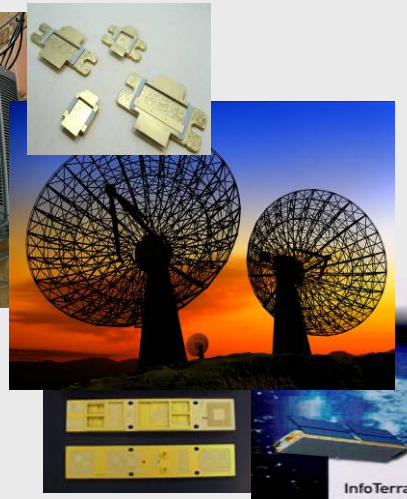
Applications and Markets



Medical Imaging & Implantables

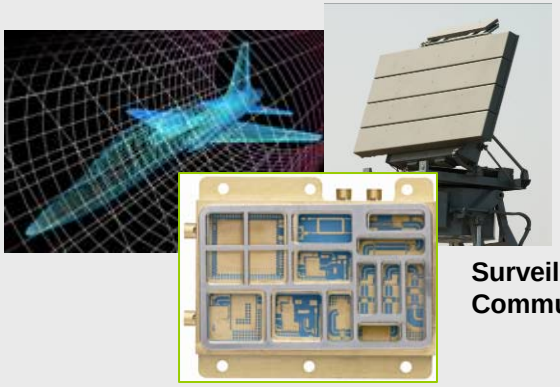
Telecom



Commercial & Government Satellites

Markets:
Hi-Rel
Commercial
Wireless
Medical

Night Vision



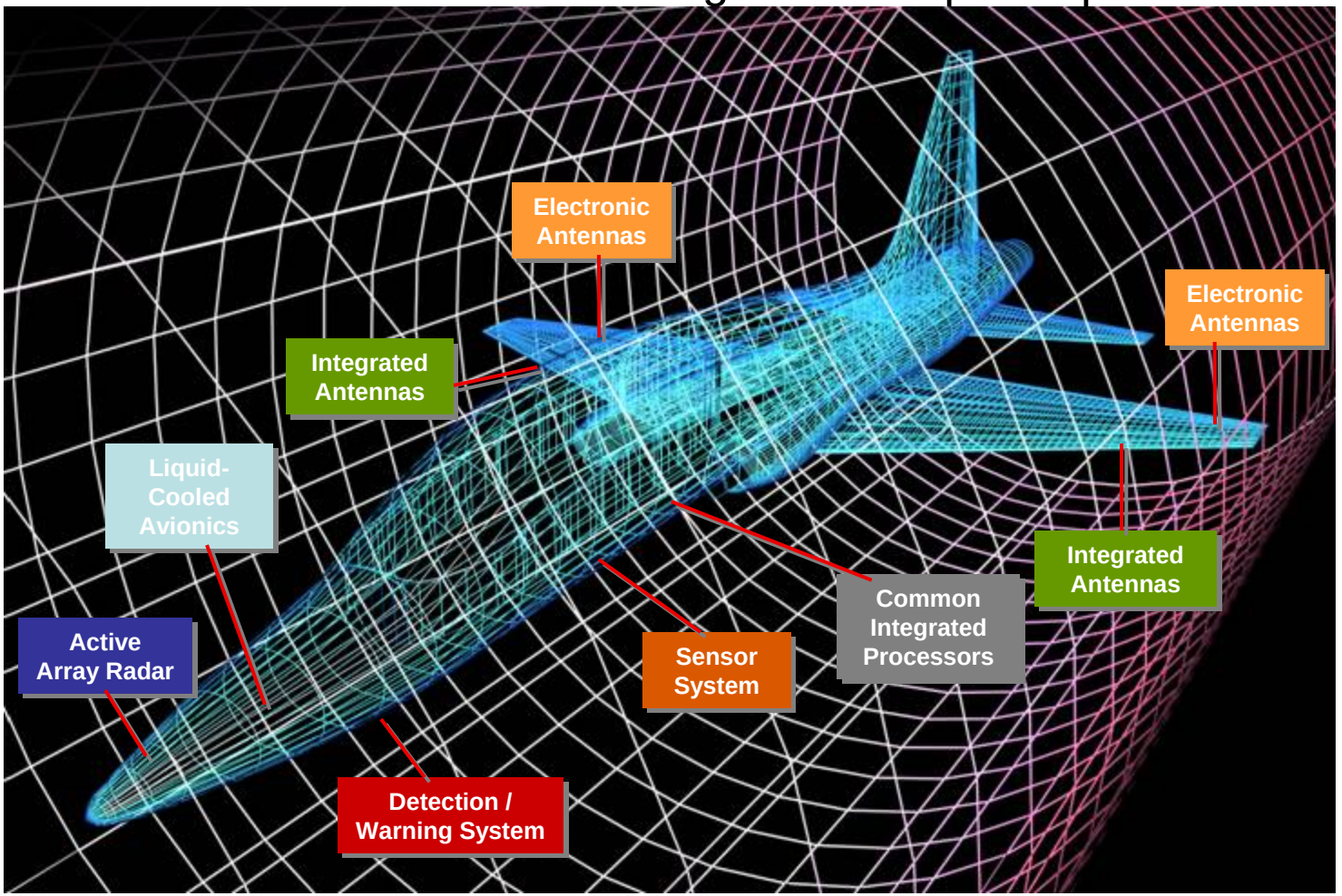
Surveillance / Communications

AESA Radar Systems

KYOCERA America, Inc.

Hi-Rel: Customers and Programs

- KAI supports numerous Hi-Rel programs with a variety of innovative ceramic modules designed for superior performance



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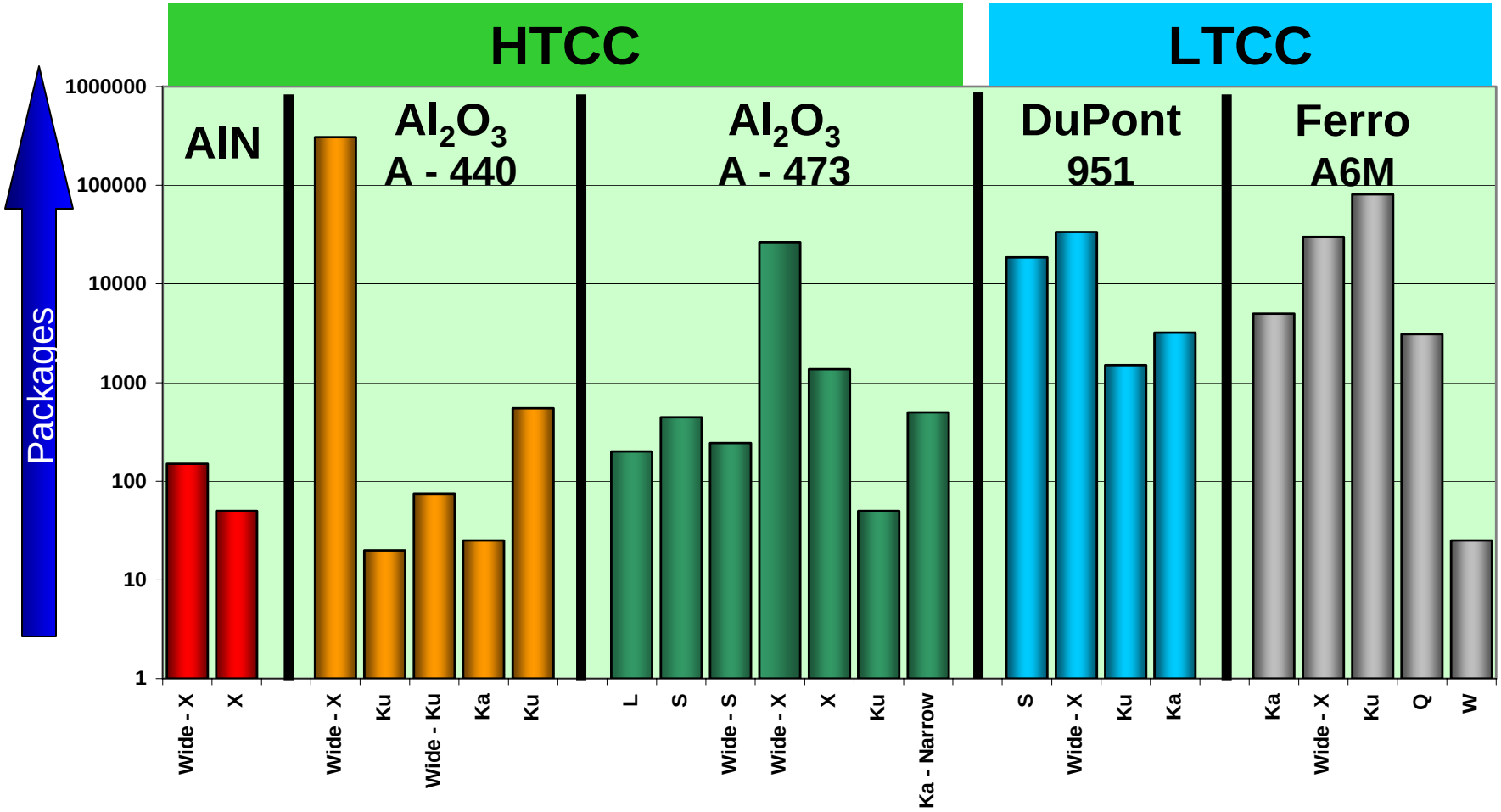
Manufacturing Experience –Transmit & Receive Modules



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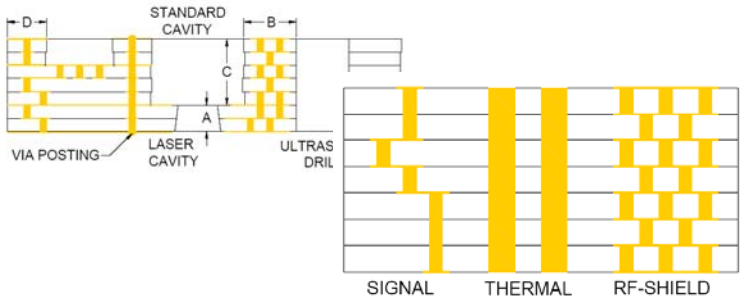
Benefits of Ceramic Packages

- Unique characteristics of Multilayer and Post-Fired Ceramic technologies can provide a wide variety of solutions.

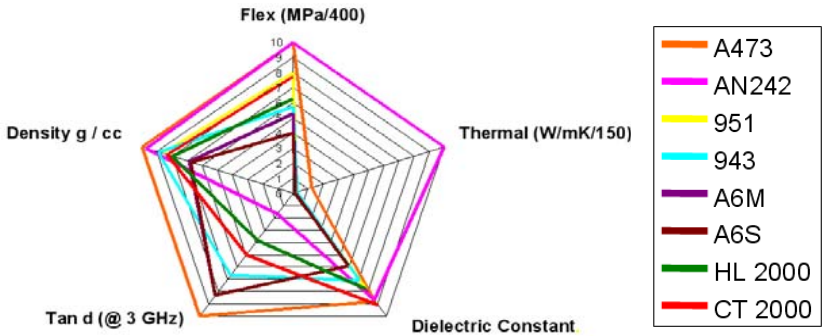


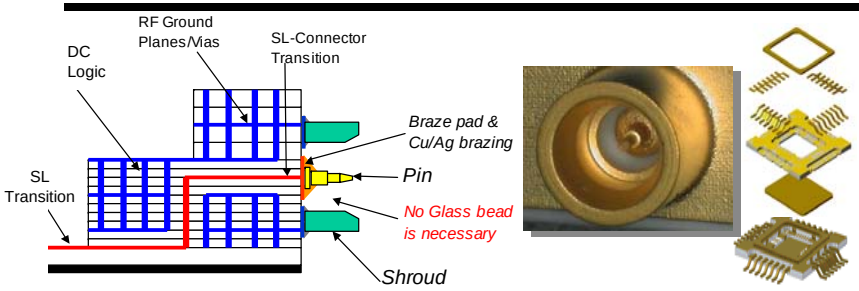
Excellent Design Flexibility

- High Density Design rule
- 3D Structure, Embedded Passives
- Single to Very High Layer Count

Excellent Material Properties

- Physical & Mechanical
- Electrical
- Thermal





Metal Parts Brazing Capability

- Heat Sinks / Seal Rings / Leads
- Many Material Options
- Reliable High Temp Brazing

KYOCERA America, Inc.

Diverse Materials Available – Ceramic Options

Ceramic Material Options		Electrical				Thermal		Mechanical		Conductor Material
		Dielectric Constant		Dissipation Factor ($x10E^{-4}$)		CTE (ppm/K) (RT – 400°C)	Thermal Conductivity (W/mK)	Flexural Strength (MPa)	Young's Modulus of Elasticity (GPa)	
		1 MHZ	2 GHz	1 MHz	2 GHz					
Alumina (Al_2O_3)	A473*	9.1	8.5	5	10	6.9	18	400	270	W, Mo
	A440*	9.8	–	24	–	7.1	14	400	310	W, Mo
	A443	9.6	–	5	–	6.9	18	460	310	W, Mo
	AO600	9.0	8.8	10	21	7.2	15	400	260	CuW
	AO700	9.4	9.2	6	6	7.2	21	620	315	Mo
AIN	AN242	8.7	8.6	1	170	4.7	150	400	320	W
LTCC	GL940	–	18.7	–	2.5	10.7	3.5	220	188	Ag
	GL950	–	9.4	–	14	8.5	4.1	400	173	Ag
	GL330* / GL331*	7.8	7.7 / 7.6	4	5 / 12	8.2 / 7.2	4.3 / 3.2	400	178 / 150	Cu
	GL570	5.6	5.7	3	7	3.4	2.8	200	128	Cu
	GL771	5.3	5.2	8	36	12.3	2.0	170	74	Cu
Air Fired LTCC	DuPont 951*	7.8	7.8	15	60 (3GHz)	5.8	3.3	320	120	Au, Resistors
	Ferro A6M*	5.9	5.9	12	12	7.0	2.0	170	92	Au, Resistors

Note: Material characteristics mentioned above are typical values. These values may change upon further improvement or modification of these materials and processes. DuPont 951 and Ferro A6M data listed are provided by the vendors. (*KAI-sourced materials)

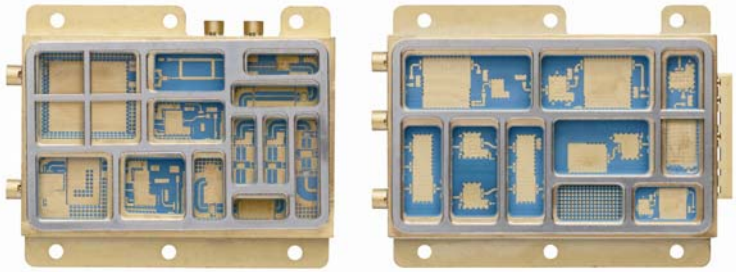
KYOCERA America, Inc.

Multilayer Packages

- HTCC, LTCC-Au, Ag, Kyocera LTCC-Cu
- Up to 100 layers or more if required
- CuAg, AuSn brazing of metal components

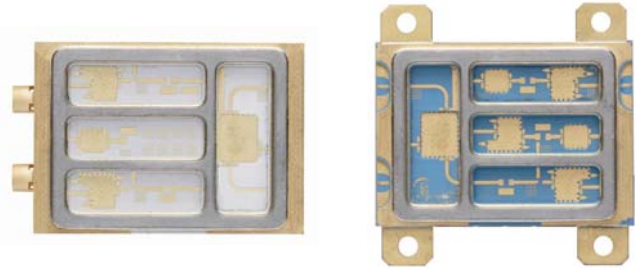
Frequency Converter Modules:

Communication, Broadband Satellite



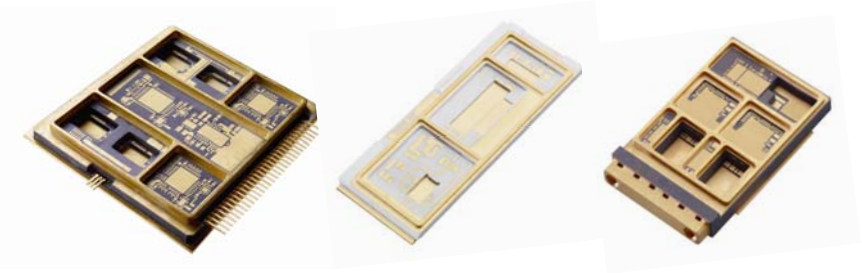
LNA Modules:

Low-K dielectric materials, RF interconnect optimization



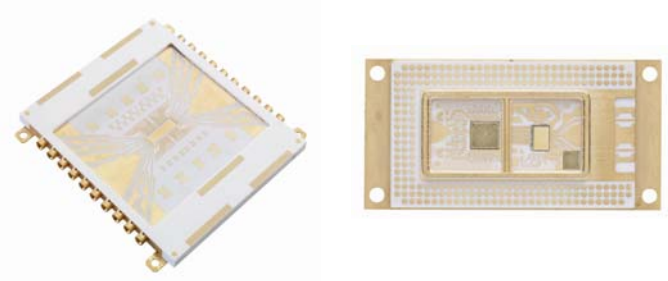
TR Modules:

S-band to V-band; custom-designed features for high-performance applications



Digital Modules:

DAC, ADC, SerDes, DSP, DREX



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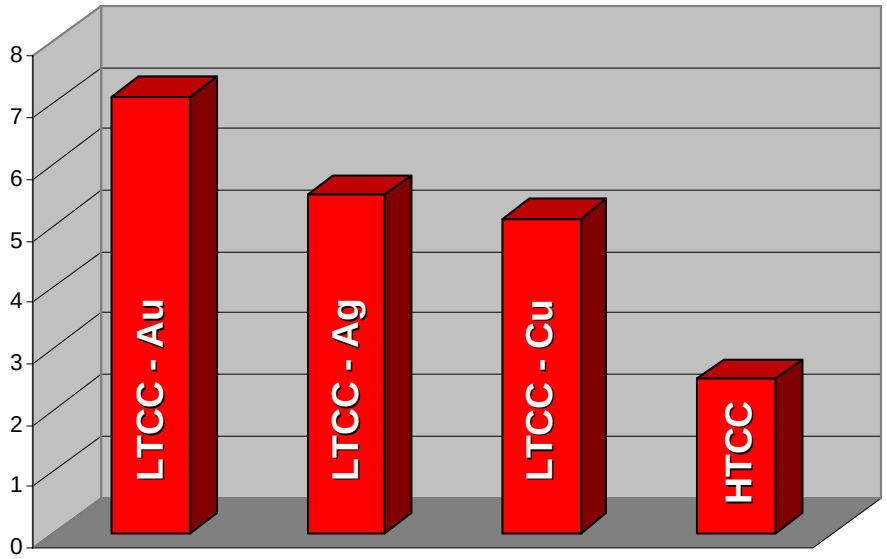
Design & Analysis: Cost Tradeoffs

- Proper design in HTCC can achieve desired price & performance objectives.
- HTCC modules are typically less expensive than LTCC modules
- For Hi-Rel programs, long range cost objectives and technology viability should be considered when choosing a material system

Average $ Per Package In High Volume on a Relative Scale



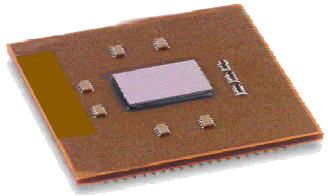
KYOCERA America, Inc.

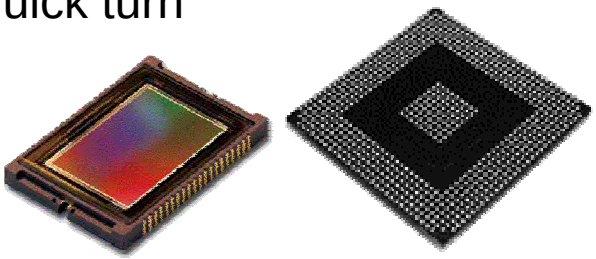
Contract Assembly

KAI's Assembly Technology Dept. offers Flip Chip, Wire bond and SMD assembly capabilities in San Diego. ATD has a strong customer support team for technical guidance and trouble shooting.

Target Business

- Low to mid volume assembly
- Prototype and engineering assembly with quick turn
- Commercial & Hi-Rel
- Optical sensor, complex module, medical
- RoHS Compliant Assembly





Capabilities

- Flip Chip Assembly
- Wire Bond Assembly
- SMD Assembly
- BGA Ball Attachment
- Vacuum Solder

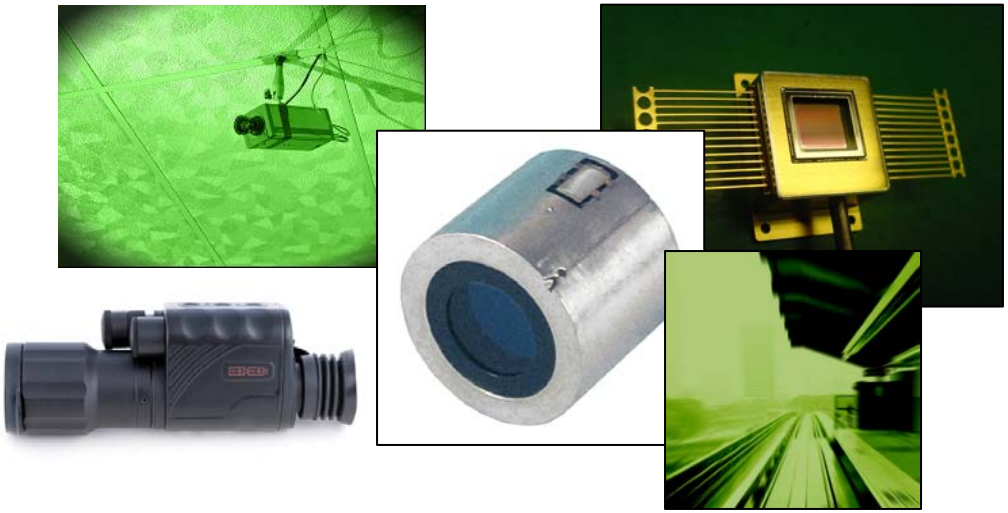
Integrated FC Assembly Line

KYOCERA America, Inc.

Contract Assembly: Image Sensors & Night Vision

Image Sensors:
- 8-22 MegaPixel
- HDTV
- Security
- Satellite
- Machine Vision

Night Vision:
- Ceramic/Metal Substrate
- Module Assembly
- TEC, Getter Attach process
- Seam seal



KYOCERA America, Inc.

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