	DESIGN GUIDE LINES FOR CERAMIC PACKAGES				
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DESIGN GUIDELINES

GENERAL - PROCESS - MATERIALS

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INTRODUCTION

Purpose :

This document is intended as a guide for the design of ceramic packages composed of metallic components and a multilayer ceramic. All the indications given by EGIDE are based on process tolerances and on our know-how acquired during more than 20 years in manufacturing this kind of package.

These guidelines are applied by EGIDE to develop and manufacture the kind of packages described above, any deviations from this guide can be evaluated by EGIDE and, if necessary, will form the subject of a qualification. EGIDE is an innovative company which supports customers with their projects from the prototyping phase through to serial production.

This guideline is subject to change without notice; the latest version is available on request.

Multilayer Ceramic:

EGIDE produces raw alumina sheets using a proprietary formula on which refractory (tungsten) inks are screen printed, to form conductive tracks.

The electric connections between two layers are obtained by punching small holes (vias) in the raw alumina sheet. These holes are filled during the manufacturing process with the same refractory (tungsten) metal as the one used for the conductive tracks.

The raw alumina sheets are then layered to a high precision, by means of an indexing system which is used throughout the process, and are compressed to obtain a good solidity. The resulting block is then co-fired at very high temperature (higher than 1500°C / 2730°F). After the co-firing step, the multilayer ceramic looks like a monolithic block with internal and external metallization closely related to the alumina sheets.

In order to make the metallization compatible with our usual processes of component assembly, the tungsten is plated with electrolytic or electroless nickel. For an electrolytic deposition it is necessary, during design layout, to ensure that at least one point of each equipotential in the circuit is connected by a conductive element to the external power supply. This conductive element is located in an unused area of the alumina sheet which is cut away following electroplating and before electrical testing.

Several I/O's can be brazed onto the metallization such as lead frames for flat packs and pins for plug-in packages. Metal frames can also be added. A second layer of nickel is then added in order to protect all the metallic elements plus a layer of electrolytic gold which is required for bonding.

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APPLICABLE DOCUMENTS AND REFERENCE DOCUMENT

Applicable documents (in order of priority)

1. Customer order
2. Customer drawing or Egide Drawing approved by customer
3. Customer specification
4. Egide drawing checked by customer
5. Egide specification 687 PP 4001 and 687 PP 5001

Reference documents

- | | | | |
|---|--|------|--|
| * | MIL STD 883 | 5008 | Test procedures for hybrid and multichip microcircuits |
| | | 2016 | Physical dimensions |
| | | 2003 | Solderability |
| | | 1010 | Temperature cycling |
| | | 2004 | Lead integrity |
| | | 1014 | Seal |
| | | 2009 | External visual |
| | | 1003 | Insulation resistance |
| * | JEDEC STANDARD N° 9 | | |
| * | MIL C 26074B (Electroless nickel standard) | | |
| * | QQN 290A (Electrolytic nickel standard) | | |
| * | MIL G 45204C (Electrolytic gold standard) | | |
| * | NFC 96 405 | | |

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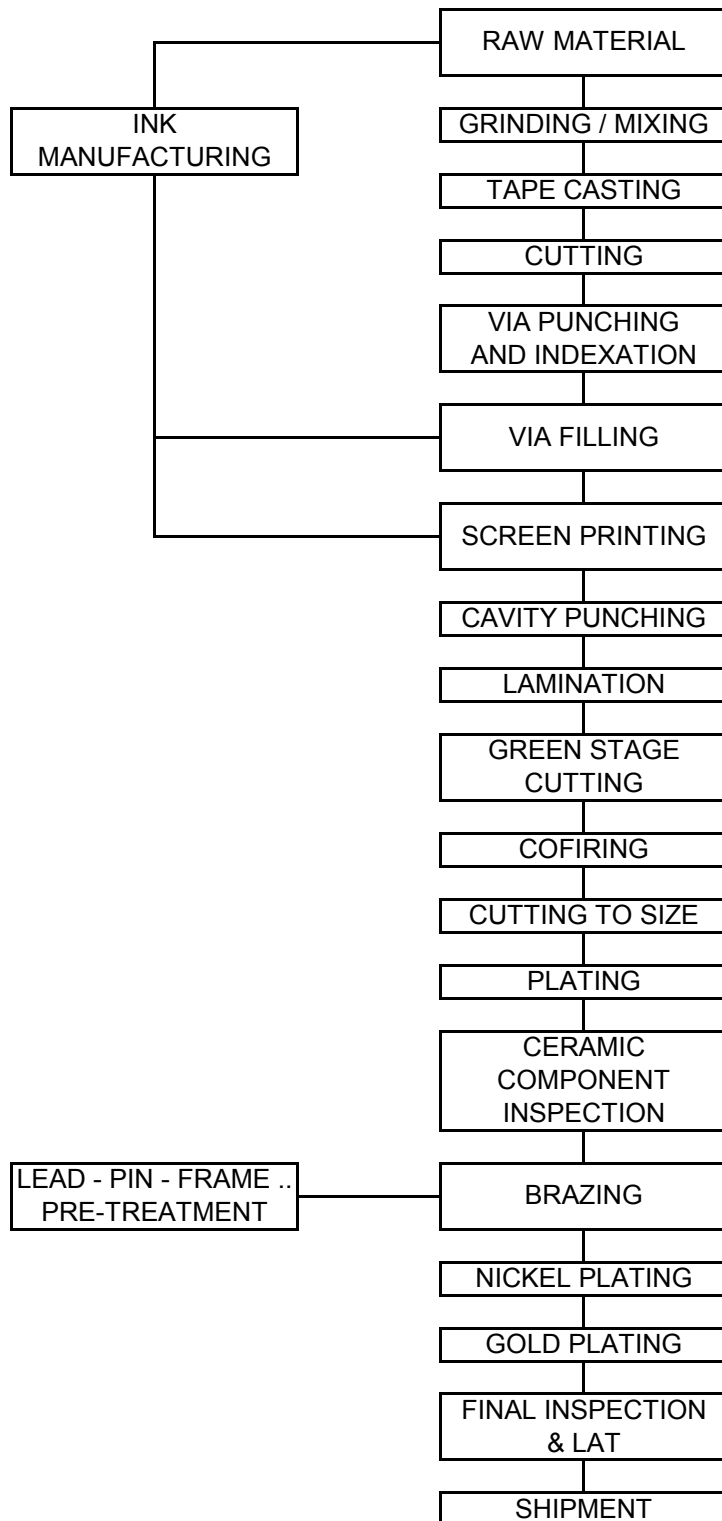
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Manufacturing Process Flow



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TYPICAL MATERIAL CHARACTERISTICS

EGIDE CERAMIC (AL2O3 90% Black)

Physical Properties	Metric	English
Density	3.8 g/cc	0.137 lb/in ³
Weibull Modulus	≥ 10	≥ 10

Mechanical Properties	Metric	English
Modulus of Elasticity (Young's Modulus)	330 GPa	47850 ksi
Tensile Strength	200 MPa	29000 psi
Flexural Strength	350 MPa	50750 psi
Compressive Strength	2400 MPa	348000 psi
Poisson's Ratio	0.22	0.22

Electrical Properties	Metric	English
Electrical Resistivity @ 25°C (77°F)	10 ¹⁴ ohm.cm	
Electrical Resistivity @ 125°C (257°F)	10 ¹³ ohm.cm	
Electrical Resistivity @ 200°C (392°F)	10 ¹¹ ohm.cm	
Dielectric Strength (Breakdown Voltage)	10 kV/mm	254 kV/in

Electrical Properties	Permittivity	Loss Tangent
Dielectric Constant @ 10GHz	9.4	0,9 x 10 ⁻³
Dielectric Constant @ 34GHz	9.1	1,0 x 10 ⁻³
Dielectric Constant @ 60GHz	8.7	1,5 x 10 ⁻³

Thermal Properties	Metric	English
CTE linear 20°C to 100°C (68°F to 212°F)	7.2 µm/m.°C	4.0 µin/in.°F
CTE linear 20°C to 200°C (68°F to 392°F)	6.7 µm/m.°C	3.7 µin/in.°F
CTE linear 20°C to 300°C (68°F to 572°F)	6.8 µm/m.°C	3.8 µin/in.°F
Thermal Conductivity (@ 25°C / 77°F)	22 W/m.°C	152 BTUin/hrft ² .°F

EGIDE CONDUCTOR INK (Based on W)

Electrical Properties	Metric
Resistivity per Square	Line Width 0,25mm / 0,010"
Resistivity per Square	Line Width 0,20mm / 0,008"
Resistivity per Square	Line Width 0,15mm / 0,006"
Resistivity per Square	Line Width 0,10mm / 0,004"
Vias Resistance (Ø0.25mm / Ø0,010" - Height 0.508mm / 0,020")	
Insulation Resistance (Space 0.254mm / 0,010" at 100V DC)	

For Insulation Resistance Test, voltage is limited by the insulation gap on surface layer (Breakdown voltage of Air 1000V/mm Max - 25400V/inch Max)

For Electrical Simulation	Metric
Conductivity Vias	≥ 2,0 x 10 ⁶ S/m
Conductivity Conductor	≥ 3,0 x 10 ⁶ S/m
Conductivity Kovar	2,0 x 10 ⁶ S/m

These Tables are intended to illustrate typical properties. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which Egide assumes legal responsibility

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KOVAR® (ASTM-F15) for Pins & Frames

Physical Properties	Metric	English
Density	8.36 g/cc	0.302 lb/in ³

Mechanical Properties	Metric	English
Modulus of Elasticity (Young's Modulus)	138 GPa	20 000 ksi
Tensile Strength Ultimate	517 MPa	75 000 psi
Tensile Strength Yield	345 MPa	50 000 psi
Poisson's Ratio	0.317	0.317

Electrical Properties	Metric	English
Electrical Resistivity	49 µΩ.cm	
Curie Temperature	435 °C	815 °F

Thermal Properties	Metric	English
CTE linear 25°C to 100°C (77°F to 212°F)	5.86 µm/m.°C	3.26 µin/in.°F
CTE linear 25°C to 300°C (77°F to 572°F)	5.13 µm/m.°C	2.85 µin/in.°F
CTE linear 30°C to 400°C (86°F to 752°F)	4.90 µm/m.°C	2.72 µin/in.°F
CTE linear 30°C to 450°C (86°F to 842°F)	5.30 µm/m.°C	2.94 µin/in.°F
Thermal Conductivity (@ 25°C / 77°F)	17.3 W/m.°C	120 BTUin/hrft ² .°F
Melting Point	1450 °C	2640 °F

Composition	Metric
Fe	54%
Co	17%
Ni	29%

* Other materials (WCu - MoCu - ...) could be used for the base of the package. Please contact your Sales Representative for more information.

BRAZE RAW MATERIAL for Pins & Frames (50.00mm max / 2.00 inch max)

Composition	Metric	English
Ag	72%	
Cu	28%	
Thermal Properties	Metric	English
Melting Point	780 °C	1440 °F

SOLDER MATERIAL for Frames (Specific Application or > 50.00mm / > 2.00 inch)

Composition	Metric	English
Au	80%	
Sn	20%	
Thermal Properties	Metric	English
Melting Point	280 °C	536 °F

* Other solder material (Example - SnAg 221°C/430°F - SnAgCu 217°C/423°F) could be used. Please contact your Sales Representative for more information.

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PLATING

All tungsten metallization is nickel plated before being brazed to other metal components. The Ni thickness deposit during this process is not taken into account in the plating finish given below.

After high temperature assembly all metal surfaces (metallization, frame, pin, lead frames, braze material,...) are:

Electrolytic Standard Plating Thickness :

Ni Plating Thickness :	1.27µm / 0,00005inch	to	5.08µm / 0,00020inch
Au Plating Thickness :	1.27µm / 0,00005inch	to	3.81µm / 0,00015inch
Flash Au Plating Thickness :	0.50µm / 0,00002inch	Maximum	

Electrical connection is required for Electrolytic Plating.

Standard plating measurement points are on the seal ring & on the bonding pads
(minimum surface for measurement : 0,80mm x 0,50mm - 0,030 inch x 0,020 inch)

Some Specific Plating Thickness' for Electrolytic plating can be carried out on request.
Please contact us with your requirement for more information.

Electroless Standard Plating Thickness :

Ni Plating Thickness :	1.27µm / 0,00005inch	min
Au Plating Thickness :	1.27µm / 0,00005inch	min
Flash Au Plating Thickness :	0.127µm / 0,000005inch	Max

Standard plating measurement points are on the seal ring & on the bonding pads
(minimum surface for measurement : 0,80mm x 0,50mm - 0,030 inch x 0,020 inch)

Some Specific Plating Thickness' for Electroless plating can be carried out on request.
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