



Micron Laser Technology

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v2.7

This is a list of requirements for order submission for microvia jobs. This list is written to handle most known issues, expedite turn times, eliminate errors, and facilitate job processing. Addressed in this list are Subcontract Information Sheets, data formats, and requirements for both the Dielectric and/or Copper Drilling processes. The Appendices go into further detail on sample layer stack-ups, coding standards, and programming samples.

Materials Required for Order Submissions:

I: A completed Subcontract Information Sheet (SIS), including the following

1. A material layer stack-up, listing all types and thicknesses of materials comprising the panel. Also, please note whether the copper layers have been plated or not.
2. A list of all tooling sizes, hole diameters, hole counts per diameter, and required drill depths. (e.g. 0.007" holes from layers "n"- "n-1"). These all greatly assist verification. See Appendix A for an example of a completed SIS.
3. Notes on panel alignment

II: Data Formatting and Preparation

1. Submit the file as an email attachment, noting the units used and any scaling
2. Files should be in standard ANSI/IPC-NC-349 format, Excellon II (EX2), or DXF formats. Please note that we can only support a subset of the EX2 commands. See Appendix B for the full list.
3. Files in the Gerber format cannot be processed.
4. Use the job or part number to name the drill file, along with the layer number if possible.
 - i. "laserdrill.ex2" is not an informative name
 - ii. Filenames like "ig88mv_1-2.ex2" or "thx1138__11-9.ex2" are better
5. List fiducials as a separate tool in the EX2 file (e.g. T1, T12) or a different layer in DXF files. Four fiducials are needed for each layer, with one fiducial out of rectangular alignment to assist panel orientation. For multi-layer drilling, please specify which layer to be aligned upon.
6. Use different tool identifier for each separate via-depth and hole diameter.
7. All drill coordinates should be positive.
8. Files for all layers should be in a top-down panel view. We will mirror if necessary.

III: Panel Requirements for Laser Drilling Processes

1. A Diazo sheet for each target layer (that is drilled to), unless provided earlier.
2. We prefer fiducials as bowties or inverted bowties, but cross hair fiducials are acceptable with a line-width of 7 to 9 mil.
3. For copper layers, we recommend fiducials with a diameter of at least 0.080". This size should prevent the fiducials from flaking off in any skiving process. See Figure 1 for an example.
4. We need four point alignment, with one fiducial offset or out of rectangular formation (to ensure proper alignment) by at least 0.050". When panel is viewed from the opposite side, a fiducial should shift position. See Figure 1 for an example.
5. All fiducials are ideally (0.500", 0.500") or greater from the edge of the panel.
6. All tooling holes should be indicated on each Diazo and/or in file(s).
7. Indicate the top and bottom layers using tooling holes, chamfered corners, or other.
8. The size of microvia access openings will be determined by the submitted SIS accompanying the order.
9. For multi-layer stack-ups and drills, the fiducials should all be shifted from layer to layer, so that no two sets of fiducials are stacked atop each other. Layer-specific fiducials shifting helps us verify both the layer/side of the panel being drilled and the layer being aligned to, while reducing risk of operator error. For example, the fiducials for layer 2 should be in a different location than that of layer 3, or that of layers 14 and 15. See Figure 2 for an example layout.

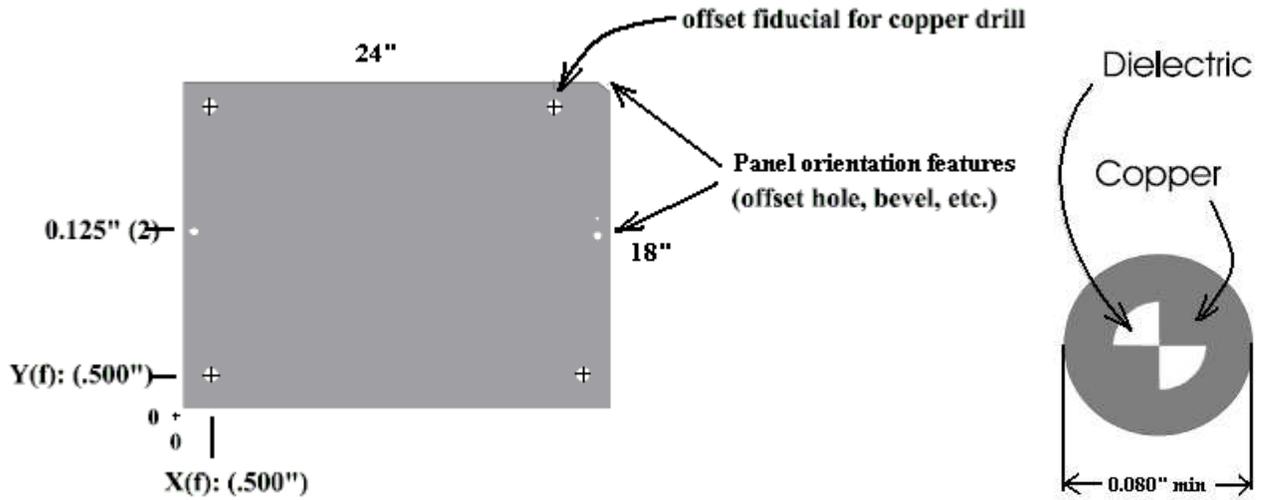


Figure 1: Sample panel layout with orientation features and sample bowtie fiducial

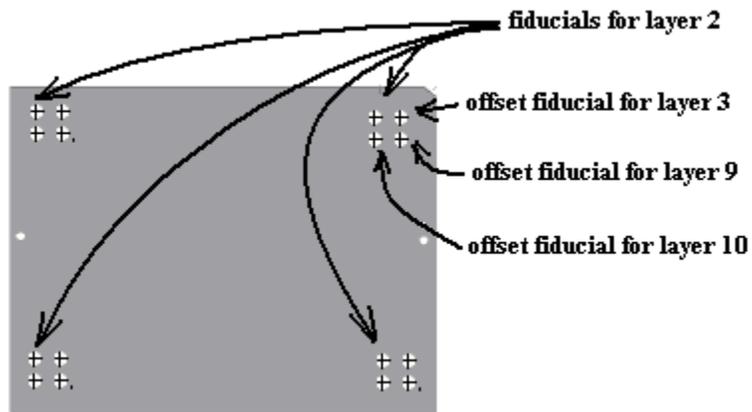


Figure 2: Sample layout for layer-specific fiducials shifting

Appendix A: Example Subcontract Information Sheet



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Part Number Name: 1138AA23

Microvia Laser Drilling Subcontract Information Sheet (SIS)

Company Name	GK Electronics	Requested Dock Date	10-Jun-06
Address 1	511 NW Couch St	Ship Method	UPS Ground
Address 2	Portland, OR 97209	PO#	AO-T1337
Address 3		Expedite #	
Contact	Milo Minderbinder	Contact Phone #	503-796-9364

Down Rev number:	Rev 1-A
Panel Count:	2

Images per panel:	15
Panel Thickness:	.057"

Top Side file: 1138AA23mv_1-2.ex2 **Positional Tolerance** ± 0.002"

Tool #	Diameter	Hole Count	Depth	Notes
T1	0.002	200	1 -> 2	holes for coupons
T2	0.005	8002	1 -> 2	microvias
T3	0.185	4	1 -> 10	tooling holes
T4	0.0045	4	1 -> 2	skive targets on layer 2, bowtie fiducials

Top Side Construction:

Layer 1 Copper: 1/2 oz, non-plated
 Dielectric + Reinforcement: 106 + 1080 + CLTE, .004"
 Layer 2 Copper: 1 oz

Bottom Side file: 1138AA23mv_10-9.ex2 **Positional Tolerance** ± 0.002"

Tool #	Diameter	Hole Count	Depth	Notes
T1	0.002	200	10 -> 9	holes for coupons
T2	0.005	6234	10 -> 9	microvias
T4	0.0045	4	10 -> 9	skive targets on layer 9, bowtie fiducials

Bottom Side Construction:

Layer 10 Copper: 1/2 oz, non-plated
 Dielectric + Reinforcement: 2x106 + Nelco-13, 0.005"
 Layer 9 Copper: 1 oz

Additional Notes:

(Put any helpful part information here, e.g. how to visually identify the top layer or a drawing showing proper alignment.)

Diazo first target layer:

Diazo second target layer:

Appendix B: Supported EX2 commands:

M01	-- End of pattern
M02X#Y#	-- repeat pattern offset
M08	-- end of step & repeat
M25	-- beginning of pattern
M30	-- End of program
M48	-- Program Header
M70	-- Swap axes*
M80	-- Mirror image x axis
M90	-- mirror image y axis
G90	-- Absolute mode
G91	-- incremental input mode
G92 / G93	-- Zero set
%	-- start of drilling

***NOTE:**

The **M70** command can only be used at the end-of-line, as it causes issues otherwise.

For example:

```
M02X-14115Y-18835M70M90  
M02X1023Y1267M70M80
```

will cause errors, but

```
M02X-14115Y-18835M90M70  
M02X1023Y1267M90M70
```

will not.

Appendix C: EX2 formatting and sample programs

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Basic format:

```
M48
T1           ; EX2 statements to the end of program
...
M25
...
M01
...
M08
...
M30
```

Sample program 1:

```
M48
T01C.006
T02C.010
T03C.187
T04C.015
%

T01
M25
X03747Y04416
Y04352
X03883Y0432
[...]
M01
M02X18Y25M80M90
M02X-14115Y-18835M90M70
M02X1023Y1267M80M70
M08
M25
X044000Y086500
X044500
X045000
X045500
X046000
X044000Y086000
Y085500
Y085000
Y084500
X136000Y086000
[...]
M01
M02X18Y25M80M90
M02X-14115Y-18835M90M70
M02X1023Y1267M80M70
M02
M08
M25
T00
M30
```

Sample Program 2:

```
M48
T01C.0059
T02C.0157
T03C.1870
T04C.1990
%

T02
Y082259X09796
Y098289
X10503
[...]
```

Sample Program 3:

```
M48
T01C.0059
T02C.0157
T03C.1870
T04C.1990
%

T01
X120486Y133306
X119501Y133306
X119009Y132814
X056726Y093550
X054411Y092914
X054570Y092550
X054608Y093550
X054982Y093540
X055192Y092779
X055291Y091653
X055339Y093442
[...]
M01
M02X0Y1404
M08
T00
M30
```