# CHECKLIST FOR MONOLITHIC MICROCIRCUIT MANUFACTURER AND LINE SURVEY

## ESCC Basic Specification No. 2029000

| | |
|---|---|
| **Manufacturer:** | . |
| **Location:** | . |
| **Survey Team Leader:** | . |
| **Date of Survey** | . |
| **Resistor Type(s):** | . |


| | |
|---|---|
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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| 826 | Specification upissued to incorporate editorial changes per DCR. |

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## 1 INTRODUCTION

This checklist is intended for use during the initial survey of a Manufacturer's ability to produce high quality articles, his management organisation, production facilities, test facilities and technical know-how. When completed, this checklist should enable the party interested in procurement of the subject components to assess the ability of the Manufacturer concerned to successfully execute a contract for the supply of high reliability space hardware.

## 2 SURVEY CHECKLIST

### 2.1 INTERVIEW ON ARRIVAL OF SURVEY TEAM

(a) Introductory Remarks by Team Leader (Explanation of purpose of survey, procedures to be followed, time limitations, etc.):-

(b) Notes (Atmosphere during reception, willingness to co-operate, interest shown, comments on personnel, general remarks):-

### 2.2 MANUFACTURER AND SURVEY TEAM INFORMATION

(a) Survey requested by:

Survey Team Leader:

Team Members:

(b) Key personnel of Manufacturer interviewed:-

| | Name | Function | Tlph. Ext |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

(c) Type of Company (Private company, limited company, etc.)

Affiliated with any other company? If so, which:

No. of employees:

| | |
|---|---|
| - Total number: | |
| - Production: | |
| - Quality Assurance: | |
| - Q.A. Inspection: | |
| - Prod. Engineering: | |
| - Design Engineering: | |
| - Reliability Control: | |
| - Other: | |

(d) Number of shifts:

(e) Plant area:

(f) General Production line:

1. Device types manufactured:

2. Will flow diagrams of steps to produce monolithic microcircuits be available to Survey Team?

YES ☐ NO ☐

Are specifications, if any, referenced in the flow diagrams?

YES ☐ NO ☐

(g) Principal Government and industrial customers:

1.
2.
3.
4.
5.

(h) The Manufacturer's Quality System is organised in accordance with:

Comments:

(i) Manufacturer's Government Service Inspection:

DCAS Inspector, resident/non-resident

(j) National Inspectorate:

(k) Is the Manufacturer's monolithic microcircuit production

| | | | | | |
|---|---|---|---|---|---|
| (1) | Continuous? | YES | ☐ | NO | ☐ |
| (2) | Pilot production? | YES | ☐ | NO | ☐ |
| (3) | Advanced R&D, limited? | YES | ☐ | NO | ☐ |

(l) The Manufacturer has adequate experience in the production of the following hi-rel parts:

2.3 MANAGEMENT ORGANISATION

(a) What is general policy/attitude of the Management regarding quality/reliability programme?

(b) Which level of Management participates actively in orientating policy towards space component production?

(c) Which organisation, if any, reviews and monitors all work involved in space component production?

(d) Is work related to space components (contracts) regarded as "normal business" or as belonging to the "unique order" category?

(e) What is the general policy concerning proprietary rights?

(f) Has the "Reliability" department the same authority from Management as the "Engineering" and "Production" departments? Does this mean direct responsibility for reliability of products in the line?

(g) Has the Q.A. Manager direct authority for implementation of quality policy and actions related to the line?

(h) Does a system exist for the regular supply of quality report summaries to Management?

Does this system lead to (corrective) actions being taken in respect of the production line?

(i) Are key management staff notified of persistent out-of-control conditions?

(j) What is length of service and experience of key management personnel (Q.A., Reliability, Production, Engineering Design)?

(k) How would contract for space components be organised?

(l) How can original requirements from Orderer (Space Agency or end-user) be assumed to be correctly translated into internal instructions?

(m) How can information necessary to the Orderer (corrective actions, deviations, notification of inspections and/or problem areas) be assumed to be issued and channelled to the Orderer?

2.4 QUALITY ASSURANCE SYSTEM AND ORGANISATION

(a) To whom does Q.A Manager report?

| | YES | NO |
|---|---|---|
| (b) Does the company reflect a positive attitude towards Quality Assurance? | ☐ | ☐ |
| Comments: | | |
| (c) Has the Q.A. group sufficient authority in relation to its position within the company's organisation (see organigram)? | ☐ | ☐ |
| Comments | | |
| (d) Are areas of responsibility within the Q.A. group clearly defined? | ☐ | ☐ |
| Comments | | |
| (e) Are corrective actions to which Q.A. management is committed delegated to responsible staff or does Q.A. management have direct authority regarding the line? | ☐ | ☐ |
| Which? | | |
| (f) Is there a periodic and comprehensive quality data reporting system which covers all operational phases? | ☐ | ☐ |
| Comments | | |
| (g) What is the relationship between Q.A. and Reliability? | | |
| (h) Is a Q.A. manual or equivalent document supplied to all levels of appropriate supervisory personnel? | ☐ | ☐ |
| Is such document kept updated? | ☐ | ☐ |
| Comments | | |
| (i) Are written procedures available for identification and positive control of accepted/rejected materials? | ☐ | ☐ |
| Comments | | |
| (j) What is ratio Q.A. inspectors : personnel directly involved in production? | | |

| | | YES | NO |
|---|---|---|---|
| (k) | Is inspection (acceptance sampling or sorting) performed by Q.A. personnel: | ☐ | ☐ |

| | | | | | | |
|---|---|---|---|---|---|---|
| On receipt? | Sampling | ☐ | Sorting | ☐ | None | ☐ |
| During processing? | Sampling | ☐ | Sorting | ☐ | None | ☐ |
| During final testing? | Sampling | ☐ | Sorting | ☐ | None | ☐ |

Comments

| | YES | NO |
|---|---|---|
| (l) Are written procedures kept and used in areas for: | | |
| - Receiving inspection? | ☐ | ☐ |
| - In-process inspection? | ☐ | ☐ |
| - Fabrication processing? | ☐ | ☐ |
| - Final testing? | ☐ | ☐ |

Comments

| | YES | NO |
|---|---|---|
| (m) Does Q.A. maintain a system of written procedures for statistic controls (control chart, lot plot, etc.) in any of the following areas? | | |
| In-process inspection? | ☐ | ☐ |
| Fabrication processing? | ☐ | ☐ |
| Final inspection? | ☐ | ☐ |

Comments

| | YES | NO |
|---|---|---|
| (n) Is Q.A. responsible for determination of need for, and the conducting of, quality training? | ☐ | ☐ |

Comments

| | YES | NO |
|---|---|---|
| (o) Are training programmes provided for special process personnel? | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | Comments | | |
| (p) | Do employees have to pass tests: | | |
| | After training? | ☐ | ☐ |
| | Periodically? | ☐ | ☐ |
| | Comments | | |
| (q) | Are production operators provided with visual aids and working instructions? | ☐ | ☐ |
| | Comments | | |

2.5 CALIBRATION

| | | YES | NO |
|---|---|---|---|
| (a) | Does Manufacturer maintain calibration facilities and standards? | ☐ | ☐ |
| | Is this service purchased? | ☐ | ☐ |
| | If so, from whom? | | |
| (b) | Do calibration personnel have written procedures for control and a time schedule for measurement frequency? | ☐ | ☐ |
| | Comments | | |
| (c) | Is there an effective calibration record control system? | ☐ | ☐ |
| (d) | Are calibration procedures adhered to and up-to-date? | ☐ | ☐ |
| | Comments | | |
| (e) | Are decals used for equipment identification to show that units have been calibrated; when next calibration date is due and calibrator identification? | ☐ | ☐ |
| | Are decals up-to-date? | ☐ | ☐ |
| (f) | Are adjustments of calibrated equipment required to be sealed and tamper-proof? | ☐ | ☐ |
| (g) | Who is in charge of initiating calibration steps? | | |
| | - User | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | - Calibration personnel | ☐ | ☐ |
| | - Q.A. | ☐ | ☐ |
| (h) | Do calibration procedures provide for removal of any equipment not maintained or calibrated according to established schedules?<br>Comments | ☐ | ☐ |
| (i) | Have calibrating personnel up-to-date certification records reflecting date, traceability to NBS and identification of calibrator? | ☐ | ☐ |
| | (1) Mechanical Standard? | ☐ | ☐ |
| | (2) Electrical Standard? | ☐ | ☐ |
| (j) | Is modified and/or repaired equipment calibrated prior to release? | ☐ | ☐ |

2.6 DRAWING AND CHANGE CONTROL

| | | YES | NO |
|---|---|---|---|
| (a) | Has Manufacturer adequate written procedures for control of specification and contract changes?<br>Comments | ☐ | ☐ |
| (b) | Does Manufacturer's system provide for documented change control guaranteeing availability of required drawing at relevant manufacturing or inspection step? | ☐ | ☐ |
| | Do flow documents show current revisions?<br>Comments | ☐ | ☐ |
| (c) | Are drawings furnished by ESTEC and contract changes adequately controlled?<br>Comments | ☐ | ☐ |
| (d) | Does Q.A. review all drawings and changes therein prior to their becoming effective?<br>Comments | ☐ | ☐ |
| (e) | Has Manufacturer established a procedure for notifying his Supplier of changes in drawings?<br>Comments | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| (f) | Are current specification revisions shown on prints of drawings? | ☐ | ☐ |

2.7 RELIABILITY

| | | YES | NO |
|---|---|---|---|
| (a) | Is structure of Reliability organisation clearly defined? | ☐ | ☐ |
| | Has Reliability same authority in respect of the line as Production or Engineering management? | ☐ | ☐ |
| | Comments | | |
| (b) | Is there a direct feed-back of information between Reliability, Design Engineering and Q.A. groups to ensure timely notification of all relevant data? | ☐ | ☐ |
| | Comments | | |
| (c) | Does Reliability respond promptly and efficiently to unexpected and/or newly detected failure modes? | ☐ | ☐ |
| | Comments | | |
| (d) | Are line failures (types and causes) analysed and reported to those responsible for corrective actions? | ☐ | ☐ |
| (e) | Are corrective actions resulting from failure analysis agreed with the Q.A. group involved or Reliability if parts or process changes must be made? | | |
| | Q.A. Group | ☐ | ☐ |
| | Reliability | ☐ | ☐ |
| | Comments | | |
| (f) | Has Reliability right to approve test specifications, data tabulation, parts or process changes? | ☐ | ☐ |
| (g) | Is there a system for in-process failure analysis? | ☐ | ☐ |
| | End-item failure? | ☐ | ☐ |
| | Reporting? | ☐ | ☐ |
| | Comments | | |

| | | YES | NO |
|---|---|---|---|
| (h) | Are following items submitted to failure analysis as a matter of routine? | | |
| | Production line rejects | ☐ | ☐ |
| | Lots with a high rejection rate | ☐ | ☐ |
| | Define: | | |
| | Items returned by Orderer | ☐ | ☐ |
| | Items returned by Orderer with special request for failure analysis | ☐ | ☐ |
| (i) | Has Manufacturer a failure analysis laboratory or an equivalent facility? | ☐ | ☐ |
| | Comments | | |
| (j) | Are failure analysis procedures: | | |
| | (1) Available? | ☐ | ☐ |
| | (2) In use? | ☐ | ☐ |
| | (3) Adequate? | ☐ | ☐ |
| | Comments | | |
| (k) | Is failure analysis equipment: | | |
| | (1) Available? | ☐ | ☐ |
| | (2) In use? | ☐ | ☐ |
| | (3) Adequate? | ☐ | ☐ |
| | Comments | | |
| (l) | Are there special personnel for failure analysis? | ☐ | ☐ |
| | Comments | | |
| (m) | Are failure analysis reports: | | |
| | (1) Available? | ☐ | ☐ |
| | (2) Adequate? | ☐ | ☐ |
| | Comments | | |
| (n) | Has Reliability a programme to ensure reliability of monolithic microcircuit device designs prior to release thereof? | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | comments | | |
| | | | |
| (o) | Has Reliability access to all pertinent development and production data of monolithic microcircuit devices for analysis purposes? | ☐ | ☐ |
| | Comments | | |
| | | | |
| (p) | Is reliability data available of monolithic microcircuit devices from the line(s) which the Manufacturer wishes to be approved? | ☐ | ☐ |
| | Comments | | |
| | | | |
| (q) | Has Manufacturer an evaluation laboratory for determination of product characteristics? | ☐ | ☐ |
| (r) | If Manufacturer has an evaluation laboratory: | | |
| | Does it operate according to an established programme? or | ☐ | ☐ |
| | According to special requests? | ☐ | ☐ |
| | Comments | | |
| | | | |
| (s) | Give examples of problems investigated by evaluation laboratory | | |
| | | | |
| (t) | Are laboratory results available on request? | ☐ | ☐ |
| (u) | Are data sheets based on these results? | ☐ | ☐ |

2.8 CONTROL OF PROCUREMENT SOURCES

| | | YES | NO |
|---|---|---|---|
| (a) | Has Manufacturer adequate written procedures for purchase control of materials, components and services?<br>Comments | ☐ | ☐ |
| (b) | Has Manufacturer an effective vendor rating system?<br>Comments | ☐ | ☐ |
| (c) | Does rating system provide for effectiveness of written corrective actions received from Suppliers?<br>Comments | ☐ | ☐ |
| (d) | Do purchase documents require delivery of test reports if such reports are specified in the relevant ESA contract?<br>Comments | ☐ | ☐ |
| (e) | Is there a means of channelling information when specification changes require modification of current purchase orders?<br>Is "Receiving Inspection" notified of changes in purchase orders?<br>Comments | ☐<br>☐ | ☐<br>☐ |

2.9 CONTROL OF INCOMING MATERIALS (PERFORMED IN SITU)

| | | YES | NO |
|---|---|---|---|
| (a) | Are Manufacturer's written standard inspection procedures adequate for control of incoming materials and services received?<br>Do inspectors know how and when to apply these procedures?<br>Comments | ☐<br>☐ | ☐<br>☐ |
| (b) | Are materials received in a controlled area from which removal prior to inspection is impossible?<br>Comments | ☐ | ☐ |
| (c) | Are materials properly handled and protected during the receiving process?<br>Comments | ☐ | ☐ |
| (d) | Does Receiving Inspection use drawings and purchase orders?<br>If so, do these documents show Quality Control review?<br>Comments | ☐<br>☐ | ☐<br>☐ |

| | | YES | NO |
|---|---|---|---|
| (e) | Are test reports from Suppliers being reviewed?<br>Comments | ☐ | ☐ |
| (f) | Are accepted materials adequately identified? | ☐ | ☐ |
| | Do documents show evidence of acceptance?<br>Comments | ☐ | ☐ |
| (g) | Are rejected materials adequately identified and segregated?<br>Comments | ☐ | ☐ |
| (h) | Which materials are subject to limited shelf life limitations? | ☐ | ☐ |
| | Comments | | |
| (i) | Are shelf life and cure date materials properly identified and controlled?<br>Comments | ☐ | ☐ |
| (j) | Do records indicate traceability of units, lots and sublots to applicable documents (specification, revision letter - if any - and inspection record)?<br>Comments | ☐ | ☐ |
| (k) | Are materials stored in a controlled area under the responsibility of an authorised Custodian?<br>Comments | ☐ | ☐ |
| (l) | Are suitable inspections and tests, including physical and chemical tests, performed on raw materials?<br>Comments | ☐ | ☐ |
| (m) | Are such tests performed:<br>In-house? | ☐ | ☐ |
| | At other locations?<br>Comments | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| (n) | Are storage containers, racks, bins, etc. adequate for type of material stored?<br>Comments | ☐ | ☐ |
| (o) | Is lot traceability maintained?<br>Comments | ☐ | ☐ |
| (p) | Is "first in/first out" method applied? | ☐ | ☐ |

2.10 IN-PROCESS INSPECTIONS AND TESTS

| | | YES | NO |
|---|---|---|---|
| (a) | To whom does In-process Q.A. Inspection report? | | |
| (b) | Are inspection and/or operation travellers used sequential to performance and control of all operations and processes?<br>Comments | ☐ | ☐ |
| (c) | Do travellers refer to inspection procedures? | ☐ | ☐ |
| | Do inspectors know how and when to use them?<br>Comments | ☐ | ☐ |
| (d) | Do travellers refer to controlled specifications? | ☐ | ☐ |
| | Do specifications show current revision status?<br>Comments | ☐ | ☐ |
| (e) | Does Q.A. have written in-process procedures to control acceptance of products?<br>Comments | ☐ | ☐ |
| (f) | Is type and quantity of available inspection equipment adequate for type of work being accomplished?<br>Comments | ☐ | ☐ |
| (g) | Are documentation and instruments used by inspectors subject to calibration control? | ☐ | ☐ |
| | Is calibration evident and up to date? | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| (h) | Is there a specific material review procedure?<br>Comments | ☐ | ☐ |
| (i) | Do in-process Q.A. inspectors summarise quality experience on the basis of specific process stages? | ☐ | ☐ |
| | Do they issue quality reports on a regular basis? | ☐ | ☐ |
| | Do reports result in assistance and/or action?<br>Comments | ☐ | ☐ |
| (j) | Are requests for corrective action issued in writing? | ☐ | ☐ |
| | Are such requests answered? | ☐ | ☐ |
| | Does corrective action ensue?<br>Comments | ☐ | ☐ |
| (k) | Does Q.A. maintain any statistic controls (X&R, etc.) in the in-process area? | ☐ | ☐ |
| | Are these controls up-to-date and at individual process stations?<br>Comments | ☐ | ☐ |
| (l) | Is wafer identification maintained throughout processing?<br>Comments | ☐ | ☐ |
| (m) | Are masks checked prior to use?<br>Comments | ☐ | ☐ |
| (n) | Is metallisation adhesion verified?<br>Comments | ☐ | ☐ |
| (o) | Are wafers stored and transported in protective carriers?<br>Comments | ☐ | ☐ |
| (p) | Are dice inspected for physical damage following scribing?<br>Comments | ☐ | ☐ |
| (q) | Are dice selected by 100% electrical screening?<br>Comments | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| (r) | Do inspectors have adequate visual aids to establish reject criteria prior to encapsulation?<br>Comments | ☐ | ☐ |
| (s) | Are there documents describing in-process manufacturing procedures and controls?<br>Comments | ☐ | ☐ |
| (t) | Are there documents describing in-process inspections? | ☐ | ☐ |
| | Do inspectors know how and when to use them?<br>Comments | ☐ | ☐ |
| (u) | Are there specific standards for handling, cleanliness and care of materials, parts and equipment?<br>Comments | ☐ | ☐ |
| (v) | Are calibrations evidenced and up-to-date? | ☐ | ☐ |
| (w) | Has Q.A. authority to stop production flow in case of out-of-control conditions? | ☐ | ☐ |
| | Is a written material review procedure in use?<br>Comments | ☐ | ☐ |
| (x) | Are records maintained of training and competence of operators for welding, soldering, radiography, radiflo and plating?<br>Comments | ☐ | ☐ |
| (y) | Are certified operators identifiable by means of a card or badge on their clothing?<br>Comments | ☐ | ☐ |

2.11 SURVEY OF MANUFACTURING LINE

This review shall be performed in 2 phases:-

1. Identification of the various steps listed in the flow chart to define the corresponding operations and collect all relevant information.
2. Actual line survey (indicate if inspection was performed).

If different technologies are applied, the inspection results shall be supplied on separate sheets.

2.11.1 Manufacturing Equipment

| | YES | NO |
|---|---|---|
| (a) Are phases of manufacture carried out under controlled environmental conditions? | ☐ | ☐ |
| (b) Detail phases and conditions. | | |

2.11.2 Fabrication of Substrate

| | YES | NO |
|---|---|---|
| (a) Is material procured from an outside source? | ☐ | ☐ |
| (b) Are goods inwards inspections ufficient to determine acceptability of each procured wafer? | ☐ | ☐ |
| Comments | | |
| (c) Are wafers produced in house? | ☐ | ☐ |
| (d) Are adequate controls documented and maintained for wafer production? | | |
| (1) Wafer slicing (thickness, flatness, parallelism) | ☐ | ☐ |
| (2) Wafer preparation (grinding, polishing, cleaning) | ☐ | ☐ |
| (3) Environmental conditions (RH, temperature, dust count) | ☐ | ☐ |
| Comments | | |
| (e) Are adequate controls documented and maintained on wafer testing? | | |
| (1) Visual inspection (“orange peel”, pyramids, stacking faults, lineage, haze, mottle, cracks, dimples, nicks, pits, scratches, twin lineage, bumps, tweezer marks) | ☐ | ☐ |
| (2) Electrical tests (conductivity, resistivity) | ☐ | ☐ |
| (3) Structural tests (surface roughness, surface orientation, crystal perfection) | ☐ | ☐ |
| (4) Number of items inspected per lot | ☐ | ☐ |

| | YES | NO |
|---|---|---|
| (5) Environmental conditions (RH, temperature, dust count) | ☐ | ☐ |
| (6) Disposition of rejects | ☐ | ☐ |

Comments

(f) Are adequate instructions and procedures issued regarding substrate handling?

| | | |
|---|---|---|
| (1) Techniques and precautions to be exercised | ☐ | ☐ |
| (2) Records of substrate damage | ☐ | ☐ |
| (3) Remedial instructions for personnel effecting significant damage | ☐ | ☐ |
| (4) Control of static discharge | ☐ | ☐ |
| (5) Protection from contamination | ☐ | ☐ |
| (6) Segregation of damaged items | ☐ | ☐ |

Comments

(g) Are adequate controls documented and maintained on wafer purity?

| | | |
|---|---|---|
| (1) Resistivity (ohms/cc at +25ºC) | ☐ | ☐ |
| (2) Solids content | ☐ | ☐ |
| (3) Organic impurities | ☐ | ☐ |
| (4) Frequency of checks | ☐ | ☐ |
| (5) Frequency of calibration of test equipment | ☐ | ☐ |

Comments

2.11.3 Circuit Integration on Wafer

| | YES | NO |
|---|---|---|
| (a) Are adequate controls documented and maintained on circuit integration techniques? | | |
| (1) Surface passivation (environmental control, substrate handling, layer thickness, flaw detection) | ☐ | ☐ |
| (2) Junction formation (furnace profiling, temperature, gas flow rate, dwell time) | ☐ | ☐ |
| (3) Patterning | ☐ | ☐ |
| (4) Metallisation (material, thickness) | ☐ | ☐ |
| (5) Formation of resistive elements | ☐ | ☐ |

Comments

(b) Do process control documents for circuit integration procedures specify the following parameters?

| | | |
|---|---|---|
| (1) Environmental conditions prevailing during processing | ☐ | ☐ |
| (2) Handling of substrate | ☐ | ☐ |
| (3) Lot identification | ☐ | ☐ |
| (4) Date of processing activity | ☐ | ☐ |
| (5) Number of items inspected | ☐ | ☐ |
| (6) Percentage defective | ☐ | ☐ |
| (7) Median value of parameters | ☐ | ☐ |
| (8) Range of parametric values | ☐ | ☐ |

Comments

2.11.4 Production Control

| | YES | NO |
|---|---|---|
| (a) Are adequate controls documented and maintained to ensure purity of materils used in production of circuits? | ☐ | ☐ |
| (b) Are adequate controls documented and maintained on the following photoresist factors? | | |
| (1) Preparation (frequency, chemicals, method) | ☐ | ☐ |
| (2) Evaluation (specific gravity, viscosity, solids, residue, definition of line width, pinhole count) | ☐ | ☐ |
| (3) Storage conditions (temperature, type of container) | ☐ | ☐ |
| (4) Application (mounting of substrate, temperature control, rpm of spinner, acceleration, time of rotation) | ☐ | ☐ |
| (5) Baking (time, temperature) | ☐ | ☐ |
| (6) Exposure (contact pressure, light intensity, time) | ☐ | ☐ |
| (7) Development (time, temperature inspection, magnification, lighting, rejection criteria) | ☐ | ☐ |
| (8) Environmental control (temperature, relative humidity, dust count, lighting) | ☐ | ☐ |
| Comments | | |
| (c) Are adequate controls documented and maintained on the following etching factors? | | |
| (1) Concentration (frequency of replacement) | ☐ | ☐ |
| (2) Temperature | ☐ | ☐ |
| (3) Time (etch rate of each passivation layer or metal) | ☐ | ☐ |
| (4) Method of drying | ☐ | ☐ |
| Comments | | |
| (d) Are the following controls and tolerances documented and maintained during the mask-making process? | | |
| (1) Environmental conditions during fabrication of mask (relative humidity, temperature, dust count) | ☐ | ☐ |
| (2) Geometry (width and length) | ☐ | ☐ |
| (3) Pinholes (density and size distribution) | ☐ | ☐ |
| (4) Scratches | ☐ | ☐ |
| (5) Storage | ☐ | ☐ |
| (6) Edge raggedness | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | (7) Method of inspection | ☐ | ☐ |
| | Comments | | |
| (e) | What method is used for forming metallisation (check)? | | |
| | (1) Vacuum chamber deposition | ☐ | ☐ |
| | (2) Electron beam deposition | ☐ | ☐ |
| | (3) Sputtering | ☐ | ☐ |
| | (4) Other | ☐ | ☐ |
| (f) | Does the Manufacturer have the capability to satisfactorily perform metal adhesion tests? | ☐ | ☐ |
| | Comments | | |
| (g) | Is a Scanning Electron Microscope available? | ☐ | ☐ |
| | Comments | | |
| (h) | Has the manufacturer the documented procedures, equipment and trained personnel to perform electrical tests on the metallised wafer to determine if the circuit meets parameter requirements? | ☐ | ☐ |
| | If not, explain | | |
| (i) | What scribing and dicing method is used (check)? | | |
| | (1) Diamond scribe | ☐ | ☐ |
| | (2) Laser scribe | ☐ | ☐ |
| | (3) Manual | ☐ | ☐ |
| | (4) Sawing | ☐ | ☐ |
| | (5) Other | ☒ | ☐ |
| (j) | Are the following controls documented and maintained on the die-mounting operation? | | |
| | (1) Temperature | ☐ | ☐ |
| | (2) Time (visual observation of eutectic flow) | ☐ | ☐ |
| | (3) Pressure (by hand) | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | (4) Ultrasonic power (when applicable) | ☐ | ☐ |
| | (5) Cleanliness | ☐ | ☐ |
| | (6) Ambient (surrounding atmosphere) (at room temperature) | ☐ | ☐ |
| | Comments | | |
| (k) | Is the die mount strength test adequately documented? | ☐ | ☐ |
| | Comments | | |
| (l) | What type of lead-bonding is used in production? | ☐ | ☐ |
| | Comments | | |
| (m) | Are the following controls documented on the lead-bonding operation? | | |
| | (1) Temperature (not applicable to ultrasonic bonding) | ☐ | ☐ |
| | (2) Pressure | ☐ | ☐ |
| | (3) Time (dwell time) | ☐ | ☐ |
| | (4) Condition of capillary or electrode control | ☐ | ☐ |
| | (5) Ultrasonic power (when applicable | ☐ | ☐ |
| | (6) Ambient (surrounding atmosphere) | ☐ | ☐ |
| | Comments | | |
| (n) | Is the strength of lead bonds verified? | ☐ | ☐ |
| | How? | | |
| (o) | Are devices cleaned prior to sealing? | ☐ | ☐ |
| | Is 100% inspection performed on cleanliness? | ☐ | ☐ |
| | Comments | | |

| | | YES | NO |
|---|---|---|---|
| (p) | Are devices stored and transported in protective carriers following cleaning operation? | ☐ | ☐ |
| | Comments | | |
| (q) | What type of internal visual inspection is performed? | | |
| (r) | Are rejected parts placed in containers for rejected parts | ☐ | ☐ |
| (s) | Are rejected parts identified as rejects? | ☐ | ☐ |
| | How? | | |
| (t) | What final disposition is made of rejected parts? | | |
| (u) | What type of seals are used in the sealing of packages? | | |
| | Comments | | |
| (v) | Are the following controls, when applicable, documented on the sealing operation? | | |
| | (1) Pre-seal bake (time, temperature, ambient) | ☐ | ☐ |
| | (2) Heat (or power) used to produce seal | ☐ | ☐ |
| | (3) Humidity during sealing (specify moisture content in ppm) | ☐ | ☐ |
| | (4) Flow rate of gases | ☐ | ☐ |
| | (5) Welding controls (pressure power, time) | ☐ | ☐ |
| | Comments | | |

2.11.5 Final Test Area and Screening Facility

| | | YES | NO |
|---|---|---|---|
| (a) | Are they separate operations? | ☐ | ☐ |
| (b) | Are final production tests (see ESCC specification) performed by personnel under Q.A. monitoring? | ☐ | ☐ |
| | Or are they performed by Q.A. personnel? | ☐ | ☐ |
| | Comments | | |
| (c) | Does the final test have written inspection and test procedures for product classes on the line? | ☐ | ☐ |
| | Do inspectors know when and how to use them? | ☐ | ☐ |
| | Comments | | |
| (d) | Do inspectors use assigned stamps to indicate inspection status on materials and accompanying documents? | ☐ | ☐ |
| | Comments | | |
| (e) | Are requests for corrective action made in writing? | ☐ | ☐ |
| | Are such requests answered? | ☐ | ☐ |
| | Comments | | |
| (f) | Are rejected devices identified and segregated in a controlled area? | ☐ | ☐ |
| | Comments | | |
| (g) | Are records of accepted and rejected material maintained? | ☐ | ☐ |
| | Are these records identifiable with such materials? | ☐ | ☐ |
| | Comments | | |
| (h) | Are device failures analysed? | ☐ | ☐ |
| | Are device failure analyses summarised and reported by final Q.A.? Comments | ☐ | ☐ |
| (i) | Is a summary inspection and test report sent regularly to quality management (lot acceptance, percentage of defects, types of failure)? | ☐ | ☐ |
| | Comments | | |
| (j) | Is a testing laboratory or equivalent facility available for quality assurance purposes? | ☐ | ☐ |

| | | YES | NO |
|---|---|---|---|
| | Which of the following tests are performed in the laboratory or facility? | | |
| | (1) Electrical tests | ☐ | ☐ |
| | (2) Mechanical tests | ☐ | ☐ |
| | (3) Chemical tests | ☐ | ☐ |
| | Comments | | |
| (k) | Is there automatic equipment for the electrical testing of monolithic microcircuit devices? | ☐ | ☐ |
| | Go-no-go? | ☐ | ☐ |
| | D.C. and A.C. test? | ☐ | ☐ |
| | Comments | | |
| (l) | Are statistical controls of device parameter distribution maintained? | ☐ | ☐ |
| | Are they reported to Q.A. or Reliability? | ☐ | ☐ |
| | Comments | | |
| (m) | Is an environmental test facility maintained in-house? | ☐ | ☐ |
| | If not, state where: | | |
| | Are the following tests performed at this facility? | | |
| | (1) Temperature (high, low, cycle) | ☐ | ☐ |
| | (2) Shock (mechanical, thermal) | ☐ | ☐ |
| | (3) Acceleration | ☐ | ☐ |
| | (4) Vibration (fixed, variable) | ☐ | ☐ |
| | (5) Moisture resistance | ☐ | ☐ |
| | (6) Altitude | ☐ | ☐ |
| | (7) Radiographic | ☐ | ☐ |
| | (8) Hermeticity tests | | |
| | (a) Fine leak, if applicable | ☐ | ☐ |
| | (b) Gross leak or penetrant dye | ☐ | ☐ |
| | (9) Lead fatigue | ☐ | ☐ |

| | YES | NO |
|---|---|---|
| (10) Life tests - operating | ☐ | ☐ |
| Comments | | |
| | | |
| (n) Is available equipment used: | | |
| - For production? | ☐ | ☐ |
| - In R&D? | ☐ | ☐ |
| - For Quality Control on a sample basis? | ☐ | ☐ |
| - For screening? | ☐ | ☐ |
| (o) Are charts provided for the monitoring of environmental test equipment? | ☐ | ☐ |
| Comments | | |
| | | |
| (p) Is test equipment adequate for fulfilment of specification requirements? | ☐ | ☐ |
| Comments | | |
| | | |
| (q) Is final external visual inspection performed on 100% of the devices? | ☐ | ☐ |
| Comments | | |
| | | |
| (r) Are devices stored in a limited access area? | ☐ | ☐ |
| Comments | | |
| | | |
| (s) Are devices adequately identified to Customer requirements? | ☐ | ☐ |
| Comments | | |
| | | |
| (t) Are there provisions for lot identification? | ☐ | ☐ |
| Comments | | |
| | | |
| (u) How many burn-in positions are available: | | |
| - At room ambient temperature? | | |
| | | |
| - At specified ambient temperature? | | |
| | | |

| | | YES | NO |
|---|---|---|---|
| | - At specified case temperature (cooled hot plate)? | | |
| (v) | Does burn-in require soldering of leads? | ☐ | ☐ |
| | Comments | | |
| (w) | What precautions are taken to maintain solderability of leads after burn-in? | | |
| (x) | How does Manufacturer ensure that failed devices are separated from processed lots? | | |
| (y) | Has Manufacturer all test equipment necessary to perform all qualification tests: | | |
| | - In-house? | ☐ | ☐ |
| | - In nearby facility? | ☐ | ☐ |
| | Specify equipment and its location: | | |
| | - In remote location | ☐ | ☐ |
| | Specify equipment and its location: | | |

2.12 FACILITIES AND EQUIPMENT

| | | YES | NO |
|---|---|---|---|
| (a) | Is facility adequately lighted? | ☐ | ☐ |
| | Ventilated? | ☐ | ☐ |
| | Temperature-controlled? | ☐ | ☐ |
| | Dust-controlled? | ☐ | ☐ |
| | Comments | | |
| (b) | Is good housekeeping being practised? | ☐ | ☐ |
| | Comments | | |
| (c) | Does vendor have own mask-making facility? | ☐ | ☐ |
| | Comments | | |
| (d) | Are mask-making operations performed in an ultra-clean room? | ☐ | ☐ |
| (e) | Are photo-engraving (photoresist exposure) operations performed in an ultra-clean room? | ☐ | ☐ |
| | Comments | | |
| (f) | If answers to (d) and (e) above are “yes”, to what clean room specifications? | | |
| (g) | Are particle counts taken and recorded regularly? | ☐ | ☐ |
| | Comments | | |
| (h) | Are the following operations performed in a 100 count environment without moving the devices to an environment with a high contamination level? | | |
| | (1) Final assembly | ☐ | ☐ |
| | (2) Internal visual inspection | ☐ | ☐ |
| | (3) Cleaning | ☐ | ☐ |
| | (4) Sealing | ☐ | ☐ |
| (i) | How often are air filters checked and changed? | | |

| | | YES | NO |
|---|---|---|---|
| (j) | How often is the contamination level of the 10000 count environment checked? | | |
| (k) | How often is the contamination level of the 100 count environment checked? | | |
| (l) | Is a log kept which shows when contamination levels are checked? | ☐ | ☐ |
| (m) | Is authority granted to cease production when contamination level is exceeded? | ☐ | ☐ |
| (n) | Personnel in 100 count environment: | | |
| | (1) What deviations from regulations and/or requirements related to this environment were noted with regard to:- | | |
| | (a) Gowns and/or smocks and trousers | | |
| | (b) Caps | | |
| | (c) Overshoes | | |
| | (d) Finger cots | | |
| | (2) Was any lint-producing material (woo, knitted garments, etc.) noticed under protective clothing? | ☐ | ☐ |
| (o) | Are components and tools cleaned according to written procedures? | ☐ | ☐ |
| | Are these procedures based on probable contaminants? | ☐ | ☐ |
| (p) | Are clean room procedures and discipline specified in respect of clothing, access, food consumption, allowable materials, cosmetics, etc.? | ☐ | ☐ |
| (q) | Are temporary storage space and products finished in the area suitably protected to maintain cleanliness level? | ☐ | ☐ |

2.13 PRESERVATION, PACKING AND SHIPPING

| | | YES | NO |
|---|---|---|---|
| (a) | Are there adequate written procedures for control of shipping?<br>Comments | ☐ | ☐ |
| (b) | Are materials designated for shipment properly identified, handled and protected?<br>Comments | ☐ | ☐ |
| (c) | Do copies of Customer's purchase order and evidence of inspection acceptance accompany materials from end of final test up to the time of shipment?<br>Comments | ☐ | ☐ |
| (d) | Do Q.A. personnel perform audits of all outgoing lots?<br>Comments | ☐ | ☐ |
| (e) | Do shipping documents reflect inspection status or evidence of inspection, identification and similar shipping requirements?<br>Comments | ☐ | ☐ |
| (f) | Does Manufacturer verify conformity of devices and invoices with purchase order?<br>Comments | ☐ | ☐ |
| (g) | Does Manufacturer implement special packaging methods for hi-rel devices? | ☐ | ☐ |
| | If so, which of following methods is used? | | |
| | - Individual packages | ☐ | ☐ |
| | - Mechanical protection | ☐ | ☐ |
| | - Environmental protection | ☐ | ☐ |
| | - Special warning labels | ☐ | ☐ |
| (h) | Is shipping method designed to allow official inspection by Customs without actual removal of protective material?<br>Comments | ☐ | ☐ |
| (i) | Do instructions prohibit the use of substandard packaging methods for shipment of hi-rel devices? | ☐ | ☐ |

2.14 SUMMARY OF INSPECTION RESULTS

Indicate inspection results per manufacturing and testing area, whereby:

V = Adequate.

O = Insufficient or non-adequate.

- = Not checked or not applicable.

N/A = Not applicable.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Environmental conditions: | | | | | | | | | | |
| Cleanliness | | | | | | | | | | |
| Temperature control | | | | | | | | | | |
| Humidity control | | | | | | | | | | |
| Occupancy | | | | | | | | | | |
| Procedures available: | | | | | | | | | | |
| Travellers | | | | | | | | | | |
| Calibration | | | | | | | | | | |
| Segregation of rejects | | | | | | | | | | |
| Inspection evidence | | | | | | | | | | |
| Area No. | | | | | | | | | | |

| | |
|---|---|
| 1 = | . |
| 2 = | . |
| 3 = | . |
| 4 = | . |
| 5 = | . |
| 6 = | . |
| 7 = | . |
| 8 = | . |
| 9 = | . |
| 10 = | . |

2.15 GENERAL OBSERVATIONS (NOT TO EXCEED 2 PAGES)

Click here to enter text.