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**Remote operation and maintenance of integrated circuit
packaging equipment - Data acquisition**

集成电路封装设备远程运维 数据采集

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1 Scope

The document sets out the composition architecture of remote operation and maintenance for integrated circuit packaging equipment, the objects and methods of data acquisition, the data acquisition functions, the classification of acquired data, the data acquisition process and the data security requirements.

It applies to data acquisition for the remote operation and maintenance of typical integrated circuit packaging equipment such as mechanical drilling machines, screen printing machines, grinding wheel dicing machines, die bonders and wire bonders; the data acquisition process of other electronic component production lines may refer to it.

2 Normative references

The contents of the following documents constitute indispensable provisions of the document through normative reference in its text. For dated references, only the edition corresponding to that date applies; for undated references, the latest edition, including all amendments, applies.

Two documents are listed: GB/T 22239-2019 Information security technology-Baseline for classified protection of cybersecurity, and GB/T 31916.1-2015 Information technology-Cloud data storage and management-Part 1: General principles.

3 Terms and definitions

3.1 remote operation and maintenance: the process of remotely achieving, over a network, functions such as data acquisition, condition monitoring, fault mode identification and predictive maintenance for the object of operation and maintenance.

3.2 data acquisition: the process of collecting from sensors or from the equipment under test the information that reflects the equipment or the environment, and analysing, processing and converting it so as to meet the data application needs of remote operation and maintenance of integrated circuit packaging equipment.

3.3 data extraction: the process of automatically collecting data from various data sources into a single device.

3.4 data transmission: the process of transmitting data from the unit under test to the data terminal over one or more data links according to a defined procedure.

3.5 data cleaning: the process of re-examining and verifying data, deleting duplicate information, correcting errors that are present and providing data consistency.

3.6 data transfer: the process of changing data from one form of representation into another. The English term printed against this Chinese entry is data transfer.

3.7 data loading: the process of saving converted data into a database.

3.8 data storage: the process of retaining and managing data using computers, application servers and other equipment.

3.9 data security: the process of adopting various technical and management measures so that the data acquisition system operates normally and data is not damaged, altered or disclosed for accidental or malicious reasons.

4 Abbreviated terms

The following abbreviated terms apply, each glossed in the document with the English expansion shown here: AOI, automatic optic inspection; HTTP, hyper text transfer protocol; MQTT, message queuing telemetry transport; OLE, object linking and embedding; OPC, object linking and embedding for process control; UA, unified architecture.

5 Composition architecture of remote operation and maintenance

Remote operation and maintenance of integrated circuit packaging equipment monitors the running state of the object of operation and maintenance by means of data acquisition technology and, under the protection of a security mechanism, provides visualized remote operation and maintenance application services. The composition architecture is shown in Figure 1 and the specific requirements are as follows.

- a) Data acquisition can achieve the extraction, transmission, cleaning, conversion, loading and storage of production, quality, process and similar data of typical integrated circuit packaging equipment, providing data support for the subsequent visualized applications.
- b) Condition monitoring can monitor the running state of the integrated circuit packaging equipment on the basis of the acquired data, presenting the analysis results dynamically and in real time in charts and other visual forms, achieving equipment early warning and alarm, and receiving fault diagnosis and prediction results.
- c) Fault mode identification and diagnosis can judge, from the state parameters monitored on the integrated circuit packaging equipment, whether the equipment is in a fault state, and can locate the fault that has occurred in the object being diagnosed.
- d) Predictive maintenance can, on the basis of the processed acquired data and the historical condition monitoring data, predict the fault modes and the remaining life of the integrated circuit packaging equipment and propose an equipment maintenance strategy according to the prediction results.

6 Data acquisition objects and methods

6.1 Data acquisition objects. The objects of data acquisition for remote operation and maintenance of integrated circuit packaging equipment include the packaging equipment

and the operating environment, with the following specific requirements. a) Packaging equipment: classified by use, typical integrated circuit packaging equipment includes but is not limited to mechanical drilling machines, screen printing machines, grinding wheel dicing machines, die bonders and wire bonders. b) Operating environment: the data acquired for the operating environment of integrated circuit packaging equipment includes but is not limited to temperature, relative humidity and cleanliness.

6.2 Data acquisition methods. The methods are as follows. a) Semi-automatic acquisition: data is imported or filled in manually through the operating terminal of the integrated circuit packaging equipment in the form of tables or other files, and the data can be screened and processed manually. b) Automatic acquisition: the remote operation and maintenance side actively requests data from the edge side at a certain frequency, or the edge side hardware actively sends equipment-side data to the platform side at a certain frequency; continuous real-time monitoring is possible and the data is screened and processed automatically by the specified method.

7 Composition architecture of data acquisition

The data acquisition function architecture for remote operation and maintenance of integrated circuit packaging equipment is to comprise a local part and a remote part; the local architecture is to comprise the equipment side and the edge side, and the remote architecture is to comprise the cloud side, as shown in Figure 2. The specific requirements are as follows.

a) The equipment side is the source of the data and is to comprise physical entities such as the integrated circuit packaging equipment and environmental sensors, together with functions such as data transmission protocol handling. Sensors inside the integrated circuit packaging equipment for pressure, temperature, position and the like, as well as environmental data sensors, can have their acquisition parameters set, complete the acquisition of the various kinds of data, and transmit it to the data acquisition gateway or other edge-side device over physical media such as a field bus or industrial Ethernet.

b) The edge side is the intermediate layer of data acquisition and is to comprise physical entities such as data acquisition gateways, routers and servers, together with software functions such as data transmission protocol handling and data storage. The data acquisition gateway is to have the functions of real-time or periodic automatic acquisition of equipment-side data of the integrated circuit packaging equipment, of storing it and of sending data to the cloud-side server, and can support conversion of data transmission protocols such as OPC. The edge-side server can store locally the data automatically acquired by the data acquisition gateway and can act as the physical entity for entry and storage of manually acquired data. Edge-side server data can communicate with the cloud-side server through protocols such as OPC UA, MQTT and HTTP.

c) The cloud side is the using end of the data, carried on various server hardware; it can