MS power

MS POWER GmbH

COMPARATIVE ADVANTAGES

SOLDER VERSION STUD DEVICES

Raw Material

Copper

MS Power uses electrolytic grade 99.99% pure copper having high thermal conductivity, ductility and resistance to deformation and corrosion.

The copper anodes are still contaminated with metals such as Ni, Pb, Ag, Pd and Au. During the electrolytic refining process, high purity copper is produced whereby the impurities drop to the bottom of the electrolyses cell and are recovered.

A solution of sulphuric acid and copper (II) sulphate, functions as electrolyte. Due to its good formability, high electric and thermal conductivity and corrosion resistance, pure electrolytic copper is used.

Plating on raw material and finish component

There are two methods of depositing a thin layer of nickel onto the surface of a metallic object.
One is electroplating, the other one is electroless plating.
MS Power adopted electroless nickel plating for all active metal component inside the package. Acid tin plating is done on finished devices.

Disadvantages of electroplating

Electroplating may result in hydrogen embrittlement, where the hydrogen gas leaks out at the surface of the cathode and diffuses into the surface of the component to be plated, making it brittle. This embrittlement can be reduced by post plate heat treatment at a low temperature, which reverses the process of hydrogen diffusion into the surface layers of the component

Electroless nickel plating

The other method of plating with nickel is electroless nickel plating.
This type of plating doesn't need an electric current because it happens using a chemical reaction.
The electroless nickel solution consists of nickel ions, reducing agents and other chemicals. The most commonly used reducing agent is sodium hypophosphite.

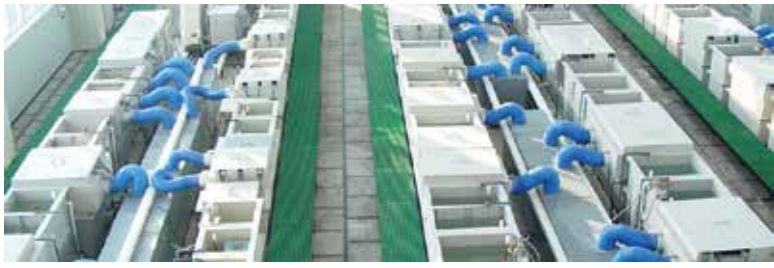
Advantages of electroless nickel plating

Electroless nickel plating has many fantastic properties which makes the process superior to other types of metal plating.

- The process extends the life of any component that it coats.
- The metal layer deposited by the electroless nickel plating process has an even thickness over all surfaces of the component.
- Electroless nickel plating also provides excellent wear and corrosion resistance, as well as hardness.

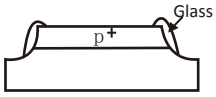
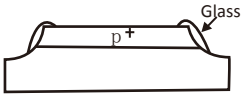
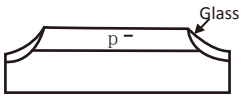
Advantages of acid tin plating

- Aesthetic look of the device is improved.
- Corrosion resistance and good resistance to oxidation.
- Good solderability.
- Resistance welding is possible after deposition of tin.



Silicon Chip

MS Power uses silicon chip with ELCTROPHORESIS process having benefits over other processes as illustrated below:

Type	Electrophoresis	Photo Glass	Doctor Blade
Cross section			
Glass	Pure glass less contamination	photo resister +glass	Glass with high contamination
Cost	Middle	High	Low
Glass crack possibility	Low	Low	Existing in dicing path
Stress induced	Low	Middle	High
Quality	Excellent	Good	poor (only for short term)
Mask applied	3 times	3 times	1-2 times
Chip size	17 mils to 976 mils	50 mils to 500 mils	25mils to 500 mils
High temeprature IR	Low	Middle	High
Percaution on assembly	Use dimple lead wire (or lead fram) to aviod the damage on glass	Use dimple lead wire (or lead fram) to aviod the damage on glass	Far lead wire

Silicon Gel

MS Power uses high quality DOW CORNING silicon gel to protect chip having following benefits:

1) Low moisture absorption.

2) Good thermal stability.

3) Excellent chemical resistance.

4) Compliance with environmental regulation.

IQC

MS power IQC Sampling plan for inspection of components is implemented as per IS: 2500 Part II, AQL-0.65. The IQC adopted statistical process control system to verify the right raw material will enter into process to avoid disturbance of production process. The AQL control charts are illustrated below:

SINGLE SAMPLING PLANS FOR NORMAL INSPECTION

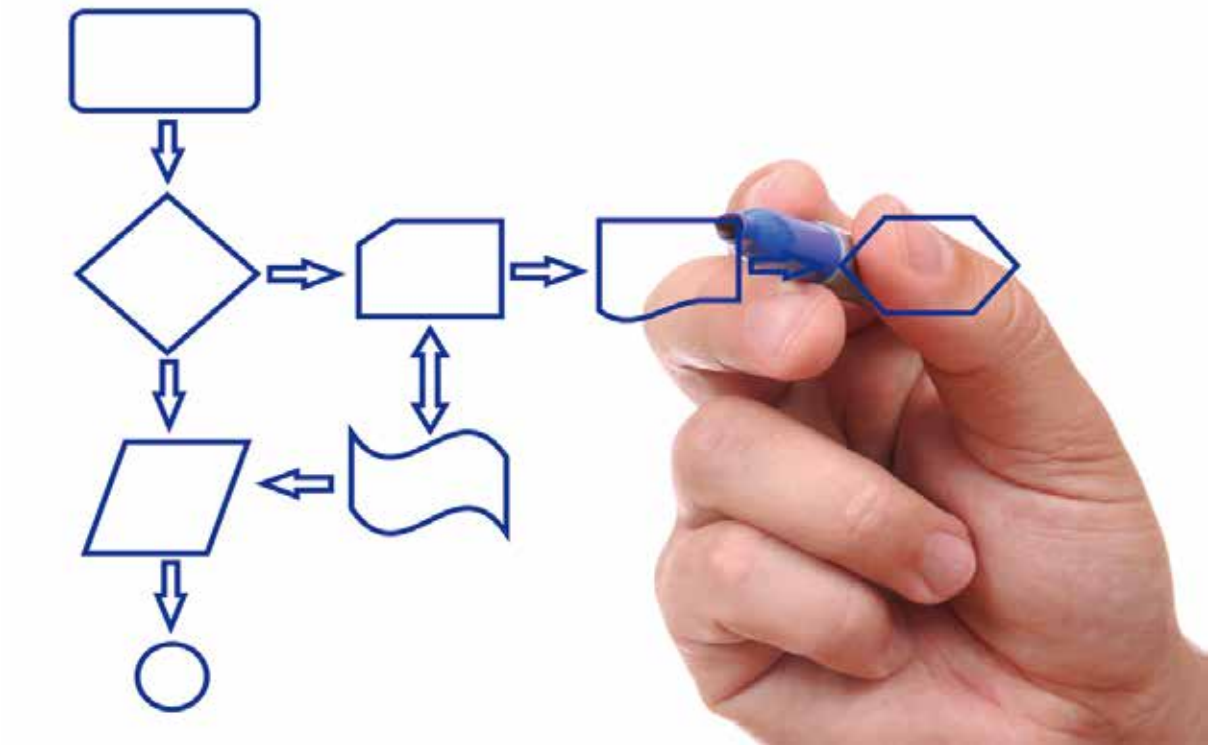
Sample Size Code Latter	Sample Size	Acceptable Quality Levels (Normal Inspection)										
		0.065 Ac Re	0.10 Ac Re	0.15 Ac Re	0.25 Ac Re	0.40 Ac Re	0.65 Ac Re	1.0 Ac Re	1.5 Ac Re	2.5 Ac Re	4.0 Ac Re	6.5 Ac Re
A	2										↓ 0 1	↑ 0 1
B	3									↓ 0 1	↓ 0 1	↕
C	5								↓ 0 1			↓ 1 2
D	8							↓ 0 1		↓ 1 2	↓ 1 2	↕ 2 3
E	13						↓ 0 1		↓ 1 2			↕ 3 4
F	20					↓ 0 1		↓ 1 2	↕ 2 3	↓ 2 3	↓ 2 3	↓ 5 6
G	32				↓ 0 1		↓ 1 2		↕ 3 4	↕ 3 4	↓ 3 4	↕ 7 8
H	50			↓ 0 1		↓ 1 2		↓ 2 3	↓ 5 6	↓ 5 6	↓ 5 6	↓ 10 11
J	80		↓ 0 1		↓ 1 2		↓ 2 3		↓ 7 8	↓ 7 8	↓ 7 8	↓ 14 15
K	125	↓ 0 1		↓ 1 2		↓ 2 3		↓ 3 4	↓ 10 11	↓ 10 11	↓ 10 11	↓ 21 22
L	200		↓ 1 2		↓ 2 3		↓ 3 4		↓ 14 15	↓ 14 15	↓ 14 15	↓
M	315	↓ 1 2		↓ 2 3		↓ 3 4		↓ 5 6	↓ 21 22	↓ 21 22	↓ 21 22	↓
N	500		↓ 1 2		↓ 3 4		↓ 5 6		↓	↓	↓	↓
P	800	↓ 1 2		↓ 3 4		↓ 5 6		↓ 7 8				
Q	1250		↓ 2 3		↓ 5 6		↓ 7 8		↓ 10 11	↓ 10 11	↓ 10 11	↓ 21 22
R	2000	↓ 2 3		↓ 3 4		↓ 5 6		↓ 7 8				
			↓ 3 4		↓ 5 6		↓ 7 8		↓ 14 15	↓ 14 15	↓ 14 15	↓
				↓ 4 5		↓ 6 7		↓ 8 9				
					↓ 7 8		↓ 9 10		↓ 21 22	↓ 21 22	↓ 21 22	↓
						↓ 10 11		↓ 12 13				
							↓ 14 15		↓	↓	↓	↓
								↓ 18 19				
									↓ 29 30	↓ 29 30	↓ 29 30	↓

↑ Use first sampling plan above arrow,if sample size equals or exceeds lot or batch size,do 100 percent inspection
↓ Use first sampling plan below arrow AC:Acceptance number Re:Rejection number

SAMPLE SIZE CODE LETTERS

Lost Size	General Inspection Levels			Specical Inspection Levels			
	I	II	III	S1	S2	S3	S4
2 to 8	A	A	R	A	A	A	A
9 to 15	A	B	C	A	A	A	A
16 to 25	B	C	D	A	A	B	B
26 to 50	C	D	F	A	B	B	C
51 to 90	C	E	F	B	B	C	C
91 to 150	D	F	G	B	B	C	D
151 to 280	F	G	H	R	C	D	E
281 to 500	F	H	J	B	C	D	E
501 to 1200	G	J	K	C	C	E	F
1201 to 3200	H	K	L	C	D	E	G
3201 to 10000	J	L	M	C	D	F	G
10001 to 35000	K	M	N	C	D	F	H
35001 to 15000	I	N	P	D	E	G	J
150001 to 500000	M	P	Q	D	E	G	J
500001 and over	N	Q	R	D	E	H	K

Process



Solder version studs are manufactured with state of art technology & all the processes are controlled by implementing Statistical Quality Control techniques at various stages of manufacturing. The processes are set by exercising FMEA & parameters are controlled by various scientific tools, viz, DOE, Fish Bone diagram etc. We have realized standardization, datamation and systematization, and have made sure the quality of our product.

Assembly

The Graphite boats are made with CNC to locate each components precisely at their position during the assembly. This avoids shifting of components during handling & soldering process. The boats are made for all types that we manufacture.

Vacuum Soldering

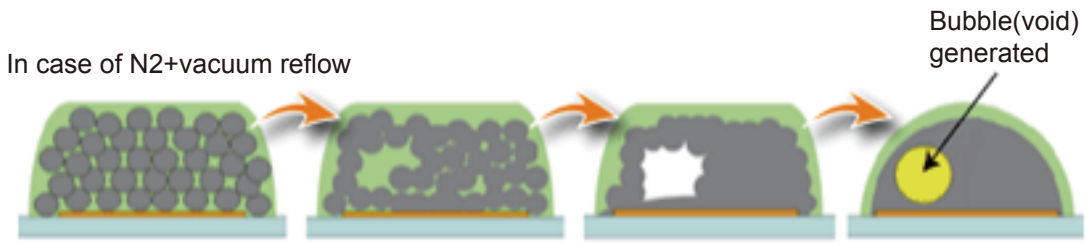
Vacuum soldering has long been a common joining technique for various applications, mainly dealing with soldering (brazing) without flux, where vacuum is used as an atmosphere which sufficiently prevents oxidation through low residual partial gas pressures and partially removes oxides. The application in electronics manufacturing, where predominantly soft solders are used, is however rather restriced, where at reasons for using vacuum in soldering are the possibility for flux less soldering and the potential to reduce or prevent trapped gas volumes within the solder joint (voids). Traditional soldering carried out using reflow furnace's/oven/hot plate and flux result voiding >15% using large area silicon chip. Flux needs to be removed post solder reflow process.

MS Power Vacuum Soldering Process

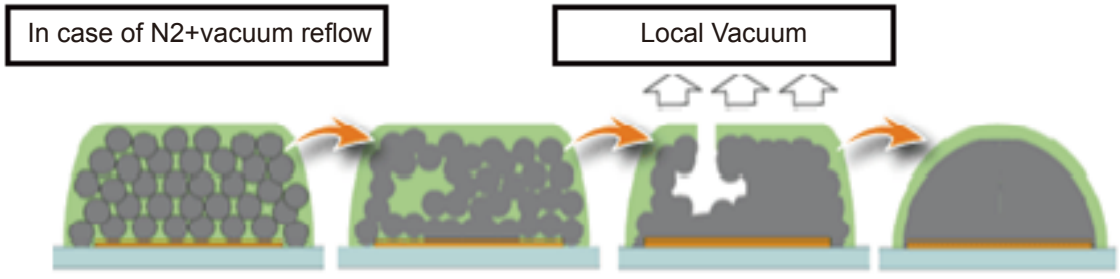
Uses nitrogen and hydrogen (as a forming gas) in conjunction with vacuum. Results the best solder joint achievable and tends to be quoted as "void-free". Hydrogen penetrates all surface layers to the base material and scrubs the surface clean and prepares the surfaces for soldering reflow.

As solder becomes liquidise the chamber is reduced in pressure before being back filled allowing the joint to be maintained at the desired temperature during its state transitions from liquidise to solidus and allows the use of changing pressure to "work" the joint and hence minimise voiding. The plus here is that no cleaning is required post soldering.

The below Figure illustrate on voiding:



Bubble (voids) generated in bump



Local pull by vacuum in reflowing prevents void being generated.

Vacuum Oven

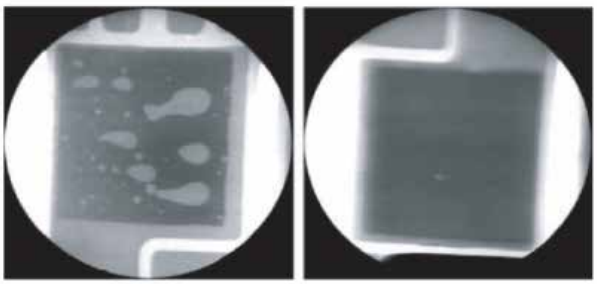
The customised designed oven which has unique features as follows:

- Vacuum generation to the tune of 1X10-3
- Can inject Nitrogen & Hydrogen to create inert atmosphere
- Temperature is settable for any kind of solder mix
- PLC based software to set & control the whole cycle
- Alarm system introduced for any kind of malfunction during the process cycle

The results of soldering by using Vacuum soldering method & Hydrogen in the process

Typical Advantages

- Reduced Voids during soldering
- Finer structure
- Less oxidation
- Better distribution due to increase in wetting capability



By Conventional method

By Vacuumm soldering method

At Coating Stage

The devices are coated with silicon rubber by automatic control for dispensing the right amount of silicon to cover the junction from absorbing any moisture. The devices are kept in temp. Controlled oven for curing the silicon rubber.

At Welding Stage

The devices are welded in Micro controller based projection welding machine & special grade copper with jigs & fixtures are used for doing the welding. The number of programs can be fed into the micro controller as per the device type to be welded. Imprint test is conducted on welding electrodes before start of every batch in order to ensure flatness of the electrodes.

Micro Controller

Jig & Fixtures

At Printing Stage

Domino ink-jet printer is used to print the devices.
The self-curable ink is used for ensure printing mark, which is visible but irremovable.

Domino Printer

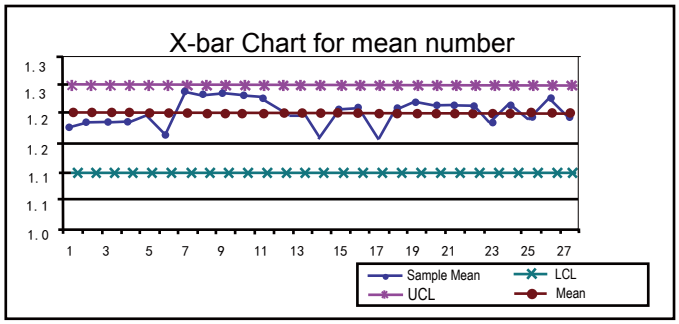
Statistical Process Control

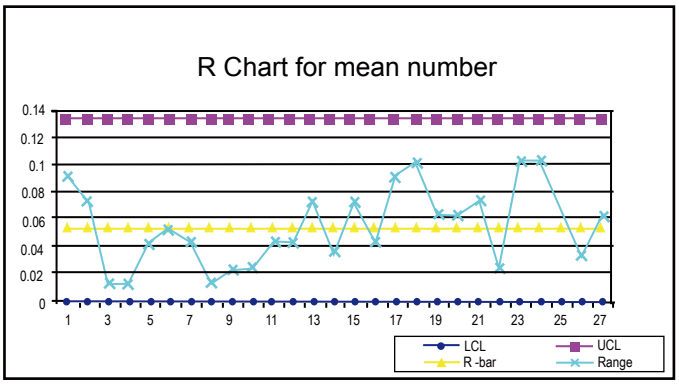
MS Power adopted State of art technology and statistical surveillance in production line to ensure each product get desired result and quality.

Adopted SPC technique in every process to detect the production error as they occur, halt the production process and alert us before it is too late and having following benefits:
Reduce scrap and rework, Maximize productivity, Improve resource utilization, Decrease manual inspection, Reduce cost.

- After soldering,all devices are tested for VFM & blocking voltage.

BLOCKING TEST

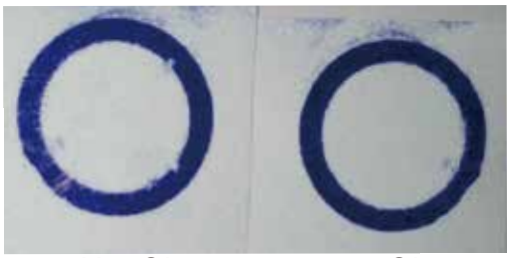




Device type DO8 Parameter VF in mV

SAMPLE CONTROL CHART FOR Vf MEASUREMENT

- At welding stage while loading each lot the imprint test is conducted to ensure the flatness of the electrode.



Not Ok Ok

- After welding each device is tested for gross leak in transformer oil @120°C by observing bubbles.

Routine Test Set Up

Blocking Voltage Tester and Forward Voltage Drop Tester

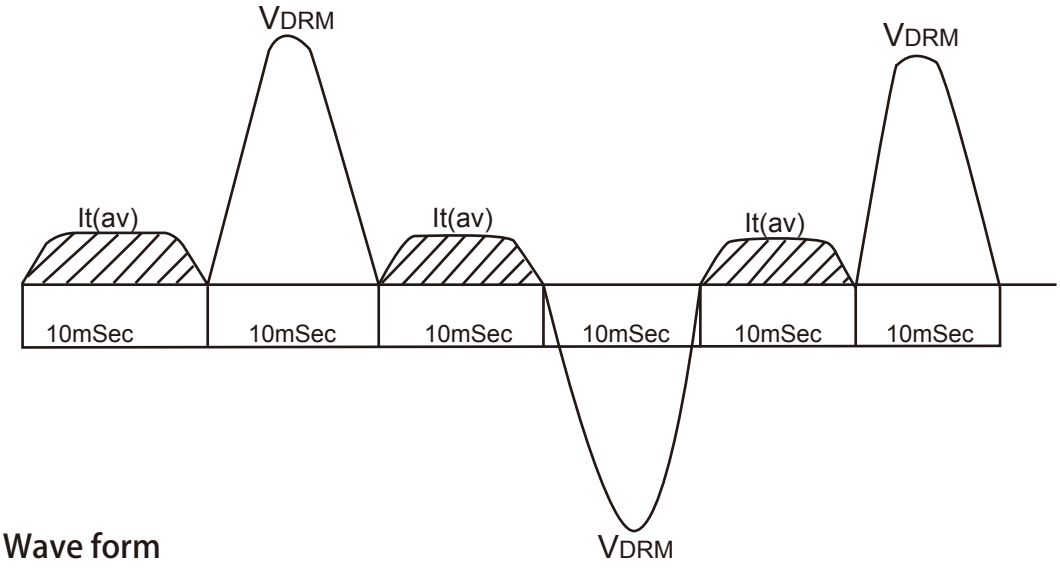
Characterisation of semiconductor devices in conduction state and in blocking voltage state at maximum specified junction temperature.

Static Parameters (Vtm / Reverse Blocking)

Dynamic Testing of Semiconductor Devices

- In-house stimulation of field conditions - Rated current passed through the device and Rated V_{DRM}/V_{RRM} applied when device is in OFF state and observed the blocking voltage characteristic on X-Y curve tracer and record I_{DRM}/I_{RRM} at specified case temperature.
- Significance of dynamic test: Confirmation of Pw, Rth(J-C)
- Test Waveform:

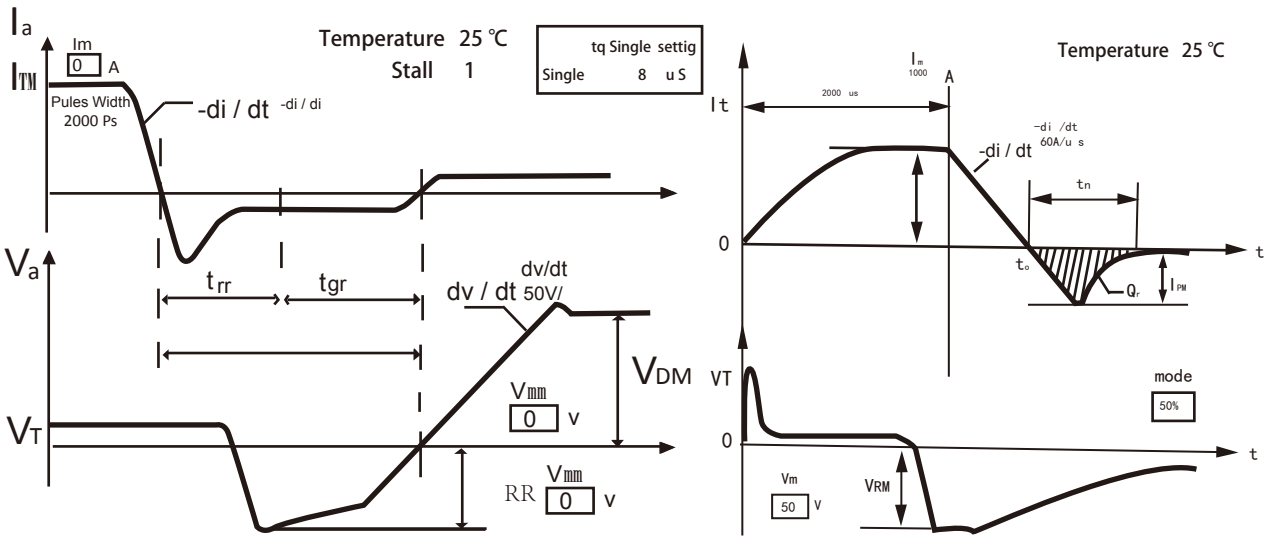
Dynamic Tester



Wave form

Characterisation of Fast Switching Parameter For Semiconductor Diodes and Thyristors

T_q, Q_{RR},Q_{RA}, T_{RR} Tester



Waveform

MS Power Semiconductor Co., Ltd.

Device Type: MSKP125S16U **Routine Test Report on Thyristor** **Date : 05/04/2016**

Quantity : 20Nos.

Batch No. : 04/16 **Sr.Nos. : 1001 - 1020**

Sr. Nos.	Gate Test @ TC = 25°C				Blocking Voltage Test								Forward Voltage Test	dv/dt at 67% VDRM Tj= 125 °C	Dynamic Test			Remark
					Cold Test @ Room Temp. = 25°C				Hot Test @ Tj max = 125°C				@ Ip = 392A, TCASE = 125°C		IT(av) = 125A Tcase = 71°C			
Max. Limits	Vgt (V)	Igt (mA)	IH (mA)	IL (mA)	VDRM (V)	IRRM (mA)	VRRM (V)	IRRM (mA)	VDRM (Volts)	IDRM (mA)	VRRM (Volts)	IRRM (mA)	Volts	Volts/µsec	VDRM/ VRRM	IDRM/ IRRM	Tcase	
	3.0	150	400	600		12		12		25		25	2.00	1000		25		
1001	1.2	50	55	180	1600	< 3	1600	< 3	1600	10	1600	6	1.78	Passed OK	1600	8	70	MSKP125S16U
1002	1.1	44	52	204	1600	< 3	1600	< 3	1600	12	1600	4	1.80	Passed OK	1600	8	70	MSKP125S16U
1003	1.4	54	50	210	1600	< 3	1600	< 3	1600	14	1600	5	1.78	Passed OK	1600	10	70	MSKP125S16U
1004	1.2	60	62	195	1600	< 3	1600	< 3	1600	09	1600	5	1.84	Passed OK	1600	6	70	MSKP125S16U
1005	1.2	60	58	210	1600	< 3	1600	< 3	1600	16	1600	4	1.76	Passed OK	1600	12	70	MSKP125S16U
1006	1.0	64	66	210	1600	< 3	1600	< 3	1600	12	1600	6	1.75	Passed OK	1600	8	70	MSKP125S16U
1007	1.1	52	54	200	1600	< 3	1600	< 3	1600	14	1600	8	1.76	Passed OK	1600	10	70	MSKP125S16U
1008	1.2	44	50	180	1600	< 3	1600	< 3	1600	10	1600	8	1.74	Passed OK	1600	9	70	MSKP125S16U
1009	1.3	52	48	190	1600	< 3	1600	< 3	1600	12	1600	6	1.70	Passed OK	1600	9	70	MSKP125S16U
1010	1.1	52	50	205	1600	< 3	1600	< 3	1600	11	1600	6	1.80	Passed OK	1600	8	70	MSKP125S16U
1011	1.2	55	52	206	1600	< 3	1600	< 3	1600	09	1600	4	1.69	Passed OK	1600	6	70	MSKP125S16U
1012	1.2	51	54	205	1600	< 3	1600	< 3	1600	15	1600	8	1.74	Passed OK	1600	11	70	MSKP125S16U
1013	1.4	50	55	215	1600	< 3	1600	< 3	1600	14	1600	7	1.80	Passed OK	1600	12	70	MSKP125S16U
1014	1.2	42	46	210	1600	< 3	1600	< 3	1600	14	1600	6	1.76	Passed OK	1600	10	70	MSKP125S16U
1015	1.3	44	48	214	1600	< 3	1600	< 3	1600	12	1600	4	1.75	Passed OK	1600	9	70	MSKP125S16U
1016	1.1	47	46	212	1600	< 3	1600	< 3	1600	14	1600	6	1.74	Passed OK	1600	10	70	MSKP125S16U
1017	1.2	48	46	204	1600	< 3	1600	< 3	1600	10	1600	8	1.76	Passed OK	1600	6	70	MSKP125S16U
1018	1.3	49	53	202	1600	< 3	1600	< 3	1600	16	1600	7	1.78	Passed OK	1600	12	70	MSKP125S16U
1019	1.3	56	50	218	1600	< 3	1600	< 3	1600	12	1600	5	1.72	Passed OK	1600	9	70	MSKP125S16U
1020	1.2	52	50	212	1600	< 3	1600	< 3	1600	10	1600	6	1.79	Passed OK	1600	8	70	MSKP125S16U

Accepting Qty.=20Nos. Rejected Qty. = Nil E(QA)

Product Reliability Test Set Up

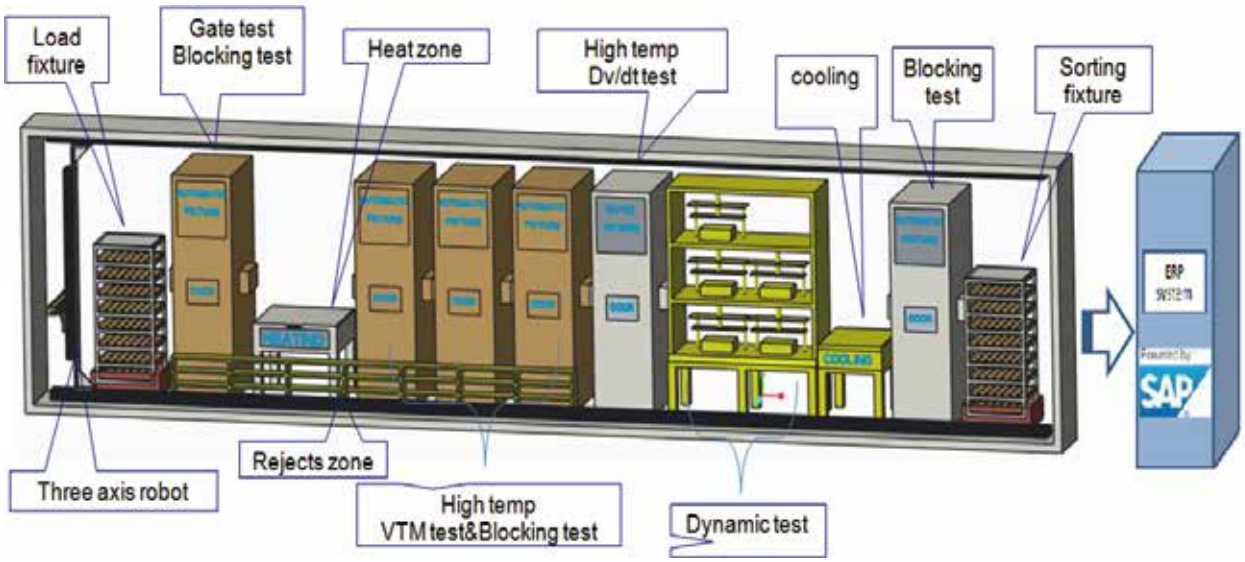
All these tests ensure that the devices leaving the factory are ready to use for the customer without doing any incoming inspection at their end.
Expertise and quality control are critical factors in the delivery of high-quality components for demanding environments and applications with robust quality control processes in place for timely delivery of high quality component.
MS Power comply with ISO 9001 quality management systems which provide validation of process integrity. This has assisted us to improve consistency and maximize operational efficiency.

HTRB (High Temp. Reverse Bias) Tester

Power Cycling Tester

Automation

Automatic control has played a vital role in the advance of engineering and science. The robotic systems in automatic control has become an important and integral part of morden manufacturing processes.
MS power is working on the automation in process, since all the project is in design stage and proto unit will be introduce in the line shortly.
The basic model is illustrate below:

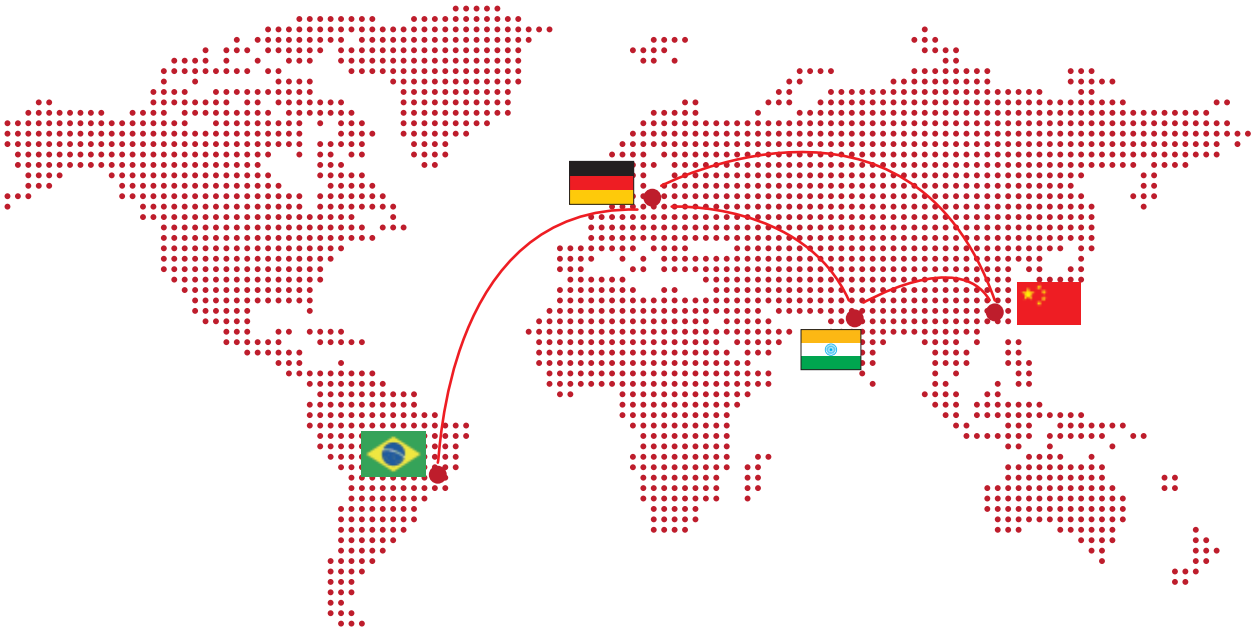


The Process will be as:
1. The worker puts the devices in the load fixture into the right side.
2. The three axis robot will take the product one by one from load fixture and put for testing in each stage.
3. The qualified products will be moved to next stage and unqualified product will be filtered to reject zone
4. Integrate the system with SAP.

MS power
MS POWER GmbH

MS provides:

Discrete Thyristors
Discrete Diodes
Power Modules
Power Bridges
Power Stack



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