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|---|----|----|----|----|------|------|-----------------------------------|
| Item: The procedure of Hi-Rel | QM | OP | OI | II | SPEC | TECN | Doc. #: V - Q A 1 0 0 7 |
| | | ✓ | | | | | |

1. Purpose :
For improve the quality and reliability of products and find the potential defect then take action.
2. Range:
Rectron produce the product of diode rectifier and bridge rectifier
3. Reference:
 - 3.1 Base on customer requirement .
 - 3.2 The spec or requirement it's issued by AE or PE.
4. Job function:
 - 4.1 Routine evaluation: AE get sample from production.
 - 4.2 Process evaluation、Engineering change、new product、customer sample、APR: AE or PE。
 - 4.3 Benchmarking: AE
5. Content:
 - 5.1 Exp. item and condition:

| Item | Exp. item | Method and condition | Ref. Doc. |
|------|---------------------------------------|--|-------------------------------|
| 1 | STEAM AGING TEST SOLDERABILITY | Steam aging 4HRS 245°C±5°C FOR 4±1SEC | MIL-STD-202F METHOD-208 |
| 2 | HIGH TEMPERATURE REVERSE BIAS TEST | Ta=100°C±5°C/125°C±5°C (SKY:100°C , Other product:125°C) VR=80% RATED VR 1000HRS/96HRS | MIL-STD-750C METHOD-1026 |
| 3 | THERMAL FATIGUE | . ON : 300SECS . OFF: 300SECS 1000 cycles/300cycles | MIL-STD-750C METHOD-1036 |
| 4 | PRESSURE COOKER LIFE TEST | 15 PSIG TA=121°C O/J 8HRS GPP 24HRS | |
| 5 | HIGH TEMPERATURE STORAGE LIFE | 150°C±5°C/ 1000HRS /96HRS | MIL-STD-750C METHOD - 1031 |
| 6 | SOLDER RESISTANCE | 260±5°C FOR 10±2SEC | MIL-STD-750C METHOD-2031 |
| 7 | THERMAL SHOCK | 0°C±5°C/5MIN AND 100±5°C/5MIN TOTAL 10 CYCLES | MIL-STD-750C METHOD-1056 |
| 8 | TEMPERATURE CYCLING | -55±5°C/30MIN AND 125±5°C/30MIN TOTAL 10 CYCLES | MIL-STD-750C METHOD-1051 |
| 9 | HUMIDITY | TA=65±5°C, RH=98% +2% 1000HRS/168HRS -10% | MIL-STD-202F METHOD-103B |
| 10 | FORWARD SURGE | 8.3 ms single half sine wave superimposed on rated load, one surge. @ Ifsm | MIL-STD-750D METHOD-4066.3 |

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5.1.1 Routine evaluation:

- a. HTRB
- b. TFT
- c. PCT
- d. HTSL
- e. Solder resistance
- f. Temp cycling
- g. Humidity
- h. Forward surge

5.1.2 In case of new product or engineering change, the Exp. item would be refer to the Hi-Rel application form

5.2 Hi-Rel Equipment.

- 5.2.1 Tin aging
- 5.2.2 HTRB
- 5.2.3 TFT
- 5.2.4 PCT
- 5.2.5 HTSL
- 5.2.6 Temp. cycling
- 5.2.7 Humidity
- 5.2.8 PIF 8000B
- 5.2.9 Steam aging
- 5.2.10 Humidity with bias
- 5.2.11 Thermal shock
- 5.2.12 5802curve tracer
- 5.2.13 MPT6000 TESTER

5.3 Quality system of Hi-Rel Lab: The inspection & testing requirement, Hi-Rel principle, procedure, OI have to be the document.

5.3.1 Hi-Rel Lab principle: Provide a accuracy, speed and efficiency testing result. The principle needs be realized and perform by Lab members.

5.3.2 Hi-Red Lab need issue the procedure it including to qualification of lab engineer, procedure of Lab., testing and judgment spec.

5.4 Qualification of Hi-Rel Lab person:

5.4.1 Supervisor of Hi-Rel Lab:

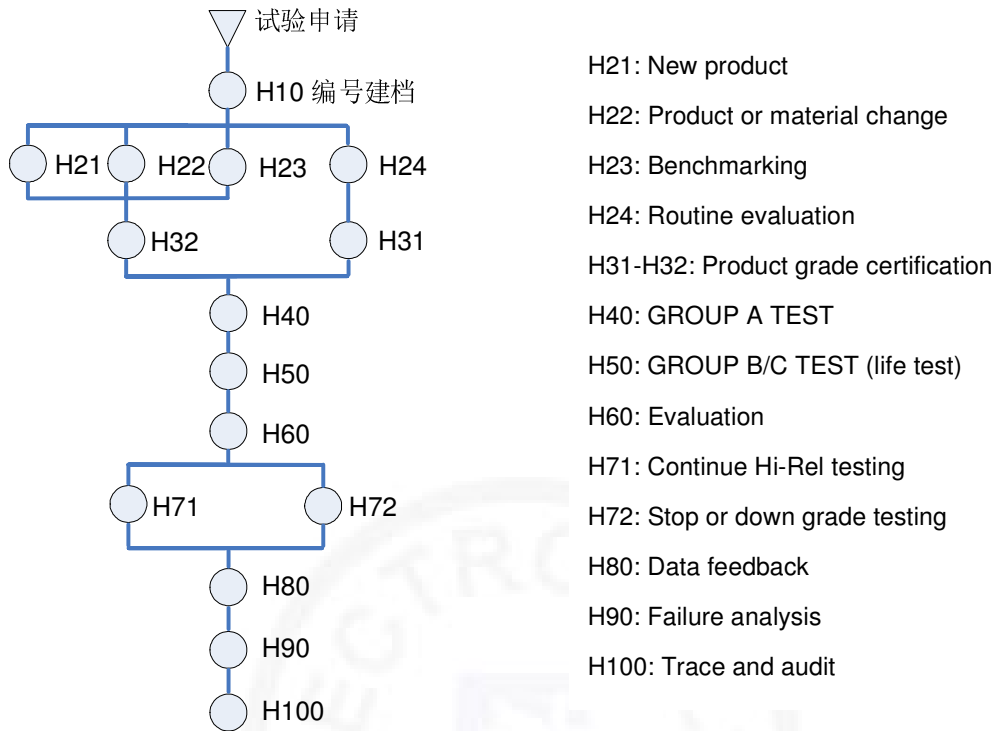
- 5.4.1.1 University graduated, engineering background , Better if have experience
- 5.4.1.2 Well know the product
- 5.4.1.3 With accounting knowledge.

5.4.2 Operator

- 5.4.2.1 High school graduated
- 5.4.2.2 Well know the product
- 5.4.2.3 Well operation the equipment and tester

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5.4.2.4 Process :

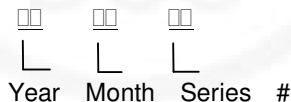


Explanation of process:

5.4.3 H10 (File #) : Each Hi-Rel product need to write the application and approved by supervisor the create a #, the process flow as below:

Applicant → Supervisor of applicant Department → HI-REL supervisor or AE manager → H10

Coding system of file#:



5.4.4 H21-H24 Classification of Exp.:

- (a) New product: It means the design sample to trial run sample by PE and based on the package, the Min. sample Q'ty refer to Table A. The sample all be provided to AE by PE for group A test, The engineering info and sample all be passed to Hi-Rel Lab , The process flow chart as: PE (Engineer need to attached the engineering info.) → HI-REL supervisor → AE Manager approved (Perform GROUP A EVALUATION)

Table A:

| | | | | | | | |
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|-------------|--------------------|----------------|-----|------------------|--------------------|--------|
| Pack age | R1, A405,DO41,DO15 | TO-220, | DB | RS1. RB. WOM/RC2 | BR15/25/35(W) | SOT23 |
| | R3,DO201,1.5KE,R6 | TO-220A,TO-247 | BDB | RD. RS2. RS5. | MB15/25/35(W) | SOD123 |
| | SMA,SMB,SMC,SMX | ITO220,ITO220A | MDS | RS4L. RS6/8. BR3 | MP15/25/35(W) | SOD323 |
| | MELF | D2PAK,DPAK | RBU | BR6. BR8/10 | RS35/25/20/15/8/6M | SOT323 |
| | | | | | RS2M,RS1M | HVM |
| Q'ty | 5K -10K | 1K | 1K | 1K | 500 | 200 |

(b) H22 (Process or material change): All of process or material changing need to perform the Hi-Rel evaluation. The process flow same with H21 new product evaluation process.

(c) H23(Benchmarking): same product of Rectron by competitor, The evaluation need use Rectron parts for control lot to compare, And, perform the Hi-rel Exp as Rectron standard., The process flow chart as :

Marketing research by sales Dept.→ HI-REL supervisor →AE Manager→Hi-Rel(GROUP A EVALUATION)

(d) H24 (Routine evaluation):

* Rectron mass production parts, Hi-Rel Lab got the sample from production line every month (The field failure family parts of this month would be choice for next month routine evaluation. And, keep 3 month), the normal frequency as:

| | |
|-----------|---------------|
| Diode | Bridge |
| LOT/MONTH | LOT/Quarterly |

(1) Exp. item is routine evaluation item, Condition be shown in table 5.1

(2) The condition be listed in table 5.1 (front 1) be performed every year, Exp. item as routine evaluation item.

* The sampling plan of routine evaluation refer to MIL-S-19500E (Sample size: DIODE/ 45EA BRIDGE/22EA) .

The Hi-Rel Lab has to issue the APR to PE when Exp. Happen the failure.

5.4.5 H31-H32 (Product certification):

(a) The rule of certification:

(1) Base on the PIV、VF、TRR& type # (like 01.02.....07), judge the sample can be meet or not it's parameters.

(2) The low grade device can be judge passed if the same process but high voltage grade sample with well performance. . If Sky device, need base on different voltage grade coz difference chip process.

(3) The sample can be down 1 grade fore re-evaluation if the high voltage sample can not pass the evaluation. But, it be limit just 1 times of down grade.

(b) H31The new product change the process or material & routine Evaluation .

(c) H32 (COMPETITOR device evaluation): The testing condition it's base on customer requirement (COMPETITOR DATA SHEET) or Internal spec. (Rectron same product spec.)

5.4.6 H40 (GROUP A TEST)

(a) Process or material change or routine product, Refer to H31process flow to test the parameter: PIV、IR、VF、TRR.

(b) COMPETITOR product, follow the spec of same with Rectron product.

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5.4.7 H50 (GROUP B/C) evaluation:

- (a) New product or competitor product, AE or PE issue the application and need note the testing condition of GROUP B/C。
- (b) Normal product just follows HI-REL STD GROUP B/C Exp. item。
- (c) Process or material changing Pls. refers to H22 Exp.

5.4.8 H60 Evaluation:

- (a) New product or material changing, the sample can be down 1 grade fore re-evaluation if the high voltage sample can not pass the evaluation. But, it be limit just 1 times of down grade(for example : 07grade failed then down to 06 grade)。
- (b) Competitor product follows the spec till failure then terminates the Exp.

5.4.9 H71-H72 down grade or terminate the Exp.

- (a) Diode & bridge electrical testing base on VR, IR, Need one by one reading。
- (b) TVS electrical testing base on VBR,ID, Need one by one reading
- (c) ZENER electrical testing base on VZ,IR, need one by one reading

The judge when device remove from chamber:

| Test item | Spec. |
|-----------|--------------------------|
| IR | IR<10*Ringtail & IR<SPEC |
| VR | VR>SPEC |
| VBR | VBL<VB<VBH |
| VZ | VZL<VZ<VZH |

- (d) Routine evaluation, 1 item failure then reject。
- (e) New product can be consider down 1 grade when had failure but need to inform PE/AE。

5.4.10 H80Data feedback: Each product completed the GROUP B/C evaluation, Need fill up the Exp. recorded and feedback the resulted to relative department。

5.4.11 H90 (Failure analysis): If any failure happen, H-Rel Lab has to issue APR to relative department.

5.5 Exp. of outside lab: In case of less capability of equipment, can send to outside Lab.

5.6 Environment of Lab:

5.6.1 Hi-Rel Lab under control on room Temp. 25±5℃, Humidity 35-75%RH in working hour

5.6.2 Enough lighting to see the device and the test data reading.

5.6.3 Equipment need to be checked daily, Details pls. refer to the checking list.

5.7 Notification:

5.7.1 Equipment need to be checked daily, Details pls. refer to the checking list.

5.7.2 Sample need to accompany with the lot # & Exp. # then put in the certain place。

5.7.3 The Hi-Rel data need to be storage 2 years at least

5.7.4 The equipment of Hi-Rel Lab needs to follow the normal calibration procedure to calibrate。

5.7.5 GROUP A room temperature test like VF、IR、TRR。

GROUP B not life testing item like SOLDER RESISTANCE。

GROUP C is life testing in Hi-Rel Lab. Like: HTRB、TFT、PCT。

5.7.6 Every Hi-Rel testing , the sample need to be well stored and pass to PE。

6. 应用表格:

| | | | | | | | | | |
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|------|--|------------|
| 6.1 | HI-REL SUMMERY REPORT | (V-QA10L2) |
| 6.2 | HI-REL T.F.T. checking list | (V-QA10L3) |
| 6.3 | HI-REL abnormal report | (V-QA10L4) |
| 6.4 | HI-REL application form | (V-QA10L5) |
| 6.5 | HI-REL H.T.S.L checking list | (V-QA10L6) |
| 6.6 | HI-REL H.T.R.B. checking list | (V-QA10L7) |
| 6.7 | HI-REL burn-in recorded | (V-QA10L8) |
| 6.8 | Humidity control chart | (V-QA10C6) |
| 6.9 | HI-REL T/S&T/C checking list | (V-QA10J8) |
| 6.10 | HI-REL PRESSURE COOKER TEST checking list | (V-QA10J9) |
| 6.11 | HI-REL HUMIDITY TEST checking list | (V-QA10K1) |
| 6.12 | HI-REL recorded of filing and traceability | (V-QA10L9) |

| Item | Routine evaluation | 工 | | | | | | | |
|---|--------------------|------|-------|-------|----------|----------|----------|----------|------------------|
| | | O/J | SKY | GPP | | | | | |
| 1. H.T. STORAGE $T_A=150^{\circ}\text{C}$ | 96H | 96H | 168H | 168H | 16 8H | - | 168 H | 168 H | - |
| 2. H.T.R.B $V_R=xx\text{ V}, T_A=xx^{\circ}\text{C}$ | 96H | 96H | 168H | 168H | 16 8H | - | 168 H | 168 H | - |
| 3.HUMIDITY $T_A=65^{\circ}\text{C}/98\%\text{RH}$ | 168H | - | - | - | - | - | 168 H | 168 H | - |
| 4.PRESSURE COOKER 15 PSIG/ 121 $^{\circ}\text{C}$ | ☆ | 16H | 48H | 48H | 48 H | - | 48H | 48H | - |
| 5. OP. LIFE/THERMAL FATIGUE $I_o=xx\text{ A}$, ON/ OFF =300SEC | 300C | 600C | 1000C | 1000C | 60 0C | 600 C | - | - | - |
| 6. THERMAL SHOCK -0 $^{\circ}\text{C}$ to 100 $^{\circ}\text{C}$ / 5MINS E_a | 10C | 10C | 10C | 10C | 10 C | 10C | - | 30C | - |
| 7. SOLDER RESISTANCE $T_A=260^{\circ}\text{C}$ | 10S | 10S | 10S | 10S | 10 S | - | - | - | - |
| 8. FORWARD SURGE 8.3MS, SINGLE HALF SINE-WAVE | PER | OVER | OVER | OVER | OV ER | - | - | - | - |
| 9. TEMP. CYCLING -55 $^{\circ}\text{C}$ to 125 $^{\circ}\text{C}$ / 30MINS | 30C | 30C | 30C | 30C | 30 C | 30C | 30C | 30C | - |
| 10. SOLDERABILITY $T_A=245^{\circ}\text{C}$ | | - | - | - | - | - | - | - | MIL-STD -202F |

※ O/J 8HRS
GPP 24HRS