# Reliability Test Result

| Product | MOSFET | Package | TO-263 (D2PAK, LPTS) |
|---|---|---|---|

## 1. TEST RESULT

| TEST DESCRIPTION | | TEST CONDITION | STANDARD | n [pcs] | Pn [pcs] |
|---|---|---|---|---|---|
| Soldering Heat Resistance | (1) | 260±5℃ , 10sec. , Reflow Soldering , 2 times | JESD22-A111 | 22 | 0 |
| | (2) | 260±5℃ , 10sec. , Solder-Bath | | 22 | 0 |
| | (3) | 350±10℃ , 3sec. , Hand Soldering | | 22 | 0 |
| Solderability | (1) | 245±5℃ , 3sec. , Reflow Soldering | J-STD-002 | 22 | 0 |
| | (2) | 245±5℃ , 3sec. , Solder-Bath | JESD22-B102 | 22 | 0 |
| Thermal Shock | | 0℃ ～ 100℃ , 100cycles | - | 22 | 0 |
| Temperature Cycle | | -55±5℃←→150±5℃ , 200cycles | JESD22-A104 | 22 | 0 |
| High Temp. High Humidity Reverse Bias | | 85±2℃, 85±5%RH, Specified Bias ,1000hours | JESD22-A101 | 22 | 0 |
| Pressure Cooker Test | | 121±2℃ , 100%RH , 203kPa , 100hours | JESD22-A102 | 22 | 0 |
| Load Life | | 25℃ , $P_D$=$P_D$ max. , 1000hours | - | 22 | 0 |
| High Temperature Reverse Bias | | Ta=Tstg max. , Specified Bias , 1000hours | JESD22-A108 | 22 | 0 |
| High Temperature Storage | | Tstg max. , 1000hours | - | 22 | 0 |
| Low Temperature Storage | | Tstg min. , 1000hours | - | 22 | 0 |
| Lead strength (lead pull) | | Sample body fixed, pulling lead axis direction, 10N , 10±1sec. | JEITA ED-4701/400 Test Method 401 | 22 | 0 |
| Intermittent Operation Life | | Ta=25℃±5℃ , ON 130sec /OFF 230sec, Pc max., 10,000 cycles | EIAJ ED-4701/100 Test Method 106 | 22 | 0 |

## 2. CRITERIA

| ITEM | CONDITION | CRITERIA | |
|---|---|---|---|
| Gate-Source Leakage : $I_{GSS}$ | Per specification | Within two times of the standard value. | |
| Zero Gate Voltage Drain Current : $I_{DSS}$ | Per specification | Within two times of the standard value. | |
| Forward Transfer Admittance : $\|Y_{fs}\|$ | Per specification | Changing rate of ±20% | |
| Physical | Visual check | No outstanding change in physical. | |
| Solderability | Visual check | Reflow Soldering | Immersed surface, other than the end of pin as cut-surface, must be covered by solder. |
| | | Solder-Bath | More than 95% of the electrode must be covered with solder. |

## 3. JUDGEMENT

No failure is observed from each test item.

## 4.TEST DESCRIPTION

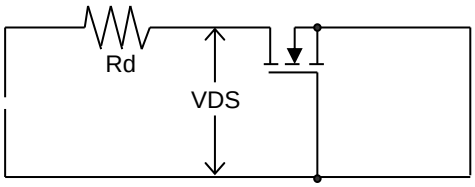
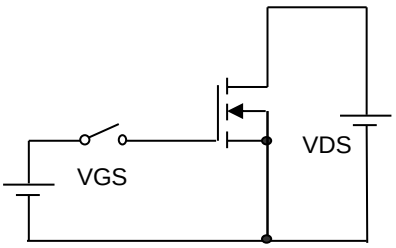
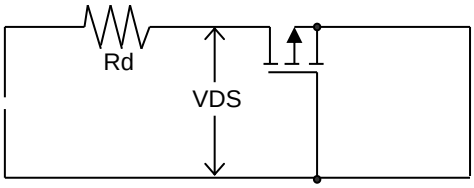
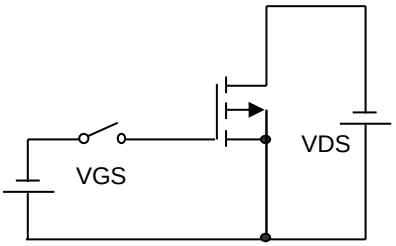
| TEST DESCRIPTION | | TEST CONDITION | CRITERIA |
|---|---|---|---|
| 1. Soldering Heat Resistance *4 | (1) | 1) Reflow Soldering,<br>260±5℃(peak) , 10 sec. , 2 times<br>2) After reflow soldering, leave at room temp.<br>for more than 2h. | ・Shall be no mechanical damage.<br>・See (*1) for criteria on electrical characteristics. |
| | (2) *3 | 1) Dip the leads once into solder bath til the point 1.5mm from the package body. 260±5℃, 10±1sec<br>Solder : Sn-3Ag-0.5Cu（Lead free）<br>2) After dipping, leave at room temp. for more than 2h. | ・Shall be no mechanical damage.<br>・See (*1) for criteria on electrical characteristics. |
| | (3) | 1) Hand Soldering, 350±10℃ , 3sec.<br>2) After testing, leave at room temp. for more than 2h. | ・Shall be no mechanical damage.<br>・See (*1) for criteria on electrical characteristics. |
| 2. Solderability *5 | (1) | 1) Reflow Soldering, 245±5℃(peak) , 3sec.<br>Solder : Sn-3Ag-0.5Cu（Lead free） | ・ Immersed surface, other than the end of pin as cut-surface, must be covered by solder. |
| | (2) *3 | Immerse the leads into flux once til the point 1.5mm from the package body for 10s, Then into solder bath of 245±5℃ til the point 1.5mm from the package body for 3±0.5s. Thereafter leave for natural dry at room temp. then wash off flux in 2-propanol.<br>Solder : Sn-3Ag-0.5Cu（lead free）<br>Flux : 2-propanol（IPA）(rosin 25wt%) | At least 95% of immersed surface, other than the end of pin as cut-surface, of must be covered by solder, which is observed through 10～20X magnifying glass. |
| 3. Thermal Shock *6 | | 1) Temp.&Time (Change within 10 sec,)<br>95～100℃ (Liquid) , 5min ←→ 0～5℃ (Liquid) , 5min<br>2) Freq. 100cycles. After completion of test,<br>leave at room temp. for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 4. Temperature Cycle *6 | | 1) Temp.&Time (Change within 5 sec.)<br>55℃ (air) , 30min ←→ 150℃ (air) , 30min<br>2) Freq. 200cycles. After completion of test,<br>leave at room temp. for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 5. High Temp. High Humidity Reverse Bias *6 | | 1) Ta=85±3℃, RH=75～90%、Time : 1000h<br>2) See (*2) for the THB bias.<br>3) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 6. Pressure Cooker Test *6 | | 1) Ta=121℃, 100%RH, P=203KPa [2atm]<br>2) Time : 100h<br>3) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 7. Load Life *6 | | 1) Ta=25±5℃, $P_D/P_D$(max), Time : 1000h<br>2) See (*2) for the THB bias.<br>3) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 8. High Temperature Reverse Bias *6 | | 1) Ta=Tstg(max)±2℃, Time : 1000h<br>2) See (*2) for the THB bias.<br>3) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 9. High Temperature Storage | | 1) Ta=Tstg(max), Time : 1000h<br>2) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 10. Low Temperature Storage | | 1) Ta=Tstg(min), Time : 1000h<br>2) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |
| 11. Lead Strength (Lead Pull) | | The sample body is fixed, and keep pulling the lead in lead axis direction with specified load for 10±1s. | Shall be no mechanical damage, detachment, extention between the lead and the package body. |
| 12. Intermittent Operation Life | | 1) Ta=25±5℃, ON 130s/OFF 230s add Pc(max.).<br>Time: 10,000 cycles, See (*2) for the LL bias.<br>3) After completion of test, leave at room temp.<br>for more than 2h. | See (*1) for criteria on electrical characteristics. |

## 5.REMARK

*1 Criteria for electrical characteristics.

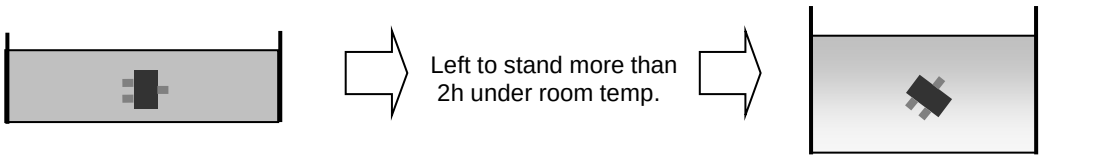
| MOSFET |
|---|
| ・$I_{DSS}$＞Standard ×2 |
| ・$I_{GSS}$＞Standard ×2 |
| ・$\frac{\triangle Yfs}{Yfs}$ ＞±20% |

*2 Bias Circuit

| THB Bias Circuit | LL Bias Circuit |
|---|---|
| (Nch)<br>  <br><br>$V_{DS} = V_{DSS}$ (max.) | (Nch)<br>  <br> |
| (Pch)<br>  <br><br>$V_{DS} = -V_{DSS}$ (max.) | (Pch)<br>  <br> |

Bias for Power devices may be reduced as per individual specification.

*3 Method of test 1, test 2




Immersed in solder bath

Wash off flux in 2-propanol

*4 Preconditioning : The test is carried out after it is left under the high temperature and the high humidity.(85℃,85%,168h)

*5 Preconditioning : Aging is done with the PCT device.（105℃,100%,1.22×$10^5$Pa,4h）

*6 Preconditioning : Soldering heat resistance(260℃,10s) is carried out. (Reflow Soldering)

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