

Ref. No. : BBHKN-20-00010  
 Date : August 28, 2020

**CHANGE NOTICE for DOUBLE MOLDED COUPLER**

*Change of transistor chip*

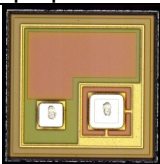
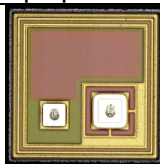
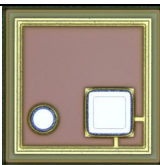
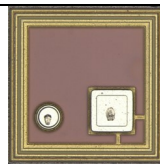
We would appreciate your continuous patronage of our semiconductor products.  
 With regards to our Photo coupler product which is used at your company, please be noticed the following change is planned.  
 Your guidance and continued support would be highly appreciated.

**1. Products to be affected (including specific products)**

|           |             |           |             |
|-----------|-------------|-----------|-------------|
| TLP185(E) | TLP184(E)   | TLP290(E) | TLP290-4(E) |
| TLP291(E) | TLP291-4(E) | TLP385(E) | TLP620M(E)  |
| TLP182(E) | TLP183(E)   | TLP292(E) | TLP292-4(E) |
| TLP293(E) | TLP293-4(E) | TLP383(E) | —           |

\*Double molded couplers with transistor output are to be affected.

**2. Description of change : The following changes are planned**

| No. | Content of change and reason                                 | Before change<br>No Equi-potential Ring   | After change<br>Add Equi-potential Ring  | Products to be affected  |
|-----|--|---|--|--|
| 1)  | Change of photo detecting chip<br>TLP185<br>(Representative) |   |   | TLP184(E), TLP290(E)<br>TLP290-4(E) TLP291(E)<br>TLP291-4(E), TLP385(E)<br>TLP620(E) |
| 2)  | Change of photo detecting chip<br>TLP293<br>(Representative) |  |  | TLP182(E), TLP183(E)<br>TLP292(E), TLP292-4(E)<br>TLP293-4(E), TLP383(E)             |

**3. Purpose of change : Consolidation of photo detecting chips.**

**4. Product characteristics :**

Since it is a consolidation of photo detecting chips, no change is expected in the product design and process. The change does not affect the initial characteristics and reliability before/after the change.

**5. Effective date of the change :**

We plan this change to be effective from the production of November 2020.

**6. Request :**

It would be appreciated if you could notify through our Sales representative in case of any inconvenience relating to this change. **Notification due date : October 16, 2020**

If Toshiba does not receive any reply with regards to this change by the due above date, it will be assumed that the change is acceptable.

Sincerely yours,



H. Matsuo / Manager  
 Quality Planning Group  
 Quality Assurance Department  
 Buzen Toshiba Electronics Corporation

<Drafted by : Uchino>



# Change Notice for Toshiba Product

## Change of photo detecting chip for General-use Tr Coupler

**TOSHIBA**

Toshiba Electronic Devices & Storage Corporation

August 28, 2020

# Background and affected product

- ① **Description of the change** : Consolidate a few kinds of photo detecting Tr chips
- ② **Purpose of the change** : Reduce the control steps by consolidating chips
- ③ **Affected product** : All General-use Double Molded Coupler introducing photo detecting Tr chips

## ■ Affected product (Photo detecting Tr chip for Photo coupler)

| Affected series   | Affected product                        | Description of the change            |
|-------------------|---|--------------------------------------|
| TLP185/293 Series | Refer to the attachment for the details | Consolidate photo detecting Tr chips |

*Change point in the process*

# Main change in the consolidation of Tr chips

| 5M1E             |                   | (Kaga)Manufacturing line |              |
|------------------|-------------------|--------------------------|--------------|
|                  |                   | Before change            | After change |
| Design / Pattern |                   | –                        | With EQR     |
| Man(人)           |                   | No change                |              |
| Machine(装置)      |                   | No change                |              |
| Material (原材料)   |                   | No change                |              |
| Method (方法)      |                   | No change                |              |
| Measurement (測定) |                   | No change                |              |
| Environment (環境) | Cleanliness level | No change                |              |
|                  | System            | No change                |              |

# QC Process Chart (Photo-Tr)

Before change

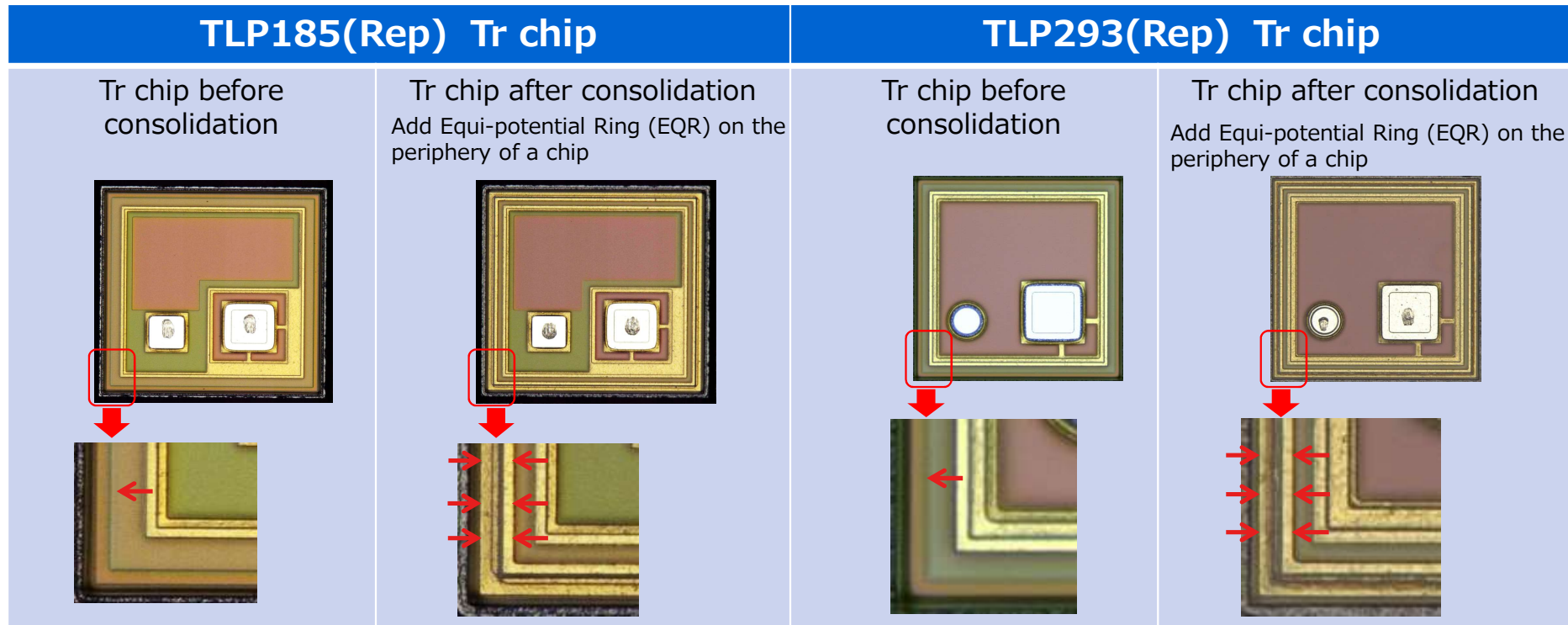
| 製 造 工 程  |            | 管 理 項 目 | 管 理 頻 度 |
|--|------------|---------|---------|
| フローチャート  | 工 程 名      |         |         |
| ▽  | ウェーハ受入     |         |         |
| ○  | 酸化         | 膜厚      | 1回/チャージ |
| ○  | ベース形成      | 温度      | 常時モニタ   |
| ○  | エミッタ形成     | 温度      | 常時モニタ   |
| ○  | コンタクト開孔    | 外観      | 1回/ロット  |
| ○  | メタル形成      | 膜厚      | 1回/ロット  |
| ○  | パッシベーション形成 | 外観      | 1回/ロット  |
| □  | 特性検査       | 電気的特性   |         |
| ○  | ラッピング      | ウェーハ厚   | 1回/ロット  |
| ○  | 裏面メタル形成    |         |         |
| ○  | ダイシング      |         |         |
| □  | 外観検査       |         |         |
| ▽  | 出荷         |         |         |
| <small>工程図記号</small> ▽: 貯蔵    ○: 加工    □: 全数検査    ◻: 抜取検査    ◻Δ: 特殊検査    ○—□: チェック |            |         |         |

After change

| 製 造 工 程  |            | 管 理 項 目 | 管 理 頻 度 |
|--|------------|---------|---------|
| フローチャート  | 工 程 名      |         |         |
| ▽  | ウェーハ受入     |         |         |
| ○  | 酸化         | 膜厚      | 1回/チャージ |
| ○  | ベース形成      | 温度      | 常時モニタ   |
| ○  | エミッタ形成     | 温度      | 常時モニタ   |
| ○  | コンタクト開孔    | 外観      | 1回/ロット  |
| ○  | メタル形成      | 膜厚      | 1回/ロット  |
| ○  | パッシベーション形成 | 外観      | 1回/ロット  |
| □  | 特性検査       | 電気的特性   |         |
| ○  | ラッピング      | ウェーハ厚   | 1回/ロット  |
| ○  | 裏面メタル形成    |         |         |
| ○  | ダイシング      |         |         |
| □  | 外観検査       |         |         |
| ▽  | 出荷         |         |         |
| <small>工程図記号</small> ▽: 貯蔵    ○: 加工    □: 全数検査    ◻: 抜取検査    ◻Δ: 特殊検査    ○—□: チェック |            |         |         |

**No change is planned in the QC Process Chart.**

# Change Point : Tr chip with EQR



After the consolidation, Tr chip will adopt the AL pattern with Equi-potential ring on the chip periphery. No difference is expected in the chip size, basic design, and characteristics.

Consequently, no change point will arise in the characteristics and reliability has a photo coupler.

Product using the same chip as TLP185 : TLP184/TLP290/TLP290-4/TLP291/TP291-4/TLP385/TLP620M

Product using the same chip as TLP293 : TLP182/TLP183/TLP292/TLP292-4/TLP293-4/TLP383

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# Product evaluation

## 1) Characteristics test

- Comparison of the electrical characteristics

\* Since the change point exists in the photo detector side, the photo detecting and coupling characteristics were compared.

## 2) Electrostatic discharge resistance

- ESD

## 3) Reliability test

- Selected TLP185/TLP293 as the representative, and conducted the tests.

| No. | Test item                              | Test condition                              | Test time | Quantity |
|-----|--|---|-----------|----------|
| 1   | High temperature continuous operation  | Ta=85°C,<br>Voltage/Current = Operation Max | 1000 h    | 60       |
| 2   | High temperature storage               | Ta=125°C                                    | 1000 h    | 60       |
| 3   | High temperature, High humidity biased | Ta=85°C, RH=85%,<br>Voltage= Operation Max  | 1000 h    | 60       |
| 4   | Pressure cooker                        | Ta=121°C, 0.203MPa(No-condensation)         | 96 h      | 60       |
| 5   | Temperature cycling                    | -55°C(30min)~125°C(30min)                   | 300 cycle | 60       |

\* Pre-treatment (saturated absorption + reflow) was conducted for all test items

## 4) Process verification

- Process capability (element characteristics item)

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# Initial characteristics distribution (Process capability)

Before change n=50

After change n=50

TLP185

Initial characteristics data : Standard condition

@Ta=25(°C)

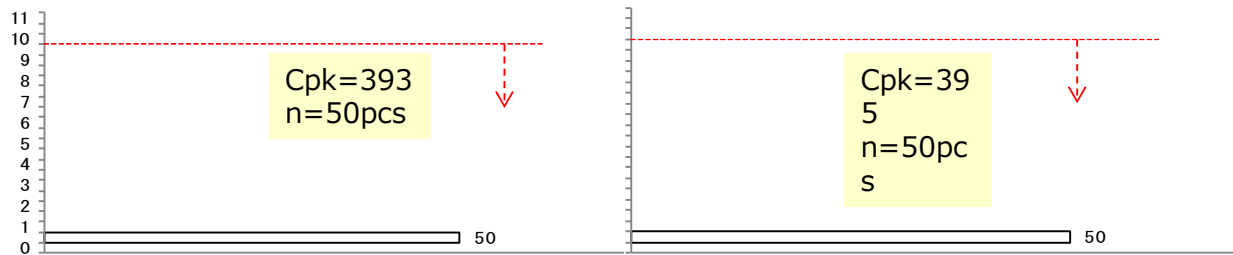
| Item       | Test condition     | Specification (TD) |      |      |      | Before change |      | After change |      |
|------------|--------------------|--------------------|------|------|------|---------------|------|--------------|------|
|            |                    | Min.               | Typ. | Max. | Unit | Ave.          | Cpk  | Ave.         | Cpk  |
| IR         | VR=5V              | –                  | –    | 10   | μA   | 0.01          | 393  | 0.01         | 395  |
| VF         | IF=10mA            | 1.1                | 1.25 | 1.4  | V    | 1.22          | 35.8 | 1.22         | 48.0 |
| VCEO       | IC=0.5mA           | 80                 | –    | –    | V    | 149           | 49.1 | 144          | 52.3 |
| VECO       | IE=0.1mA           | 7                  | –    | –    | V    | 9.77          | 31.4 | 9.90         | 36.8 |
| Iceo       | VCE=48V            | –                  | 0.01 | 0.08 | μA   | 0.01          | 3.54 | 0.01         | 3.57 |
| IC/IF(1)   | IF=5mA<br>VCE=5V   | 50                 | –    | 400  | %    | 314           | 2.95 | 312          | 5.97 |
| IC/IF(sat) | IF=1mA<br>VCE=0.4V | 30                 | –    | –    | %    | 186           | 8.88 | 184          | 17.3 |
| VCE(sat)   | IC=2.4mA<br>IF=8mA | –                  | –    | 0.3  | V    | 0.133         | 23.6 | 0.145        | 26.4 |
| IC(off)    | VF=0.7V<br>VCE=48V | –                  | 1    | 10   | μA   | 0.03          | 135  | 0.02         | 151  |

**Changed product has sufficient process capability**

# Initial characteristics distribution

Part No. : TLP185

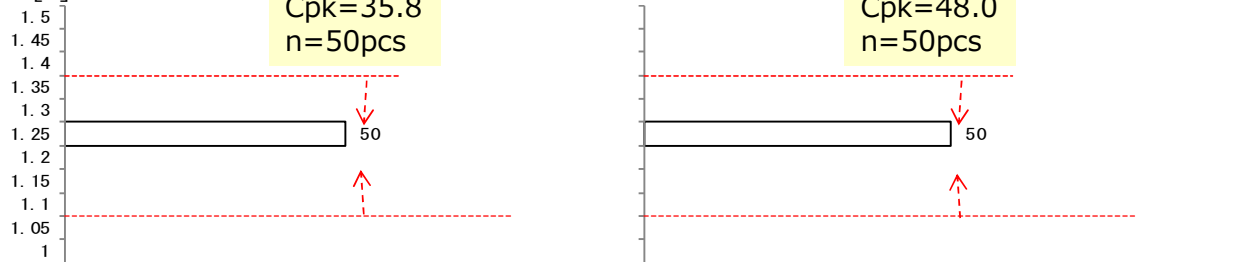
IR [uA] VR=5V



Before change

After change

VF [V] IF=10mA

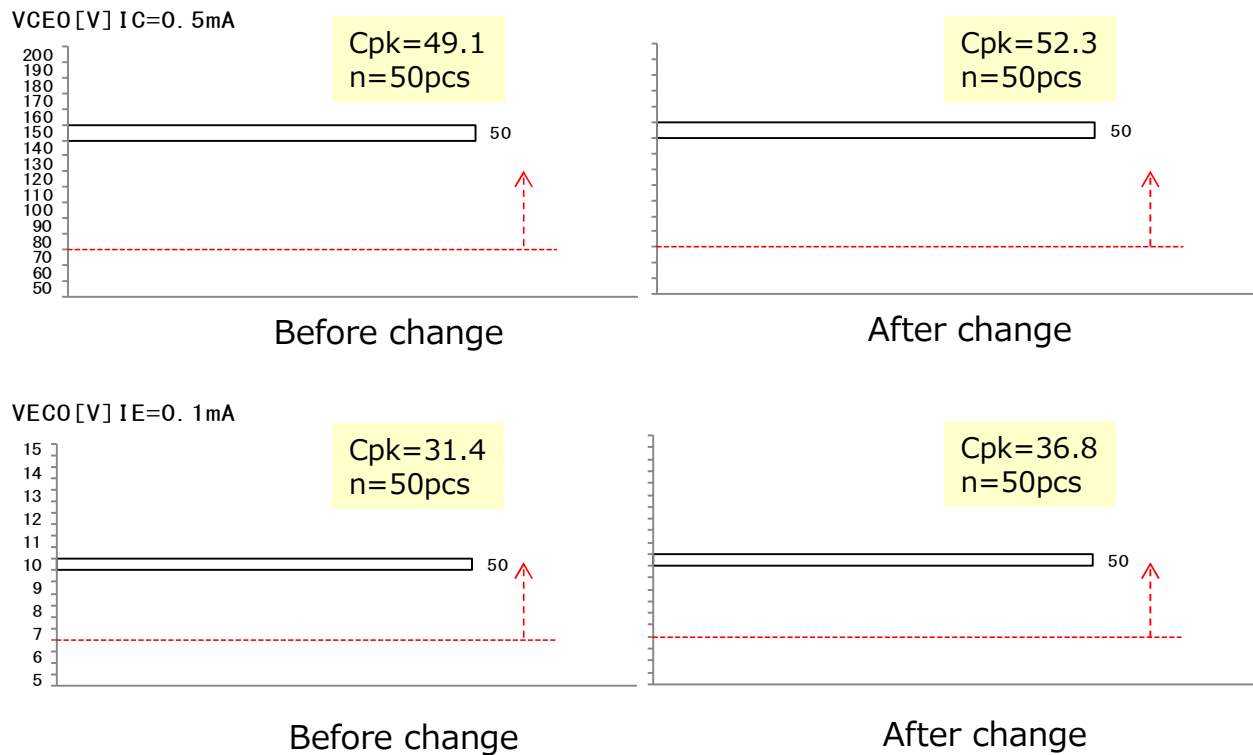


Before change

After change

# Initial characteristics distribution

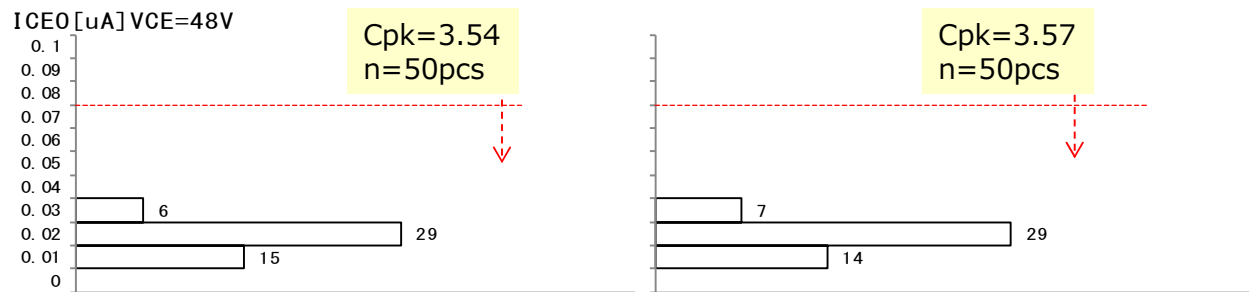
Part No. : TLP185



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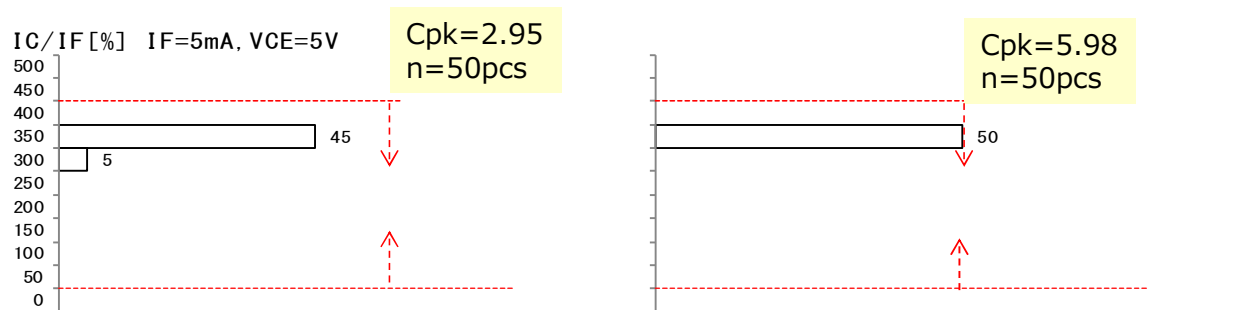
# Initial characteristics distribution

Part No. : TLP185



Before change

After change



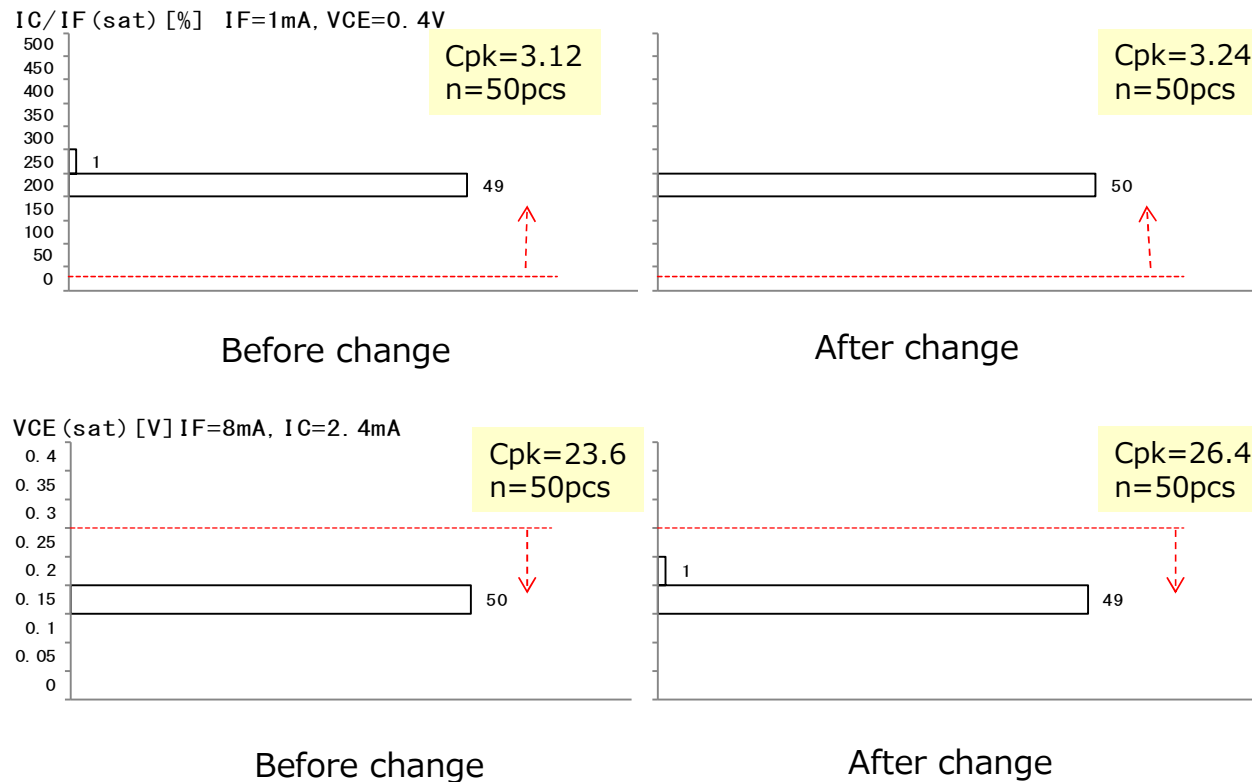
Before change

After change

Confidential

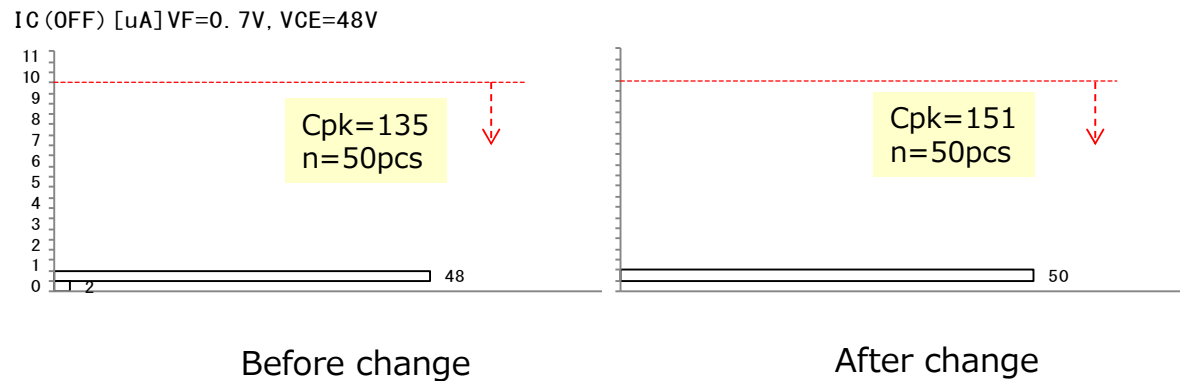
# Initial characteristics distribution

Part No. : TLP185



# Initial characteristics distribution

Part No. : TLP185



Comparing to the conventional product,  
process capability of changed product is equivalent or more.

# Application test data (ESD test)

Part No. : TLP185

## Test result : Machine mode (MM)

| Part No. | Test result( $\pm 200V$ ) :<br>Failed Q'ty / Tested Q'ty |          |
|----------|--|----------|
| TLP185   | Before change  | 0/10 pcs |
|          | After change   | 0/10 pcs |

Test condition : C=200pF, R= 0 $\Omega$ , Applying once

Changed product demonstrated sufficient performance.

## Test result : Human Body Model (HBM)

| Part No. | Test result( $\pm 2000V$ ) :<br>Failed Q'ty / Tested Q'ty |          |
|----------|---|----------|
| TLP185   | Before change   | 0/10 pcs |
|          | After change  | 0/10 pcs |

Test condition : C= 100pF, R= 1.5 k $\Omega$ , Applying once

Changed product demonstrated sufficient performance.

## Test result : Charged Device Model (CDM)

| Part No. | Test result( $\pm 500V$ ) :<br>Failed Q'ty / Tested Q'ty |          |
|----------|--|----------|
| TLP185   | Before change  | 0/10 pcs |
|          | After change   | 0/10 pcs |

JEITA test condition: Applying once

Changed product demonstrated sufficient performance.

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# Reliability test result

Part No. : TLP185 (Representative)

| No. | Test item   | Test condition                     | Judgement (Failed Q'ty / Tested Q'ty) |               |              |
|-----|---|------------------------------------|---------------------------------------|---------------|--------------|
|     |   |                                    | Test time                             | Before change | After change |
| 1   | Continuous operation                                | Ta=110°C,IF=20mA,Po=23mW           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 2   | High temperature storage                            | Ta=125°C                           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 3   | High temperature High humidity Continuous operation | Ta=85°C, RH=85%, VCE=80V           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 4   | Pressure cooker                                     | Ta=121°C, 203kPa (No-condensation) | 96 h                                  | 0/60 pcs      | 0/60 pcs     |
| 5   | Temperature cycling                                 | -55°C(30min)~125°C(30min)          | 300 cycle                             | 0/60 pcs      | 0/60 pcs     |

\* Pre-treatment (saturated absorption + reflow) was conducted for all test items

**No failure occurred in each test item. We therefore conclude that changed product has equivalent level with the conventional product.**



# Initial characteristics distribution (Process capability)

Before change n=50pcs

After change n=50pcs

TLP293

Initial characteristic data: Standard condition

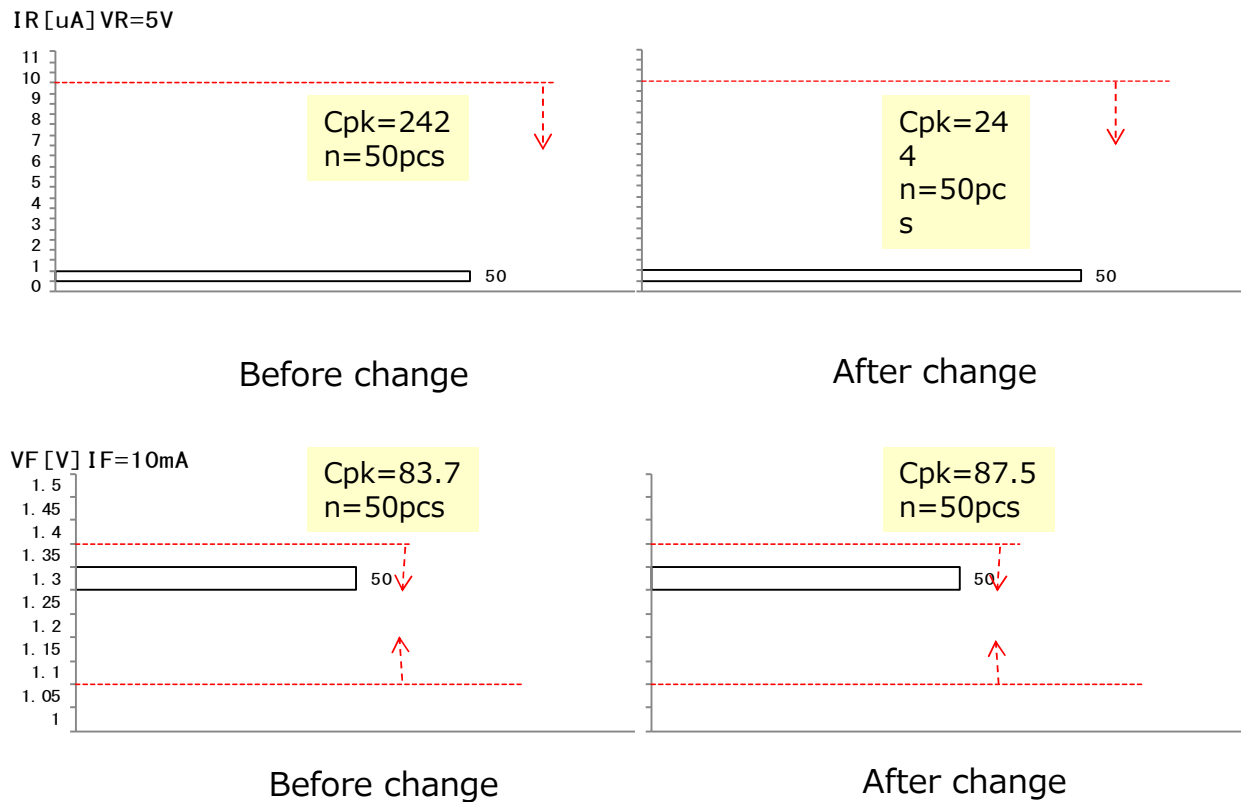
@Ta=25(°C)

| Item       | Test condition     | Specification (TD) |      |      |      | Before change |      | After change |      |
|------------|--------------------|--------------------|------|------|------|---------------|------|--------------|------|
|            |                    | Min.               | Typ. | Max. | Unit | Ave.          | Cpk  | Ave.         | Cpk  |
| IR         | VR=5V              | –                  | –    | 10   | μA   | 0.03          | 242  | 0.03         | 244  |
| VF         | IF=10mA            | 1.1                | 1.25 | 1.4  | V    | 1.27          | 63.7 | 1.28         | 87.5 |
| VCEO       | IC=0.5mA           | 80                 | –    | –    | V    | 128           | 37.6 | 135          | 38.5 |
| VECO       | IE=0.1mA           | 7                  | –    | –    | V    | 10.0          | 106  | 10.0         | 128  |
| IDARK      | VCE=48V            | –                  | 0.01 | 0.08 | μA   | 0.02          | 3.45 | 0.01         | 3.47 |
| IC/IF(1)   | IF=5mA<br>VCE=5V   | 50                 | –    | 600  | %    | 259           | 4.89 | 230          | 5.53 |
| IC/IF(2)   | IF=0.5mA<br>VCE=5V | 50                 | –    | 600  | %    | 256           | 3.12 | 230          | 3.24 |
| IC/IF(sat) | IF=1mA<br>VCE=0.4V | 30                 | –    | –    | %    | 233           | 5.54 | 212          | 6.02 |
| VCE(sat)   | IC=2.4mA<br>IF=8mA | –                  | –    | 0.3  | V    | 0.125         | 25.4 | 0.13         | 27.1 |
| IC(off)    | VF=0.7V<br>VCE=48V | –                  | –    | 10   | μA   | 0.08          | 135  | 0.08         | 145  |

**Changed product has sufficient process capability**

# Initial characteristics distribution

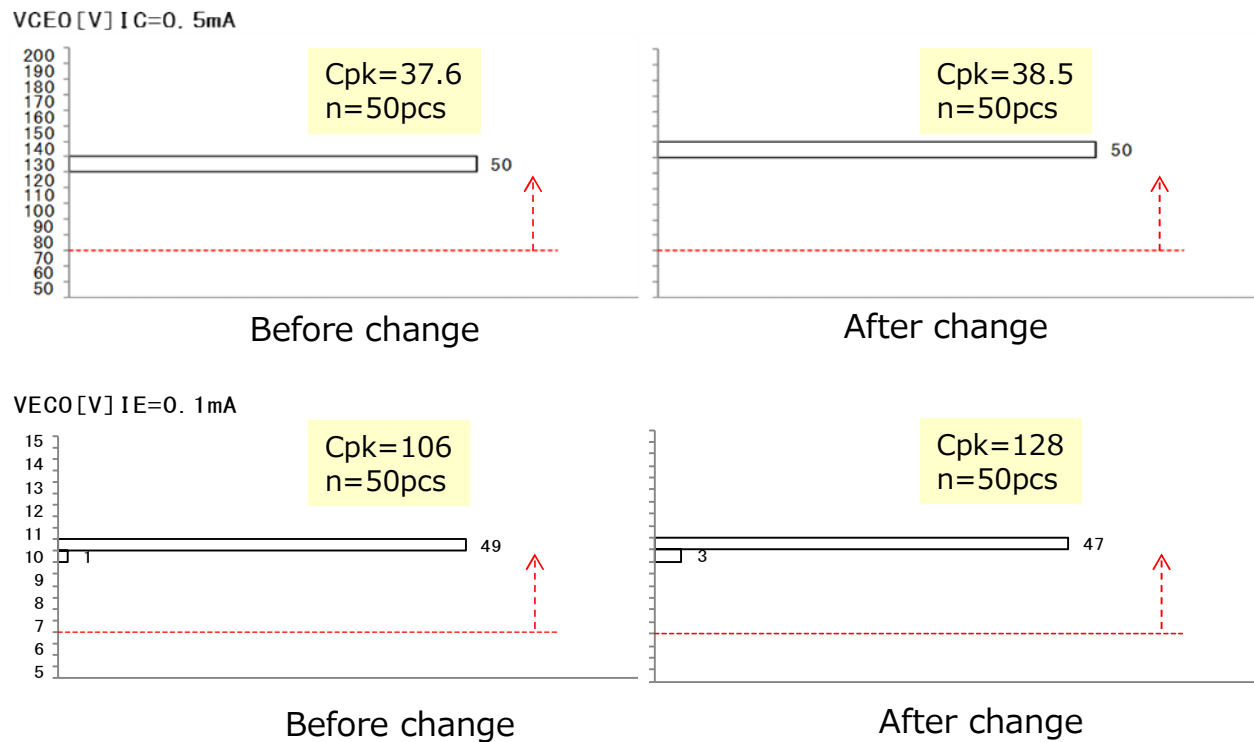
Part No. : TLP293



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# Initial characteristics distribution

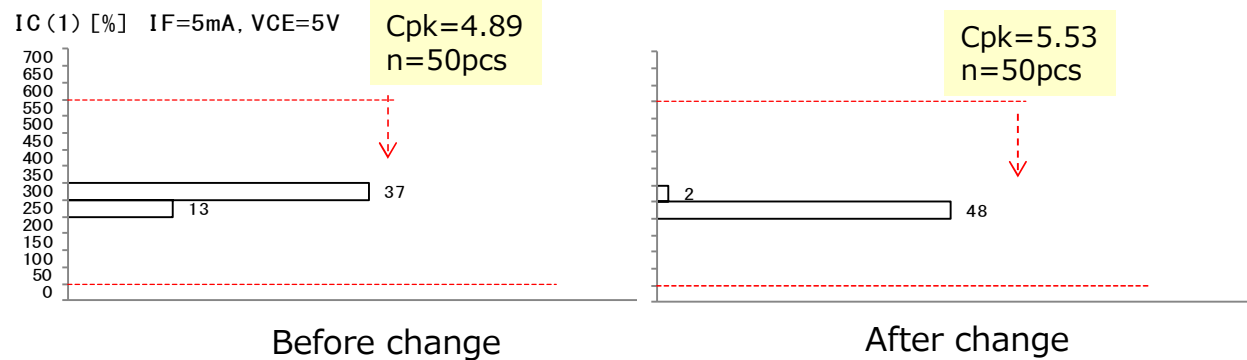
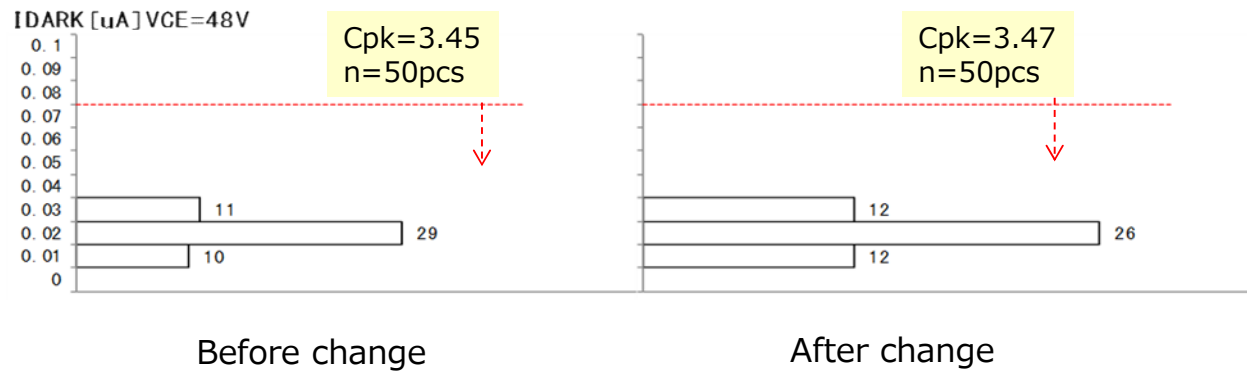
Part No. : TLP293



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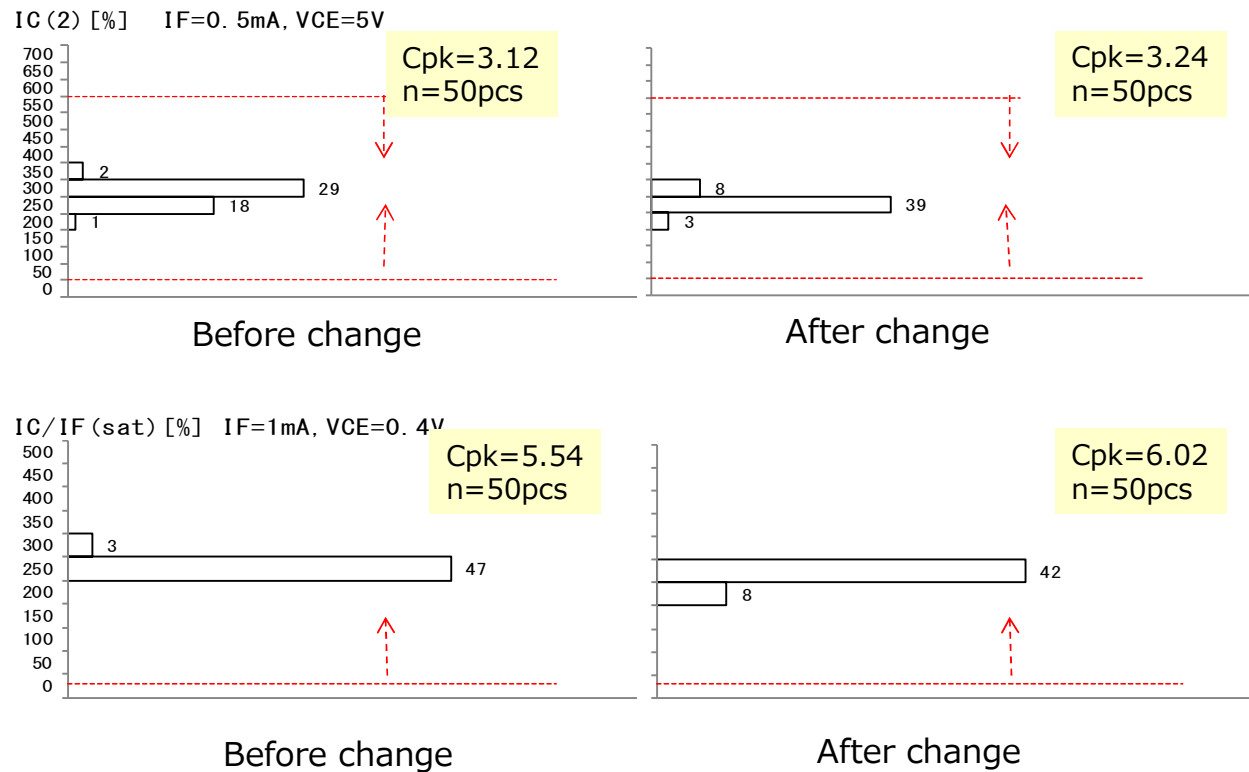
# Initial characteristics distribution

Part No. : TLP293



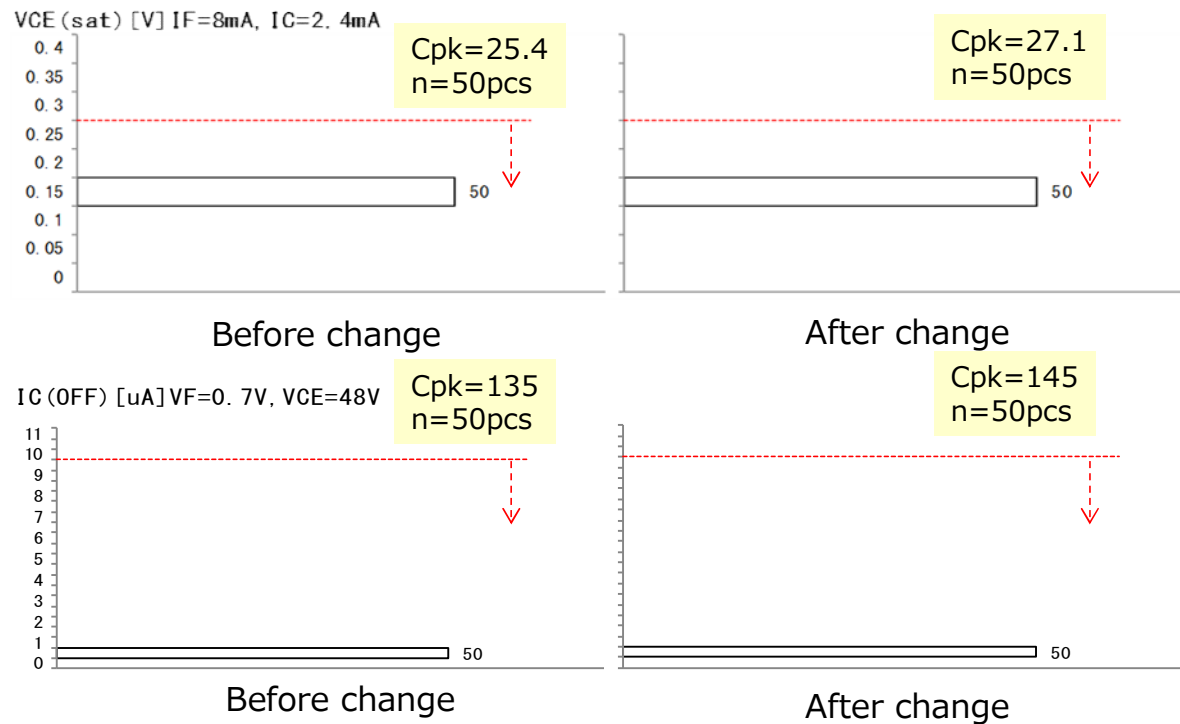
# Initial characteristics distribution

Part No. : TLP293



# Initial characteristics distribution

Part No. : TLP293



Comparing to the conventional product,  
process capability of changed products is equivalent or more.

# Application test data (ESD test)

Part No. : TLP293

## Test result: Machine mode (MM)

Test condition : C=200pF, R= 0Ω, Applying once

| Part No. | Test result(±200V) :<br>Failed Q'ty / Tested Q'ty |          |
|----------|---|----------|
| TLP29 3  | Before change                                     | 0/10 pcs |
|          | After change                                      | 0/10 pcs |

Changed product demonstrated sufficient performance.

## Test result: Human Body Model (HBM)

Test condition : C= 100pF, R= 1.5 kΩ, Applying once

| Part No. | Test result(±2000V) :<br>Failed Q'ty / Tested Q'ty |          |
|----------|--|----------|
| TLP293   | Before change                                      | 0/10 pcs |
|          | After change                                       | 0/10 pcs |

Changed product demonstrated sufficient performance.

## Test result: Charged Device Model (CDM)

JEITA test condition: Applying once

| Part No. | Test result(± 5 00V) :<br>Failed Q'ty / Tested Q'th |          |
|----------|---|----------|
| TLP293   | Before change                                       | 0/10 pcs |
|          | After change  | 0/10 pcs |

Changed product demonstrated sufficient performance.

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# Reliability test result

Part No. : TLP293 (Representative)

| No. | Test item   | Test condition                     | Judgement (Failed Q'ty / Tested Q'ty) |               |              |
|-----|---|------------------------------------|---------------------------------------|---------------|--------------|
|     |   |                                    | Test time                             | Before change | After change |
| 1   | Continuous operation                                      | Ta=125°C,IF=12mA,Po=14mW           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 2   | High temperature storage                                  | Ta=125°C                           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 3   | High temperature<br>High humidity<br>Continuous operation | Ta=85°C, RH=85%, VCE=80V           | 1000 h                                | 0/60 pcs      | 0/60 pcs     |
| 4   | Pressure cooker   | Ta=121°C, 203kPa (No-condensation) | 96 h                                  | 0/60 pcs      | 0/60 pcs     |
| 5   | Temperature cycling                                       | -55°C(30 min)~125°C(30 min)        | 300 cycle                             | 0/60 pcs      | 0/60 pcs     |

\* Pre-treatment (saturated absorption + reflow) was conducted for all test items

**No failure occurred in each test item. We therefore conclude that changed product has equivalent level with the conventional product.**



# Conclusion

As explained in the report, we have obtained the equivalent results at each test before and after the change.

Consequently, we would like to ask your consideration for the approval of consolidation of Tr chip.

Your understanding and corporation would be highly appreciated.

**TOSHIBA**