

**Ferrite Chip Inductor(Lead Free)**

FCI1608F-Series

| <b>ECN HISTORY LIST</b> |          |  |          |         |       |
|-------------------------|----------|--|----------|---------|-------|
| REV                     | DATE     | DESCRIPTION  | APPROVED | CHECKED | DRAWN |
| 1.0                     | 13/06/06 | 變更可靠度條件  | 楊祥忠      | 羅培君     | 張嘉玲   |
| 2.0                     | 14/01/24 | 變更電鍍錫層厚度<br>3.0um min. => 3.5um min.                         | 楊祥忠      | 羅培君     | 張嘉玲   |
| 3.0                     | 14/08/01 | 變更 Reflow 圖示   | 楊祥忠      | 羅培君     | 張嘉玲   |
| 3.1                     | 14/08/01 | 修正包裝帶尺寸  | 楊祥忠      | 羅培君     | 張嘉玲   |
| 4.0                     | 14/10/13 | 訂正 1608 包裝帶 Ao 尺寸  | 楊祥忠      | 羅培君     | 張嘉玲   |
| 5.0                     | 16/01/26 | 修訂可靠度 Life Test:<br>(Inductor) Temperature:85±2°C → 105±2°C. | 楊祥忠      | 詹偉特     | 張嘉玲   |
| 6.0                     | 17/02/16 | 修訂 Recommended PC Board Pattern                              | 楊祥忠      | 詹偉特     | 張嘉玲   |
|                         |          |  |          |         |       |
|                         |          |  |          |         |       |
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| 備<br>註                  |          |  |          |         |       |

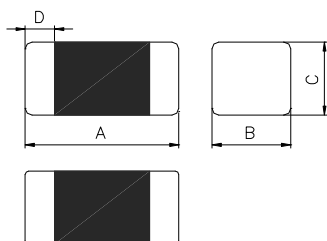
**Ferrite Chip Inductor(Lead Free)** FCI1608F-Series

**1.Features**

1. Monolithic inorganic material construction.
2. Closed magnetic circuit avoids crosstalk.
3. S.M.T. type.
4. Suitable for reflow soldering.
5. Shapes and dimensions follow E.I.A. spec.
6. Available in various sizes.
7. Excellent solder ability and heat resistance.
8. High reliability.
9. 100% Lead(Pb) & Halogen-Free and RoHS compliant.



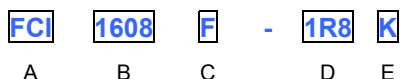
**2. Dimensions**



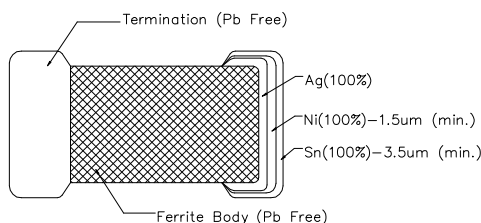
| Chip Size |           |           |
|-----------|-----------|-----------|
| <b>A</b>  | 1.60±0.15 | 1.80±0.15 |
| <b>B</b>  | 0.80±0.15 |           |
| <b>C</b>  | 0.80±0.15 |           |
| <b>D</b>  | 0.30±0.20 |           |

Units: mm

**3. Part Numbering**



- A: Series
  - B: Dimension
  - C: Material
  - D: Inductance
  - E: Inductance Tolerance
- L x W  
Lead Free Material  
1R8=1.8uH  
K=±10%,L=±15%,M=±20%



**4.Specification**

| Tai-Tech<br>Part Number | Inductance(uH) |                     | Q    |                      | Rated Current<br>(mA) max. | DCR<br>(Ω) max. | SRF<br>(MHz) min. |
|-------------------------|----------------|---------------------|------|----------------------|----------------------------|-----------------|-------------------|
|                         | Tolerance      | Test Frequency (Hz) | min. | Test Frequency (MHz) |                            |                 |                   |
| FCI1608F-47N□           | 0.047          | 60mV / 50M          | 10   | 50                   | 50                         | 0.30            | 260               |
| FCI1608F-68N□           | 0.068          | 60mV / 50M          | 10   | 50                   | 50                         | 0.30            | 250               |
| FCI1608F-82N□           | 0.082          | 60mV / 50M          | 10   | 50                   | 50                         | 0.30            | 245               |
| FCI1608F-R10□           | 0.10           | 60mV / 25M          | 15   | 25                   | 50                         | 0.50            | 240               |
| FCI1608F-R12□           | 0.12           | 60mV / 25M          | 15   | 25                   | 50                         | 0.50            | 205               |
| FCI1608F-R15□           | 0.15           | 60mV / 25M          | 15   | 25                   | 50                         | 0.60            | 180               |
| FCI1608F-R18□           | 0.18           | 60mV / 25M          | 15   | 25                   | 50                         | 0.60            | 165               |
| FCI1608F-R22□           | 0.22           | 60mV / 25M          | 15   | 25                   | 50                         | 0.80            | 150               |
| FCI1608F-R27□           | 0.27           | 60mV / 25M          | 15   | 25                   | 50                         | 0.80            | 136               |
| FCI1608F-R33□           | 0.33           | 60mV / 25M          | 15   | 25                   | 35                         | 0.85            | 125               |
| FCI1608F-R39□           | 0.39           | 60mV / 25M          | 15   | 25                   | 35                         | 1.00            | 110               |
| FCI1608F-R47□           | 0.47           | 60mV / 25M          | 15   | 25                   | 35                         | 1.35            | 105               |
| FCI1608F-R56□           | 0.56           | 60mV / 25M          | 15   | 25                   | 35                         | 1.55            | 95                |
| FCI1608F-R68□           | 0.68           | 60mV / 25M          | 15   | 25                   | 35                         | 1.70            | 80                |
| FCI1608F-R82□           | 0.82           | 60mV / 25M          | 15   | 25                   | 35                         | 2.10            | 75                |

NOTE: □:TOLERANCE K=±10%,L=±15%,M=±20%

| Tai-Tech<br>Part Number | Inductance( $\mu$ H) |                     | Q    |                      | Rated Current<br>(mA) max. | DCR<br>( $\Omega$ ) max. | SRF<br>(MHz) min. |
|-------------------------|----------------------|---------------------|------|----------------------|----------------------------|--------------------------|-------------------|
|                         | Tolerance            | Test Frequency (Hz) | min. | Test Frequency (MHz) |                            |                          |                   |
| FCI1608F-1R0□           | 1.0                  | 60mV / 10M          | 30   | 10                   | 25                         | 0.60                     | 70                |
| FCI1608F-1R5□           | 1.5                  | 60mV / 10M          | 30   | 10                   | 25                         | 0.80                     | 55                |
| FCI1608F-1R8□           | 1.8                  | 60mV / 10M          | 30   | 10                   | 25                         | 0.95                     | 50                |
| FCI1608F-2R2□           | 2.2                  | 60mV / 10M          | 30   | 10                   | 15                         | 1.15                     | 45                |
| FCI1608F-3R3□           | 3.3                  | 60mV / 10M          | 30   | 10                   | 15                         | 1.55                     | 38                |
| FCI1608F-4R7□           | 4.7                  | 60mV / 10M          | 30   | 10                   | 15                         | 2.10                     | 33                |
| FCI1608TF-100□          | 10                   | 60mV / 2M           | 30   | 2                    | 15                         | 2.55                     | 17                |

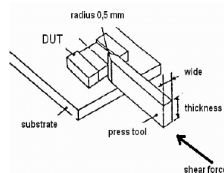
NOTE: □:TOLERANCE K=±10%,L=±15%,M=±20%  
(1608T) Dimension A=1.8±0.15mm

- Rated current: based on temperature rise test
- In compliance with EIA 595

## 5. Reliability and Test Condition

| Item                               | Performance   |                          |           |                           | Test Condition   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
|------------------------------------|---|--------------------------|-----------|---------------------------|--|------|------------------|--------------------------|-----------|---------------------------|-----|----|----|-----------|------|------|----|----|-----------|------|
| Series No.                         | FCI   | FHI                      | FCH       | HCI                       | --   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Operating Temperature              | -40~+105°C<br>(Including self-temperature rise)   |                          |           |                           | --   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Transportation Storage Temperature | -40~+105°C<br>(on board)  |                          |           |                           | For long storage conditions, please see the Application Notice   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Inductance (Ls)                    | Refer to standard electrical characteristics list   |                          |           |                           | Agilent4291  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Q Factor                           |   |                          |           |                           | Agilent E4991  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| DC Resistance                      |   |                          |           |                           | Agilent4287  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Rated Current                      |   |                          |           |                           | Agilent16192   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
|                                    |   |                          |           |                           | Agilent 4338   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Temperature Rise Test              | Rated Current < 1A ΔT 20°CMax<br>Rated Current ≥ 1A ΔT 40°CMax  |                          |           |                           | 1. Applied the allowed DC current.<br>2. Temperature measured by digital surface thermometer.  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Life test                          | Appearance: no damage.<br><br>Impedance: within±15%of initial value.<br>Inductance: within±10%of initial value.<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value |                          |           |                           | Preconditioning: Run through IR reflow for 2 times.( IPC/JEDEC J-STD-020D Classification Reflow Profiles)<br>Temperature: 105±2°C<br>Applied current: rated current.<br>Duration: 1000±12hrs.<br>Measured at room temperature after placing for 24±2 hrs.  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Load Humidity                      | RDC : within ±15% of initial value and shall not exceed the specification value   |                          |           |                           | Preconditioning: Run through IR reflow for 2 times.( IPC/JEDEC J-STD-020D Classification Reflow Profiles)<br>Humidity: 85±2%R.H.<br>Temperature: 85±2°C.<br>Duration: 1000hrs Min. with 100% rated current.<br>Measured at room temperature after placing for 24±2 hrs.  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Thermal shock                      | Appearance: no damage.<br><br>Impedance: within±15%of initial value.<br>Inductance: within±10%of initial value.<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value |                          |           |                           | Preconditioning: Run through IR reflow for 2 times.( IPC/JEDEC J-STD-020D Classification Reflow Profiles)<br>Condition for 1 cycle<br>Step1: -40±2°C 30±5 min.<br>Step2: 25±2°C ≤0.5min<br>Step3: +105±2°C 30±5min.<br>Number of cycles: 500<br>Measured at room temperature after placing for 24±2 hrs.   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Vibration                          | Appearance : No damage.<br>Impedance : within±15% of initial value<br>Inductance : within±10% of initial value<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value  |                          |           |                           | Preconditioning: Run through IR reflow for 2 times.( IPC/JEDEC J-STD-020D Classification Reflow Profiles)<br>Oscillation Frequency: 10 ~ 2K ~ 10Hz for 20 minutes<br>Equipment : Vibration checker<br>Total Amplitude:1.52mm±10%<br>Testing Time : 12 hours(20 minutes, 12 cycles each of 3 orientations) °  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Bending                            | Appearance : No damage.<br>Impedance : within±10% of initial value<br>Inductance : within±10% of initial value<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value  |                          |           |                           | Shall be mounted on a FR4 substrate of the following dimensions:<br>>=0805inch(2012mm):40x100x1.2mm<br><0805inch(2012mm):40x100x0.8mm<br>Bending depth:<br>>=0805inch(2012mm):1.2mm<br><0805inch(2012mm):0.8mm<br>Duration of 10 sec for a min.  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Shock                              | Appearance : No damage.<br>Impedance : within±10% of initial value<br>Inductance : within±10% of initial value<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value  |                          |           |                           | Test condition:<br><table border="1"> <thead> <tr> <th>Type</th> <th>Peak Value (g's)</th> <th>Normal duration (D) (ms)</th> <th>Wave form</th> <th>Velocity change (V)ft/sec</th> </tr> </thead> <tbody> <tr> <td>SMD</td> <td>50</td> <td>11</td> <td>Half-sine</td> <td>11.3</td> </tr> <tr> <td>Lead</td> <td>50</td> <td>11</td> <td>Half-sine</td> <td>11.3</td> </tr> </tbody> </table> | Type | Peak Value (g's) | Normal duration (D) (ms) | Wave form | Velocity change (V)ft/sec | SMD | 50 | 11 | Half-sine | 11.3 | Lead | 50 | 11 | Half-sine | 11.3 |
| Type                               | Peak Value (g's)  | Normal duration (D) (ms) | Wave form | Velocity change (V)ft/sec |  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| SMD                                | 50  | 11                       | Half-sine | 11.3                      |  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Lead                               | 50  | 11                       | Half-sine | 11.3                      |  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Insulation Resistance              | IR>1GΩ  |                          |           |                           | Chip Inductor Only<br>Test Voltage:100±10%V for 30Sec.   |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |
| Solderability                      | More than 95% of the terminal electrode should be covered with solder.  |                          |           |                           | Preheat: 150°C,60sec.<br>Solder: Sn96.5%-Ag3%-Cu0.5%<br>Solder temperature: 245±5°C<br>Flux for lead free: Rosin. 9.5%<br>Depth: completely cover the termination.<br>Dip time: 4±1sec.  |      |                  |                          |           |                           |     |    |    |           |      |      |    |    |           |      |

| Item                            | Performance  | Test Condition  |                  |  |  |                      |       |                |
|---------------------------------|--|---|------------------|--|--|----------------------|-------|----------------|
| Resistance to Soldering<br>Heat | Appearance : No damage.<br>Impedance : within±15% of initial value<br>Inductance : within±10% of initial value<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value | Number of heat cycles: 1<br><table border="1"> <thead> <tr> <th>Temperature (°C)</th> <th>Time (s)</th> <th>Temperature ramp/immersion and emersion rate</th> </tr> </thead> <tbody> <tr> <td>260 ±5 (solder temp)</td> <td>10 ±1</td> <td>25mm/s ±6 mm/s</td> </tr> </tbody> </table> Depth: completely cover the termination  | Temperature (°C) | Time (s)                                     | Temperature ramp/immersion and emersion rate | 260 ±5 (solder temp) | 10 ±1 | 25mm/s ±6 mm/s |
|                                 |  | Temperature (°C)  | Time (s)         | Temperature ramp/immersion and emersion rate |  |                      |       |                |
| 260 ±5 (solder temp)            | 10 ±1  | 25mm/s ±6 mm/s  |                  |  |  |                      |       |                |
| Terminal strength               | Appearance : No damage.<br>Impedance : within±15% of initial value<br>Inductance : within±10% of initial value<br>Q : Shall not exceed the specification value.<br>RDC : within ±15% of initial value and shall not exceed the specification value | Preconditioning: Run through IR reflow for 2 times.( IPC/JEDEC J-STD-020D Classification Reflow Profiles)<br>Component mounted on a PCB apply a force >0805inch(2012mm):1kg <=0805inch(2012mm):0.5kg to the side of a device being tested. This force shall be applied for 60 +1 seconds. Also the force shall be applied gradually as not to shock the component being tested. |                  |  |  |                      |       |                |



**\*\*Derating Curve**

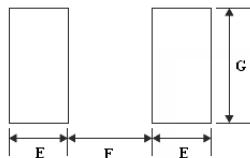
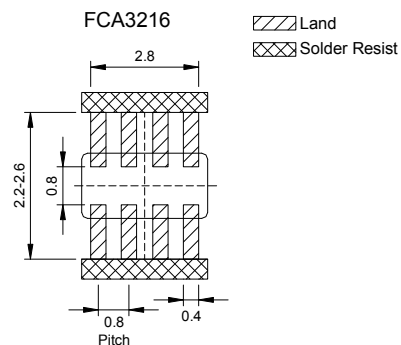
For the ferrite chip bead which withstanding current over 1.5A, as the operating temperature over 85°C, the derating current information is necessary to consider with. For the detail derating of current, please refer to the Derated Current vs. Operating Temperature curve.



**6.Soldering and Mounting**

**6-1. Recommended PC Board Pattern**

| Series | Type | Chip Size |           |           |           | Land Patterns For Reflow Soldering |       |       |
|--------|------|-----------|-----------|-----------|-----------|------------------------------------|-------|-------|
|        |      | A(mm)     | B(mm)     | C(mm)     | D(mm)     | E(mm)                              | F(mm) | G(mm) |
| FCB    | 0603 | 0.6±0.03  | 0.30±0.03 | 0.30±0.03 | 0.15±0.05 | 0.35                               | 0.30  | 0.40  |
|        | 1005 | 1.0±0.10  | 0.50±0.10 | 0.50±0.10 | 0.25±0.10 | 0.50                               | 0.40  | 0.60  |
| FCM    | 1608 | 1.6±0.15  | 0.80±0.15 | 0.80±0.15 | 0.30±0.20 | 0.80                               | 0.85  | 0.95  |
| HCB    | 2012 | 2.0±0.20  | 1.25±0.20 | 0.85±0.20 | 0.50±0.30 | 1.05                               | 1.00  | 1.45  |
| GHB    |      | 2.0±0.20  | 1.25±0.20 | 1.25±0.20 | 0.50±0.30 |                                    |       |       |
| FCI    | 3216 | 3.2±0.20  | 1.60±0.20 | 1.10±0.20 | 0.50±0.30 | 1.05                               | 2.20  | 1.80  |
| FHI    | 3225 | 3.2±0.20  | 2.50±0.20 | 1.30±0.20 | 0.50±0.30 | 1.05                               | 2.20  | 2.70  |
| FCH    | 4516 | 4.5±0.20  | 1.60±0.20 | 1.60±0.20 | 0.50±0.30 | 1.05                               | 3.30  | 1.80  |
| HCI    | 4532 | 4.5±0.20  | 3.20±0.20 | 1.50±0.20 | 0.50±0.30 | 1.05                               | 3.30  | 3.40  |



PC board should be designed so that products can prevent damage from mechanical stress when warping the board.

**6-2. Soldering**

Mildly activated rosin fluxes are preferred. The terminations are suitable for re-flow soldering systems. If hand soldering cannot be avoided, the preferred technique is the utilization of hot air soldering tools.

Note.

If wave soldering is used ,there will be some risk.

Re-flow soldering temperatures below 240 degrees, there will be non-wetting risk

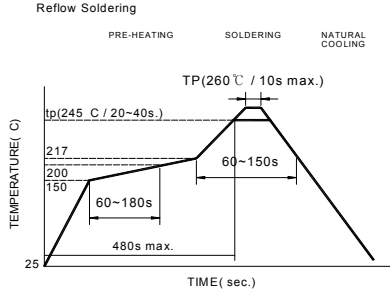
**6-2.1 Lead Free Solder re-flow:**

Recommended temperature profiles for lead free re-flow soldering in Figure 1. (Referred to J-STD-020C)

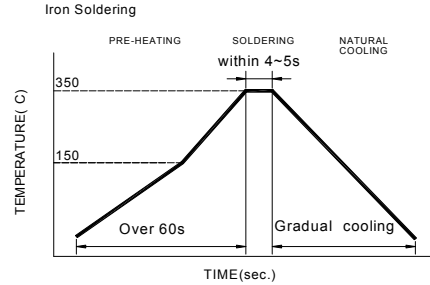
**6-2.2 Soldering Iron:**

Products attachment with a soldering iron is discouraged due to the inherent process control limitations. If a soldering iron must be employed the following precautions are recommended. for Iron Soldering in Figure 2.

- Preheat circuit and products to 150°C
- Never contact the ceramic with the iron tip
- Use a 20 watt soldering iron with tip diameter of 1.0mm
- 350°C tip temperature (max)
- 1.0mm tip diameter (max)
- Limit soldering time to 4-5sec.



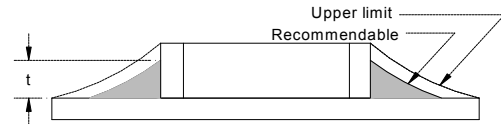
Reflow times: 3 times max  
Fig.1



Iron Soldering times : 1 times max  
Fig.2

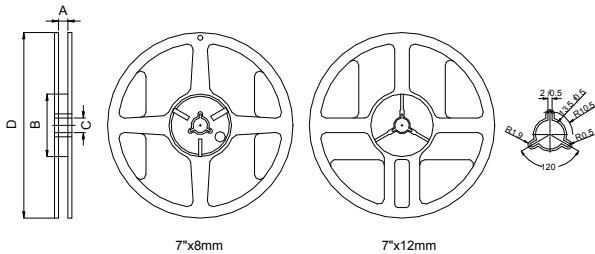
**6-2.3 Solder Volume:**

Accordingly increasing the solder volume, the mechanical stress to product is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance. Solder shall be used not to be exceed as shown in right side:  
Minimum fillet height = soldering thickness + 25% product height



**7.Packaging Information**

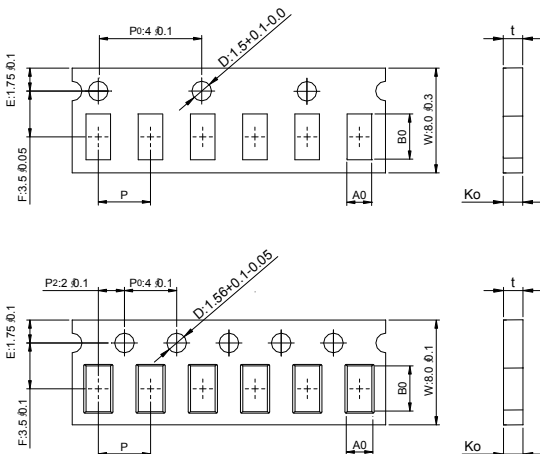
**7-1. Reel Dimension**



| Type    | A(mm)    | B(mm) | C(mm)    | D(mm) |
|---------|----------|-------|----------|-------|
| 7"x8mm  | 9.0±0.5  | 60±2  | 13.5±0.5 | 178±2 |
| 7"x12mm | 13.5±0.5 | 60±2  | 13.5±0.5 | 178±2 |

**7-2.1 Tape Dimension / 8mm**

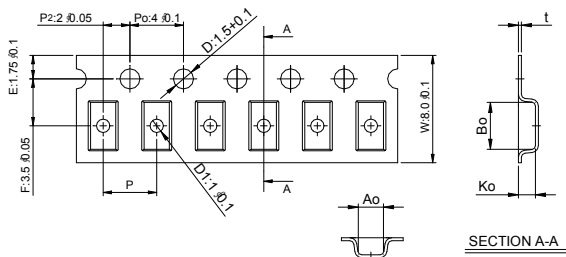
Material of taping is paper



| Size   | Bo(mm)    | Ao(mm)    | Ko(mm)    | P(mm)    | t(mm)     |
|--------|-----------|-----------|-----------|----------|-----------|
| 060303 | 0.70±0.06 | 0.40±0.06 | 0.45max   | 2.0±0.05 | 0.45max   |
| 100505 | 1.12±0.03 | 0.62±0.03 | 0.60±0.03 | 2.0±0.05 | 0.60±0.03 |

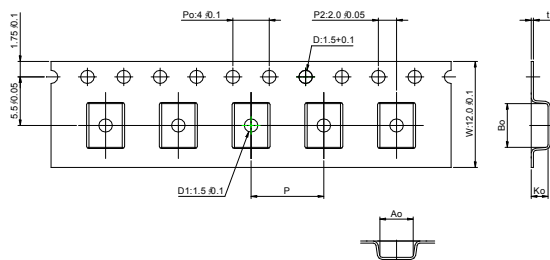
| Size   | Bo(mm)    | Ao(mm)          | Ko(mm)    | P(mm)    | t(mm)     |
|--------|-----------|-----------------|-----------|----------|-----------|
| 160808 | 1.80±0.05 | 0.96+0.05/-0.03 | 0.95±0.05 | 4.0±0.10 | 0.95±0.05 |
| 201209 | 2.10±0.05 | 1.30±0.05       | 0.95±0.05 | 4.0±0.10 | 0.95±0.05 |

Material of taping is plastic



| Size   | Bo(mm)    | Ao(mm)    | Ko(mm)    | P(mm)    | t(mm)     | D1(mm)   |
|--------|-----------|-----------|-----------|----------|-----------|----------|
| 201212 | 2.10±0.10 | 1.28±0.10 | 1.28±0.10 | 4.0±0.10 | 0.22±0.05 | 1.0±0.10 |
| 321611 | 3.35±0.10 | 1.75±0.10 | 1.25±0.10 | 4.0±0.10 | 0.23±0.05 | 1.0±0.10 |
| 322513 | 3.42±0.10 | 2.77±0.10 | 1.55±0.10 | 4.0±0.10 | 0.22±0.05 | 1.0±0.10 |
| 321609 | 3.40±0.10 | 1.77±0.10 | 1.04±0.10 | 4.0±0.10 | 0.22±0.05 | 1.0±0.10 |

7-2.2 Tape Dimension / 12mm

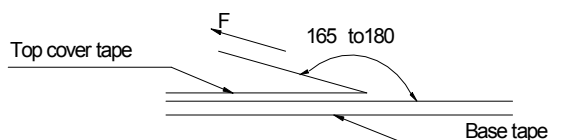


| Size   | Bo(mm)    | Ao(mm)    | Ko(mm)    | P(mm)    | t(mm)     | D1(mm)   |
|--------|-----------|-----------|-----------|----------|-----------|----------|
| 451616 | 4.70±0.10 | 1.75±0.10 | 1.75±0.10 | 4.0±0.10 | 0.24±0.05 | 1.5±0.10 |
| 453215 | 4.70±0.10 | 3.45±0.10 | 1.60±0.10 | 8.0±0.10 | 0.24±0.05 | 1.5±0.10 |

7-3. Packaging Quantity

| Chip Size   | 453215 | 451616 | 322513 | 321611 | 321609 | 201212 | 201209 | 160808 | 100505 | 060303 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Chip / Reel | 1000   | 2000   | 2500   | 3000   | 3000   | 2000   | 4000   | 4000   | 10000  | 15000  |
| Inner box   | 4000   | 8000   | 12500  | 15000  | 15000  | 10000  | 20000  | 20000  | 50000  | 75000  |
| Middle box  | 20000  | 40000  | 62500  | 75000  | 75000  | 50000  | 100000 | 100000 | 250000 | 375000 |
| Carton      | 40000  | 80000  | 125000 | 150000 | 150000 | 100000 | 200000 | 200000 | 500000 | 750000 |

7-4. Tearing Off Force



The force for tearing off cover tape is 15 to 60 grams in the arrow direction under the following conditions.

| Room Temp. (°C) | Room Humidity (%) | Room atm (hPa) | Tearing Speed mm/min |
|-----------------|-------------------|----------------|----------------------|
| 5~35            | 45~85             | 860~1060       | 300                  |

Application Notice

- Storage Conditions(component level)
  - To maintain the solder ability of terminal electrodes:
    1. TAI-TECH products meet IPC/JEDEC J-STD-020D standard-MSL, level 1.
    2. Temperature and humidity conditions: Less than 40°C and 60% RH.
    3. Recommended products should be used within 12 months from the time of delivery.
    4. The packaging material should be kept where no chlorine or sulfur exists in the air.
- Transportation
  1. Products should be handled with care to avoid damage or contamination from perspiration and skin oils.
  2. The use of tweezers or vacuum pick up is strongly recommended for individual components.
  3. Bulk handling should ensure that abrasion and mechanical shock are minimized.

**Q vs Frequency,DC Bias Characteristics(Typical)**

