

## Ferrite Chip Inductor(Lead Free)

FCI1608F-Series

## ECN HISTORY LIST

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 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: (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
備 註					

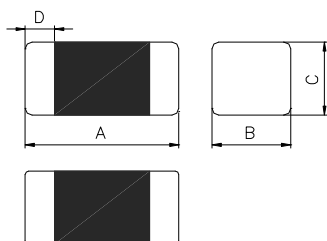
# Ferrite Chip Inductor(Lead Free) FCI1608F-Series

## 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.



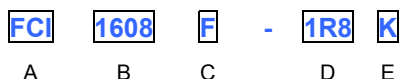
## 2. Dimensions



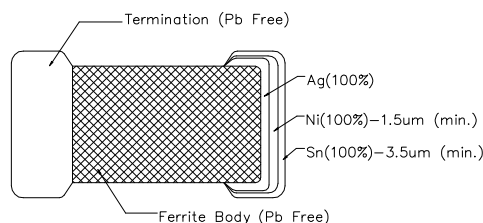
Chip Size		
<b>A</b>	1.60±0.15	1.80±0.15
<b>B</b>	0.80±0.15	
<b>C</b>	0.80±0.15	
<b>D</b>	0.30±0.20	

Units: mm

## 3. Part Numbering



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



## 4.Specification

Tai-Tech Part Number	Inductance(uH)		Q		Rated Current (mA) max.	DCR (Ω) max.	SRF (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 Part Number	Inductance( $\mu$ H)		Q		Rated Current (mA) max.	DCR ( $\Omega$ ) max.	SRF (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

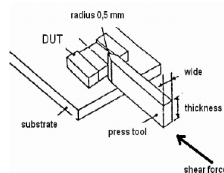
NOTE: □:TOLERANCE K=±10%,L=±15%,M=±20%  
(1608T) Dimension A=1.8±0.15mm

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

## 5. Reliability and Test Condition

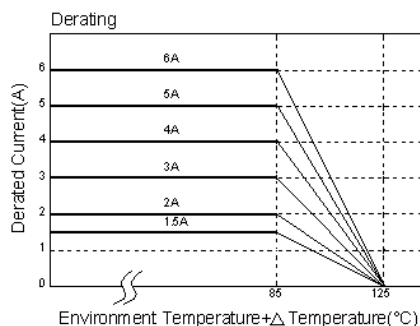
Item	Performance				Test Condition															
Series No.	FCI	FHI	FCH	HCI	--															
Operating Temperature	-40~+105℃ (Including self-temperature rise)				--															
Transportation Storage Temperature	-40~+105℃ (on board)				For long storage conditions, please see the Application Notice															
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℃Max Rated Current ≧ 1A ΔT 40℃Max				1. Applied the allowed DC current. 2. Temperature measured by digital surface thermometer.															
Life test	Appearance: no damage.  Impedance: within±15%of initial value. Inductance: within±10%of initial value. Q : Shall not exceed the specification value. 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) Temperature: 105±2℃ Applied current: rated current. Duration: 1000±12hrs. 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) Humidity: 85±2%R.H. Temperature: 85±2℃. Duration: 1000hrs Min. with 100% rated current. Measured at room temperature after placing for 24±2 hrs.															
Thermal shock	Appearance: no damage.  Impedance: within±15%of initial value. Inductance: within±10%of initial value. Q : Shall not exceed the specification value. 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) Condition for 1 cycle Step1: -40±2℃ 30±5 min. Step2: 25±2℃ ≦0.5min Step3: +105±2℃ 30±5min. Number of cycles: 500 Measured at room temperature after placing for 24±2 hrs.															
Vibration	Appearance : No damage. Impedance : within±15% of initial value Inductance : within±10% of initial value Q : Shall not exceed the specification value. 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) Oscillation Frequency: 10 ~ 2K ~ 10Hz for 20 minutes Equipment : Vibration checker Total Amplitude:1.52mm±10% Testing Time : 12 hours(20 minutes, 12 cycles each of 3 orientations) °															
Bending	Appearance : No damage. Impedance : within±10% of initial value Inductance : within±10% of initial value Q : Shall not exceed the specification value. RDC : within ±15% of initial value and shall not exceed the specification value				Shall be mounted on a FR4 substrate of the following dimensions: >=0805inch(2012mm):40x100x1.2mm <0805inch(2012mm):40x100x0.8mm Bending depth: >=0805inch(2012mm):1.2mm <0805inch(2012mm):0.8mm Duration of 10 sec for a min.															
Shock	Appearance : No damage. Impedance : within±10% of initial value Inductance : within±10% of initial value Q : Shall not exceed the specification value. RDC : within ±15% of initial value and shall not exceed the specification value				Test condition: <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 Test Voltage:100±10%V for 30Sec.															
Solderability	More than 95% of the terminal electrode should be covered with solder.				Preheat: 150℃,60sec. Solder: Sn96.5%-Ag3%-Cu0.5% Solder temperature: 245±5℃ Flux for lead free: Rosin. 9.5% Depth: completely cover the termination. Dip time: 4±1sec.															

Item	Performance	Test Condition						
Resistance to Soldering Heat	Appearance : No damage. Impedance : within±15% of initial value Inductance : within±10% of initial value Q : Shall not exceed the specification value. RDC : within ±15% of initial value and shall not exceed the specification value	Number of heat cycles: 1 <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. Impedance : within±15% of initial value Inductance : within±10% of initial value Q : Shall not exceed the specification value. 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) 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**

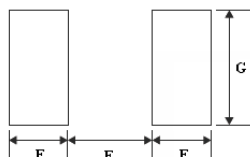
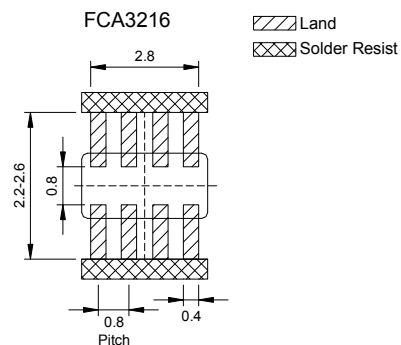
For the ferrite chip bead which withstanding current over 1.5A, as the operating temperature over 85°C, the derating current information is necessary to consider with. For the detail derating of current, please refer to the Derated Current vs. Operating Temperature curve.



**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

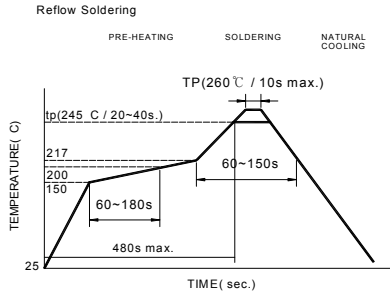
**6-2.1 Lead Free Solder re-flow:**

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

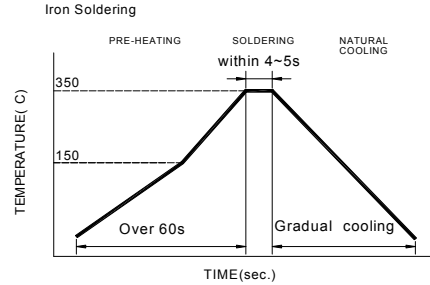
**6-2.2 Soldering Iron:**

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.



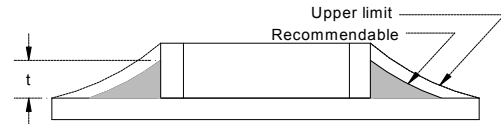
Reflow times: 3 times max  
Fig.1



Iron Soldering times : 1 times max  
Fig.2

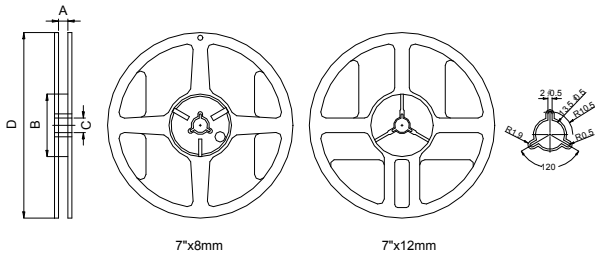
**6-2.3 Solder Volume:**

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**

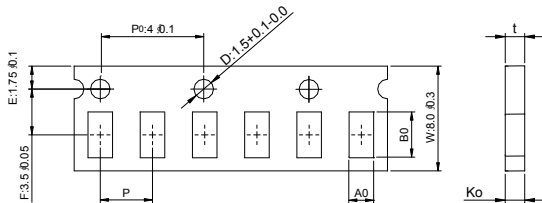
**7-1. Reel Dimension**



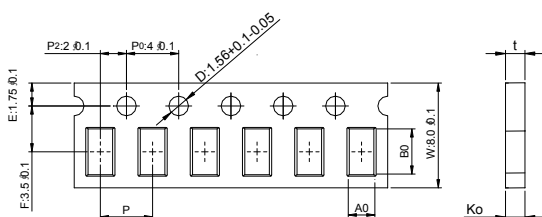
Type	A(mm)	B(mm)	C(mm)	D(mm)
7"x8mm	9.0±0.5	60±2	13.5±0.5	178±2
7"x12mm	13.5±0.5	60±2	13.5±0.5	178±2

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

■Material of taping is paper

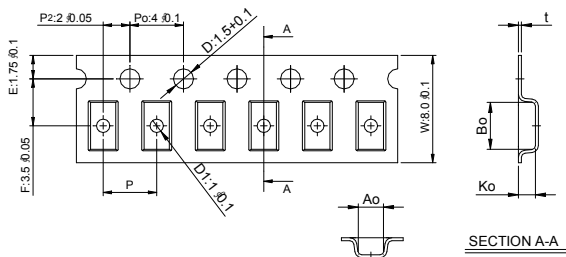


Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)
060303	0.70±0.06	0.40±0.06	0.45max	2.0±0.05	0.45max
100505	1.12±0.03	0.62±0.03	0.60±0.03	2.0±0.05	0.60±0.03



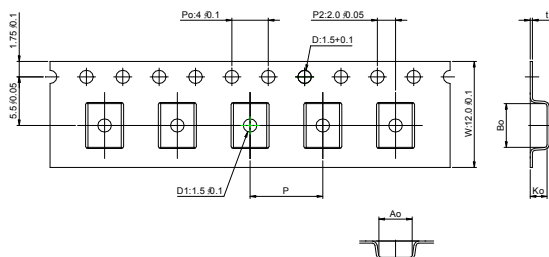
Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)
160808	1.80±0.05	0.96+0.05/-0.03	0.95±0.05	4.0±0.10	0.95±0.05
201209	2.10±0.05	1.30±0.05	0.95±0.05	4.0±0.10	0.95±0.05

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

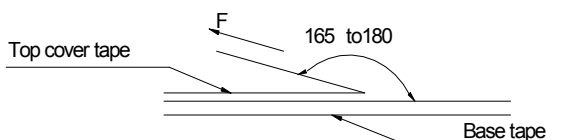


Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)	D1(mm)
451616	4.70±0.10	1.75±0.10	1.75±0.10	4.0±0.10	0.24±0.05	1.5±0.10
453215	4.70±0.10	3.45±0.10	1.60±0.10	8.0±0.10	0.24±0.05	1.5±0.10

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)**

