富麗磁元
FERRITE CORES

DOCUMENT: T00161-2-0000-KBM01-231200498

Specification for Approval

Date: 2024/01/11

Customer : Valeo

TAI-TECH P/N:HCB3216KV-500T40

CUSTOMER P/N:

DESCRIPTION:

SAMPLE QUANTITY: 10 PCS

REMARK:		
Customer Approval Feedback		

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APPROVED	CHECKED
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High Current Ferrite Chip Bead(Lead Free) HCB3216KV-500T40

ECN HISTORY LIST

REV	DATE	DESCRIPTION	APPROVED	CHECKED	DRAWN
1.0	14/01/24	Change the thickness of tin plating layer 3.0um min.=>3.5um min.	Mike Yang	Pei Jun Lo	Alin Zhang
2.0	14/08/01	Change the reflow diagram.	Mike Yang	Pei Jun Lo	Alin Zhang
2.1	14/08/01	Revise packing tape size.	Mike Yang	Pei Jun Lo	Alin Zhang
3.0	16/01/26	Revised the reliability temperature as listed, and make corresponding adjustments to the operating temperature. 1.High Temperature Exposure(Storage) 2.High Temperature Operational Life 3.Thermal Shock 4.Temperature Cycling	Mike Yang	Pei Jun Lo	Alin Zhang
4.0	17/02/16	Revised recommended PC Board Pattern.	Mike Yang	Pei Jun Lo	Alin Zhang
5.0	20/08/01	Revised reflow and according to IPC EDEC J-STD-020E.	FS Deng	Robin Pu	Jessie Wang
6.0	22/12/05	Update the reliability and correct the reflow description.	FS Deng	Robin Pu	Jessie Wang
7.0	23/12/01	Comprehensively revise the reliability to REV E version.	FS Deng	Robin Pu	Jessie Wang
8.0	24/01/11	1. Add Anti-static packaging. 2. Add IDC(A) current data.	FS Deng	Robin Pu	Jessie Wang
Remark					

High Current Ferrite Chip Bead(Lead Free) HCB3216KV-500T40

1.Features

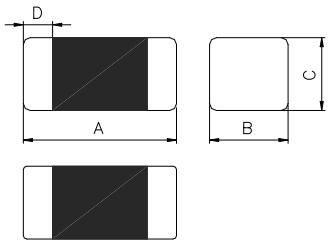
AEC-Q200

Halogen-free

RoHS

1. Monolithic inorganic material construction.
2. Closed magnetic circuit to avoids crosstalk.
3. Suitable for reflow soldering.
4. Shapes and dimensions follow E.I.A. spec.
5. Available in various sizes.
6. Excellent solder ability and heat resistance.
7. High reliability. Reliability test complied with AEC-Q200.
8. 100% Lead (Pb) & Halogen-Free and RoHS compliant.
9. Low DC resistance structure of electrode to prevent wasteful electric power consumption.
10. Operating Temperature: -55~+150℃(Including self-temperature rise).

2.Dimensions



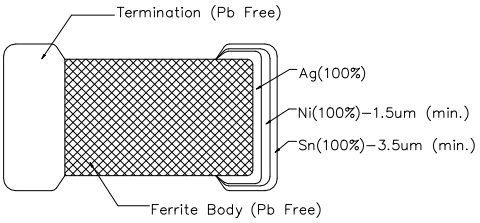
Chip Size	
A	3.20±0.20
B	1.60±0.20
C	1.10±0.20
D	0.50±0.30

Units: mm

3.Part Numbering

HCB	3216	K	V	-	500	T	40
A	B	C	D		E	F	G

A: Series
B: Dimension — L x W
C: Material — Lead Free Material
D: Category Code — V=Vehicle
E: Impedance F: — 500=50Ω
Packaging — T=Taping and Reel, B=Bulk(Bags)
G: Rated Current — 40=4000mA
Anti-static packaging

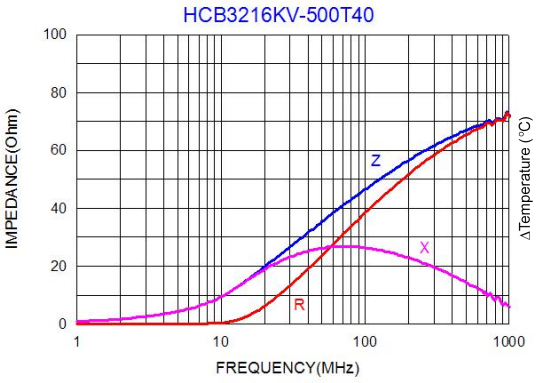


4.Specification

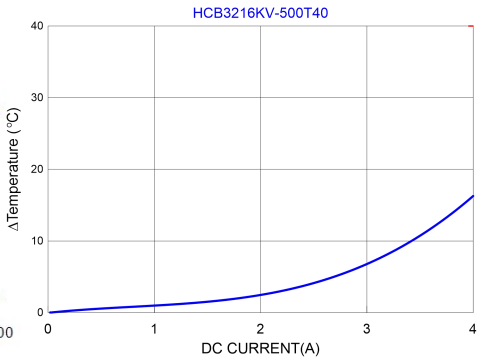
Tai-Tech Part Number	Impedance (Ω)	Test Frequency (Hz)	DC Resistance (Ω) max.	Rated Current (mA) max.
HCB3216KV-500T40	50±25%	60mV/100M	0.03	4000

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

■ Impedance-Frequency Characteristics



■ Temperature Characteristics



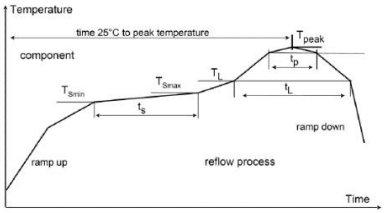
IDC(A)	CORE TEMP (℃)	△T (℃)
0.0	**24.6**	**0.0**
1.0	**25.5**	**0.9**
2.0	**27.2**	**2.6**
3.0	**31.3**	**6.7**
4.0	**40.9**	**16.3**

5. Reliability and Test Condition

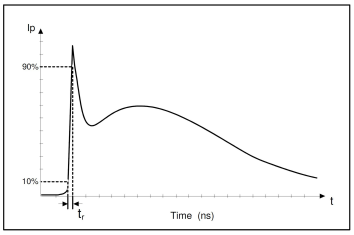
Item	Performance			Test Condition
Series No.	FCB	FCM	HCB	--
Operating Temperature	-55~+150℃ (Including self-temperature rise).			--
Transportation Storage Temperature	-55~+150℃ (on board).			For long storage conditions, please see the application notice.
Impedance (Z)	Refer to spec. electrical characteristics list.			Agilent4291. Agilent E4991. Agilent4287. Agilent16192.
DC Resistance				Agilent 4338.
Rated Current				DC Power Supply.
Temperature Rise Test	Rated Current ΔT 40℃Max.			1. Applied the allowed DC current. 2. Temperature measured by digital surface thermometer.
High Temperature Exposure(Storage)	Appearance：no damage. Impedance：within±15% of initial value RDC：within ±15% of initial value and shall not exceed the specification value.			Preconditioning: run through reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles). Unpowered Temperature：150±2℃. Upper Temperature: maximum specified operating Temperature or maximum specified storage Temperature (whichever is higher). Minimum test temperature shall be 85℃ (For ferrite EMI suppressors/filters only) Duration：1000hrs min. Measured at room temperature after placing for 24±4 hrs.
Temperature Cycling				Preconditioning: run through reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles) Unpowered Lower Temperature of the Chamber： -40℃(for Inductors/transformers). -55℃(for ferrite EMI suppressors/filters). Upper Temperature of the Chamber: maximum Specified operating temperature (temperature and shall not exceed 125℃) Condition for 1 cycle Step1：-55±2℃ 30min min. Step2：150±2℃ transition time 1min max. Step3：150±2℃ 30min min. Step4：Dwell time (Soak Time) 15 minutes minimum, 30 minutes minimum if component weighs above 28g. Transition Time: 1 minute maximum. Number of cycles： 1000 Measured at room temperature at least 24 hours after test conclusion.
Destructive Physical Analysis	According to design guide standards.			For ferrite EMI suppressors/filters only. Pre and post electrical test not required.
Humidity Bias	Appearance：no damage. Impedance：within±15% of initial value. RDC：within ±15% of initial value and shall not exceed the specification value.			Preconditioning: run through reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles.) Unpowered(for Inductors/transformers) Apply 10% of maximum rated power.(for ferrite EMI suppressors/filters). Humidity :85±3%RH. Temperature :85±2℃. Duration :1000 hrs Min. Measured at room temperature after placing for 24±4 hrs.

<table>
<tr><th>Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>High Temperature Operational Life</td><td>Appearance：no damage.
Impedance：within±15% of initial value.
RDC：within ±15% of initial value and shall not exceed the specification value.</td><td>Preconditioning: run through reflow for 3 times.
(IPC/JEDEC J-STD-020E reflow profiles).
Temperature：150±2℃
Upper temperature of the chamber: maximum specified operating temperature (not including heat rise) at maximum rated power and shall not exceed 125℃.
(for inductors/transformers).
Temperature of the Chamber: maximum specified operating temperature up to 150℃. (for ferrite EMI suppressors/filters).
Duration：1000hrs min. with 100% rated current.
Measured at room temperature after placing for 24±4 hrs.
Rated I_L applied.(for ferrite EMI suppressors/filters)</td></tr>
<tr><td>External Visual</td><td>Appearance：no damage.</td><td>Inspect device construction, marking and workmanship.
Pre and post electrical test not required.</td></tr>
<tr><td>Physical Dimension</td><td>According to the product specification size measurement.</td><td>Verify physical dimensions to specification.
Pre and Post Electrical Test not required.</td></tr>
<tr><td>Terminal Strength (for axial and radial THT components) (THT: Through Hole Technology)</td><td rowspan="4">Appearance：no damage.
Impedance：within±15% of initial value.
RDC：within ±15% of initial value and shall not exceed the specification value.</td><td>Test THT component lead integrity only.
Test Condition A (pull test)
<table><tr><th>Nominal cross- sectional area (mm^2)</th><th>Force (N)</th></tr><tr><td>≤ 0.05</td><td>1</td></tr><tr><td>0.06 to 0.10</td><td>2.5</td></tr><tr><td>0.11 to 0.20</td><td>5</td></tr><tr><td>0.21 to 0.50</td><td>10</td></tr><tr><td>0.51 to 1.20</td><td>20</td></tr><tr><td>> 1.20</td><td>40</td></tr></table>Test Condition C (wire-lead bend test)
<table><tr><th>Section Modulus (Z_X) (mm^3)</th><th>Force (N)</th></tr><tr><td>≤ $1.5x10^{-3}$</td><td>0.5</td></tr><tr><td>$1.6x10^{-3}$ to $4.2x10^{-3}$</td><td>1.25</td></tr><tr><td>$4.3x10^{-3}$ to $1.2x10^{-2}$</td><td>2.5</td></tr><tr><td>$1.3x10^{-2}$ to $0.5x10^{-1}$</td><td>5</td></tr><tr><td>$0.6x10^{-1}$ to $1.9x10^{-1}$</td><td>10</td></tr><tr><td>> $1.9x10^{-1}$</td><td>20</td></tr></table>For round terminations: ZX = (πd3)/32 where d is the lead diameter.
For strip terminations: ZX = (ba2)/6 where a is the thickness of the rectangular strip perpendicular to the bending axis, b is the other dimension of the rectangular strip.</td></tr>
<tr><td>Resistance to Solvents</td><td>Add an aqueous wash chemical and follow chemical manufacturer's recommended parameters (i.e. solution temperature and immersion time).
Applicable to ink marked components and not laser marked components.</td></tr>
<tr><td>Mechanical Shock</td><td>Preconditioning: run through reflow for 3 times
(IPC/JEDEC J-STD-020E Classification Reflow profiles.)
Test condition:
<table><tr><th>Type</th><th>Peak alue (g's)</th><th>Normal duration (D) (ms)</th><th>Wave form</th><th>Velocity change (Vi)ft/sec</th></tr><tr><td>SMD</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr><tr><td>THT</td><td>100</td><td>6</td><td>Half-sine</td><td>12.3</td></tr></table>3 shocks in each direction along 3 perpendicular axes (18shocks).</td></tr>
<tr><td>Vibration</td><td>Preconditioning: run through reflow for 3 times.
(IPC/JEDEC J-STD-020E Classification Reflow profiles.)
Oscillation Frequency: 10Hz ~ 2KHz ~ 10Hz for 20 minute.
Equipment：vibration checker.
Total Amplitude:5g.
Testing Time：12 hours(20 minutes, 12 cycles each of 3 orientations).</td></tr>
</table>

<table>
<tr><th>Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>Resistance to Soldering Heat</td><td>Appearance：no damage.
Impedance：within±15% of initial value.
RDC：within ±15% of initial value and shall not exceed the specification value.</td><td>Test condition ：
THT: Conditions B or C
Number of heat cycles: 1
<table>
<tr><th>Solder technique simulation</th><th>Test condition</th><th>Temperature (°C)</th><th>Time (s)</th><th>Temperature ramp/immersion and emersion rate</th></tr>
<tr><td>Dip</td><td>B</td><td>260 ±5 (solder temp)</td><td>10±1</td><td>25mm/s±6mm /s</td></tr>
<tr><td>Wave: topside board-mount product</td><td>C</td><td>260 ±5 (solder temp)</td><td>20±1</td><td></td></tr>
</table>
Depth: completely cover the termination.

SMD: condition K, time above 217℃, 60s －150s · number of heat cycles:3.


Continental

Table 1: Minimum requirements for lead-free soldering
*peak temperature is measured on the centre top of the component package
** tp measured @ Tpeak-5°C</td></tr>
<tr><td>ESD</td><td>Appearance：no damage.
Impedance：within±15% of initial value
RDC：within ±15% of initial value and shall not exceed the specification value</td><td>Direct contact and air discharge :
passive component HBM ESD.
Discharge Waveform to a Coaxial Target
Test method: AEC-Q200-002
Test mode：Contact Discharge
Discharge level：4 KV (Level: 2)

</td></tr>
<tr><td>Solder ability</td><td>More than 95% of the terminal electrode should be covered with solder.</td><td>▪ Through-hole Technology (THT)
Method A1, Coating Durability Category 2
▪ SMD:
Method B1, Coating Durability Category 2
Method D, Coating Durability Category 2
▪ Magnification 50x
▪ Pre and Post Electrical Test not required.
▪ Non-soldered type mounting/attach are not applicable.
<table>
<tr><td>Reference</td><td>Method A1</td><td>Method B1</td><td>Method D</td></tr>
<tr><td>Soldering process</td><td>Reflow soldering</td><td>Reflow soldering of other components</td><td>Lead-free soldering</td></tr>
<tr><td>Soldering type</td><td>Tin silver copper solder</td><td>tin silver copper solder</td><td>tin silver copper solder</td></tr>
<tr><td>Flux soaking time</td><td>5-10s</td><td>5-10s</td><td>5-10s</td></tr>
<tr><td>Dipping furnace angle</td><td>20˚~45˚</td><td>20˚~45˚</td><td>20˚~45˚</td></tr>
<tr><td>Solder temperature</td><td>245 ±5°C</td><td>245 ±5°C</td><td>260 ±5°C</td></tr>
<tr><td>Immersion time</td><td>5+0/-0.5s</td><td>5+0/-0.5s</td><td>30+5/-0s</td></tr>
<tr><td>Dip and lift speed</td><td>25 ±6mm/s</td><td>25 ±6mm/s</td><td>25 ±6mm/s</td></tr>
</table></td></tr>
</table>

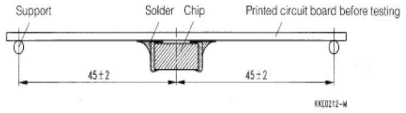
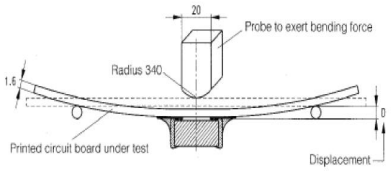
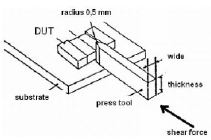
<table>
<tr><th>Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>Electrical Characterization</td><td>Refer to specification for approval.</td><td>Parametrically test sample size per lot.
(Inductance only).
Summary to show data of minimum, maximum, mean and standard deviation at room, minimum and maximum operating temperatures.
Pre and post electrical test not required.</td></tr>
<tr><td>Flammability</td><td>In accordance with referenced standards.</td><td>UL-94 or IEC 60695-11-5</td></tr>
<tr><td>Board Flex
(SMD)</td><td>Appearance：no damage.
Impedance：within±15% of initial value.
RDC：within ±15% of initial value and shall not exceed the specification value.
 
  </td><td>Preconditioning: run through reflow for 3 times.
(IPC/JEDEC J-STD-020E Classification Reflow Profiles).
Place the 100mm X 40mm board into a fixture similar to the one shown in below figure with the component facing down. The apparatus shall consist of mechanical way to apply a force which will bend the board (D) x = 2 mm minimum. The duration of the applied forces shall be 60 (+ 5) sec. The force is to be applied only once to the board.</td></tr>
<tr><td>Terminal strength
(SMD)</td><td>Appearance：no damage.
Impedance：within±15% of initial value.
RDC：within ±15% of initial value and shall not exceed the specification value.
  </td><td>Preconditioning: run through reflow for 3 times.
(IPC/JEDEC J-STD-020E Classification Reflow Profiles).
With the component mounted on a PCB with the device to be tested, apply a 17.7 N (1.8 Kg) force to the side of the device being tested. This force shall be applied for 60 +1 seconds. Also the force shall be applied gradually as not to apply a shock to the component being tested.</td></tr>
<tr><td>Electrical Transient Conduction</td><td>Method: AEC-Q200-002
Test mode：contact discharge
Discharge level：4 KV (Level: 2)

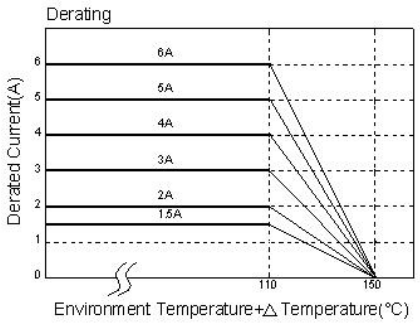
Table A.1 — Examples of test pulse severity levels for nominal 12 V system
<table><tr><th rowspan="2">Test pulse[a]</th><th rowspan="2">Selected test level[b]</th><th colspan="3">Test pulse severity level, U_s^{cd} V</th><th rowspan="2">Min. number of pulses or test time</th><th colspan="2">Burst cycle/ pulse repetition time</th></tr><tr><th>IV</th><th>III</th><th>I / II</th><th>min.</th><th>max.</th></tr><tr><td>1</td><td></td><td>−150</td><td>−112</td><td>−75</td><td>500 pulses</td><td>0,5 s</td><td>[e]</td></tr><tr><td>2a</td><td></td><td>+112</td><td>+55</td><td>+37</td><td>500 pulses</td><td>0,2 s</td><td>5 s</td></tr><tr><td>2b</td><td></td><td>+10</td><td>+10</td><td>+10</td><td>10 pulses</td><td>0,5 s</td><td>5 s</td></tr><tr><td>3a</td><td></td><td>−220</td><td>−165</td><td>−112</td><td>1 h</td><td>90 ms</td><td>100 ms</td></tr><tr><td>3b</td><td></td><td>+150</td><td>+112</td><td>+75</td><td>1 h</td><td>90 ms</td><td>100 ms</td></tr></table>[a] Test pulses as in 5.6.
[b] Values agreed between vehicle manufacturer and equipment supplier.
[c] The amplitudes are the values of U_s as defined for each test pulse in 5.6.
[d] The former levels I and II are revised because they did not ensure sufficient immunity in subsequent road vehicles' design.
[e] The maximum pulse repetition time shall be chosen such that it is the minimum time for the DUT to be correctly initialized before the application of the next pulse and shall be ≥0,5 s.

Table A.2 — Suggested test pulse severity levels for nominal 24 V system
<table><tr><th rowspan="2">Test pulse[a]</th><th rowspan="2">Selected test level[b]</th><th colspan="3">Test pulse severity level, U_s^{cd} V</th><th rowspan="2">Min. number of pulses or test time</th><th colspan="2">Burst cycle/ pulse repetition time</th></tr><tr><th>IV</th><th>III</th><th>I / II</th><th>min.</th><th>max.</th></tr><tr><td>1</td><td></td><td>−600</td><td>−450</td><td>−300</td><td>500 pulses</td><td>0,5 s</td><td>[e]</td></tr><tr><td>2a</td><td></td><td>+112</td><td>+55</td><td>+37</td><td>500 pulses</td><td>0,2 s</td><td>5 s</td></tr><tr><td>2b</td><td></td><td>+20</td><td>+20</td><td>+20</td><td>10 pulses</td><td>0,5 s</td><td>5 s</td></tr><tr><td>3a</td><td></td><td>−300</td><td>−220</td><td>−150</td><td>1 h</td><td>90 ms</td><td>100 ms</td></tr><tr><td>3b</td><td></td><td>+300</td><td>+220</td><td>+150</td><td>1 h</td><td>90 ms</td><td>100 ms</td></tr></table>[a] Test pulses as in 5.6.
[b] Values agreed between vehicle manufacturer and equipment supplier.
[c] The amplitudes are the values of U_s as defined for each test pulse in 5.6.
[d] The former levels I and II are revised because they did not ensure sufficient immunity in subsequent road vehicles' design.
[e] The maximum pulse repetition time shall be chosen such that it is the minimum time for the DUT to be correctly initialized before the application of the next pulse and shall be ≥0,5 s.</td><td>A selected level and test time for testing at or in between these values may be chosen according to the agreement between vehicle manufacturer and supplier. In cases where no specific values are defined, it is recommended to use
Test pulsea:2b
Test pulse severity level: III

Supply voltages
<table><tr><th>Supply voltage</th><th>Nominal 12 V system V</th><th>Nominal 24 V system V</th></tr><tr><td>UA</td><td>13,5 ± 0,5</td><td>27 ± 1</td></tr></table></td></tr>
</table>

**Derated Curve

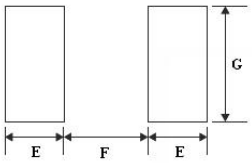
For the ferrite chip bead which withstanding current over 1.5A, as the operating temperature over 110℃, the derating current information is necessary to consider with. For the detail derating of current, please refer to the derated current vs. operating temperature curve.



6. Soldering and Mounting

6-1. Recommended PC Board Pattern

Chip Size						Land Patterns For Reflow Soldering		
Series	Type	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)	F(mm)	G(mm)
HCB	3216	3.2±0.20	1.60±0.20	1.10±0.20	0.50±	1.05	2.20	1.80



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. TAI-TECH 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.

6-2.1 Soldering Reflow:

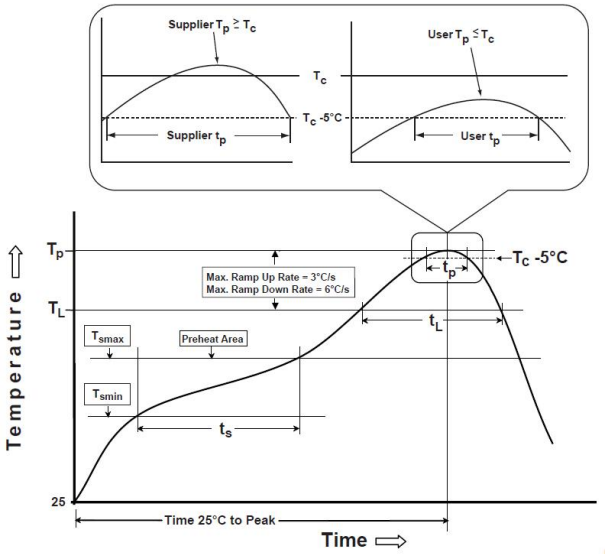
Recommended temperature profiles for lead free re-flow soldering in Figure 1. Table 1.1&1.2 (J-STD-020E)

6-2.2 Soldering Iron:

Products attachment with a soldering iron is discouraged due to the inherent process control limitations. In the event that a soldering iron must be employed the following precautions are recommended. (Figure 2.)

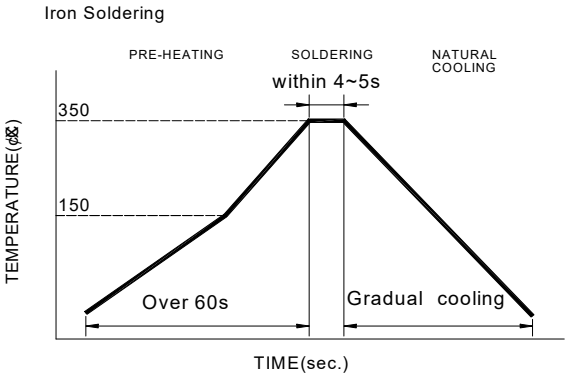
·Preheat circuit and products to 150℃ ·Never contact the ceramic with the iron tip ·Use a 20 watt soldering iron with tip diameter of 1.0mm
·350℃ tip temperature (max) ·1.0mm tip diameter (max) ·Limit soldering time to 4~5sec.

Fig.1 Soldering Reflow



Reflow times: 3 times max

Fig.2 Iron soldering temperature profiles



Iron Soldering times：1 times max

Table (1.1): Reflow Profiles

Profile Type:	Pb-Free Assembly
Preheat -Temperature Min(T_{smin}) -Temperature Max(T_{smax}) -Time(t_s)from(T_{smin} to T_{smax})	 150℃ 200℃ 60-120seconds
Ramp-up rate($T_L$to T_p)	3℃/second max.
Liquidus temperature(T_L) Time(t_L)maintained above T_L	217℃ 60-150 seconds
Classification temperature(T_c)	See Table (1.2)
Time(t_p) at Tc- 5℃ (Tp should be equal to or less than Tc.)	< 30 seconds
Ramp-down rate(T_p to T_L)	6℃ /second max.
Time 25℃ to peak temperature	8 minutes max.

Tp: maximum peak package body temperature, **Tc**: the classification temperature.
For user (customer) **Tp** should be equal to or less than **Tc**.

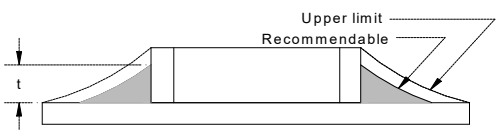
Table (1.2) Package Thickness/Volume and Classification Temperature (T_c)

	Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
PB-Free Assembly	<1.6mm	260℃	260℃	260℃
	1.6-2.5mm	260℃	250℃	245℃
	≥2.5mm	250℃	245℃	245℃

Reflow is referred to standard IPC/JEDEC J-STD-020E.

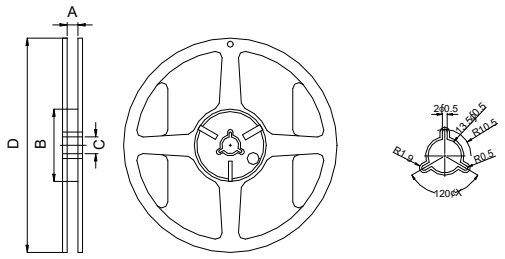
6-2.3 Solder Volume:

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

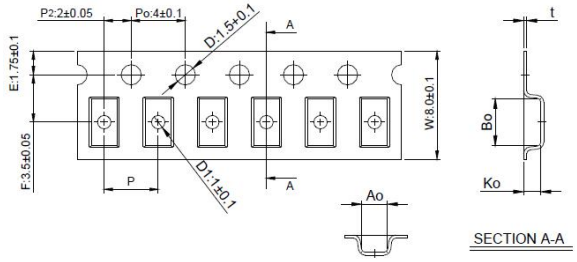
7-1. Reel Dimension (※Antistatic material)



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

7-2. Tape Dimension / 8mm

■Material of taping is plastic **(※Antistatic material)**

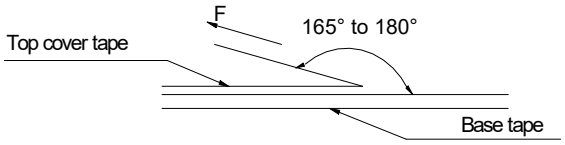


Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)	D1(mm)
321611	3.35±0.10	1.75±0.10	1.25±0.10	4.0±0.10	0.23±0.05	1.0±0.10

7-3. Packaging Quantity

Chip Size	321611
Chip / Reel	3000
Inner box	15000
Middle box	75000
Carton	150000

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. (℃)	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 solderability of terminal electrodes:

1. TAI-TECH products meet IPC/JEDEC J-STD-020E standard-MSL, level 1.
2. Temperature and humidity conditions: Less than 40℃ 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.