microgate
麦捷科技

CUSTOMER: _____ **DATE:** _____

APPROVAL SPECIFICATION

ROHS
COMPLIANT

PRODUCT NAME:	SMD Wire Wound Chip Inductor
YOUR PART NO.:	
OUR PART NO.:	MGTC0603H Series
VERSION:	V1.0

RECEPTION **THE SPECIFICATION HAS BEEN ACCEPTED.** **COMPANY:** **DATE:**		
CFMD	**CHKD**	**RCVD**

MANUFACTURING NAME

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CATALOG

Component SPEC Version Record

Rev.	Effective Date	Changed Contents	Change Reasons	Approved By
1.0	2014.12.04	New released	/	Remo

1. Scope

This specification applies to the MGTC0603H series of SMD Wire Wound Chip Inductors.

2. Product Identification

MGTC	0603	H	1N6	J	S	T
①	②	③	④	⑤	⑥	⑦

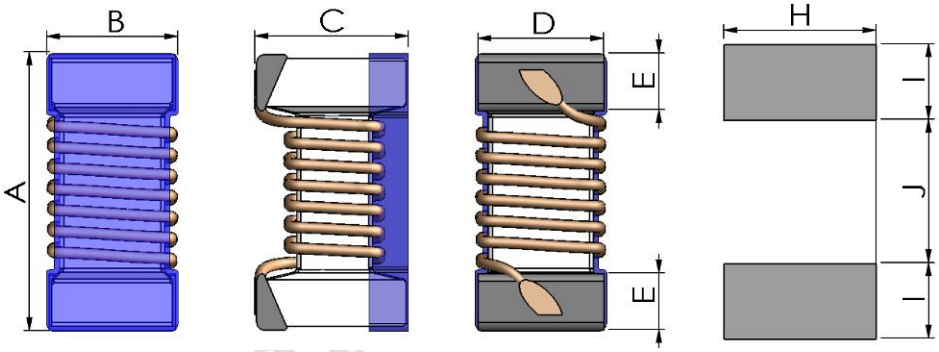
① Product Symbol
② Dimensions (0603 inch)
③ Features
④ Inductance Value (1N6:1.6nH 27N:27nH; R10:100nH; 1R0:1.0uH)
⑤ Inductance Tolerance

Code	B	C	S	D	F	G	H	J
Tolerance	±0.1nH	±0.2nH	±0.3nH	±0.5nH	±1%	±2%	±3%	±5%

⑥ Termination materials (G: gold ; S: sn)
⑦ Packaging style (T: Taping ; B: Bulk)

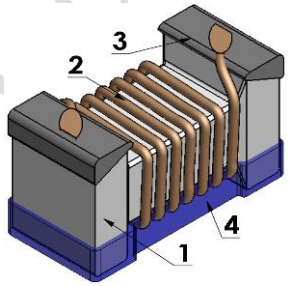
3. Appearance, Dimensions and Material

(1) Appearance and dimensions



Dimensions in mm							
A Max.	B Max.	C Max.	D Ref.	E	H Typ.	I Typ.	J Typ.
1.80	1.12	1.02	0.80	0.3±0.1	1.02	0.64	0.64

(2) Material List



No.	Item	Material
1	Core	Ceramic
2	Wire	Enameled Copper Wire
3	Terminal Electrode	Sn
4	Coating	Ultraviolet epoxy resin

4. Testing Conditions

Unless otherwise specified, the standard conditions for measurement/test as:
Ambient Temperature : 5 to 35℃
Relative Humidity: 25 to 85% RH
Atmospheric Pressure: 86 to 106 kPa

If any doubt on the results, measurements/tests should be made within the following limits:
Ambient Temperature : 25±1℃
Relative Humidity: 60 to 70% RH
Atmospheric Pressure: 86 to 106 kPa

5. Rating

Operating temperature:-40℃~125℃

Microgate Part No.	Inductance（nH）	Tolerance	Q (min.)	L/Q Test Frequency (MHz)	DC Resistance（Ω max.）	Rated Current (mA)	SRF (MHz) (min.)
MGTC0603H2N2□ST	2.2	C,D	16	100/250	0.042	700	6000
MGTC0603H2N7□ST	2.7	C,D	25	250/250	0.059	850	6000
MGTC0603H3N6□ST	3.6	C,D	25	100/250	0.059	850	6000
MGTC0603H3N9□ST	3.9	C,D	35	100/250	0.059	850	6000
MGTC0603H4N3□ST	4.3	C,D	35	100/250	0.059	850	6000
MGTC0603H4N7□ST	4.7	C,D	35	100/250	0.059	850	6000
MGTC0603H5N6□ST	5.6	C,D	35	100/250	0.082	750	6000
MGTC0603H6N2□ST	6.2	C,D	35	100/250	0.082	750	6000
MGTC0603H6N8□ST	6.8	C,D	35	100/250	0.082	750	6000
MGTC0603H7N5□ST	7.5	C,D	35	100/250	0.082	750	6000
MGTC0603H8N2□ST	8.2	C,D	35	100/250	0.110	650	6000
MGTC0603H8N7□ST	8.7	C,D	35	100/250	0.110	650	6000
MGTC0603H9N1□ST	9.1	C,D	35	100/250	0.110	650	6000
MGTC0603H9N5□ST	9.5	C,D	35	100/250	0.110	650	6000
MGTC0603H10N□ST	10	G,J	35	100/250	0.110	650	6000
MGTC0603H11N□ST	11	G,J	35	100/250	0.110	650	6000
MGTC0603H12N□ST	12	G,J	35	100/250	0.130	600	6000
MGTC0603H13N□ST	13	G,J	35	100/250	0.130	600	6000
MGTC0603H15N□ST	15	G,J	40	100/250	0.130	600	6000
MGTC0603H16N□ST	16	G,J	40	100/250	0.160	550	5500
MGTC0603H18N□ST	18	G,J	40	100/250	0.160	550	5500
MGTC0603H20N□ST	20	G,J	40	100/250	0.160	550	4900
MGTC0603H22N□ST	22	G,J	40	100/250	0.170	500	4600
MGTC0603H24N□ST	24	G,J	40	100/250	0.210	500	3800
MGTC0603H27N□ST	27	G,J	40	100/250	0.210	440	3700
MGTC0603H30N□ST	30	G,J	40	100/250	0.230	420	3300
MGTC0603H33N□ST	33	G,J	40	100/250	0.230	420	3200
MGTC0603H36N□ST	36	G,J	40	100/250	0.260	400	2900
MGTC0603H39N□ST	39	G,J	40	100/250	0.260	400	2800
MGTC0603H43N□ST	43	G,J	40	100/200	0.290	380	2700
MGTC0603H47N□ST	47	G,J	38	100/200	0.290	380	2600
MGTC0603H51N□ST	51	G,J	38	100/200	0.330	370	2500
MGTC0603H56N□ST	56	G,J	38	100/200	0.350	360	2400

Microgate Part No.	Inductance（nH）	Tolerance	Q (min.)	L/Q Test Frequency (MHz)	DC Resistance（Ω max.）	Rated Current (mA)	SRF (MHz) (min.)
MGTC0603H62N□ST	62	G,J	38	100/200	0.510	280	2300
MGTC0603H68N□ST	68	G,J	38	100/200	0.380	340	2200
MGTC0603H72N□ST	72	G,J	34	100/150	0.560	270	2100
MGTC0603H75N□ST	75	G,J	34	100/150	0.560	270	2050
MGTC0603H82N□ST	82	G,J	34	100/150	0.600	250	2000
MGTC0603H91N□ST	91	G,J	34	100/150	0.640	230	1900
MGTC0603HR10□ST	100	G,J	34	100/150	0.680	220	1800
MGTC0603HR11□ST	110	G,J	32	100/150	1.200	200	1700
MGTC0603HR12□ST	120	G,J	32	100/150	1.300	180	1600
MGTC0603HR13□ST	130	G,J	32	100/150	1.400	170	1450
MGTC0603HR15□ST	150	G,J	32	100/150	1.500	160	1400
MGTC0603HR16□ST	160	G,J	32	100/150	2.100	150	1350
MGTC0603HR18□ST	180	G,J	25	100/100	2.200	140	1300
MGTC0603HR20□ST	200	G,J	25	100/100	2.400	120	1250
MGTC0603HR22□ST	220	G,J	25	100/100	2.500	120	1200
MGTC0603HR27□ST	270	G,J	30	100/100	3.400	110	960
MGTC0603HR33□ST	330	G,J	30	100/100	5.500	85	800
MGTC0603HR39□ST	390	G,J	30	100/100	6.200	80	800
MGTC0603HR47□ST	470	G,J	30	100/100	7.000	75	700

6. Electrical Performance

Inductance；Q factor

Inductance；Q factor shall meet item 5 when measured on the condition of Table 1.

Table 1

Measuring Equipment	Impedance analyzer keysight E4982A or equivalent
Measuring Frequency	Item 5
Measuring signal level	-13dBm
Measuring Fixture	keysight 16197A

DC Resistance

D.C Resistance shall meet item 5 when measured on the condition of Table 2.

Table 2

Measuring Equipment	LCR Meter HIOKI 3542 or equivalent

Self-Resonant Frequency (S.R.F)

S.R.F. shall meet item 5 when measured on the condition of Table 3.

Table 3

Measuring Equipment	Impedance analyzer Agilent E4991A，Network analyzer Keysight E5071C or equivalent

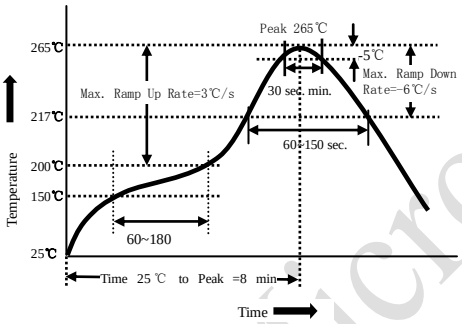
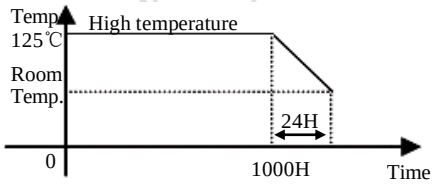
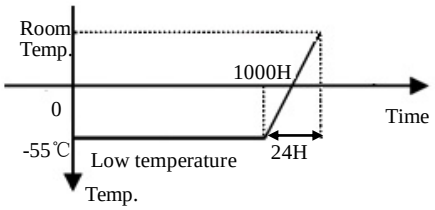
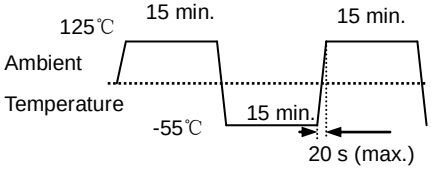
Rated current

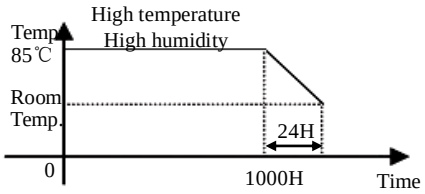
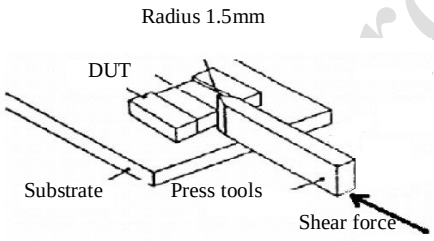
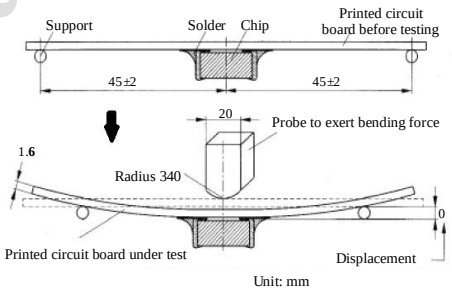
Temperature rise no more than 40℃ against chip surface temperature when the allowable current is applied.

Table 4

Measuring Equipment	DC Power Supplier, Current Meter, Thermometer

7. Reliability

No.	Item	Requirements	Test Methods and Remarks	Reference	Sample Size
1	Solderability	Terminal area shall be at least 95% covered .	①Temperature:240±5℃, flux 5-10 s. ②Sample immersion tin furnace 3 ±1s. ③Sn/3.0Ag/0.5Cu	AEC-Q200 (J-STD-002)	15
2	Resistance to Soldering Heat	(1) No case deformation or change in appearance. (2)｜ΔL/L0｜≤5% (3)｜ΔQ/Q0｜≤20%	①The peak temperature: 260+5/-0℃. ②Reflow:3times. ③Temperature curve is as below: 	AEC-Q200 (MIL-STD-202 Method 210)	30
3	High Temperature Storage		①Temperature: 125±2℃. ②Time : 1000(+48,0) hours. ③Measurement at 24±4 hours after test conclusion. 	AEC-Q200 (MIL-STD-202 Method 108)	77
4	Low Temperature Storage		①Temperature: -55±2℃. ②Time : 1000(+48,0) hours. ③Measurement at 24±4 hours after test conclusion. 	JESD22-A119	77
5	Thermal shock		①First -55℃ for 15 minutes, last 125℃ 15minutes as 1 cycle. Go through 100 cycles. ②Max transfer time is 20 second. ③Measurement at 24±4 hours after test conclusion. 	MIL-STD-202 Method 107	30

No.	Item	Requirements	Test Methods and Remarks	Reference	Sample Size
6	Humidity Resistance	(1) No case deformation or change in appearance. (2)｜ΔL/L0｜≤10% (3)｜ΔQ/Q0｜≤20%	①1000(+48,0) hours, 85℃/85%RH. ②Unpowered. ③Measurement at 24±4 hours after test conclusion. 	AEC-Q200 (MIL-STD -202 Method 103)	77
7	Terminal Strength	No case deformation or change in appearance.	①The test samples shall be soldered to the board. ②A Force of 5.0N, 5s 	-	30
8	Board Flex	(1) No case deformation or change in appearance. (2)｜ΔL/L0｜≤10% (3)｜ΔQ/Q0｜≤20%	①Part mounted on a 100mm*40mm FR4 PCB board, which is 0.8mm thick and as a Layer-thickness 35 μm ±10 μm. ②Bending speed is 1mm/s. ③Keeping the P.C Board 2 mm minimum for 60 seconds. 	AEC-Q200 (AEC-Q200-0 05)	30
9	Drop		①Height: 1 m, Free fall, 10times. ②Direction: 1 Angle, 1side, 2surface.	JESD22-B111	30
10	Vibration		①Frequency range : 10~50Hz. ②Amplitude: 1.5mm or 20 G. ③Sweep time and duration: 10~50~10Hz for 20 minutes. ④Each four hours(12 times) in X,Y,Z direction, 12 hours in total.	AEC-Q200 (MIL-STD-20 2 Method 204)	30

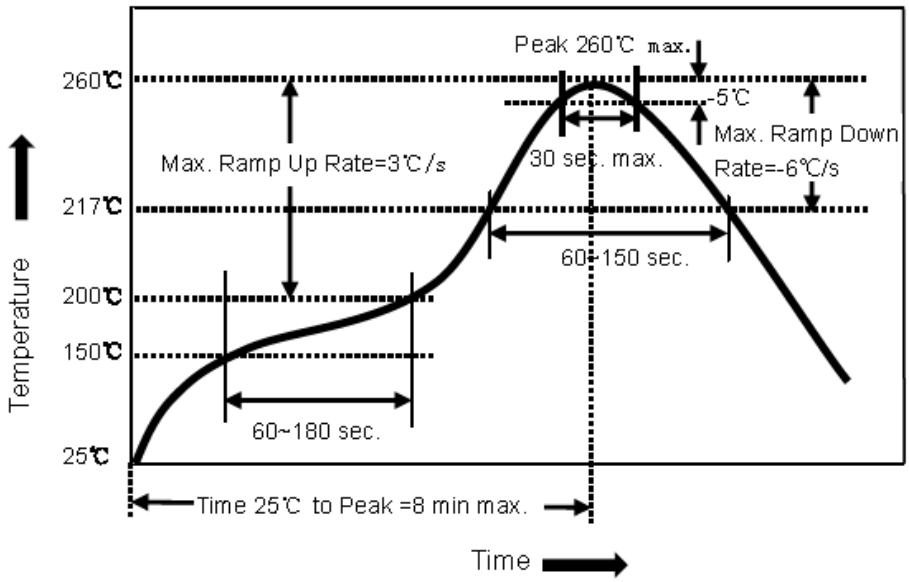
No.	Item	Requirements	Test Methods and Remarks	Reference	Sample Size
11	Loading at High Temperature	(1) No case deformation or change in appearance. (2) ｜ΔL/L0｜≤10% (3) ｜ΔQ/Q0｜≤20%	①Temperature: 125±2℃. ②Time : 1000(+48,0) hours. ③Proper current. ④Measurement at 24±4 hours after test conclusion.	AEC-Q200 (MIL-PRF-27)	77
12	Loading at Damp Heat	(1) No case deformation or change in appearance. (2) ｜ΔL/L0｜≤5% (3) ｜ΔQ/Q0｜≤20%	①Temperature: 60±2℃, Humidity: 90% to 95% RH ; ② Duration: 1000(+48,0) hours ③Applied current: Rated current. ④Measurement at 24±4 hours after test conclusion.	AEC-Q200	77

*All above experiments items need 3 Lot., sample size is as specified in the table above.

*Sample size standard is from AEC-Q200: qualification sample size requirements.

8. Recommended Soldering Conditions

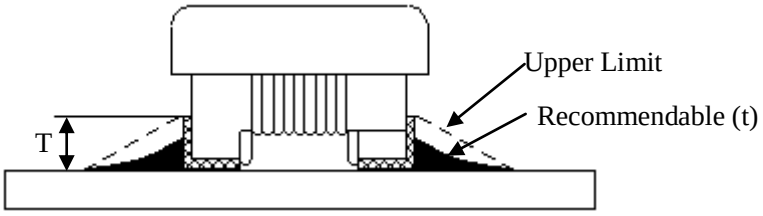
(1) Reflow soldering conditions



*Above reflow soldering curve is from J-STD-020D.

(2)Solder Volume

Solder shall be used not to be exceeded the upper limits as shown below.



1/3T≦t≦T

(T: Height of electrode)

a. Exceeding solder volume may cause the failure of mechanical or electrical performance.

b. Before soldering, please ensure that the solder should not adhere to the wire part of chip.

c. Please pay particular attention to whether there is flux remaining on surface of the wire part of chip after subjected to reflow soldering since this may causing short circuit of parts.

(3) Iron soldering

The following conditions must be strictly followed when using a soldering iron.

①

Pre-heating	150℃, 1 minute
Tip temperature	350℃ max
Soldering iron output	30w max
End of soldering iron	Φ1mm max
Soldering time	3 seconds max

②Don't touch the coil core directly with the top of the iron

③In the welding process, the electric iron cannot bump into the enamel-insulated wire, lest components should have evidence of damage.

④The test, link products and so on solder correct and support on both sides the method contrast wrongly:

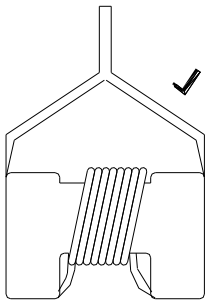


Figure 1 Correct method

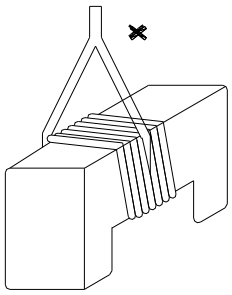
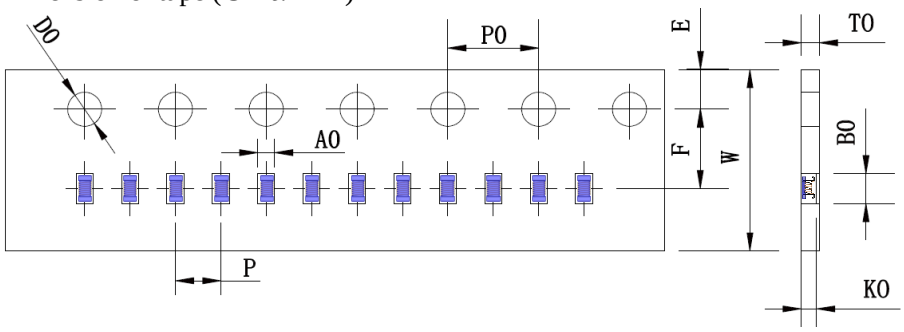


Figure 2 Wrongly method

Tweezers of fixture should support on both sides of the chip, and the correct support way as shown as Figure1. Tweezers of fixture should not support on enamel-insulated wire of the chip, lest enamel-insulated wire should have evidence of damage, the wrong support way as shown as Figure 2.

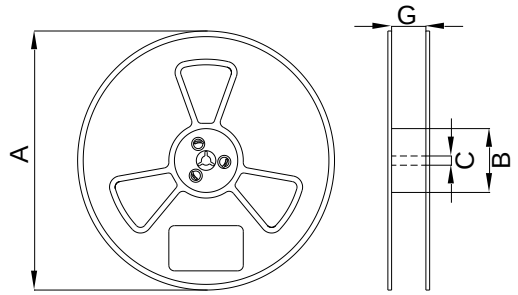
9.Packaging Information

(1) Dimension of tape (Unit: mm)



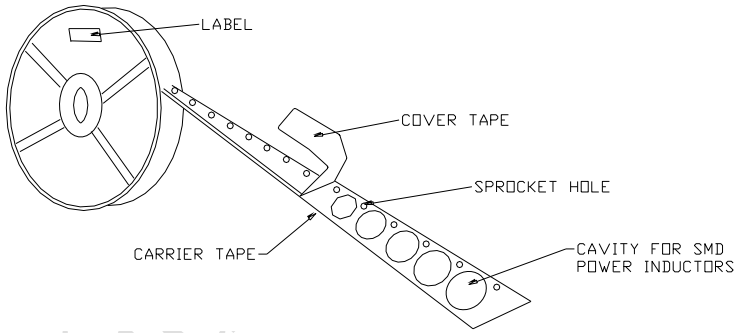
W	E	F	P	P0	D0	T0
8.0±0.2	1.75±0.05	3.5±0.05	4.0±0.1	4.0-±0.1	1.5+0.1/-0.0	1.10 max.

(2) Dimension of reel (Unit: mm)



Symbol	Dimension
A	178±2
B	58±2
C	13.5±0.2
G	10.0±1.5

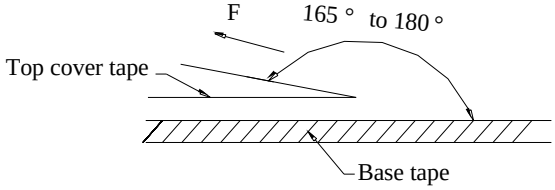
(3) Taping figure and drawing direction



(4) Packaging quantities: 4,000PCS/Reel.

(5) Peeling strength of cover tape:

The force tearing off cover tape is 15 to 65 grams in the arrow direction under the following conditions.



Room Temp. (℃)	Room Humidity (%)	Room aim (hpa)	Peel Speed mm/min
5-35	45-85	860-1060	300

10. Storage

a. The solder ability of the external electrode may be deteriorated if packages are stored where they are exposed to high temperature or high humidity. Besides, to ensure packing material's good state, packages must be stored at -10℃ to 40℃ and 15% ~85% RH.
b. The solder ability of the external electrode may be deteriorated if packages are stored where they are exposed to dust of harmful gas (e.g. HCl, sulfurous gas of H_2S).
c. Packaging materials may deform if packages are exposed directly to sunlight.
d. Minimum packages, such as polyvinyl heat-seal packages shall not be opened until they are used. If opened, use the reels as soon as possible.
e. Solderability shall be guaranteed for 12 months from the date of delivery on condition that they are stored at the environment specified in specification. For those parts, which passed more than the time shall be checked solder-ability before use.

11. Transportation

The cases shall not be damaged, destroyed and rained on.

12. Warning and Attentions

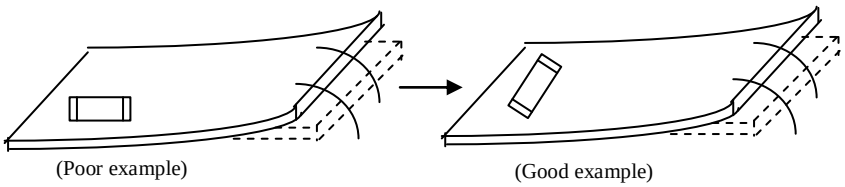
(1) Precautions on Use

a. Always wear static control bands to protect against ESD.
b. Any devices used (soldering iron, measuring instruments) should be properly grounded.
c. Use non-magnetic tweezers when handing the chips.
d. Pre-heating when soldering, and refer to the recommended condition specified in specification.
e. Don't apply current in excess of the rated current value. It may cause damage to components due to over-current.
f. Keep clear of anything that may generate magnetic fields such as speakers, coils.
g. When soldering, the electrical characteristics may be varied due to hot energy and mechanical stress.
h. When coating products with resin, the relatively high resin curing stress may change the electrical characteristics. For exterior coating, select resin carefully so that electrical and mechanical performance of the product is not affected. Before using, please evaluate reliability with the product mounted in your application set.
i. When mount chips with adhesive in preliminary assembly, do appropriate check before the soldering stage, i.e., the size of land pattern, type of adhesive, amount applied, hardening of the adhesive on proper usage and amounts of adhesive to use.
j. Mounting density: Add special attention to radiating heat of products when mounting other components nearby. The excessive heat by other products may cause deterioration at joint of this product with substrate.
k. Since some products are constructed like an open magnetic circuit, narrow spacing between components may cause magnetic coupling.
l. Please do not give the product any excessive mechanical shocks in transportation.
m. Please do not touch wires by sharp terminals such as tweezers to avoid causing any damage to wires.
n. Please do not add any shock and power to the soldered product to avoid causing any damage to chip body.
o. Please do not touch the electrodes by naked hand as the solderability of the external electrodes may deteriorate by grease or oil on the skin.

(2) PCB Bending Design

The following shall be considered when designing and laying out PCB's.

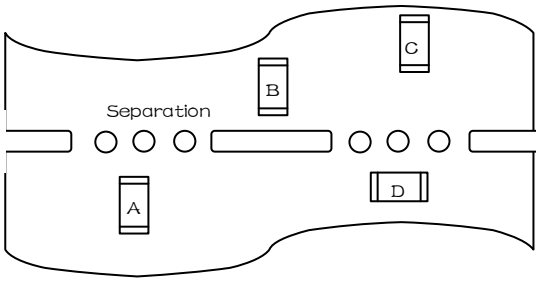
1. PCB shall be designed so that products are not subjected to the mechanical stress from board warp or deflection.



(Poor example) (Good example)

Products shall be located in the sideways direction to the mechanical stress.

2. Products location on PCB separation.



Product shall be located carefully because they may be subjected to the mechanical stress in order of A>C=B>D.

3. When splitting the PCB board, or insert (remove) connector, or fasten thread after mounting components, care is required so as not to give any stress of deflection or twisting to the board. Because mechanical force may cause deterioration of the bonding strength of electrode and solder, even crack of product body. Board separation should not be done manually, but by using appropriate devices.

(3) Recommended PCB Design for SMT Land-Patterns

When chips are mounted on a PCB, the amount of solder used (size of fillet) and the size of PCB Land-Patterns can directly affect chip performance. Therefore, the following items must be carefully considered in the design of solder land patterns.

a. Please use the PCB pad and solder paste we recommend, and contact us in advance if they need to be changed.

b. The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.

c. When more than one part is jointly soldered onto the same land or pad, the pad must be designed that each component's soldering point is separated by solder-resist.

Recommended land dimensions please refer to product specification.

13. Cleaning

Products shall be cleaned on the following conditions:

(1) Cleaning temperature shall be limited to 60℃Max. (40℃Max. for IPA)

(2)Ultrasonic cleaning shall comply with the following conditions, avoiding the resonance phenomenon at the mounted products and PCB.

Power: 20W/l Max. Frequency: 28 KHz to 40 KHz Time: 5 minutes Max

(3)Cleaner

a. Alcohol type cleaner

Isopropyl alcohol (IPA)

b. Aqueous agent

Surface Active Agent Type (Clean through-750H)

Hydrocarbon Type (Techno Cleaner-335)

Higher Alcohol Type (Pine Alpha ST-100S)

c. There shall be no residual flux and residual cleaner after cleaning.

In the case of using aqueous agent, product shall be dried completely after rinse with de-ionized water in order to remove the cleaner.

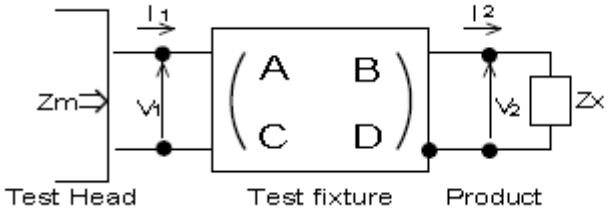
d. Some products may become slightly whitened. However, product performance or usage is not affected.

e. Please take care of winding part while cleaning.

f. After cleaning, parts could be subjected to the next reflow soldering till the solvent remaining on surface of parts being volatilized.

14. Measuring Method of Inductance

(1) Residual elements and stray elements of test fixture can be described by F-parameter shown in following.



$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ I_2 \end{bmatrix}$$

(2) The impedance of chip coil Zx and measured value Zm can be described by input/output current/voltage.

$$Zm = \frac{V_1}{I_1}, \qquad Zx = \frac{V_2}{I_2}$$

(3) Thus, the relation between Zx and Zm is following:

$$Zx = \alpha \frac{Zm - \beta}{1 - Zm\Gamma}$$

where, $\alpha = D / A = 1$

$\beta = B / D = Zsm - (1 - Yom\ Zsm) Zss$

$\Gamma = C / A = Yom$

MGTC0603H Series compensation value is 0.78nH

(4) Lx and Qx shall be calculated with the following equation.

$$Lx = \frac{Im(Zx)}{2\pi f}, \qquad Qx = \frac{Im(Zx)}{Re(Zx)}$$

Lx: Inductance of chip coil

Qx: Q of chip coil

f: Measuring frequency