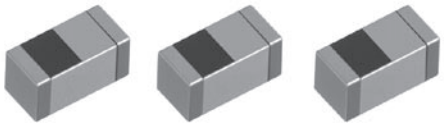
高周波積層チップインダクタ
MULTILAYER CHIP INDUCTOR FOR HIGH FREQUENCY HKQ SERIES



リフロー／REFLOW

OPERATING TEMP.	−55〜125℃

特長　FEATURES

・内部導体として比抵抗値の低いAgを使用し、良好なQ特性と自己共振周波数特性を実現
・積層シート工法による、高生産性、高品質、高インダクタンス値対応
・モノリシック構造のため、高い信頼性を有する

・Multilayer inductor made of advanced ceramics with low-resistivity silver used as internal conductors provides excellent Q and SRF characteristics.
・Designed to address surface mount inductor needs for applications above 500MHz.
・Multilayer block structure ensures outstanding reliability, high productivity and product quality.

用途　APPLICATIONS

・携帯電話、PHS、無線LAN
・その他の高周波回路、中間周波増幅回路
・高周波帯域でのEMI対策

・Portable telephones, PHS and W-LAN
・Miscellaneous high-frequency circuits
・EMI countermeasure in high-frequency circuits.

形名表記法　ORDERING CODE

H K Q 0 6 0 3 S 1 0 N J − T
1 2 3 4 5 6

1 形式

HKQ	高周波積層チップインダクタ High Qバージョン

2 形状寸法（L×W）〔mm〕

0603（0201）	0.6×0.3

3 端子電極

S	メッキ品

4 公称インダクタンス〔nH〕

例	
3N9	3.9
10N	10

※N＝nHとしての小数点

5 インダクタンス許容差

H	±3%
J	±5%
C	±0.2nH
S	±0.3nH

6 包装

−T	リールテーピング

1 Type

HKQ	Multilayer chip inductors for high frequency High Q Version

2 External Dimensions〔mm〕

0603（0201）	0.6×0.3

3 End termination

S	Plated

4 Nominal Inductance〔nH〕

Example	
3N9	3.9
10N	10

*N＝0.0（nH type）

5 Inductance Tolerances

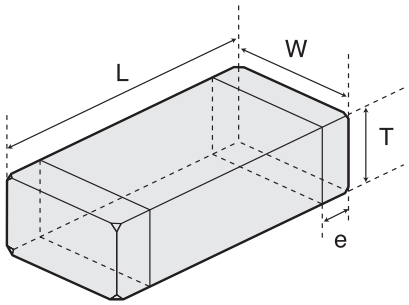
H	±3%
J	±5%
C	±0.2nH
S	±0.3nH

6 Packaging

−T	Tape & Reel

外形寸法　EXTERNAL DIMENSIONS

HKQ Type



Type	L	W	T	e
HKQ0603S (0201)	0.6±0.05 (0.024±0.002)	0.3±0.05 (0.012±0.002)	0.3±0.05 (0.012±0.002)	0.1±0.05 (0.004±0.002)

Unit：mm（inch）

＊製品の仕様につきましてはお問い合せ下さい。
＊Please Contact Our Sales Department office for Products Details.

概略バリエーション　AVAILABLE INDUCTANCE RANGE

Range / Type		HKQ0603S	
		使用温度範囲 −55〜+125℃	
inductance [nH]	[nH]		Imax [mA]
	0.6	0N6□	600
	0.7	0N7□	550
	0.8	0N8□	550
	0.9	0N9□	520
	1.0	1N0□	490
	1.2	1N2□	380
	1.5	1N5□	420
	1.8	1N8□	370
	2.2	2N2□	270
	2.7	2N7□	300
	3.3	3N3□	260
	3.9	3N9□	210
	4.7	4N7□	220
	5.6	5N6□	210
	6.8	6N8○	190
	8.2	8N2○	190
	10.0	10N○	160
	12.0	12N○	160
	15.0	15N○	150
	18.0	18N○	140
	22.0	22N○	130

代表値 Examples	Inductance	Imax[mA]	Rdcmax[Ω]
	1.5nH	420	0.12
	10.0nH	160	0.85
	100.0nH	—	—

※形名の□、○にはインダクタンス許容差記号が入ります。±0.3nH（□）、±5%（○）以下の許容差も対応可能ですので、お問い合わせ下さい。
□, ○mark indicates the Inductance tolerance code. The product with tolerance less than ±0.3nH (□), ±5% (○) is also available. Please contact your local sales office.

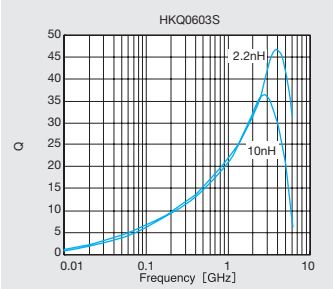
セレクションガイド Selection Guide ◀ P.12 etc
アイテム一覧 Part Numbers P.204 ▶
特性図 Electrical Characteristics P.205 ▶
梱包 Packaging P.238 ▶
信頼性 Reliability Data P.240 ▶
使用上の注意 Precautions P.248 ▶

HKQ0603S

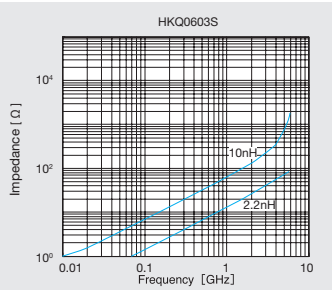
形名 Ordering code		インダクタンス Inductance〔nH〕	インダクタンス公差 Tolerance	Q min.	LQ測定周波数 Measuring frequency [MHz]	Q (Typical) 周波数 Frequency [Hz]					自己共振周波数 Self-resonant frequency [MHz]	直流抵抗 DC.Resistance〔Ω〕	定格電流 Rated current [mA] max.	厚さ Thickness [mm] (inch)
						500M	800M	1.8G	2.0G	2.4G	min.	max.		
HKQ0603S 0N6□	0.1nH Step	0.6	±0.2nH	13	500	>24	>31	>53	>56	>64	10000	0.06	600	0.3±0.05 (0.012±0.002)
HKQ0603S 0N7□		0.7	±0.2nH	13	500	>24	>31	>53	>56	>64	10000	0.07	550	
HKQ0603S 0N8□		0.8	±0.2nH	13	500	>24	>31	>53	>56	>64	10000	0.07	550	
HKQ0603S 0N9□		0.9	±0.2nH	13	500	>24	>31	>53	>56	>64	10000	0.08	520	
HKQ0603S 1N0□		1	±0.3nH, ±0.2nH	13	500	24	31	53	56	64	10000	0.09	490	
HKQ0603S 1N1□		1.1	±0.2nH	13	500	19	26	44	47	54	10000	0.12	420	
HKQ0603S 1N2□		1.2	±0.3nH, ±0.2nH	13	500	19	25	42	44	51	10000	0.15	380	
HKQ0603S 1N3□		1.3	±0.2nH	13	500	19	25	40	42	47	10000	0.19	330	
HKQ0603S 1N4□		1.4	±0.2nH	13	500	19	24	39	41	47	10000	0.11	440	
HKQ0603S 1N5□		1.5	±0.3nH, ±0.2nH	13	500	19	24	39	41	46	10000	0.12	420	
HKQ0603S 1N6□		1.6	±0.2nH	13	500	19	24	39	41	46	10000	0.13	410	
HKQ0603S 1N7□		1.7	±0.2nH	13	500	19	24	39	41	46	10000	0.15	380	
HKQ0603S 1N8□		1.8	±0.3nH, ±0.2nH	13	500	18	24	39	41	46	10000	0.16	370	
HKQ0603S 1N9□		1.9	±0.2nH	13	500	18	23	38	40	45	10000	0.20	330	
HKQ0603S 2N0□		2	±0.3nH, ±0.2nH	13	500	17	23	37	39	44	10000	0.24	300	
HKQ0603S 2N1□		2.1	±0.2nH	13	500	17	23	37	39	44	10000	0.26	290	
HKQ0603S 2N2□		2.2	±0.3nH, ±0.2nH	13	500	17	23	37	39	43	10000	0.28	270	
HKQ0603S 2N3□		2.3	±0.2nH	13	500	17	23	36	38	43	10000	0.30	270	
HKQ0603S 2N4□		2.4	±0.3nH, ±0.2nH	13	500	17	22	36	38	42	10000	0.32	260	
HKQ0603S 2N5□		2.5	±0.2nH	13	500	17	22	34	35	39	9500	0.20	330	
HKQ0603S 2N6□		2.6	±0.2nH	13	500	17	22	33	35	39	9300	0.22	310	
HKQ0603S 2N7□		2.7	±0.3nH, ±0.2nH	13	500	17	22	33	35	39	9100	0.24	300	
HKQ0603S 2N8□		2.8	±0.2nH	13	500	17	22	33	35	39	8900	0.25	290	
HKQ0603S 2N9□		2.9	±0.2nH	13	500	17	22	33	35	39	8700	0.28	270	
HKQ0603S 3N0□		3	±0.3nH, ±0.2nH	13	500	17	22	33	35	39	8600	0.28	270	
HKQ0603S 3N1□		3.1	±0.2nH	13	500	17	22	33	35	39	8400	0.29	270	
HKQ0603S 3N2□		3.2	±0.2nH	13	500	17	22	33	35	39	8200	0.30	270	
HKQ0603S 3N3□		3.3	±0.3nH, ±0.2nH	13	500	17	22	33	35	39	8100	0.32	260	
HKQ0603S 3N4□		3.4	±0.2nH	13	500	16	22	33	35	39	8000	0.36	240	
HKQ0603S 3N5□		3.5	±0.2nH	13	500	16	22	33	35	39	7800	0.40	230	
HKQ0603S 3N6□		3.6	±0.3nH, ±0.2nH	13	500	16	22	33	35	39	7700	0.41	230	
HKQ0603S 3N7□		3.7	±0.2nH	13	500	16	22	33	35	38	7600	0.44	220	
HKQ0603S 3N8□		3.8	±0.2nH	13	500	16	22	33	35	38	7500	0.48	210	
HKQ0603S 3N9□		3.9	±0.3nH, ±0.2nH	13	500	16	22	33	35	38	7300	0.48	210	
HKQ0603S 4N3□	E24 Step	4.3	±0.3nH, ±0.2nH	13	500	16	21	32	34	37	6500	0.39	230	
HKQ0603S 4N7□		4.7	±0.3nH, ±0.2nH	13	500	16	21	32	34	37	6200	0.44	220	
HKQ0603S 5N1□		5.1	±0.3nH, ±0.2nH	13	500	16	21	32	34	37	5900	0.49	210	
HKQ0603S 5N6□		5.6	±0.3nH, ±0.2nH	13	500	16	21	32	34	37	5500	0.47	210	
HKQ0603S 6N2□		6.2	±0.3nH, ±0.2nH	13	500	16	21	32	33	36	5100	0.52	200	
HKQ0603S 6N8○		6.8	±5%, ±3%	13	500	16	21	31	32	35	4800	0.55	190	
HKQ0603S 7N5○		7.5	±5%, ±3%	13	500	16	20	30	32	34	4600	0.51	200	
HKQ0603S 8N2○		8.2	±5%, ±3%	13	500	16	20	30	31	33	4300	0.57	190	
HKQ0603S 9N1○		9.1	±5%, ±3%	13	500	16	20	30	30	32	4000	0.73	170	
HKQ0603S 10N○	E12 Step	10	±5%, ±3%	13	500	16	20	28	29	31	3800	0.85	160	
HKQ0603S 12N○		12	±5%, ±3%	12	500	16	20	27	27	27	3300	0.85	160	
HKQ0603S 15N○		15	±5%, ±3%	12	500	15	19	24	24	23	2600	0.89	150	
HKQ0603S 18N○		18	±5%, ±3%	11	500	15	19	23	23	21	2300	1.05	140	
HKQ0603S 22N○		22	±5%, ±3%	10	500	15	19	22	22	19	1900	1.29	130	

※形名の□、○にはインダクタンス許容差記号が入ります。
※□, ○mark indicates the Inductance tolerance code.

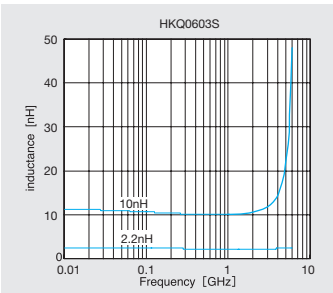
Q-周波数特性例　Q-Characteristics（Measured by HP8719C）



インピーダンス周波数特性例　Impedance-vs-Frequency characteristics（Measured by HP8719C）



インダクタンス周波数特性例　Inductane-vs-Frequency characteristics（Measured by HP8719C）

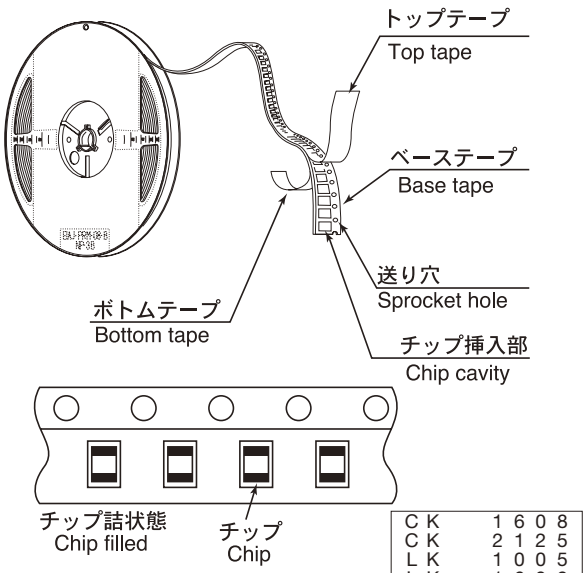


①最小受注単位数　Minimum Quantity
■テーピング梱包　Tape & Reel Packaging

形　式 Type	製品厚み Thickness [mm] (inch)	標準数量 [pcs] Standard Quantity	
		紙テープ Paper Tape	エンボステープ Embossed Tape
CK1608(0603)	0.8 (0.031)	4000	—
CK2125(0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
CKP2520(1008)	0.85 (0.033)	—	3000
LK1005(0402)	0.5 (0.020)	10000	—
LK1608(0603)	0.8 (0.031)	4000	—
LK2125(0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
HK0603(0201)	0.3 (0.012)	15000	—
HK1005(0402)	0.5 (0.020)	10000	—
HK1608(0603)	0.8 (0.031)	4000	—
HK2125(0805)	0.85 (0.033)	—	4000
	1.0 (0.039)	—	3000
HKQ0603(0201)	0.3 (0.012)	15000	—
AQ105(0402)	0.5 (0.020)	10000	—
BK0603(0201)	0.3 (0.012)	15000	—
BK1005(0402)	0.5 (0.020)	10000	—
BK1608(0603)	0.8 (0.031)	4000	—
BK2125(0805)	0.85 (0.033)	4000	—
	1.25 (0.049)	—	2000
BK2010(0804)	0.45 (0.018)	4000	—
BK3216(1206)	0.8 (0.031)	—	4000
BKP1005(0402)	0.5 (0.020)	10000	—
BKP1608(0603)	0.8 (0.031)	4000	—
BKP2125(0805)	0.85 (0.033)	4000	—

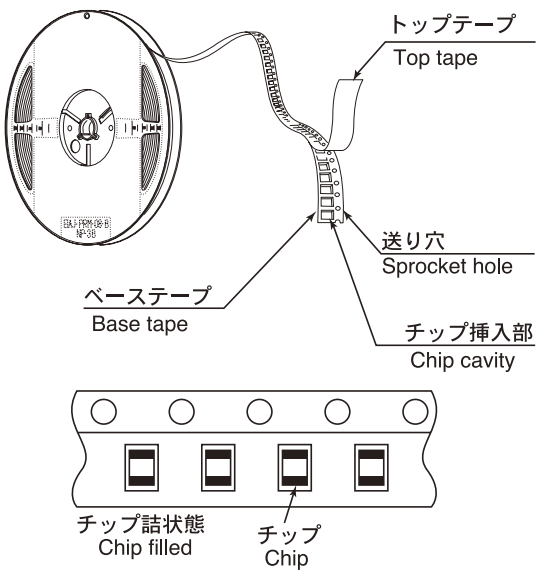
②テーピング材質　Taping material

紙テープ
Card board carrier tape



CK	1608
CK	2125
LK	1005
LK	1608
LK	2125
HK	0603
HK	1005
HK	1608
HKQ	0603
AQ	105
BK	0603
BK	1005
BK	1608
BK	2125
BK	2010
BKP	1005
BKP	1608
BKP	2125

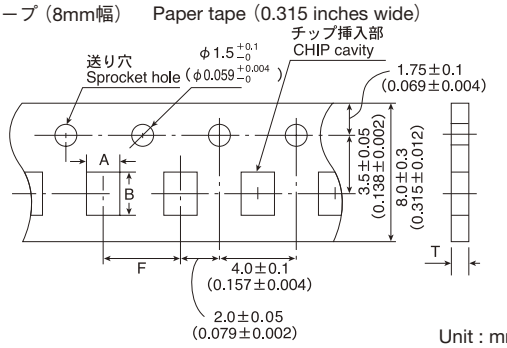
エンボステープ
Embossed Tape



CK	2125
CKP	2520
LK	2125
HK	2125
BK	2125
BK	3216

③テーピング寸法　Taping Dimensions

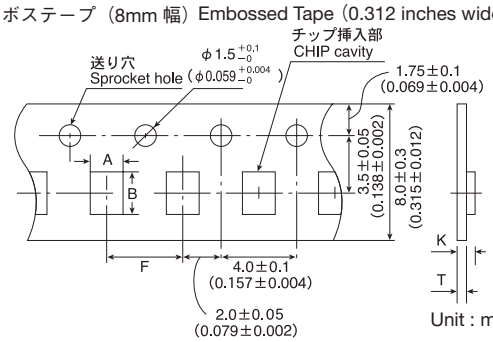
・紙テープ（8mm幅）　Paper tape（0.315 inches wide）



Unit : mm（inch）

形　式 Type	製品厚み Thickness〔mm〕	チップ挿入部 Chip cavity A	チップ挿入部 Chip cavity B	挿入ピッチ Insertion Pitch F	テープ厚み Tape Thickness T
CK1608（0603）	0.8（0.031）	1.0±0.2（0.039±0.008）	1.8±0.2（0.071±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
CK2125（0805）	0.85（0.033）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
LK1005（0402）	0.5（0.020）	0.65±0.1（0.026±0.004）	1.15±0.1（0.045±0.004）	2.0±0.05（0.079±0.002）	0.8max（0.031max）
LK1608（0603）	0.8（0.031）	1.0±0.2（0.039±0.008）	1.8±0.2（0.071±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
LK2125（0805）	0.85（0.033）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
HK0603（0201）	0.3（0.012）	0.40±0.06（0.016±0.002）	0.70±0.06（0.028±0.002）	2.0±0.05（0.079±0.002）	0.45max（0.018max）
HK1005（0402）	0.5（0.020）	0.65±0.1（0.026±0.004）	1.15±0.1（0.045±0.004）	2.0±0.05（0.079±0.002）	0.8max（0.031max）
HK1608（0603）	0.8（0.031）	1.0±0.2（0.039±0.008）	1.8±0.2（0.071±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
HKQ0603（0201）	0.3（0.012）	0.40±0.06（0.016±0.002）	0.70±0.06（0.028±0.002）	2.0±0.05（0.079±0.002）	0.45max（0.018max）
AQ105（0402）	0.5（0.020）	0.75±0.1（0.030±0.004）	1.15±0.1（0.045±0.004）	2.0±0.05（0.079±0.002）	0.8max（0.031max）
BK0603（0201）	0.3（0.012）	0.40±0.06（0.016±0.002）	0.70±0.06（0.028±0.002）	2.0±0.05（0.079±0.002）	0.45max（0.018max）
BK1005（0402）	0.5（0.020）	0.65±0.1（0.026±0.004）	1.15±0.1（0.045±0.004）	2.0±0.05（0.079±0.002）	0.8max（0.031max）
BK1608（0603）	0.8（0.031）	1.0±0.2（0.039±0.008）	1.8±0.2（0.071±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
BK2125（0805）	0.85（0.033）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
BK2010（0804）	0.45（0.018）	1.2±0.1（0.047±0.004）	2.17±0.1（0.085±0.004）	4.0±0.1（0.157±0.004）	0.80max（0.031max）
BKP1005（0402）	0.5（0.020）	0.65±0.1（0.026±0.004）	1.15±0.1（0.045±0.004）	2.0±0.05（0.079±0.002）	0.8max（0.031max）
BKP1608（0603）	0.8（0.031）	1.0±0.2（0.039±0.008）	1.8±0.2（0.071±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）
BKP2125（0805）	0.85（0.033）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	1.1max（0.043max）

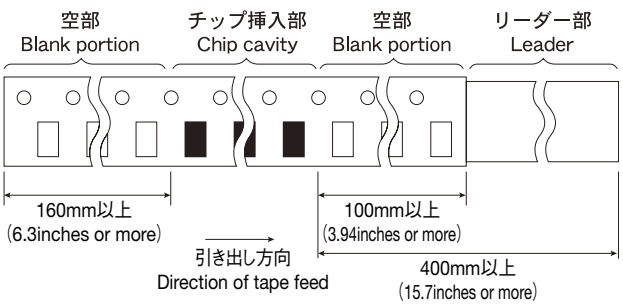
・エンボステープ（8mm 幅）Embossed Tape（0.312 inches wide）



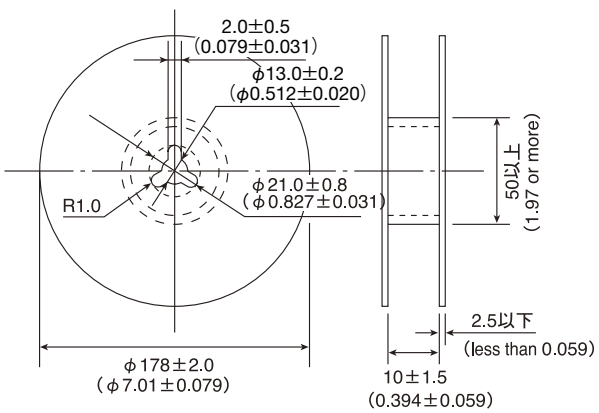
Unit : mm（inch）

形　式 Type	製品厚み Thickness〔mm〕	チップ挿入部 Chip cavity A	チップ挿入部 Chip cavity B	挿入ピッチ Insertion Pitch F	テープ厚みmax. Tape Thickness K	テープ厚みmax. Tape Thickness T
CK2125（0805）	1.25（0.049）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	2.0（0.079）	0.3（0.012）
CKP2520（1008）	0.85（0.033）	2.15±0.1（0.085±0.004）	2.7±0.1（0.107±0.004）	4.0±0.1（0.157±0.004）	1.5（0.059）	0.3（0.012）
LK2125（0805）	1.25（0.049）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	2.0（0.079）	0.3（0.012）
HK2125（0805）	0.85（0.033）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	1.5（0.059）	0.3（0.012）
	1.0（0.039）				2.0（0.079）	
BK2125（0805）	1.25（0.049）	1.5±0.2（0.059±0.008）	2.3±0.2（0.091±0.008）	4.0±0.1（0.157±0.004）	2.0（0.079）	0.3（0.012）
BK3216（1206）	0.8（0.031）	1.9±0.1（0.075±0.004）	3.5±0.1（0.138±0.004）	4.0±0.1（0.157±0.004）	1.4（0.055）	0.3（0.012）

④リーダー部・空部 LEADER AND BLANK PORTION

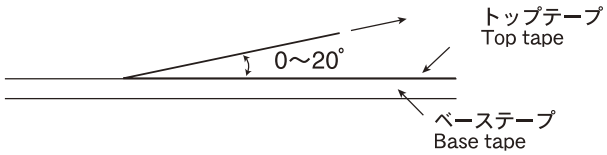


⑤リール寸法 Reel Size



⑥トップテープ強度　Top tape strength

トップテープの剥離力は、下図矢印方向にて0.1～0.7Nとなります。
The top tape requires a peel-off force of 0.1～0.7N in the direction of the arrow as illustrated below.

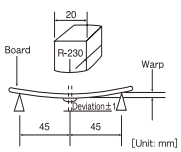


Multilayer chip inductors and beads

Item	Specified Value																						Test Methods and Remarks
	BK0603	BK1005	BK1608	BK2125	ARRAY BK2010	ARRAY BK3216	BKP1005	BKP1608	BKP2125	CK1608	CK2125	CKP2520	LK1005	LK1608	LK2125	HK0603	HK1005	HK1608	HK2125	HKQ0603	AQ105	
1.Operating Temperature Range	−55～+125℃						−55～+85℃			−40～+85℃						−55～+125℃		−40～+85℃		−55～+125℃	−55～+125℃	
2.Storage Temperature Range	−55～+125℃						−55～+85℃			−40～+85℃						−55～+125℃		−40～+85℃		−55～+125℃	−55～+125℃	
3.Rated Current	100～500mA DC	150～1000mA DC	150～1500mA DC	200～1200mA DC	100mA DC	100～200mA DC	1.0A DC	1.0～3.0A DC	2.0～4.0A DC	50～60mA DC	60～500mA DC	1.1～1.4A DC	10～25mA DC	1～50mA DC	5～300mA DC	40～250mA DC	110～300mA DC	150～300mA DC	300mA DC	100～400mA DC	200～510mA DC	
4.Impedance	10～600Ω ±25%	10～1000Ω ±25%	22～2500Ω ±25%	15～2500Ω ±25%	5～600Ω ±25%	68～1000Ω ±25%	120Ω ±25%	33～390Ω ±25%	33～220Ω ±25%	—	—	—	—	—	—	—	—	—	—	—	—	BK0603 Series: Measuring frequency: 100±1MHz Measuring equipment: HP4291A Measuring jig: 16193A BK1005 Series: BKP1005 Series: Measuring frequency: 100±1MHz Measuring equipment: HP4291A Measuring jig: 16192A, 16193A BK1608, 2125 Series: BKP1608, 2125 Series: Measuring frequency: 100±1MHz Measuring equipment: HP4291A, HP4195A Measuring jig: 16092A or 16192A (HW) BK2010, 3216 Series: Measuring frequency: 100±1MHz Measuring equipment: HP4291A, HP4195A Measuring jig: 16192A
5.Inductance	—									4.7～10.0μH :±20%	0.1～10.0μH :±20%	1.0～4.7μH :±20%	0.12～2.2μH :±10%	0.047～33.0μH :±20% 0.10～12.0μH :±10%	0.047～33.0μH :±20% 0.10～12.0μH :±10%	1.0～6.2nH :±0.3nH 6.8～100nH :±5%	1.0～6.2nH :±0.3nH 6.8～270nH :±5%	1.0～5.6nH :±0.3nH 6.8～470nH :±5%	1.0～5.6nH :±0.3nH 6.8～470nH :±5%	0.6～6.2nH :±0.3nH 6.8～22nH :±5%	1.0～6.2nH :±0.3nH 6.8～15nH :±5%	CK Series: Measuring frequency: 2 to 4MHz (CK1608) Measuring frequency: 2 to 25MHz (CK2125) Measuring frequency: 1MHz (CKP2520) LK Series: Measuring frequency: 10 to 25MHz (LK1005) Measuring frequency: 1 to 50MHz (LK1608) Measuring frequency: 0.4 to 50MHz (LK2125) Measuring equipment, jig: HP4194+16085B+16092A (or its equivalent) HP4195+41951+16092A (or its equivalent) HP4294+16192A HP4291A+16193A (LK1005) HP4285A+42841A+42842C+ 42851-61100 (CKP2520) Measuring current: 1mA rms (0.047 to 4.7μH) 0.1mA rms (5.6 to 33μH) HK·HKQ·AQ Series: Measuring frequency: 100MHz (HK0603, HK1005,AQ105) Measuring frequency: 50/100MHz (HK1608, HK2125) Measuring frequency: 500MHz (HKQ0603) Measuring equipment, jig: HP4291A+16197A (HK0603·AQ105) HP4291A+16193A (HK1005) E4991A+16197A (HKQ0603) HP4291A (or its equivalent)+16092A+in-house made jig (HK1608, 2125)

* Definition of rated current : In the CK and BK Series, the rated current is the value of current at which the temperature of the element is increased within 20℃ .
In the BK Series P type and CK Series P type, the rated current is the value of current at which the temperature of the element is increased within 40℃ .
In the LK,HK,HKQ,and AQ Series, the rated current is either the DC value at which the internal L value is decreased within 5% with the application of DC bias, or the value of current at which the temperature of the element is increased within 20℃ .

Multilayer chip inductors and beads

Item	Specified Value																					Test Methods and Remarks
	BK0603	BK1005	BK1608	BK2125	ARRAY BK2010	ARRAY BK3216	BKP1005	BKP1608	BKP2125	CK1608	CK2125	CKP2520	LK1005	LK1608	LK2125	HK0603	HK1005	HK1608	HK2125	HKQ0603	AQ105	
6.Q	—									20 min.	15～20 min.	—	10～20 min.	10～35 min.	15～50 min.	4～5 min.	8min.	8～12 min.	10～18 min.	10～13 min.	8min.	CK Series: Measuring frequency: 2 to 4 MHz (CK1608) Measuring frequency: 2 to 25 MHz (CK2125) LK Series: Measuring frequency: 10 to 25 MHz (LK1005) Measuring frequency: 1 to 50 MHz (LK1608) Measuring frequency: 0.4 to 50MHz (LK2125) Measuring equipment, jig: HP4194A＋16085B＋16092A (or its equivalent) HP4195A＋41951 ＋16092A (or its equivalent) HP4294A ＋16192A HP4291A ＋16193A (LK1005) Measuring current: 1mA rms (0.047 to 4.7μH) 0.1mA rms (5.6 to 33μH) HK, HKQ, AQ Series: Measuring frequency: 100MHz (HK0603, HK1005,AQ105) Measuring frequency: 50 / 100MHz (HK1608, 2125) Measuring frequency: 500MHz (HKQ0603) Measuring frequency: HP4291A ＋16197A (HK0603,AQ105) HP4291A ＋16193A (HK1005) E4991A ＋16197A (HKQ0603) HP4195A＋16092A＋in-house made jig (HK1608, 2125)
7.DC Resistance	0.075～1.50Ω max.	0.05～0.80Ω max.	0.05～1.10Ω max.	0.05～0.75Ω max.	0.10～0.90Ω max.	0.15～0.80Ω max.	0.140Ω max.	0.025～0.140Ω max.	0.020～0.050Ω max.	0.45～0.85Ω (±30%)	0.16～0.65Ω max.	0.08～0.15Ω max.	0.7～1.70Ω max.	0.3～2.95Ω max.	0.20～1.25Ω max.	0.14～4.0Ω max.	0.08～4.8Ω max.	0.05～2.6Ω max.	0.10～1.5Ω max.	0.10～1.28Ω max.	0.07～0.45Ω max.	Measuring equipment: VOAC−7412 (made by Iwasaki Tsushinki) VOAC−7512 (made by Iwasaki Tsushinki)
8.Self Resonance Frequency (SRF)	—									17～25MHz min.	24～235MHz min.	—	40～180MHz min.	9～260MHz min.	13～320MHz min.	900～10000MHz min.	400～10000MHz min.	300～10000MHz min.	200～4000MHz min.	2000～10000MHz min.	2300～10000MHz min.	LK Series: Measuring equipment: HP4195A Measuring jig: 41951 ＋16092A (or its equivalent) HK, HKQ, AQ Series: Measuring equipment: HP8719C ・HP8753D (HK2125)
9.Temperature Characteristic	—									—						Inductance change: Within±10%						HK, HKQ, AQ Series: Temperature range: −30 to +85℃ Reference temperature: +20℃
10. Resistance to Flexure of Substrate	No mechanical damage.																					Warp: 2mm Testing board: glass epoxy-resin substrate Thickness: 0.8mm 

Multilayer chip inductors and beads

Item	Specified Value	Test Methods and Remarks
11.Solderability	At least 75% of terminal electrode is covered by new solder.	Solder temperature: 230±5℃ Duration: 4±1 sec.
12.Resistance to Soldering	Appearance: No significant abnormality Impedance change: Within±30%	Solder temperature: 260±5℃ Duration: 10±0.5 sec. Preheating temperature: 150 to 180℃ Preheating time: 3 min. Flux: Immersion into methanol solution with colophony for 3 to 5 sec. Recovery: 2 to 3 hrs of recovery under the standard condition after the test. (See Note 1)
13.Thermal Shock	Appearance: No significant abnormality Impedance change: Within ±30%	Conditions for 1 cycle step 1: Minimum operating temperature +0/−3℃ 30±3 min. step 2: Room temperature 2 to 3min. step 3: Minimum operating temperature +0/−3℃ 30±3 min. step 4: Room temperature 2 to 3min. Number of cycles: 5 Recovery: 2 to 3 hrs of recovery under the standard condition after the test. (See Note 1)

Item	BK0603	BK1005	BK1608	BK2125	ARRAY BK2010	ARRAY BK3216	BKP1005	BKP1608	BKP2125	CK1608	CK2125	CKP2520	LK1005	LK1608	LK2125	HK0603	HK1005	HK1608	HK2125	HKQ0603	AQ105
12.Resistance to Soldering										No mechanical damage. Remaining terminal electrode: 70% min. Inductance change R10～4R7: Within±10% 6R8～100: Within±15% CKP2520: Within±30%			No mechanical damage. Remaining terminal electrode: 70% min. Inductance change: Within ±15%	No mechanical damage. Remaining terminal electrode: 70% min. Inductance change 47N～4R7: Within±10% 5R6～330: Within±15%		No mechanical damage. Remaining terminal electrode: 70% min. Inductance change: Within±5%					
13.Thermal Shock										No mechanical damage. Inductance change: Within ±20% Qchange: Within ±30%	No mechanical damage. Inductance change: Within ±30%		No mechanical damage. Inductance change: Within±10% Qchange: Within±30%			No mechanical damage. Inductance change: Within±10% Qchange: Within±20%					

(Note 1) When there are questions concerning mesurement result ; measurement shall be made after 48 ± 2 hrs of recovery under the standard condition.

Multilayer chip inductors and beads

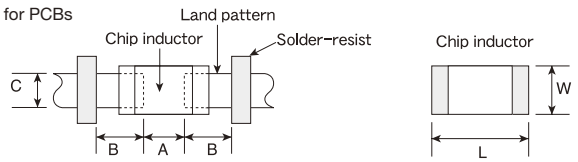
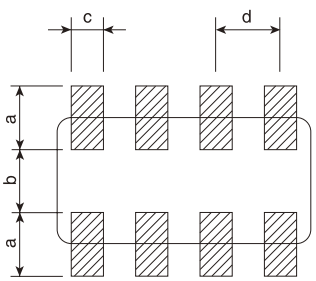
Item	Specified Value	Test Methods and Remarks
14. Damp Heat fSteady stateg	Appearance: No significant abnormality Impedance change: Within ±30%	BK Series: Temperature: 40±2℃ Humidity: 90 to 95%RH Duration: 500 $^{+24}_{0}$ hrs Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1) LK, CK, CKP, HK, HKQ, AQ Series: Temperature: 40±2℃ (LK, CK Series) 60±2℃ (HK, HKQ, AQ Series) Humidity: 90 to 95%RH Duration: 500±12 hours Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1)
15.Loading under Damp Heat	No mechanical damage, Inductance change within±30%	BK Series: Temperature: 40±2℃ (LK Series) Humidity: 90 to 95%RH Duration: 500 $^{+24}_{0}$ hrs Applied current: Rated current Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1) LK, CK, CKP, HK, HKQ, AQ Series: Temperature: 40±2℃ (LK, CK Series) 60±2℃ (HK, HKQ, AQ Series) Humidity: 90 to 95%RH Duration: 500±12 hrs Applied current: Rated current Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1)
16.Loading at High Temperature	Appearance: No significant abnormality Impedance change: Within ±30%	BK Series: Temperature: 125±3℃ Applied current: Rated current Duration: 500 $^{+24}_{0}$ hrs Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1) LK, CK, CKP, HK, HKQ, AQ Series, BK Series P type: Temperature: 85±2℃ (LK, CK, CKP Series) : 85±3℃ (BK Series P type) : 85±2℃ (HK 1608, 2125) : 85±2℃ (HK 1005 AQ105 operating temperature range −55 to +85℃) : 125±2℃ (HK 0603, HK1005, HKQ0603, AQ105) operating temperature range −55 to +125℃) Applied current: Rated current Duration: 500±12 hrs Recovery: 2 to 3 hrs of recovery under the standard condition after the removal from test chamber. (See Note1)

Item	Specified Value																								
	BK0603	BK1005	BK1608	BK2125	ARRAY BK2010	ARRAY BK3216	BKP1005	BKP1608	BKP2125	CK1608	CK2125	CKP2520	LK1005	LK1608	LK2125	HK0603	HK1005	HK1608	HK2125	HKQ0603	AQ105				
14. Damp Heat fSteady stateg	Appearance: No significant abnormality Impedance change: Within ±30%									No mechanica damage. Inductance change: Within ±20% Q change: Within ±30%		No mechanica damage. Inductance change: Within ±30%	No mechanica damage. Inductance change: Within±10% Q change: Within±30%		No mechanica damage. Inductance change: Within ±10% Q change: Within ±30%	No mechanica damage. Inductance change: Within±10% Q change: Within±20%								
15.Loading under Damp Heat	No mechanical damage, Inductance change within±30%									No mechanica damage. Inductance change: Within ±20% Q change: Within ±30%		No mechanica damage. Inductance change: Within ±30%	No mechanica damage. Inductance change: Within ±10% Q change: Within ±30%	No mechanica damage. Inductance change: 0.047 to 12.0μH: Within ±10% 15.0 to 33.0μH: Within ±15% Q change: Within ±30%	No mechanica damage. Inductance change: Within ±10% Q change: Within ±30%	No mechanica damage. Inductance change: Within±10% Q change: Within±20%							
16.Loading at High Temperature	Appearance: No significant abnormality Impedance change: Within ±30%									No mechanica damage. Inductance change: Within ±20% Q change: Within ±30%		No mechanica damage. Inductance change: Within ±30%	No mechanica damage. Inductance change: Within ±10% Q change: Within ±30%	No mechanica damage. Inductance change: 0.047 to 12.0μH: Within ±10% 15.0 to 33.0μH: Within ±15% Q change: Within ±30%	No mechanica damage. Inductance change: Within ±10% Q change: Within ±30%	No mechanica damage. Inductance change: Within±10% Q change: Within±20%							

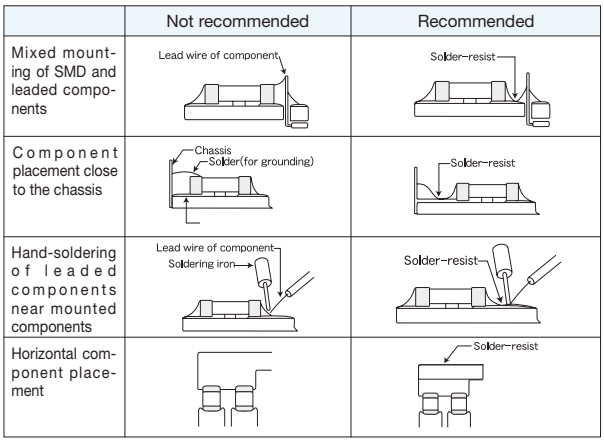
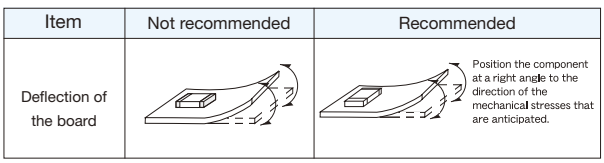
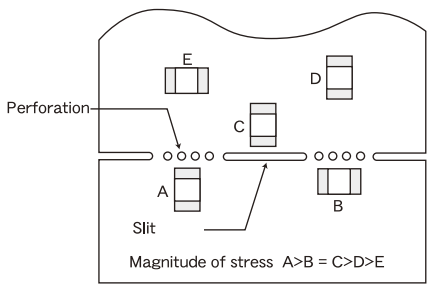
Note on standard condition: "standard condition" referred to herein is defined as follows:
5 to 35℃ of temperature, 45 to 85% relative humidity, and 86 to 106kPa of air pressure.
When there are questions concerning measurement results:
In order to provide correlation data, the test shall be conducted under condition of 20 ± 2℃ of temperature, 60 to 70% relative humidity, and 86 to 106kPa of air pressure. Unless otherwise specified, all the tests are conducted under the "standard condition."

(Note 1)
measurement shall be made after 48 ± 2 hrs of recovery under the standard condition.

Precautions on the use of Multilayer chip Inductors, Multilayer chip inductors for high frequency, Multilayer ferrite chip beads

Stages	Precautions	Technical considerations
1. Circuit Design	◆Verification of operating environment, electrical rating and performance 1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications. As such, any inductors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications. ◆Operating Current (Verification of Rated current) 1. The operating current for inductors must always be lower than their rated values. 2. Do not apply current in excess of the rated value because the inductance may be reduced due to the magnetic saturation effect.	
2. PCB Design	◆Pattern configurations (Design of Land-patterns) 1. When inductors are mounted on a PCB, the size of land patterns and the amount of solder used (size of fillet) can directly affect inductor performance. Therefore, the following items must be carefully considered in the design of solder land patterns: (1) 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. (2) When more than one part is jointly soldered onto the same land or pad, the pad must be designed so that each component's soldering point is separated by solder-resist. (3) The larger size of land patterns and amount of solder, the smaller Q value after mounting on PCB. It makes higher the Q value to design land patterns smaller than terminal electrode of chips.	1. The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts (larger fillets which extend above the component end terminations). Examples of improper pattern designs are also shown. (1) Recommended land dimensions for a typical chip inductor land patterns for PCBs  Recommended land dimensions for wave-soldering (unit: mm) <table><tr><td colspan="2">Type</td><td>1608</td><td>2125</td><td>3216</td></tr><tr><td rowspan="2">Size</td><td>L</td><td>1.6</td><td>2.0</td><td>3.2</td></tr><tr><td>W</td><td>0.8</td><td>1.25</td><td>1.6</td></tr><tr><td colspan="2">A</td><td>0.8~1.0</td><td>1.0~1.4</td><td>1.8~2.5</td></tr><tr><td colspan="2">B</td><td>0.5~0.8</td><td>0.8~1.5</td><td>0.8~1.7</td></tr><tr><td colspan="2">C</td><td>0.6~0.8</td><td>0.9~1.2</td><td>1.2~1.6</td></tr></table> Recommended land dimensions for reflow-soldering (unit: mm) <table><tr><td colspan="2">Type</td><td>0603</td><td>1005</td><td>105</td><td>1608</td><td>2125</td><td>3216</td><td>2520</td></tr><tr><td rowspan="2">Size</td><td>L</td><td>0.6</td><td>1.0</td><td>1.0</td><td>1.6</td><td>2.0</td><td>3.2</td><td>2.5</td></tr><tr><td>W</td><td>0.3</td><td>0.5</td><td>0.6</td><td>0.8</td><td>1.25</td><td>1.6</td><td>2.0</td></tr><tr><td colspan="2">A</td><td>0.20~0.30</td><td>0.45~0.55</td><td>0.50~0.55</td><td>0.6~0.8</td><td>0.8~1.2</td><td>1.8~2.5</td><td>1.0~1.4</td></tr><tr><td colspan="2">B</td><td>0.20~0.30</td><td>0.40~0.50</td><td>0.30~0.40</td><td>0.6~0.8</td><td>0.8~1.2</td><td>0.6~1.5</td><td>0.6~1.0</td></tr><tr><td colspan="2">C</td><td>0.25~0.40</td><td>0.45~0.55</td><td>0.60~0.70</td><td>0.6~0.8</td><td>0.9~1.6</td><td>1.2~2.0</td><td>1.8~2.2</td></tr></table> Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.  Recommended land dimension for Reflow-soldering (unit: mm) <table><tr><td colspan="2"></td><td>3216</td><td>2010</td></tr><tr><td rowspan="2">Size</td><td>L</td><td>3.2</td><td>2.0</td></tr><tr><td>W</td><td>1.6</td><td>1.0</td></tr><tr><td colspan="2">a</td><td>0.7~0.9</td><td>0.5~0.6</td></tr><tr><td colspan="2">b</td><td>0.8~1.0</td><td>0.5~0.6</td></tr><tr><td colspan="2">c</td><td>0.4~0.5</td><td>0.2~0.3</td></tr><tr><td colspan="2">d</td><td>0.8</td><td>0.5</td></tr></table>

Precautions on the use of Multilayer chip Inductors, Multilayer chip inductors for high frequency, Multilayer ferrite chip beads

Stages	Precautions	Technical considerations
2.PCB Design	◆Pattern configurations (Inductor layout on panelized [breakaway] PC boards) 1. After inductors have been mounted on the boards, chips can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering the reflow soldered boards etc.) For this reason, planning pattern configurations and the position of SMD inductors should be carefully performed to minimize stress.	(2) Examples of good and bad solder application  1-1. The following are examples of good and bad inductor layout; SMD inductors should be located to minimize any possible mechanical stresses from board warp or deflection.  1-2. To layout the inductors for the breakaway PC board, it should be noted that the amount of mechanical stresses given will vary depending on inductor layout. An example below should be counted for better design.  1-3. When breaking PC boards along their perforations, the amount of mechanical stress on the inductors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, any ideal SMD inductor layout must also consider the PCB splitting procedure.

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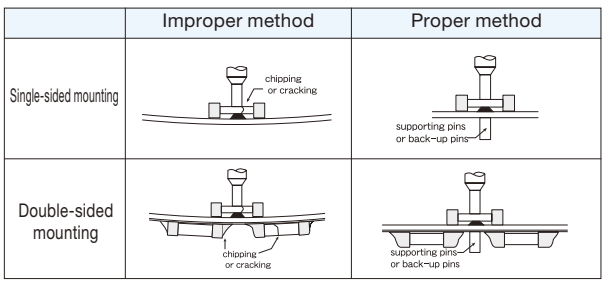
<table>
<tr><th>Stages</th><th>Precautions</th><th>Technical considerations</th></tr>
<tr><td>3.Considerations for automatic placement</td><td>◆Adjustment of mounting machine
1. Excessive impact load should not be imposed on the inductors when mounting onto the PC boards.
2. The maintenance and inspection of the mounter should be conducted periodically.</td><td>1. If the lower limit of the pick-up nozzle is low, too much force may be imposed on the inductors, causing damage. To avoid this, the following points should be considered before lowering the pick-up nozzle:
(1) The lower limit of the pick-up nozzle should be adjusted to the surface level of the PC board after correcting for deflection of the board.
(2) The pick-up pressure should be adjusted between 1 and 3 N static loads.
(3) To reduce the amount of deflection of the board caused by impact of the pick-up nozzle, supporting pins or back-up pins should be used under the PC board. The following diagrams show some typical examples of good pick-up nozzle placement:
 

2. As the alignment pin wears out, adjustment of the nozzle height can cause chipping or cracking of the inductors because of mechanical impact on the inductors. To avoid this, the monitoring of the width between the alignment pin in the stopped position, and maintenance, inspection and replacement of the pin should be conducted periodically.</td></tr>
<tr><td></td><td>◆Selection of Adhesives
1. Mounting inductors with adhesives in preliminary assembly, before the soldering stage, may lead to degraded inductor characteristics unless the following factors are appropriately checked; the size of land patterns, type of adhesive, amount applied, hardening temperature and hardening period. Therefore, it is imperative to consult the manufacturer of the adhesives on proper usage and amounts of adhesive to use.</td><td>1. Some adhesives may cause reduced insulation resistance. The difference between the shrinkage percentage of the adhesive and that of the inductors may result in stresses on the inductors and lead to cracking. Moreover, too little or too much adhesive applied to the board may adversely affect component placement, so the following precautions should be noted in the application of adhesives.

(1) Required adhesive characteristics
a. The adhesive should be strong enough to hold parts on the board during the mounting & solder process.
b. The adhesive should have sufficient strength at high temperatures.
c. The adhesive should have good coating and thickness consistency.
d. The adhesive should be used during its prescribed shelf life.
e. The adhesive should harden rapidly
f. The adhesive must not be contaminated.
g. The adhesive should have excellent insulation characteristics.
h. The adhesive should not be toxic and have no emission of toxic gasses.</td></tr>
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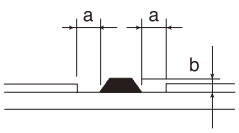
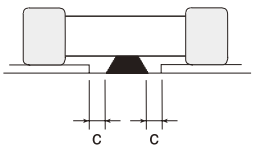
Stages	Precaution	Technical considerations
3.Considerations for automatic placement		When using adhesives to mount inductors on a PCB, inappropriate amounts of adhesive on the board may adversely affect component placement. Too little adhesive may cause the inductors to fall off the board during the solder process. Too much adhesive may cause defective soldering due excessive flow of adhesive on to the land or solder pad. [Recommended conditions] Figure / 0805 case sizes as examples a / 0.3mm min b / 100 ~120 μm c / Area with no adhesive Amount of adhesives  After inductors are bonded 
4.Soldering	◆Selection of Flux 1. Since flux may have a significant effect on the performance of inductors, it is necessary to verify the following conditions prior to use; (1) Flux used should be with less than or equal to 0.1 wt% (Chlorine conversion method) of halogenated content. Flux having a strong acidity content should not be applied. (2) When soldering inductors on the board, the amount of flux applied should be controlled at the optimum level. (3) When using water-soluble flux, special care should be taken to properly clean the boards. ◆Soldering Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions.	1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate the flux, or highly acidic flux is used, an excessive amount of residue after soldering may lead to corrosion of the terminal electrodes or degradation of insulation resistance on the surface of the Inductor. 1-2. Flux is used to increase solderability in flow soldering, but if too much is applied, a large amount of flux gas may be emitted and may detrimentally affect solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system. 1-3. Since the residue of water-soluble flux is easily dissolved by water content in the air, the residue on the surface of Inductor in high humidity conditions may cause a degradation of insulation resistance and therefore affect the reliability of the components. The cleaning methods and the capability of the machines used should also be considered carefully when selecting water-soluble flux. 1-1. Preheating when soldering Heating: Chip inductor components should be preheated to within 100 to 130℃ of the soldering. Cooling: The temperature difference between the components and cleaning process should not be greater than 100 ℃. Chip inductors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling. Therefore, the soldering process must be conducted with a great care so as to prevent malfunction of the components due to excessive thermal shock.

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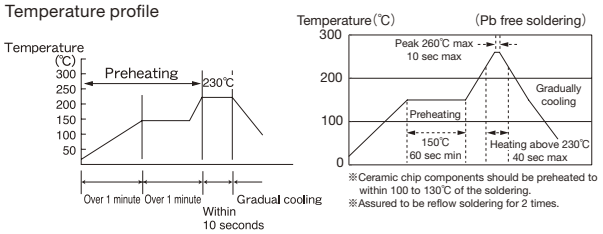
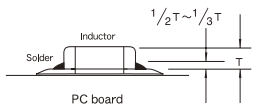
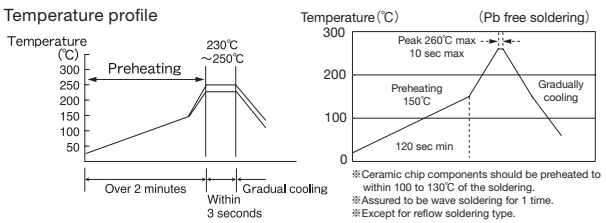
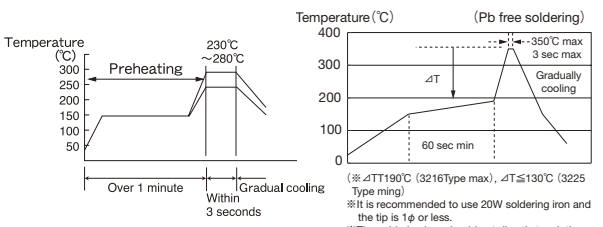
Stages	Precautions	Technical considerations
4.Soldering	◆And please contact us about peak temperature when you use lead-free paste.	Recommended conditions for soldering [Reflow soldering] Temperature profile  ※Ceramic chip components should be preheated to within 100 to 130℃ of the soldering. ※Assured to be reflow soldering for 2 times. Caution 1. The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of the inductor, as shown below:  2. Because excessive dwell times can detrimentally affect solderability, soldering duration should be kept as close to recommended times as possible. [Wave soldering] Temperature profile  ※Ceramic chip components should be preheated to within 100 to 130℃ of the soldering. ※Assured to be wave soldering for 1 time. ※Except for reflow soldering type. Caution 1. Make sure the inductors are preheated sufficiently. 2. The temperature difference between the inductor and melted solder should not be greater than 100 to 130℃ 3. Cooling after soldering should be as gradual as possible. 4. Wave soldering must not be applied to the inductors designated as for re-flow soldering only. [Hand soldering] Temperature profile  (※ΔT190℃ (3216Type max), ΔT≦130℃ (3225 Type ming) ※It is recommended to use 20W soldering iron and the tip is 1φ or less. ※The soldering iron should not directly touch the components. ※Assured to be soldering iron for 1 time. Note: The above profiles are the maximum allowable soldering condition, therefore these profiles are not always recommended. Caution 1. Use a 20W soldering iron with a maximum tip diameter of 1.0 mm. 2. The soldering iron should not directly touch the inductor.
5.Cleaning	◆Cleaning conditions 1. When cleaning the PC board after the Inductors are all mounted, select the appropriate cleaning solution according to the type of flux used and purpose of the cleaning (e.g. to remove soldering flux or other materials from the production process.)	1. The use of inappropriate solutions can cause foreign substances such as flux residue to adhere to the inductor, resulting in a degradation of the inductor's electrical properties (especially insulation resistance).

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Stages	Precautions	Technical considerations
5.Cleaning	2. Cleaning conditions should be determined after verifying, through a test run, that the cleaning process does not affect the inductor's characteristics.	2. Inappropriate cleaning conditions (insufficient or excessive cleaning) may detrimentally affect the performance of the inductors. (1) Excessive cleaning In the case of ultrasonic cleaning, too much power output can cause excessive vibration of the PC board which may lead to the cracking of the inductor or the soldered portion, or decrease the terminal electrodes' strength. Thus the following conditions should be carefully checked; Ultrasonic output Below 20 w/ℓ Ultrasonic frequency Below 40 kHz Ultrasonic washing period 5 min. or less
6. Post cleaning processes	◆Application of resin coatings, moldings, etc. to the PCB and components. 1. With some type of resins a decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the inductor's performance. 2. When a resin's hardening temperature is higher than the inductor's operating temperature, the stresses generated by the excess heat may lead to inductor damage or destruction. 3. Stress caused by a resin's temperature generated expansion and contraction may damage inductors. The use of such resins, molding materials etc. is not recommended.	
7. Handling	◆Breakaway PC boards (splitting along perforations) 1. When splitting the PC board after mounting inductors and other components, care is required so as not to give any stresses of deflection or twisting to the board. 2. Board separation should not be done manually, but by using the appropriate devices. ◆General handling precautions 1. Always wear static control bands to protect against ESD. 2. Keep the inductors away from all magnets and magnetic objects. 3. Use non-magnetic tweezers when handling inductors. 4. Any devices used with the inductors (soldering irons, measuring instruments) should be properly grounded. 5. Keep bare hands and metal products (i.e., metal desk) away from chip electrodes or conductive areas that lead to chip electrodes. 6. Keep inductors away from items that generate magnetic fields such as speakers or coils. ◆Mechanical considerations 1. Be careful not to subject the inductors to excessive mechanical shocks. (1) If inductors are dropped on the floor or a hard surface they should not be used. (2) When handling the mounted boards, be careful that the mounted components do not come in contact with or bump against other boards or components.	

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8. Storage conditions	◆Storage 1. To maintain the solderability of terminal electrodes and to keep the packaging material in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible. Recommended conditions Ambient temperature Below 40 ℃ Humidity Below 70% RH The ambient temperature must be kept below 30 ℃. Even under ideal storage conditions inductor electrode solderability decreases as time passes, so inductors should be used within 6 months from the time of delivery. *The packaging material should be kept where no chlorine or sulfur exists in the air.	1. If the parts are stocked in a high temperature and humidity environment, problems such as reduced solderability caused by oxidation of terminal electrodes and deterioration of taping/packaging materials may take place. For this reason, components should be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the inductors