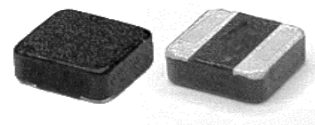


## FEATURES

- RoHS, Halogen Free and REACH Compliance
- High performance (Isat) realized by metal dust core.
- Low coil resistance with large currents.
- Operate temperature range ....  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$  (Including self temp. rise)



## APPLICATIONS

- Smart phone, pad
- Notebooks, VR, AR
- Portable gaming devices, Smart wear, Wi-Fi module

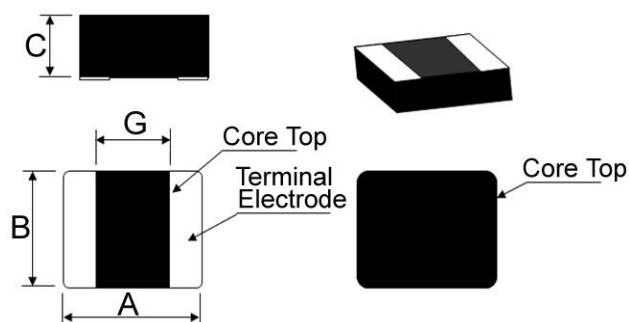
## PRODUCT IDENTIFICATION

AFE 201610 S 2R2 M B T

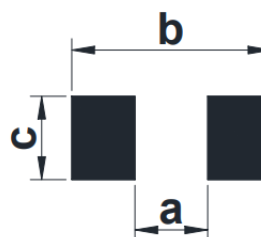
① ② ③ ④ ⑤ ⑥ ⑦

- ① Series Name: Mini Molding Chip type power inductor
- ② Size Code: L\*W\*T
- ③ Feature Type: Standard
- ④ Initial inductance value: 2R2 = 2.2uH
- ⑤ Inductance Tolerance: M $\pm$ 20%
- ⑥ Coating color: B=Black
- ⑦ Packing: Tape & Reel

## Dimensions: [mm]



### Recommended Pattern



| Series     | A             | G             | B             | C        | b    | a    | c    |
|------------|---------------|---------------|---------------|----------|------|------|------|
| AFE201655S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 0.55Max. | 2.10 | 0.50 | 1.70 |
| AFE201665S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 0.65Max. | 2.10 | 0.50 | 1.70 |
| AFE201607S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 0.70Max. | 2.10 | 0.50 | 1.70 |
| AFE201608S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 0.80Max. | 2.10 | 0.50 | 1.70 |
| AFE201610S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 1.00Max. | 2.10 | 0.50 | 1.70 |
| AFE201612S | $2.0 \pm 0.2$ | $0.6 \pm 0.2$ | $1.6 \pm 0.2$ | 1.20Max. | 2.10 | 0.50 | 1.70 |

**Electrical Properties:****AFE201655(2.0\*1.6\*0.55mm)**

| P/N              | L0(μH)<br>@(0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |     | Saturation current<br>Isat(A) |     |
|------------------|----------------------|---------|-----|--------------------------------|-----|-------------------------------|-----|
|                  |                      | Typical | Max | Typical                        | Max | Typical                       | Max |
| AFE201655SR33MBT | 0.33                 | 34      | 41  | 4.0                            | 3.5 | 4.0                           | 3.5 |
| AFE201655SR47MBT | 0.47                 | 44      | 53  | 3.5                            | 3.0 | 3.5                           | 3.0 |

**AFE201665(2.0\*1.6\*0.65mm)**

| P/N              | L0(μH)<br>@(0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |     | Saturation current<br>Isat(A) |     |
|------------------|----------------------|---------|-----|--------------------------------|-----|-------------------------------|-----|
|                  |                      | Typical | Max | Typical                        | Max | Typical                       | Max |
| AFE201665S1R0MBT | 1.0                  | 58      | 70  | 3.5                            | 3.0 | 3.0                           | 2.7 |

**AFE201607(2.0\*1.6\*0.70mm)**

| P/N              | L0(μH)<br>@(0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |     | Saturation current<br>Isat(A) |     |
|------------------|----------------------|---------|-----|--------------------------------|-----|-------------------------------|-----|
|                  |                      | Typical | Max | Typical                        | Max | Typical                       | Max |
| AFE201607S2R2MBT | 2.2                  | 150     | 175 | 2.1                            | 1.8 | 2.3                           | 2.0 |

**AFE201608(2.0\*1.6\*0.80mm)**

| P/N              | L0(μH)<br>@(0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |     | Saturation current<br>Isat(A) |     |
|------------------|----------------------|---------|-----|--------------------------------|-----|-------------------------------|-----|
|                  |                      | Typical | Max | Typical                        | Max | Typical                       | Max |
| AFE201608SR22MBT | 0.22                 | 14      | 19  | 6.6                            | 5.9 | 6.1                           | 5.6 |
| AFE201608SR24MBT | 0.24                 | 14      | 20  | 6.5                            | 5.8 | 6.0                           | 5.5 |
| AFE201608SR33MBT | 0.33                 | 18      | 24  | 5.5                            | 4.8 | 5.8                           | 5.3 |
| AFE201608SR47MBT | 0.47                 | 24      | 27  | 4.6                            | 4.4 | 5.5                           | 5.0 |
| AFE201608SR68MBT | 0.68                 | 39      | 44  | 3.8                            | 3.5 | 4.6                           | 4.2 |
| AFE201608S1R0MBT | 1.0                  | 53      | 60  | 3.6                            | 3.3 | 3.3                           | 3.1 |
| AFE201608S1R5MBT | 1.5                  | 73      | 85  | 3.1                            | 2.8 | 3.0                           | 2.8 |
| AFE201608S2R2MBT | 2.2                  | 123     | 140 | 2.2                            | 2.0 | 2.5                           | 2.3 |
| AFE201608S3R3MBT | 3.3                  | 200     | 220 | 1.8                            | 1.5 | 2.1                           | 1.8 |
| AFE201608S4R7MBT | 4.7                  | 260     | 290 | 1.6                            | 1.4 | 1.7                           | 1.5 |
| AFE201608S100MBT | 10.0                 | 690     | 800 | 1.0                            | 0.9 | 1.0                           | 0.9 |

**AFE201610(2.0\*1.6\*1.0mm)**

| P/N              | L0(μH)<br>@ (0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |     | Saturation current<br>Isat(A) |     |
|------------------|-----------------------|---------|-----|--------------------------------|-----|-------------------------------|-----|
|                  |                       | Typical | Max | Typical                        | Max | Typical                       | Max |
| AFE201610SR10MBT | 0.10                  | 7.0     | 12  | 8.5                            | 8.0 | 9.0                           | 8.4 |
| AFE201610SR11MBT | 0.11                  | 7.5     | 13  | 8.0                            | 7.5 | 8.9                           | 8.2 |
| AFE201610SR15MBT | 0.15                  | 8.0     | 14  | 7.6                            | 7.0 | 8.7                           | 8.0 |
| AFE201610SR22MBT | 0.22                  | 11      | 18  | 6.9                            | 6.3 | 8.2                           | 7.5 |
| AFE01610SR24MBT  | 0.24                  | 12      | 19  | 6.8                            | 6.2 | 8.0                           | 7.4 |
| AFE201610SR24MBT | 0.24                  | 11      | 14  | 6.8                            | 6.2 | 8.0                           | 7.4 |
| AFE201610SR33MBT | 0.33                  | 17      | 22  | 5.7                            | 5.3 | 7.0                           | 6.5 |
| AFE201610SR47MBT | 0.47                  | 22      | 25  | 5.5                            | 5.0 | 6.3                           | 5.5 |
| AFE201610SR68MBT | 0.68                  | 25      | 32  | 4.6                            | 4.3 | 5.2                           | 4.7 |
| AFE201610S1R0MBT | 1.0                   | 35      | 43  | 4.5                            | 4.1 | 4.6                           | 4.2 |
| AFE201610S1R5MBT | 1.5                   | 80      | 100 | 2.6                            | 2.3 | 3.2                           | 2.9 |
| AFE201610S2R2MBT | 2.2                   | 120     | 130 | 2.5                            | 2.1 | 3.0                           | 2.8 |
| AFE201610S3R3MBT | 3.3                   | 140     | 170 | 1.7                            | 1.5 | 2.3                           | 2.0 |
| AFE201610S4R7MBT | 4.7                   | 190     | 220 | 1.6                            | 1.4 | 2.0                           | 1.8 |
| AFE201610S100MBT | 10.0                  | 483     | 580 | 1.0                            | 0.7 | 1.4                           | 1.1 |

**AFE201612(2.0\*1.6\*1.2mm)**

| P/N              | L0(μH)<br>@ (0A) 1MHz | Rdc(mΩ) |     | Heat rating current<br>Irms(A) |      | Saturation current<br>Isat(A) |      |
|------------------|-----------------------|---------|-----|--------------------------------|------|-------------------------------|------|
|                  |                       | Typical | Max | Typical                        | Max  | Typical                       | Max  |
| AFE201612SR10MBT | 0.10                  | 4.0     | 6.0 | 12                             | 10   | 13                            | 11.5 |
| AFE201612SR11MBT | 0.11                  | 4.8     | 5.6 | 15.5                           | 14.5 | 12.5                          | 11.0 |
| AFE201612SR15MBT | 0.15                  | 7.5     | 10  | 10                             | 9.0  | 12                            | 10.5 |
| AFE201612SR24MBT | 0.24                  | 9.0     | 11  | 9.1                            | 8.6  | 9.2                           | 8.7  |
| AFE201612SR33MBT | 0.33                  | 10      | 15  | 7.7                            | 7.2  | 7.8                           | 7.3  |
| AFE201612SR47MBT | 0.47                  | 13      | 17  | 6.7                            | 6.0  | 6.7                           | 6.0  |
| AFE201612SR68MBT | 0.68                  | 19      | 23  | 6.0                            | 5.3  | 6.0                           | 5.3  |
| AFE201612S1R0MBT | 1.0                   | 30      | 36  | 5.0                            | 4.5  | 5.0                           | 4.5  |
| AFE201612S1R5MBT | 1.5                   | 40      | 50  | 4.0                            | 3.5  | 4.0                           | 3.5  |
| AFE201612S2R2MBT | 2.2                   | 77      | 90  | 3.3                            | 2.9  | 3.1                           | 2.7  |
| AFE201612S3R3MBT | 3.3                   | 135     | 165 | 2.4                            | 2.0  | 2.7                           | 2.3  |

## Test remarks

Note 1.: All test data is referenced to 25 °C ambient.

Note 2.: Test Condition: 1MHz, 1.0Vrms.

Note 3.: Irms:DC current (A) that will cause an approximate  $\Delta T$  of 40 °C.

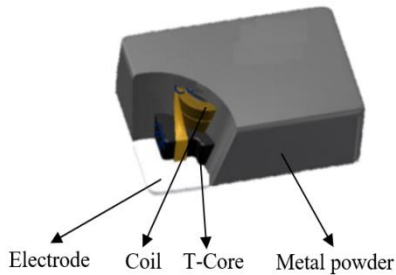
Note 4.: Isat:DC current (A) that will cause L0 to drop approximately 30%.

Note 5.: Operating Temperature Range -40°C to + 125°C.

Note 6.: The part temperature (ambient + temp rise) should not exceed 125 under °C the worst case operating conditions. Circuit design, component placement, PCB trace size and thickness, airflow and other cooling provision all affect the part temperature. Part temperature should be verified in the end application.

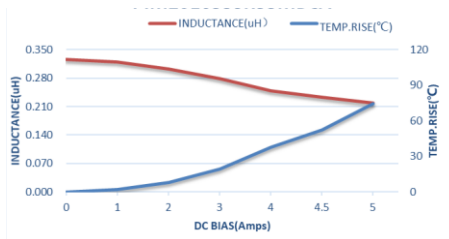
Note 7.: The rated current as listed is either the saturation current or the heating current depending on which value is lower.

## Structure

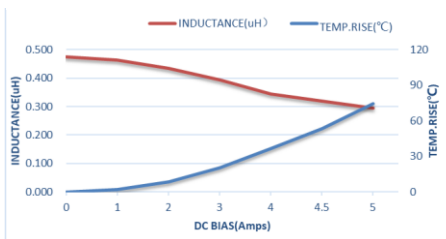


## Current Characteristic

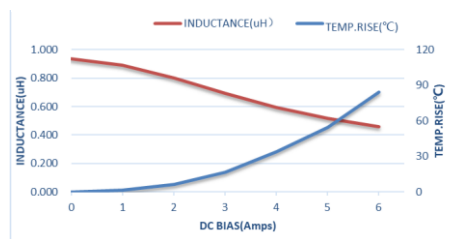
AFE201655SR33MBT



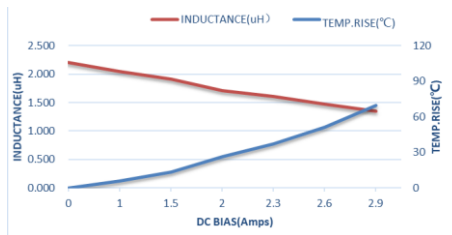
AFE201655SR47MBT



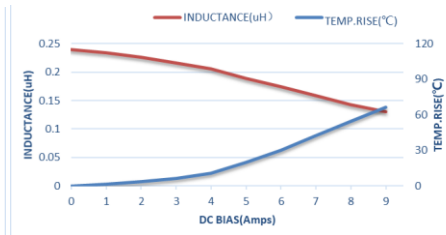
AFE201665S1R0MBT



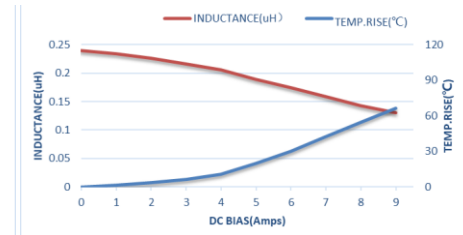
AFE201607S2R2MBT



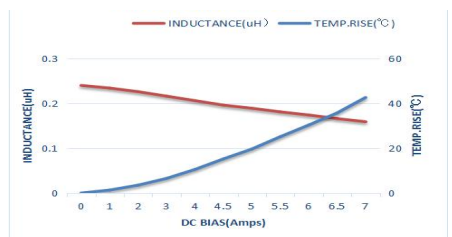
AFE201608SR22MBT



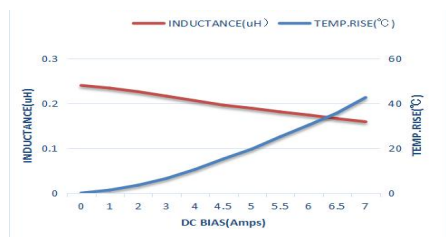
AFE201608SR24MBT



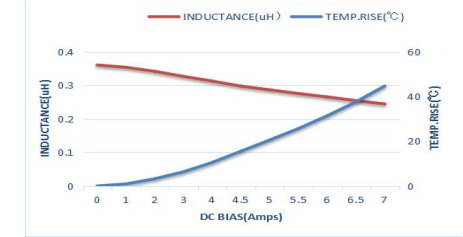
AFE201608SR22MBT



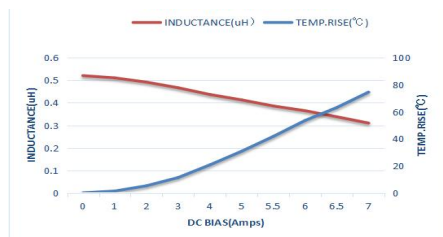
AFE201608SR24MBT



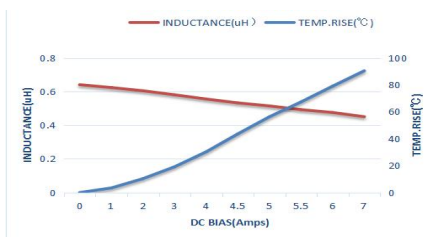
AFE201608SR33MBT



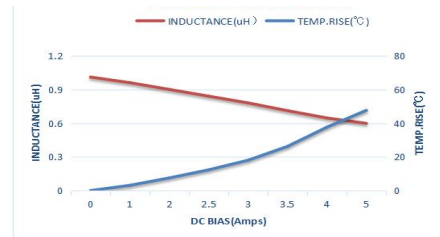
AFE201608SR47MBT



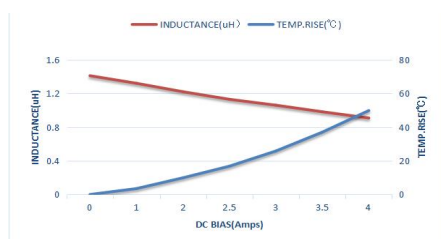
AFE201608SR68MBT



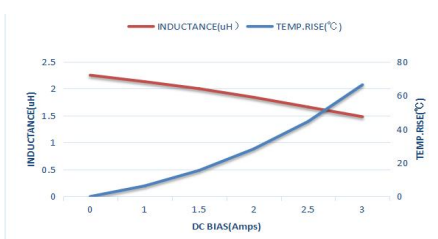
AFE201608S1R0MBT



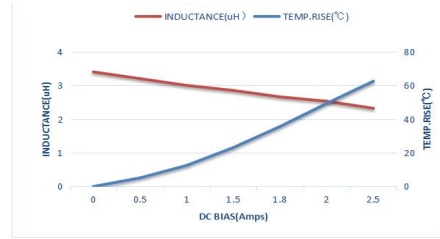
AFE201608S1R5MBT



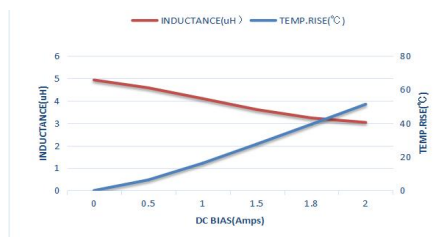
AFE201608S2R2MBT



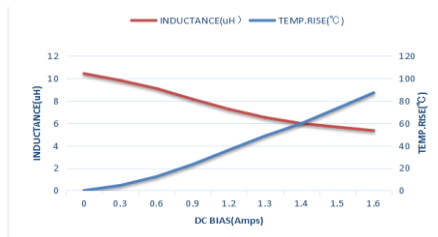
AFE201608S3R3MBT



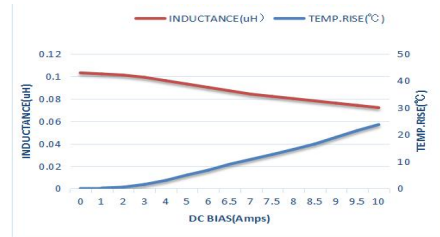
AFE201608S4R7MBT



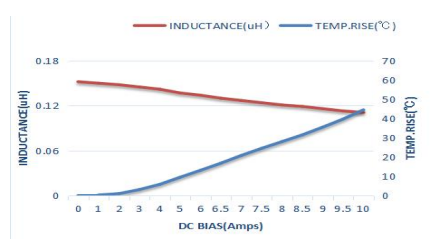
AFE201608S100MBT



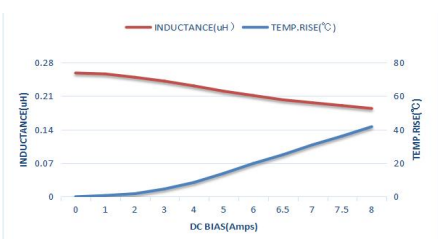
AFE201610SR10MBT



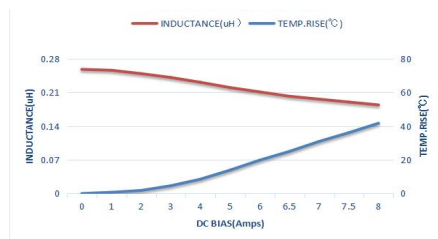
AFE201610SR15MBT



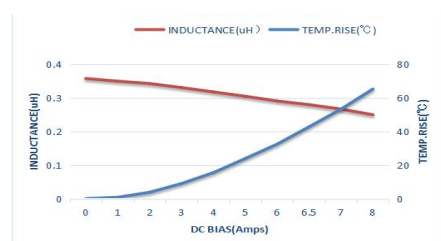
AFE201610SR22MBT



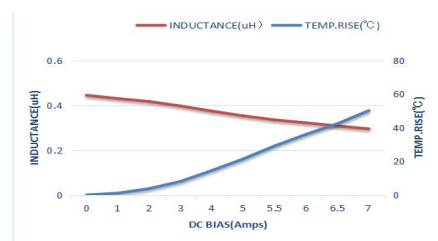
AFE201610SR24MBT



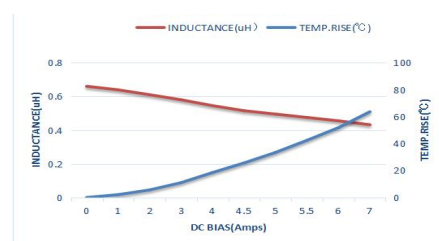
AFE201610SR33MBT



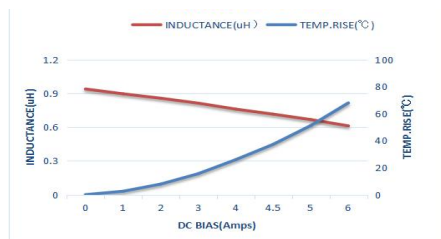
AFE201610SR47MBT



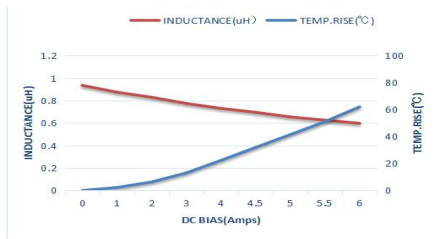
AFE201610SR68MBT



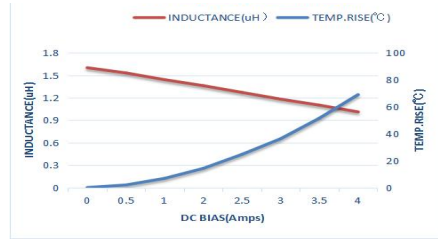
AFE201610S1R0MBT



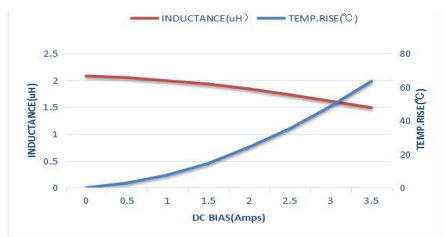
AFE201610S1R0MBTD



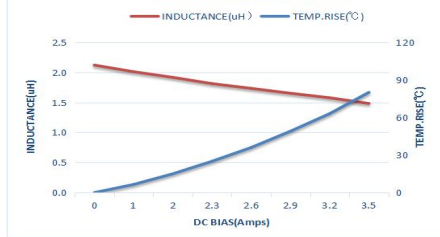
AFE201610S1R5MBT



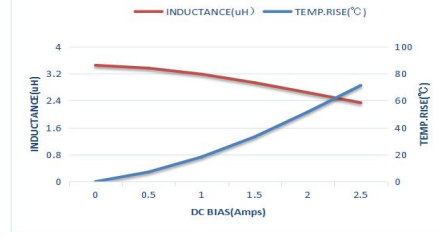
AFE201610S2R2MBT



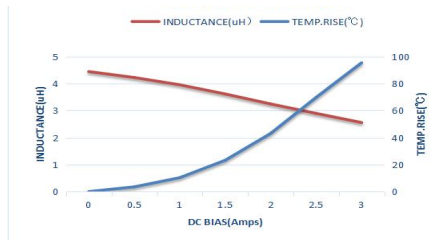
AFE201610S2R2MBT



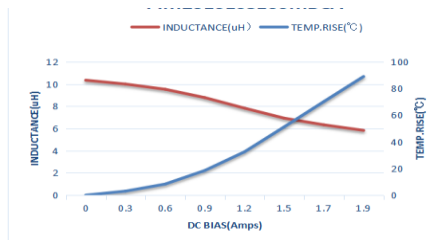
AFE201610S3R3MBT



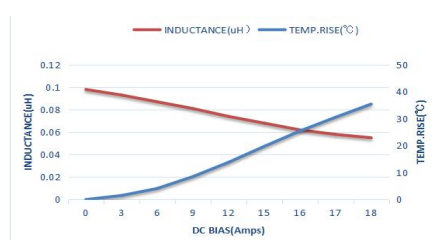
AFE201610S4R7MBT



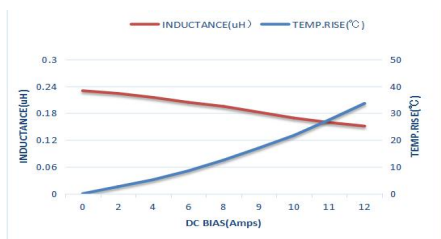
AFE201610S100MBT



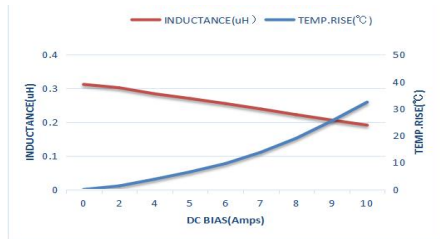
AFE201612SR10MBT



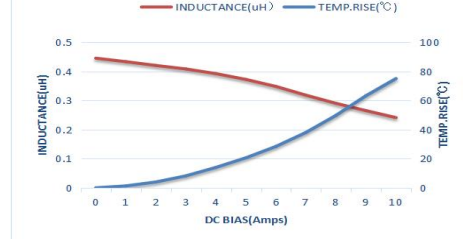
AFE201612SR24MBT



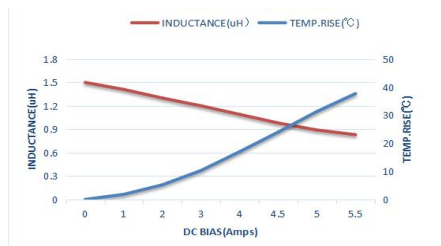
AFE201612SR33MBT



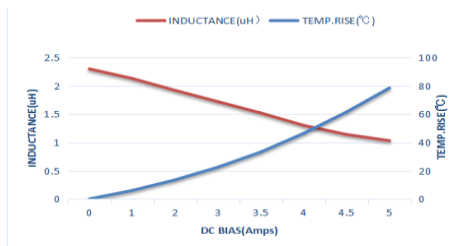
AFE201612SR47MBT



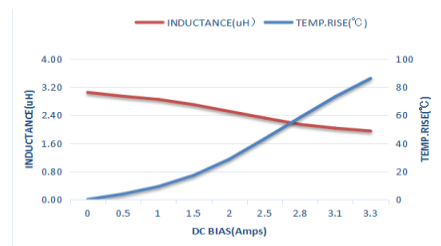
AFE201612S1R5MBT



AFE201612S2R2MBT



AFE201612S3R3MBT



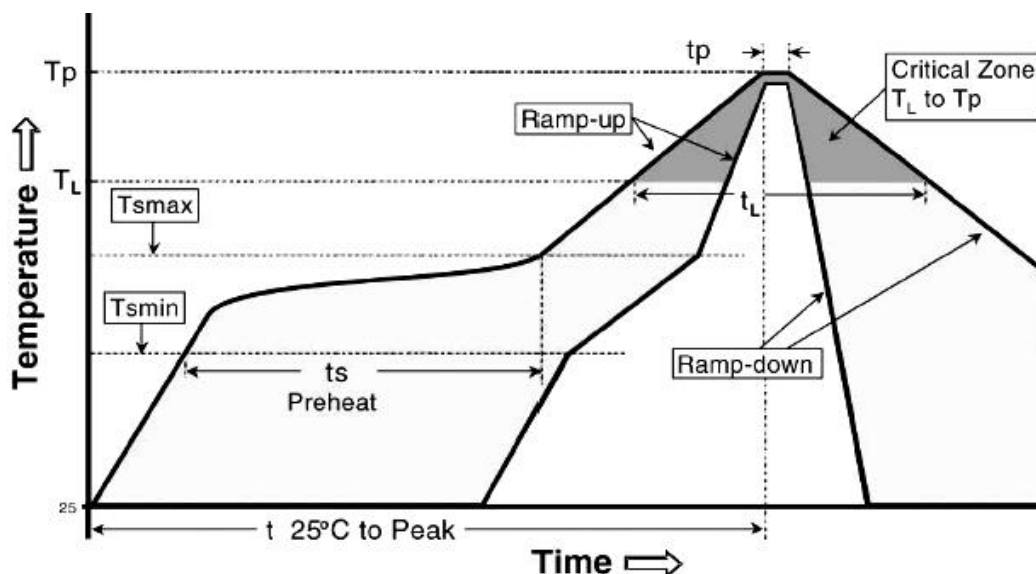
## Reliability

| Item                         | Requirements                                                                         | Test Methods and Remarks                                                                                                                                                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insulation Resistance        | $\geq 100\text{M}\Omega$                                                             | 100 VDC between inductor coil and The middle of the top surface of the body for 60 seconds.                                                                                                                                                                                                               |
| Solderability                | 90% or more of electrode area shall be coated by new solde.                          | Dip pads in flux .<br>Solder Composition: Sn/Ag3.0/Cu0.5(Pb-Free).<br>Solder Temperature: $245 \pm 5^\circ\text{C}$ .<br>Immersion Time: $(5 \pm 1)$ s.                                                                                                                                                   |
| Resistance to Soldering Heat | No visible mechanical damage.<br>Inductance change: Within $\pm 10\%$ .              | Dip pads in flux.<br>Solder Composition: Sn/Ag3.0/Cu0.5(Pb-Free).<br>Solder Temperature: $260 \pm 5^\circ\text{C}$ .<br>Immersion Time: $10 \pm 1$ sec.                                                                                                                                                   |
| Adhesion of teral electrode  | Strong bond between the pad and the core, without come off PCB.                      | Inductors shall be subjected to $(260 \pm 5)^\circ\text{C}$ for $(20 \pm 5)$ s Soldering in the base whit 0.3mm solder.<br>And then aplombelectrode way plus tax 10 N for $(10 \pm 1)$ seconds.                                                                                                           |
| High temperature             | No case deformation or change in appearance.<br>Inductance change: Within $\pm 10\%$ | Temperature: $125 \pm 2^\circ\text{C}$ .<br>Time : 1000 hours.<br>Measurement at $24 \pm 4$ hours after test conclusion.                                                                                                                                                                                  |
| Low temperature              | No visible mechanical damage.<br>Inductance change: Within $\pm 10\%$                | Temperature: $-40 \pm 2^\circ\text{C}$ .<br>Time : 1000 hours.<br>Measurement at $24 \pm 4$ hours after test conclusion.                                                                                                                                                                                  |
| Thermal shock                | No visible mechanical damage.<br>Inductance change: Within $\pm 10\%$                | The test sample shall be placed at $(-55 \pm 3)^\circ\text{C}$ and $(125 \pm 3)^\circ\text{C}$ for $(30 \pm 3)$ , different temperature conversion time is 2~3 utes.<br>The temperature cycle shall be repeated 32 cycles.<br>Placed at room temperature for 2 hours, within $48 \pm 4$ hours of testing. |
| Temperature characteristic   | Inductance change Pc-b,Pc-d:<br>Within $\pm 20\%$                                    | a: $+20^\circ\text{C}$ (30~45) →<br>b: $-40^\circ\text{C}$ (30~45) →<br>c: $+20^\circ\text{C}$ (30~45) →<br>d: $+125^\circ\text{C}$ (30~45) →<br>e: $+20^\circ\text{C}$ (30~45)<br>$P_{c-b} = \frac{L_b - L_c}{L_c} \times 100\%$ ; $P_{c-d} = \frac{L_d - L_c}{L_c} \times 100\%$                        |
| Static Humidity              | No visible mechanical damage.<br>Inductance change: Within $\pm 10\%$                | Inductors shall be subjected to $(95 \pm 3)\% \text{RH}$ .<br>at $(60 \pm 2)^\circ\text{C}$ for $(1000 \pm 4)$ h.<br>Placed at room temperature for 2 hours, within 48 hours of testing.                                                                                                                  |
|                              | No visible mechanical damage.<br>Inductance change: Within $\pm 10\%$                | Inductors shall be store at $(85 \pm 2)^\circ\text{C}$ for $(1000 \pm 4)$ hours with Irms applied.<br>Placed at room temperature for 2 hours, within 48 hours of testing                                                                                                                                  |

## Soldering Condition

(This is for recommendation, please customer perform adjustment according to actual application)

Recommend Reflow Soldering Profile : (solder : Sn96.5 / Ag3 / Cu0.5)



| Profile Feature                                                                                                                        | Lead (Pb)-Free solder |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Preheat:                                                                                                                               |                       |
| Temperature Min (T <sub>smin</sub> )                                                                                                   | 150°C                 |
| Temperature Max (T <sub>smax</sub> )                                                                                                   | 200°C                 |
| Time (T <sub>smin</sub> to T <sub>smax</sub> ) (ts)                                                                                    | 60 -120 seconds       |
| Average ramp-up rate:<br>(Ts max to Tp)                                                                                                | 3°C / second max.     |
| Time maintained above :                                                                                                                |                       |
| Temperature (T <sub>L</sub> )                                                                                                          | 217°C                 |
| Time (t <sub>L</sub> )                                                                                                                 | 60-150 seconds        |
| Peak Temperature (T <sub>p</sub> )                                                                                                     | 260°C                 |
| Time within $\begin{smallmatrix} +0^{\circ}\text{C} \\ -5 \end{smallmatrix}$ of actual peak Temperature (t <sub>p</sub> ) <sup>2</sup> | 10 seconds            |
| Ramp-down Rate                                                                                                                         | 6°C/second max.       |
| Time 25°C to Peak Temperature                                                                                                          | 8minutes max.         |

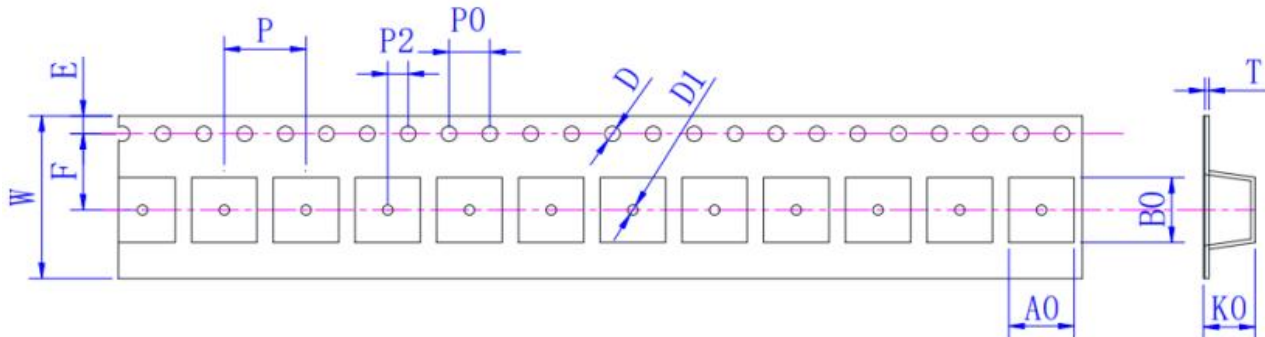
Allowed Re-flow times : 2 times

Remark : To avoid discoloration phenomena of chip on terminal electrodes, please use N<sub>2</sub> Re-flow furnace .



## Packing

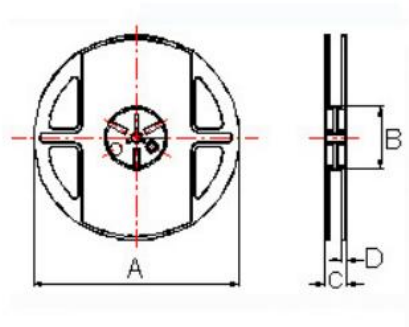
Dimension of plastic taping: (Unit: mm)



| Series    | W<br>±0.30 | A0<br>±0.05 | B0<br>+0.1/-0 | D<br>+0.1/-0 | D1<br>Min | E<br>±0.10 | F<br>±0.10 | K0<br>±0.05 | P0<br>±0.10 | P2<br>±0.10 | P<br>±0.10 | T<br>±0.05 |
|-----------|------------|-------------|---------------|--------------|-----------|------------|------------|-------------|-------------|-------------|------------|------------|
| 201655/65 | 8.00       | 1.90        | 2.30          | 1.50         | 1.0       | 1.75       | 3.50       | 0.8         | 4.00        | 2.00        | 4.00       | 0.23       |
| 201607/08 | 8.00       | 1.90        | 2.30          | 1.50         | 1.0       | 1.75       | 3.50       | 0.8         | 4.00        | 2.00        | 4.00       | 0.23       |
| 201610    | 8.00       | 1.90        | 2.30          | 1.50         | 1.0       | 1.75       | 3.50       | 1.20        | 4.00        | 2.00        | 4.00       | 0.23       |
| 201612    | 8.00       | 1.90        | 2.30          | 1.50         | 1.0       | 1.75       | 3.50       | 1.40        | 4.00        | 2.00        | 4.00       | 0.23       |

Dimension of Reel : (Unit: mm)

| Type | A<br>±0.5 | B<br>±0.5 | C<br>±0.5 | D<br>±1 |
|------|-----------|-----------|-----------|---------|
| All  | 178       | 60        | 12        | 1.5     |



Packing Quantity: 3000pcs/Reel