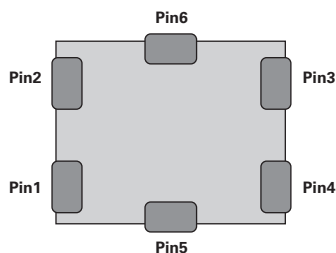


### LCFE Series

RoHS

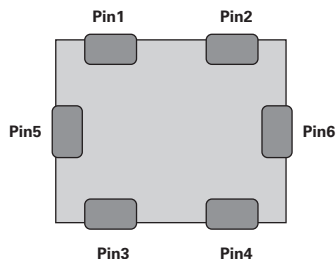

#### Pinout

0605mm Size



Item	Description	Source	Equipment
R <sub>dc</sub>	Pin 1-4, 2-3	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 3-4(Short)	500mV	LCR Meter (3GHz)
IL	Pin 5 or 6 to Pin 1,2,3,4	5V DC Source	Source Meter
I <sub>R<sub>CR</sub></sub>	Pin 1-2 or Pin 3-4	5V DC Source	Source Meter

0806mm Size



Item	Description	Source	Equipment
R <sub>dc</sub>	Pin 1-3, 2-4	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 3-4(Short)	500mV	LCR Meter (3GHz)
IL	Pin 5 or 6 to Pin 1,2,3,4	5V DC Source	Source Meter
I <sub>R<sub>CR</sub></sub>	Pin 1-2 or Pin 3-4	5V DC Source	Source Meter

#### Description

This specification covers the engineering requirements for both Common Mode Noise Filter (CMF) and ESD Protection, especially high speed differential serial interfaces, such as USB 3.1, USB 3.0, MIPI D-PHY or HDMI.

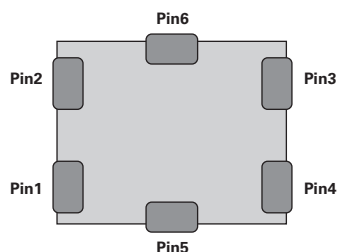
#### Features

- Effective for suppressing common mode noise and almost no effect for high speed differential data line
- Differential mode cut-off frequency up to 10.5GHz at -3dB
- One common mode filters and two ESD suppression devices integrated
- Ultra low profile as low as 0.68x0.55x0.35mm
- Ceramic multilayer type SMD component
- Non-polarized product
- Conforming to RoHS directive
- ±15kV air, ±8kV contact ESD protection (IEC 61000-4-2 Level 4)
- High temperature soldering guaranteed: 260°C/10 seconds

#### Applications

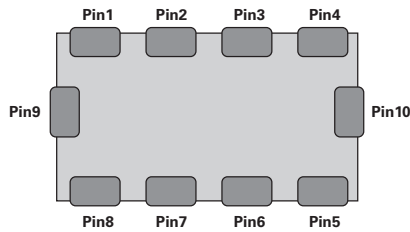
- Mobile Phone and Tablet
- USB 3.1 Gen 1 and 2 (5 and 10Gbps) with Type C
- Display Port 1.2 (5.4Gbps)
- HDMI 2.0 (6.0Gbps)
- MDDI, MIPI, MHL
- Portable/Wearable Devices
- Game console, POS, VR, Dongle
- Consumer Products
- PDP, LCD TV, DVD Player, PC, Audio player, DSC, Set top box, Laptop, SSD, Home Automation, IoT module

1210mm Size



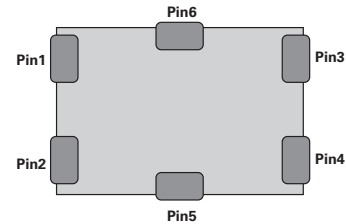
Item	Description	Source	Equipment
R <sub>dc</sub>	Pin 1-4, 2-3	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 3-4(Short)	500mV	LCR Meter (3GHz)
IL	Pin 5 or 6 to Pin 1,2,3,4	5V DC Source	Source Meter
I <sub>R<sub>CR</sub></sub>	Pin 1-2 or Pin 3-4	5V DC Source	Source Meter

### 1608mm Size



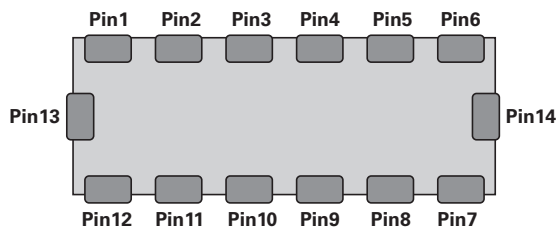
Item	Description	Source	Equipment
Rdc	Pin 1-8, 2-7, 3-6, 4-5	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 8-7(Short) Pin 3-4(Short) to Pin 6-5(Short)	500mV	LCR Meter (3GHz)
IL	Pin 9 or 10 to Pin 1~4 or 5~8	5V DC Source	Source Meter

### 2012mm Size (LCFE201202A900TG, LCFE201202A121TG)



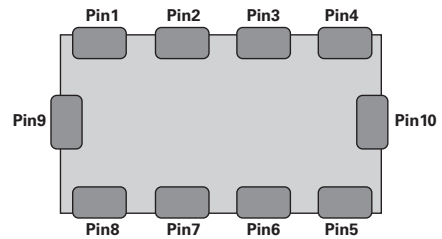
Item	Description	Source	Equipment
Rdc	Pin 1-3, 2-4	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 3-4(Short)	500mV	LCR Meter (3GHz)
IL	Pin 5 or 6 to Pin 1,2,3,4	5V DC Source	Source Meter
IR <sub>CR</sub>	Pin 1-2 or Pin 3-4	5V DC Source	Source Meter

### 3008mm Size



Item	Description	Source	Equipment
Rdc	Pin 1-12, 2-11, 3-10, 4-9, 5-8, 6-7	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 12-11(Short) Pin 3-4(Short) to Pin 10-9(Short) Pin 5-6(Short) to Pin 8-7(Short)	500mV	LCR Meter (3GHz)
IL	Pin 13 or 14 to Pin 1~6 or 7~12	5V DC Source	Source Meter

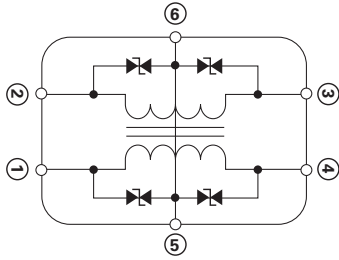
### 2012mm Size (LCFE201204A101TG)



Item	Description	Source	Equipment
Rdc	Pin 1-8, 2-7, 3-6, 4-5	10mA DC Source	Source Meter
CM Impedance	Pin 1-2(Short) to Pin 8-7(Short) Pin 3-4(Short) to Pin 6-5(Short)	500mV	LCR Meter (3GHz)
IL	Pin 9 or 10 to Pin 1~4 or 5~8	5V DC Source	Source Meter

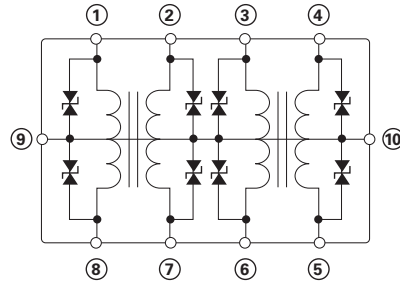
**Functional Block Diagram**

LCFE060502A120TG, LCFE060502A350TG, LCFE060502A650TG,  
 LCFE121002A120TG, LCFE121002A350TG, LCFE121002A500TG,  
 LCFE121002A650TG, LCFE121002A900TG, LCFE121002H900TG



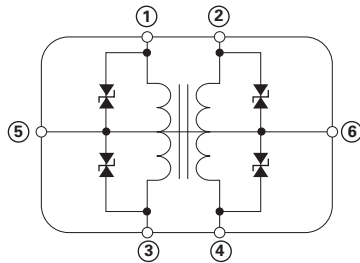
①~④: Data Line; ⑤ and ⑥:Ground

LCFE160804A180TG, LCFE160804A350TG, LCFE160804A550TG,  
 LCFE160804A750TG, LCFE160804H101TG, LCFE201204A101TG



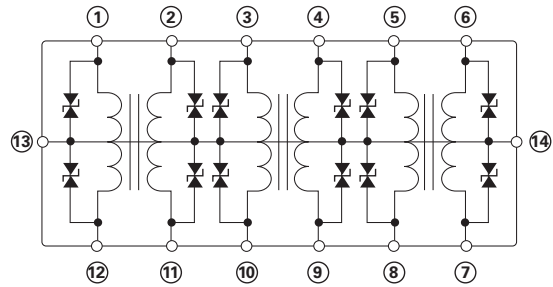
①~⑧: Data Line; ⑨ and ⑩:Ground

LCFE080602A120TG, LCFE080602A250TG, LCFE080602W500TG,  
 LCFE080602A750TG, LCFE080602A900TG, LCFE080602H900TG,  
 LCFE080602G900TG, LCFE201202A900TG, LCFE201202A121TG



①~④: Data Line; ⑤ and ⑥:Ground

LCFE300806A750TG



①~⑫: Data Line; ⑬ and ⑭: Ground

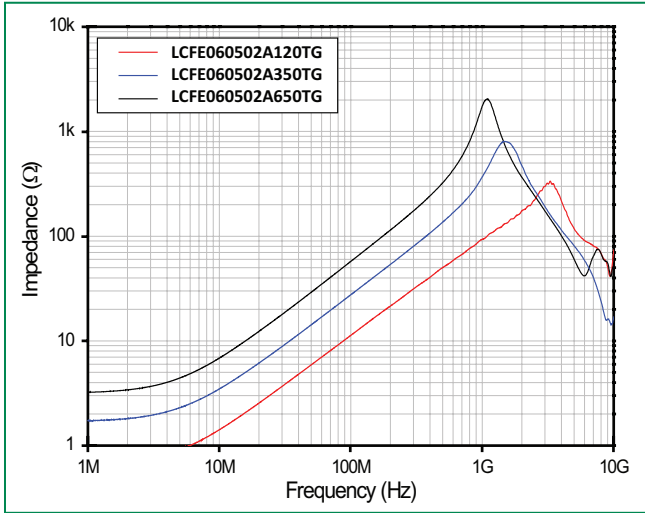
### Electrical Characteristics

Part Number	Size (mm)	Size (inch)	Common Mode Impedance (Ω)	Rated Current (mA) Max.	Cut-off Freq/ GHz	DC Resistance (Ω) Max.	Number of Lines	Leakage Current (μA) Max.	Capacitance (pF)	Insulation Resistance (MΩ) Min.	Rated Voltage (V)
LCFE060502A120TG	0605	0202	12(±30%)	100	14.1	3.0	2	1.0	1.2	10	5
LCFE060502A350TG	0605	0202	35(±25%)	50	7.09	5.5	2	1.0	1.7	10	5
LCFE060502A650TG	0605	0202	65(±25%)	50	4.76	8.0	2	1.0	1.7	10	5
LCFE080602A120TG	0806	0302	12(±30%)	100	7.38	5.0	2	1.0	1.7	10	5
LCFE080602A250TG	0806	0302	25(±25%)	100	7.97	5.0	2	1.0	1.7	10	5
LCFE080602W500TG	0806	0302	50(±25%)	100	3.60	7.0	2	1.0	1.7	10	5
LCFE080602A750TG	0806	0302	75(±25%)	100	3.80	6.0	2	1.0	1.7	10	5
LCFE080602A900TG	0806	0302	90(±25%)	100	3.80	6.0	2	1.0	1.7	10	5
LCFE080602H900TG	0806	0302	90(±25%)	100	3.74	8.0	2	1.0	2.0	10	5
LCFE080602G900TG	0806	0302	90(±25%)	100	2.82	8.0	2	1.0	2.0	10	5
LCFE121002A120TG	1210	0504	12(±30%)	100	9.02	4.0	2	1.0	1.7	10	5
LCFE121002A350TG	1210	0504	35(±25%)	100	6.38	4.0	2	1.0	1.7	10	5
LCFE121002A500TG	1210	0504	50(±25%)	100	4.96	4.0	2	1.0	1.7	10	5
LCFE121002A650TG	1210	0504	65(±25%)	100	4.30	4.0	2	1.0	1.7	10	5
LCFE121002A900TG	1210	0504	90(±25%)	100	4.57	4.0	2	1.0	1.7	10	5
LCFE121002H900TG	1210	0504	90(±25%)	100	3.90	6.0	2	1.0	1.7	10	5
LCFE160804A180TG	1608	0603	18(±30%)	100	10.35	6.0	4	1.0	1.7	10	5
LCFE160804A350TG	1608	0603	35(±30%)	100	7.20	6.0	4	1.0	1.7	10	5
LCFE160804A550TG	1608	0603	55(±25%)	100	4.09	6.0	4	1.0	2.0	10	5
LCFE160804A750TG	1608	0603	75(±25%)	100	4.91	6.0	4	1.0	1.7	10	5
LCFE160804H101TG	1608	0603	100(±25%)	100	3.96	8.0	4	1.0	2.0	10	5
LCFE201202A900TG	2012	0805	90(±25%)	100	3.38	4.0	2	1.0	1.7	10	5
LCFE201202A121TG	2012	0805	120(±25%)	100	3.62	4.0	2	1.0	1.7	10	5
LCFE201204A101TG	2012	0805	100(±25%)	100	4.22	4.0	4	1.0	1.7	10	5
LCFE300806A750TG	3008	1203	75(±25%)	100	4.51	6.0	6	1.0	2.0	10	5

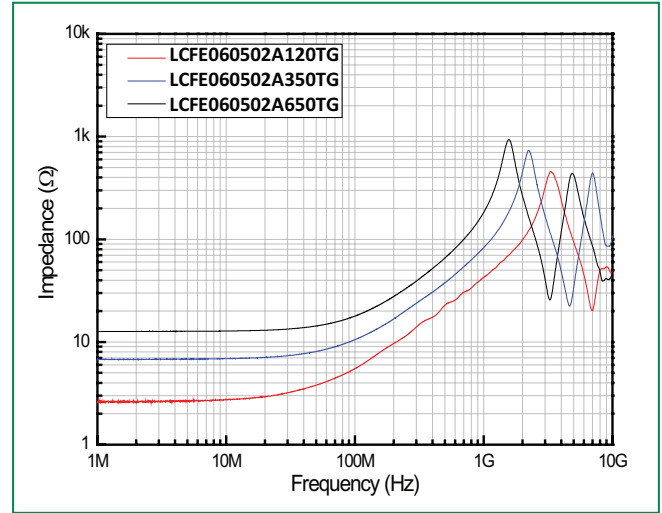
#### Test Conditions

- Common Mode Impedance (Ω): @100MHz
- DC Resistance (Ω): 25°C±2°C
- Leakage Current (μA): 5V
- Capacitance (pF) : 0.5Vrms @1MHz
- Insulation Resistance (Max. MΩ): 5V
- Rated Voltage (V): 25°C±2°C
- Rated Current (mA): 25°C±2°C

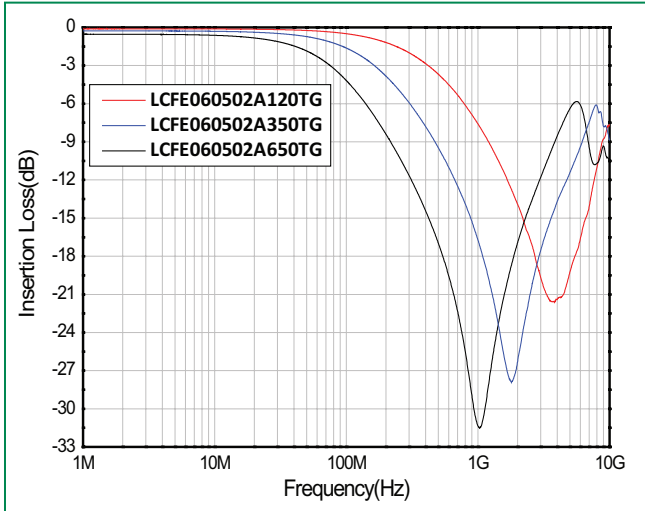
**Impedance Curves - 0605mm Size**  
**Common Mode**



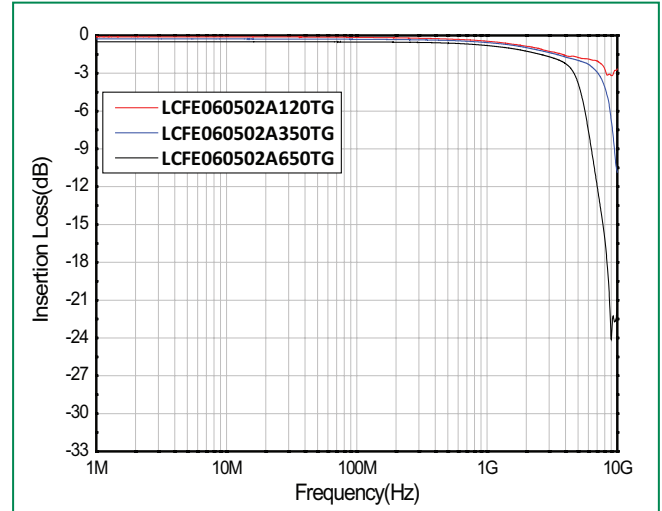
**Differential Mode**



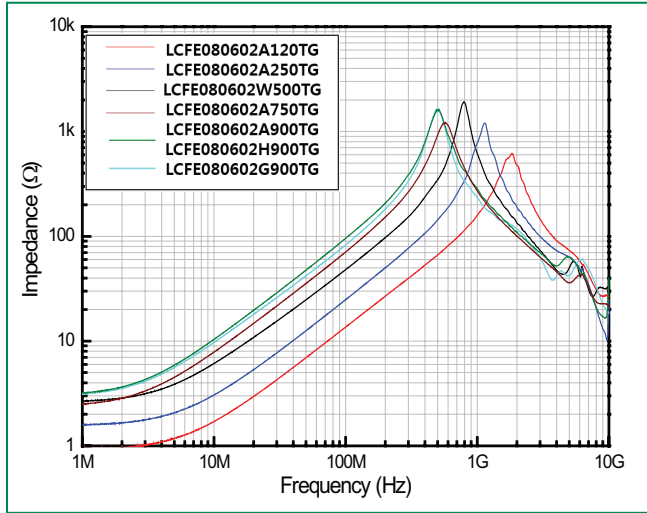
**Transmission Characteristics (S-parameter)**  
**Common Mode S21**



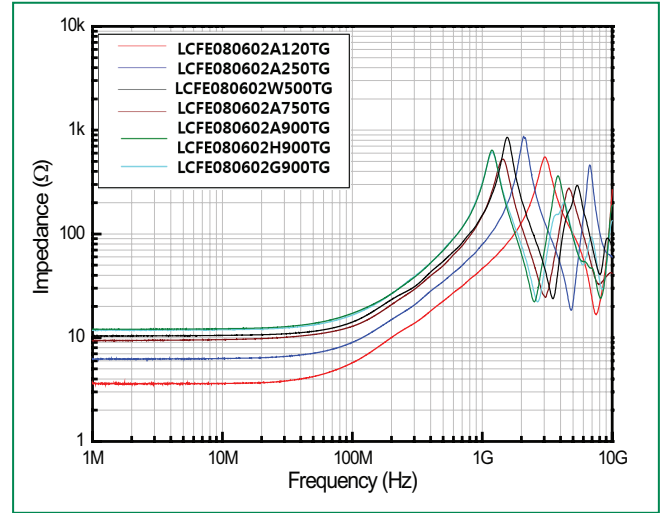
**Differential Mode S21**



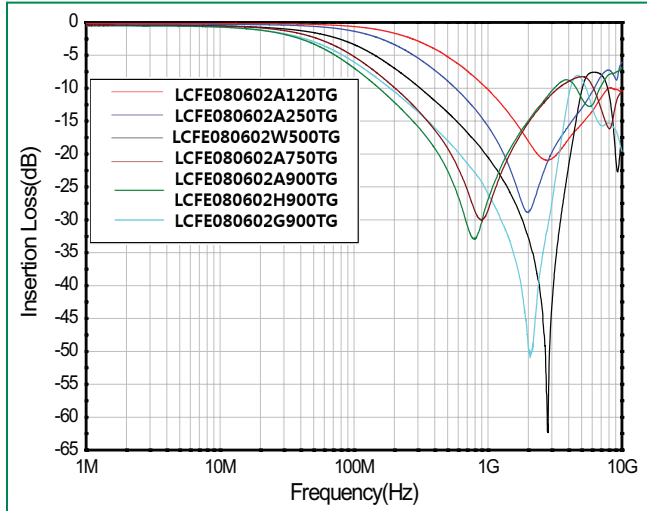
**Impedance Curves - 0806mm Size  
Common Mode**



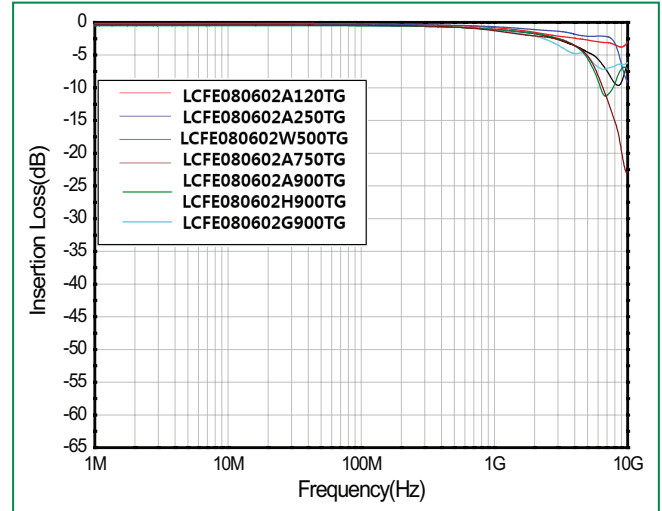
**Differential Mode**



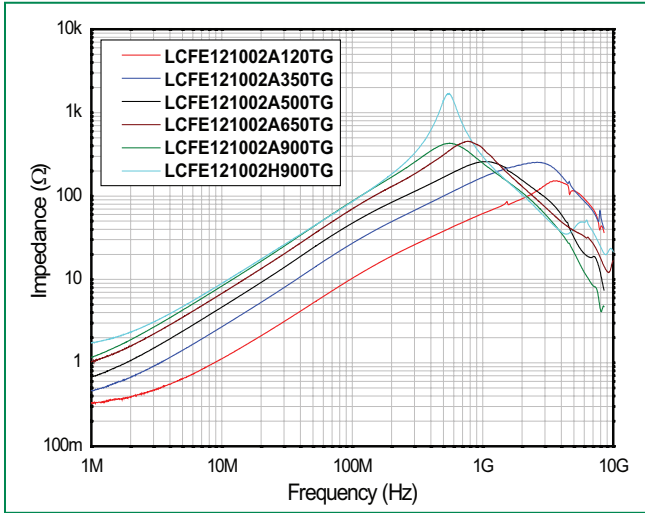
**Transmission Characteristics (S-parameter)  
Common Mode S21**



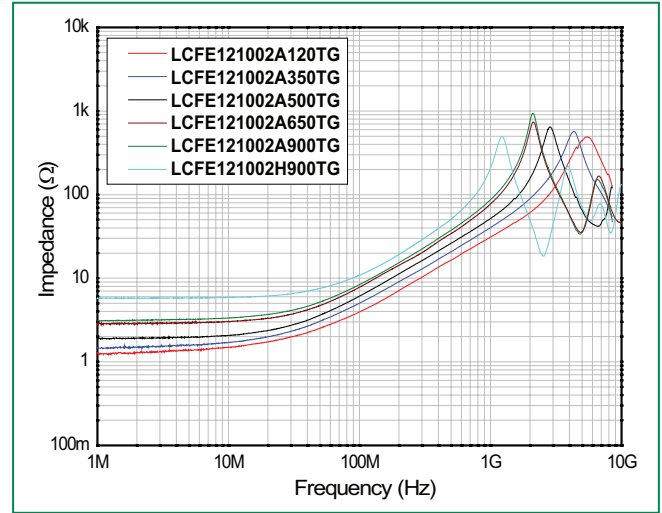
**Differential Mode S21**



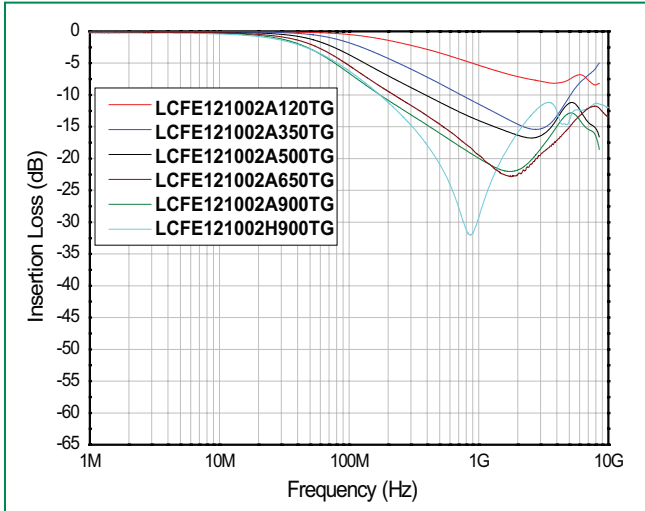
**Impedance Curves - 1210mm Size**  
**Common Mode**



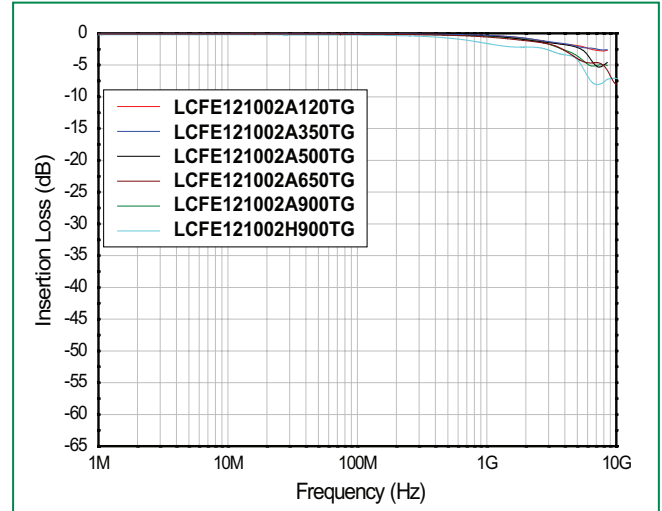
**Differential Mode**



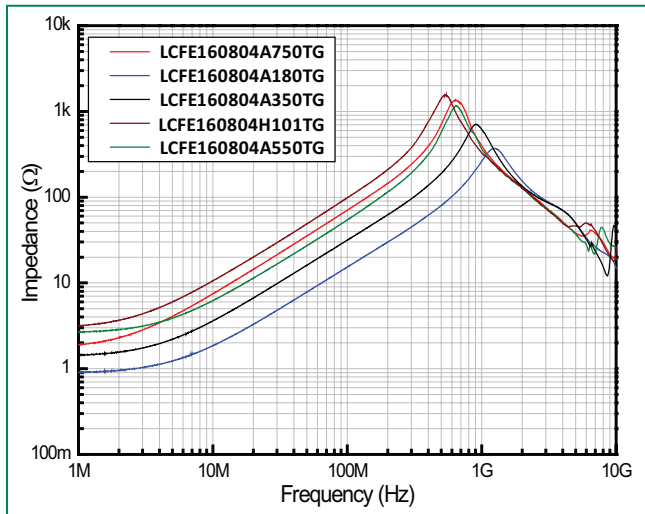
**Transmission Characteristics (S-parameter)**  
**Common Mode S21**



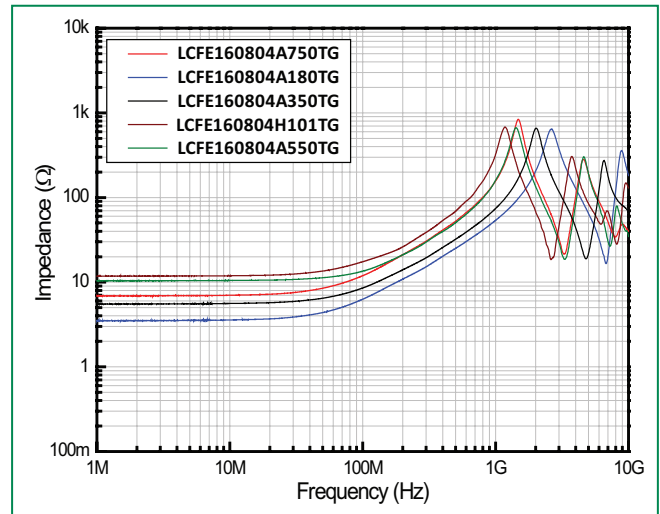
**Differential Mode S21**



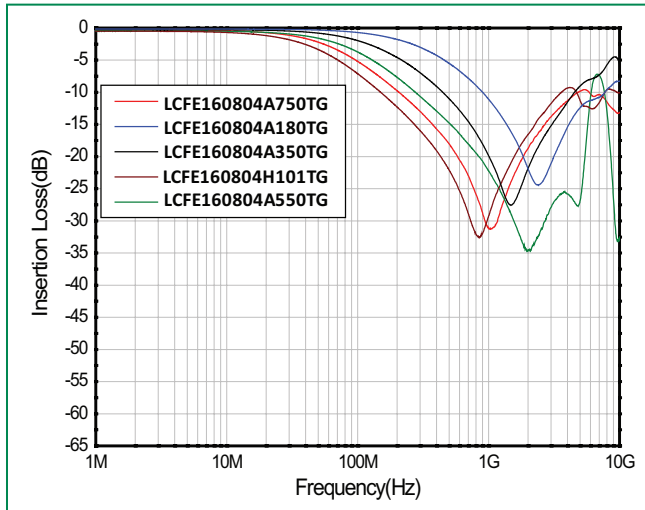
## Impedance Curves - 1608mm Size Common Mode



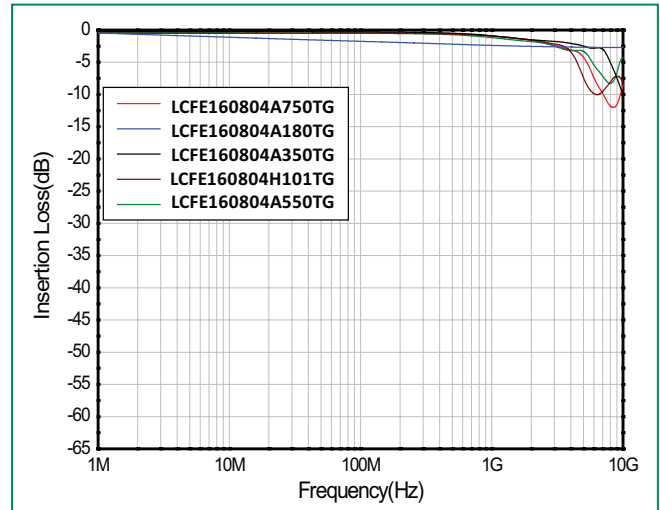
## Differential Mode



## Transmission Characteristics (S-parameter) Common Mode S21

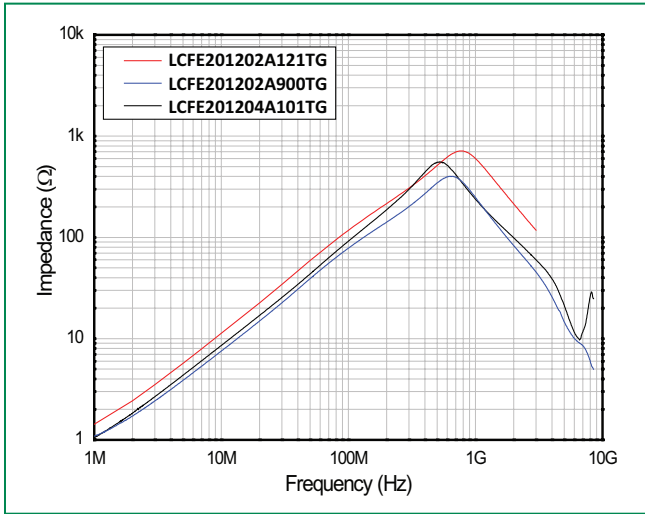


## Differential Mode S21

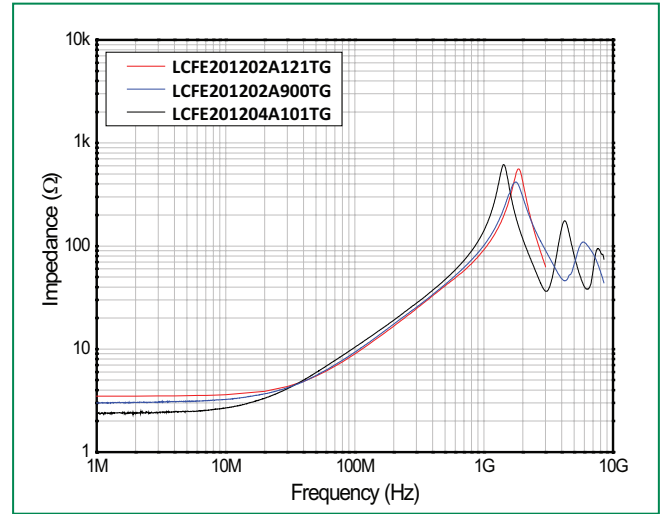




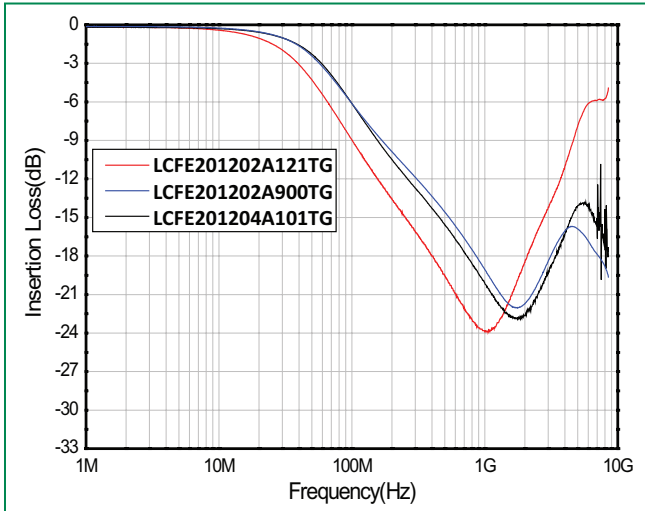
**Impedance Curves - 2012mm Size**  
**Common Mode**



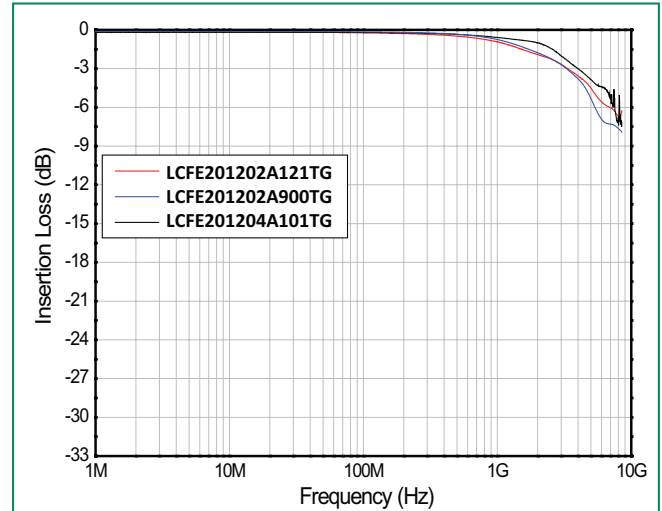
**Differential Mode**



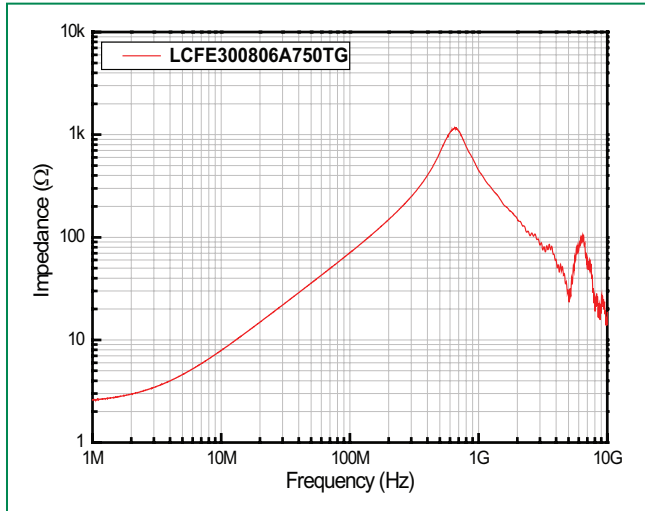
**Transmission Characteristics (S-parameter)**  
**Common Mode S21**



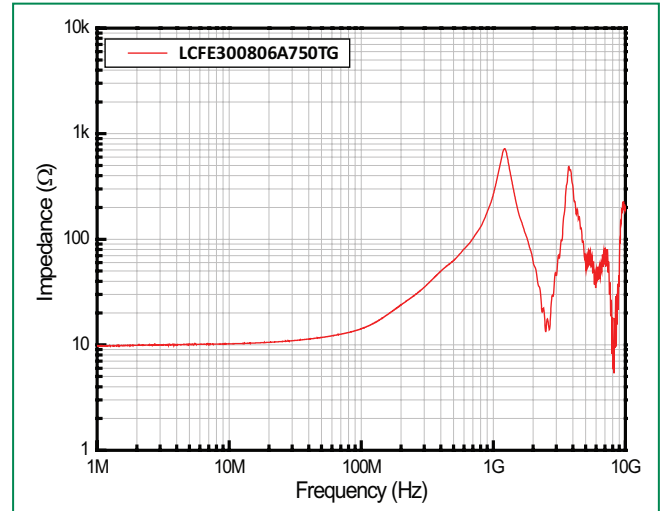
**Differential Mode S21**



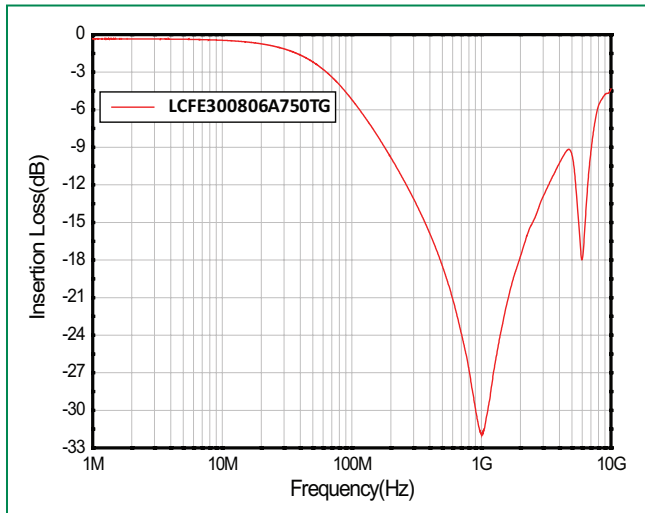
**Impedance Curves - 3008mm Size  
Common Mode**



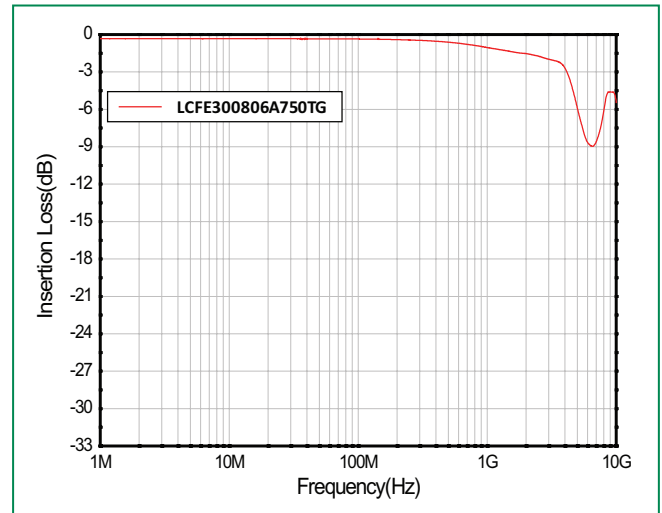
**Differential Mode**



**Transmission Characteristics (S-parameter)  
Common Mode S21**

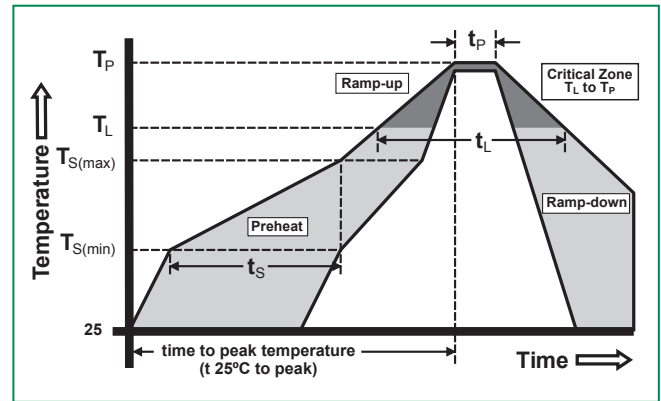


**Differential Mode S21**



### Soldering Parameters

Reflow Condition		Pb-free assembly
Pre Heat	- Temperature Min ( $T_{S(min)}$ )	160°C
	- Temperature Max ( $T_{S(max)}$ )	185°C
	- Time (Min to Max) ( $t_s$ )	100 – 120 seconds
Average Ramp-up Rate (Liquidus Temp ( $T_L$ ) to peak)		1°C/second max
$T_{S(max)}$ to $T_L$ - Ramp-up Rate		1°C/second max
Reflow	- Temperature ( $T_L$ ) (Liquidus)	220°C
	- Temperature ( $t_L$ )	30 – 50 seconds
Peak Temperature ( $T_P$ )		260°C
Time within 5°C of actual peak Temperature ( $t_p$ )		5~10 seconds
Ramp-down Rate		2°C/second max
Time 25°C to Peak Temperature ( $T_P$ )		4 minutes max
Do not exceed		260°C
Wave Soldering		260°C, 10 sec. max



Recommended Soldering Profile ( Lead free condition)

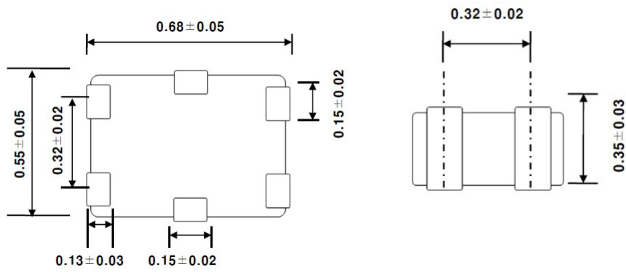
### Product Characteristics

<b>Lead Pull Strength</b>	5N
<b>Solderability</b>	260°C, ≤10s (Reflow), Max 380°C, ≤5s (Soldering iron)
<b>Soldering Heat Resistance</b>	Max 260°C 10sec(Wave), Max Temperature: Max 380°C (Max 5sec)
<b>Operating Temperature</b>	-40°C to +85°C
<b>Climatic Category</b>	-40°C to +85°C/8 days
<b>Stock Conditions</b>	-10°C + 40°C RH, ≤ 70%
<b>Vibration Resistance</b>	5 g's for 20 minutes, 12 cycles each of 3 orientations

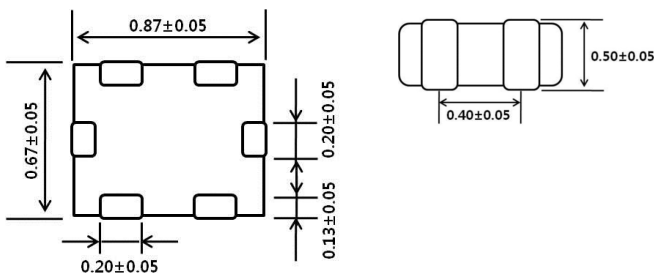
### Dimensions

Unit = mm

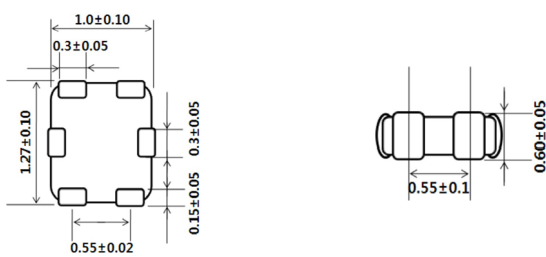
#### 0605mm Size



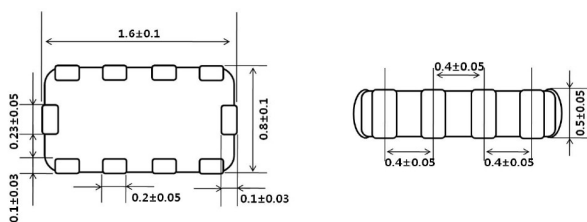
#### 0806mm Size



#### 1210mm Size



#### 1608mm Size

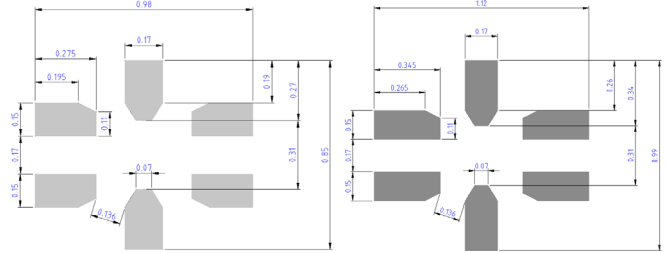


### Recommended Footprint and Stencil Mask

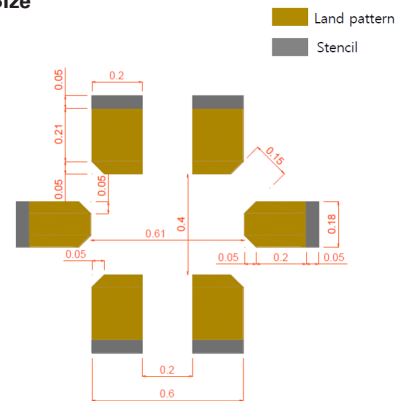
Unit = mm

Stencil Mask T = 0.10mm

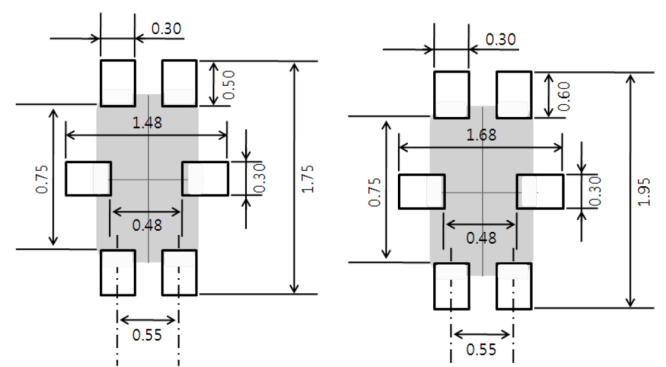
#### 0605mm Size



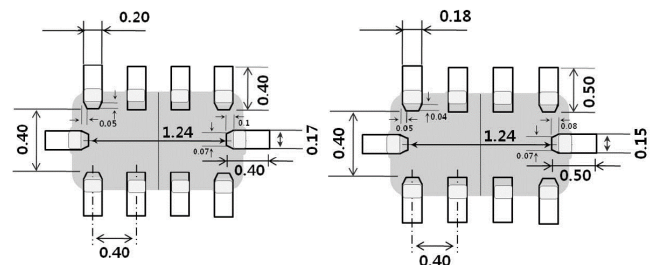
#### 0806mm Size



#### 1210mm Size



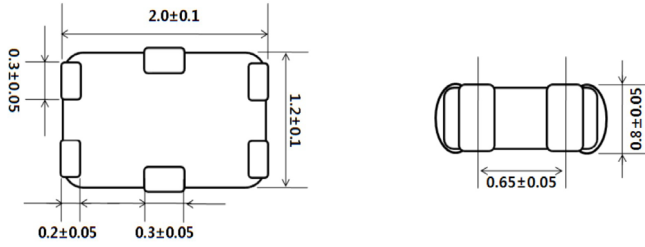
#### 1608mm Size



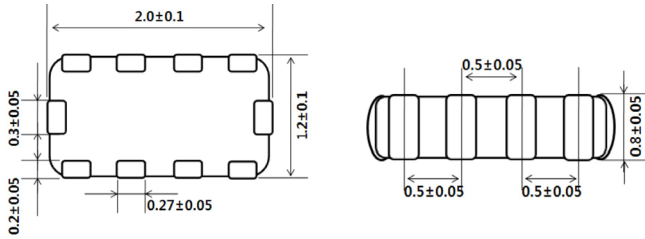
**Dimensions**

Unit = mm

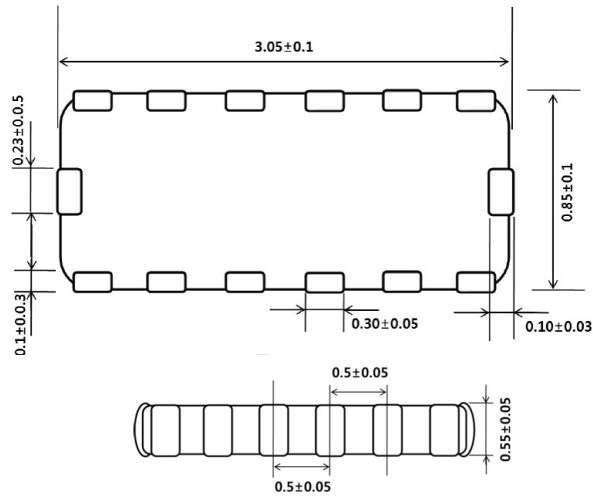
**2012mm Size (LCFE201202A900TG, LCFE201202A121TG)**



**2012mm Size (LCFE201204A101TG)**



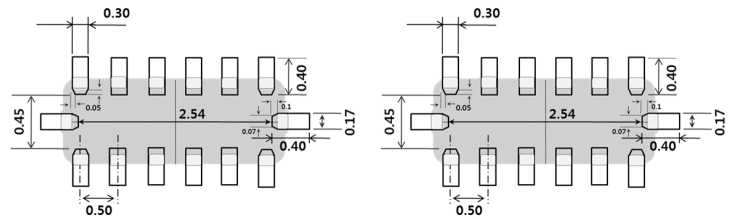
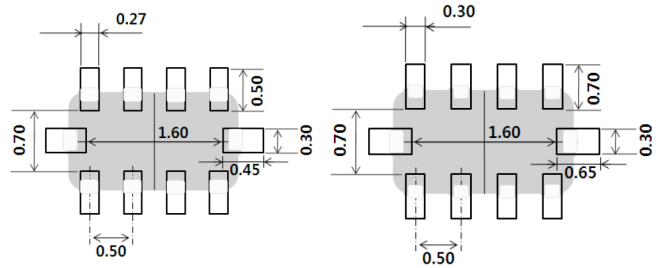
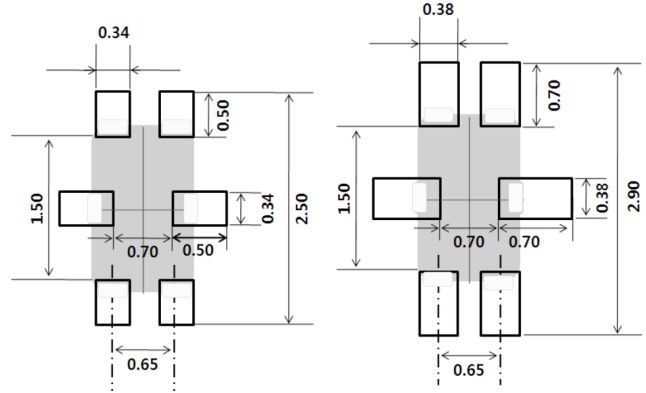
**3008mm Size**



**Recommended Footprint and Stencil Mask**

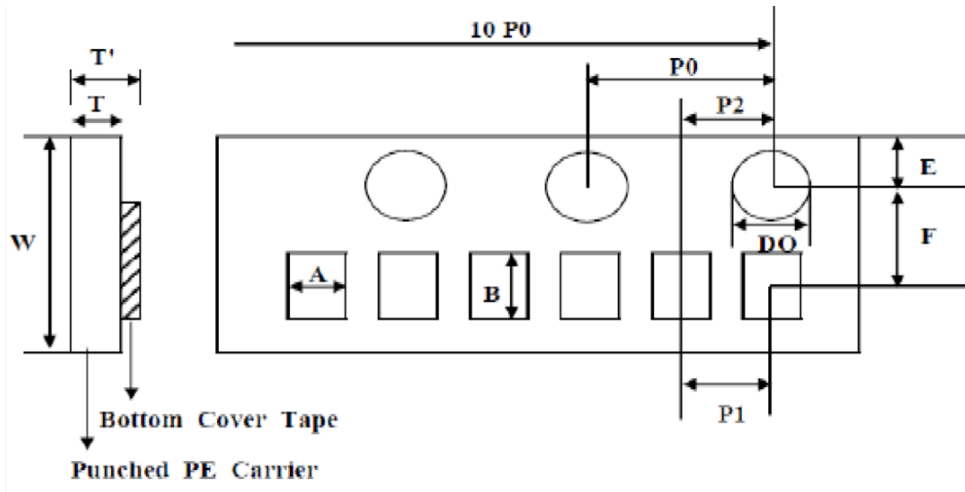
Unit = mm

Stencil Mask T = 0.10mm



### Carrie Tape Dimensions

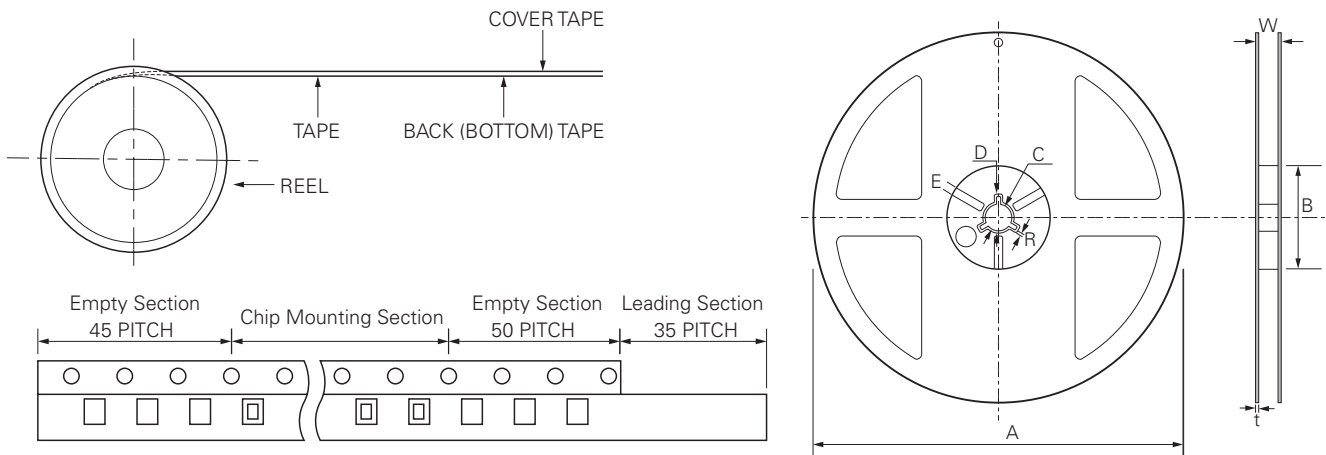
0605mm size



Symbol	Dimensions
	Millimeters
A	0.62±0.03
B	0.78±0.03
E	1.75±0.05
F	3.50±0.05
D0	1.55±0.03
P1	2.00±0.05
P2	2.00±0.05
P0	4.00±0.05
10P0	40.00±0.10
W	8.00±0.10
T	0.40±0.02
T'	0.43±0.05

### Tape and Reel Dimension

0605mm size

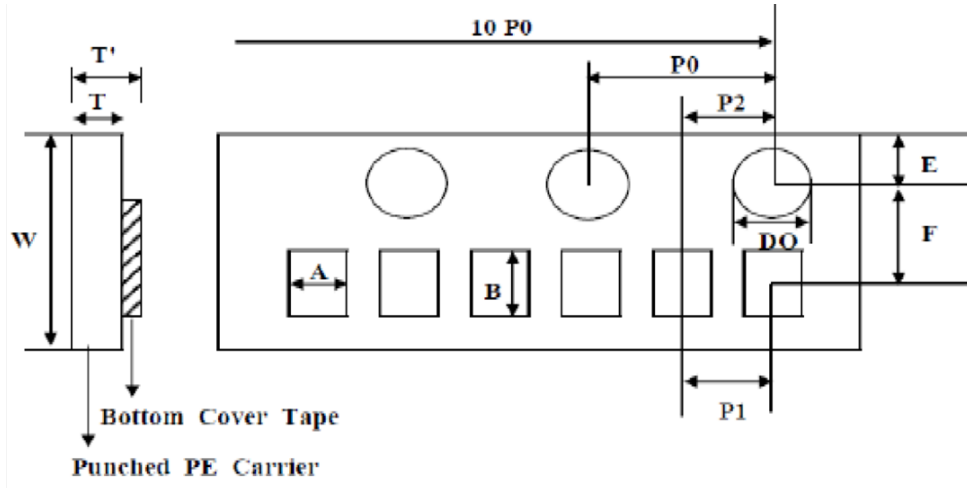


- (1) Reel Materials: Polystyrene (2) Label (3) Taping
- Standard Packing Quantity per Reel (Ø178)
- PE Tape: 10,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	2.0±0.5	10±1.5	0.8±0.2	1.0

### Carrie Tape Dimensions

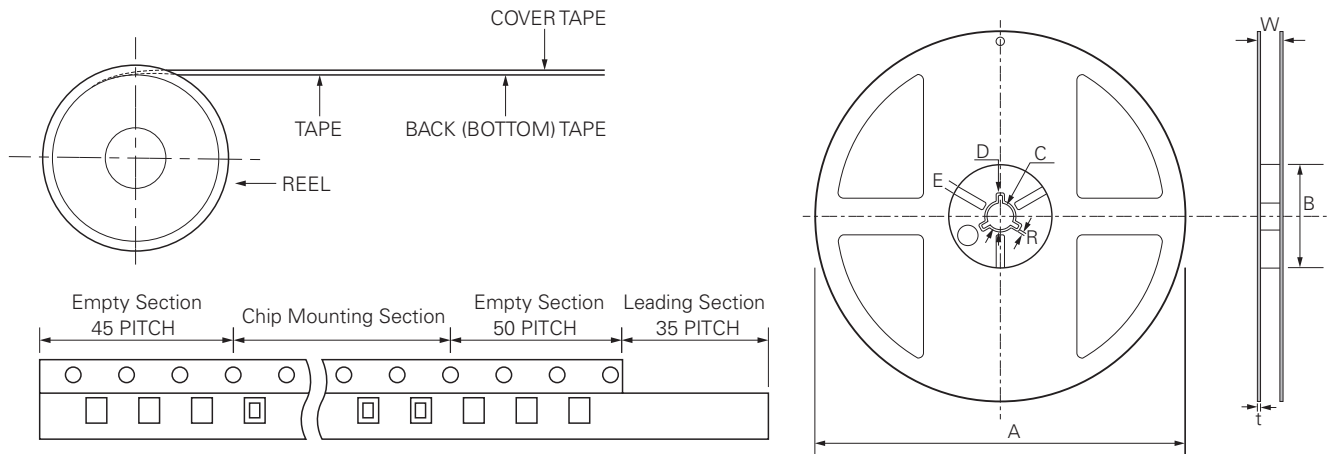
0806mm size



Symbol	Dimensions
	Millimeters
A	0.80±0.03
B	1.02±0.03
E	1.75±0.05
F	3.50±0.05
D0	1.55±0.03
P1	2.00±0.05
P2	2.00±0.05
P0	4.00±0.05
10P0	40.00±0.10
W	8.00±0.10
T	0.60±0.02
T'	0.63±0.05

### Tape and Reel Dimension

0806mm size

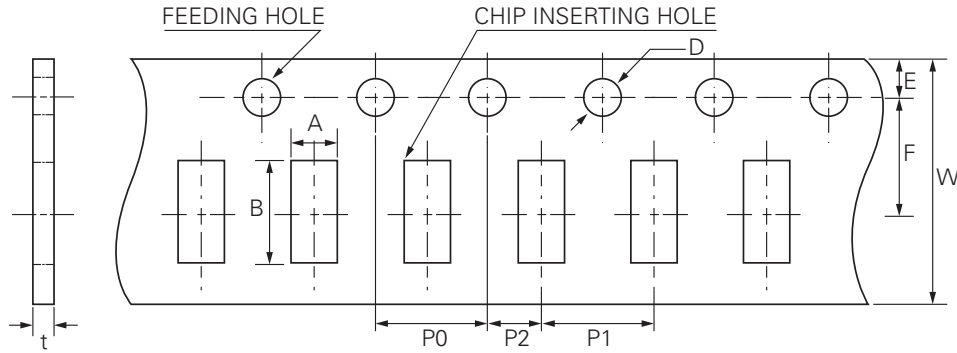


- (1) Reel Materials: Polystyrene (2) Label (3) Taping
- Standard Packing Quantity per Reel (Ø178)
- PE Tape: 10,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	2.0±0.5	10±1.5	0.8±0.2	1.0

### Carrie Tape Dimensions

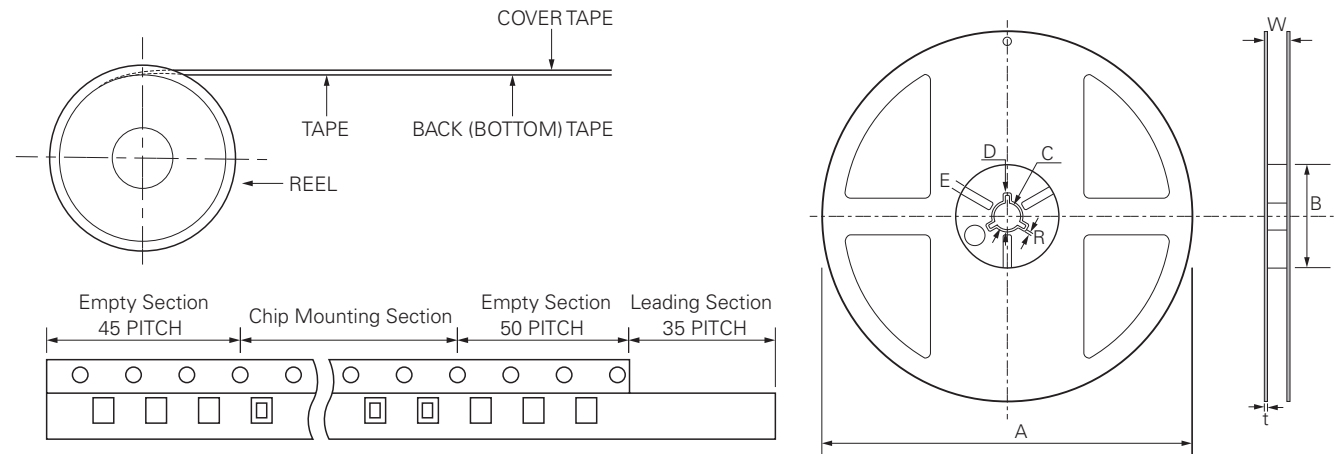
1210mm size



Symbol	Dimensions
	Millimeters
A	1.15±0.05
B	1.50±0.05
W	8.00+0.30-0.10
F	3.50±0.05
E	1.75±0.05
P1	4.00±0.10
P2	2.00±0.05
P0	4.00±0.05
D	1.55±0.03
T	0.75±0.05

### Tape and Reel Dimension

1210mm size



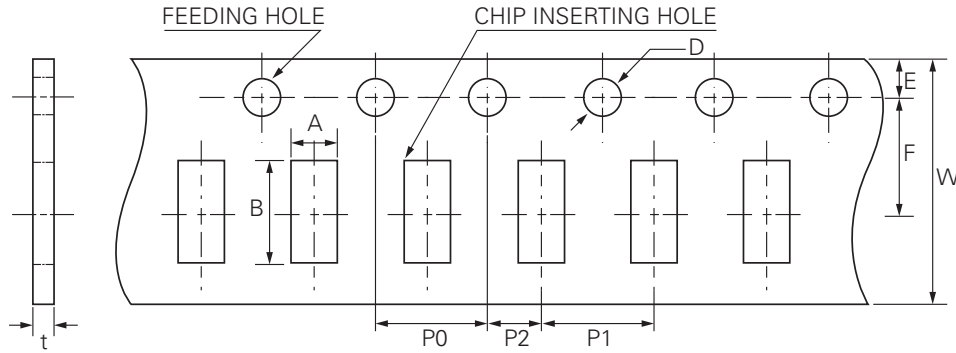
- (1) Reel Materials: Polystyrene (2) Label (3) Taping  
 - Standard Packing Quantity per Reel (Ø178)  
 - PE Tape: 4,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	2.0±0.5	10±1.5	0.8±0.2	1.0



### Carrie Tape Dimensions

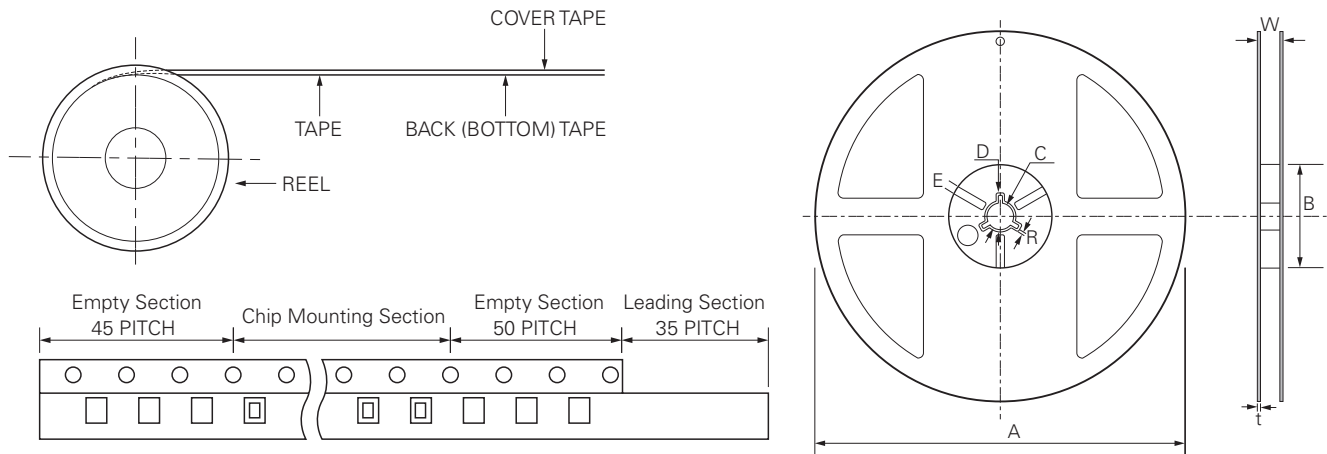
1608mm size



Symbol	Dimensions
	Millimeters
A	0.97±0.03
B	1.80±0.03
W	8.00±0.10
F	3.50±0.05
E	1.75±0.05
P1	4.00±0.10
P2	2.00±0.05
P0	4.00±0.05
D	1.55±0.03
T	0.58±0.03

### Tape and Reel Dimension

1608mm size

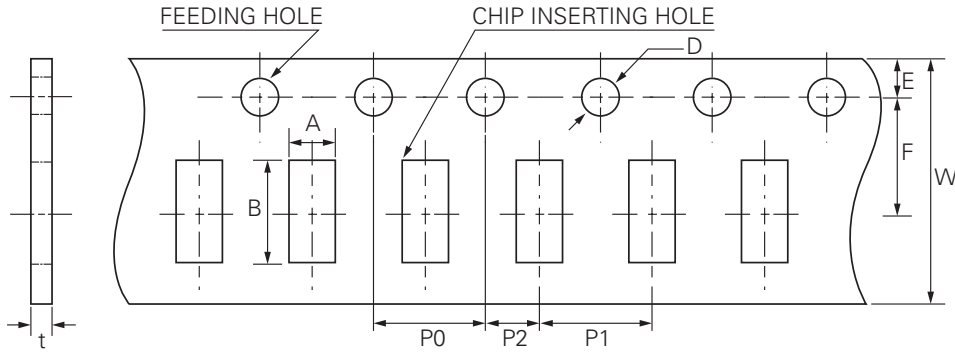


- (1) Reel Materials: Polystyrene (2) Label (3) Taping  
 - Standard Packing Quantity per Reel (Ø178)  
 - PE Tape: 4,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	2.0±0.5	10±1.5	0.8±0.2	1.0

### Carrie Tape Dimensions

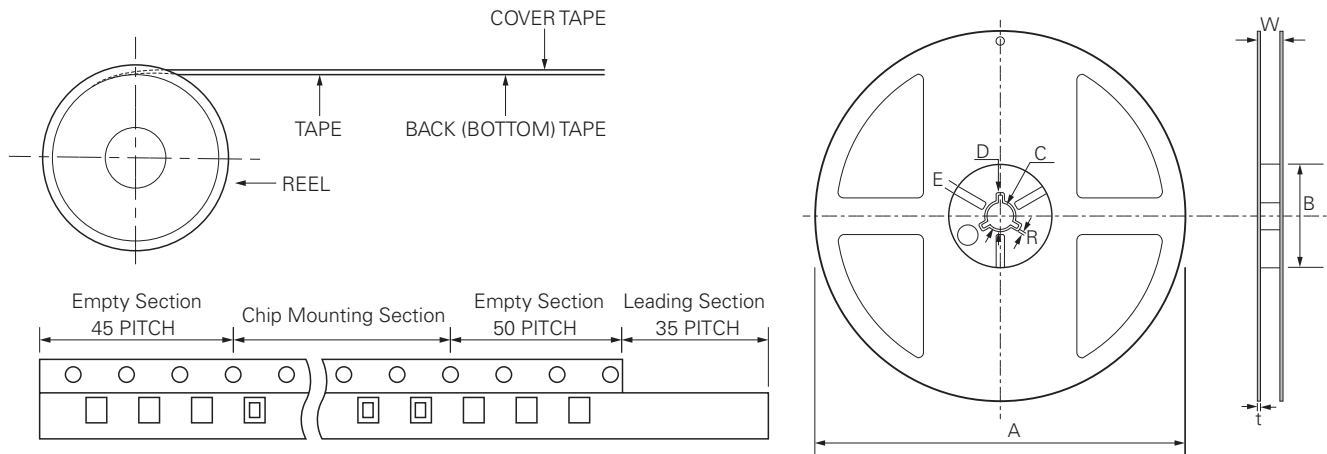
2012mm size



Symbol	Dimensions
	Millimeters
A	1.55±0.05
B	2.30±0.05
W	8.00±0.10
F	3.50±0.05
E	1.75±0.05
P1	4.00±0.10
P2	2.00±0.05
P0	4.00±0.10
D	1.55±0.03
T	0.95±0.05

### Tape and Reel Dimension

2012mm size

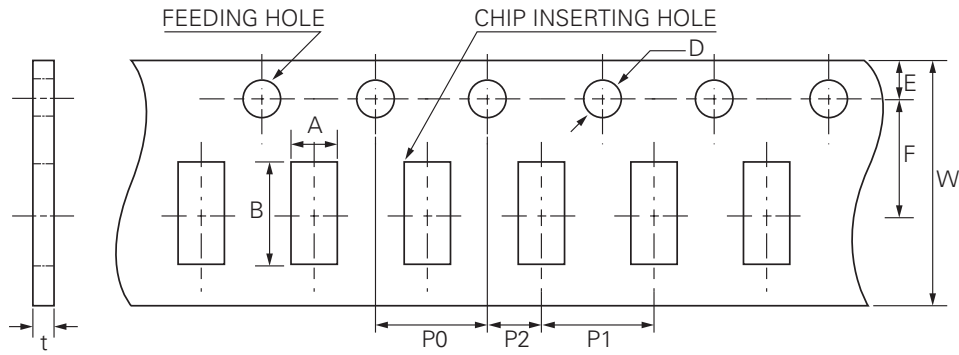


- (1) Reel Materials: Polystyrene (2) Label (3) Taping  
 - Standard Packing Quantity per Reel (Ø178)  
 - PE Tape: 4,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	2.0±0.5	10±1.5	0.8±0.2	1.0

### Carrie Tape Dimensions

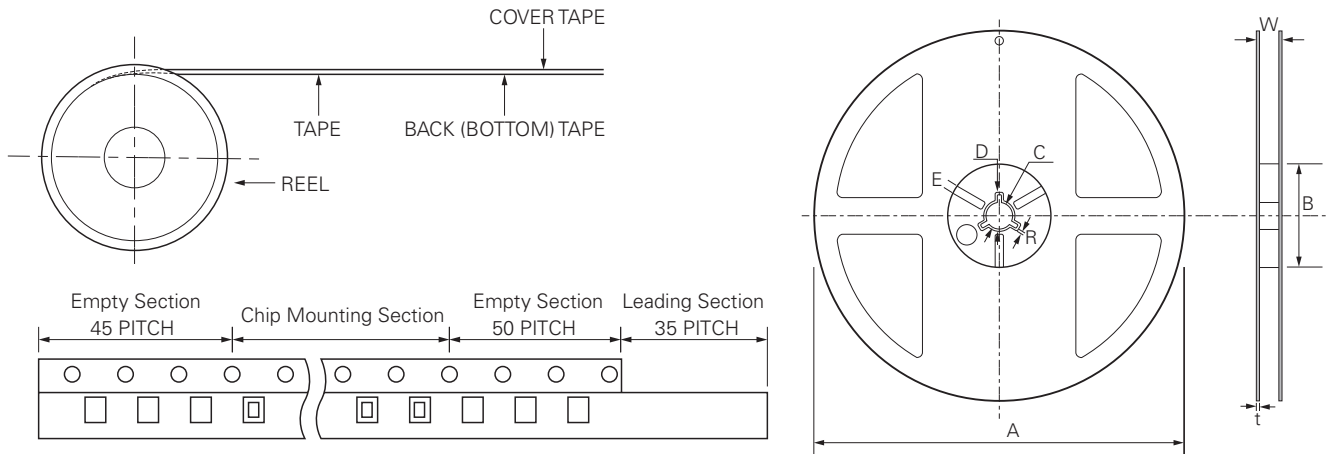
3008mm size



Symbol	Dimensions
	Millimeters
A	1.05±0.05
B	3.30±0.05
W	8.00±0.10
F	3.50±0.05
E	1.75±0.05
P1	4.00±0.10
P2	2.00±0.05
P0	4.00±0.10
D	1.55±0.03
T	0.60±0.05

### Tape and Reel Dimension

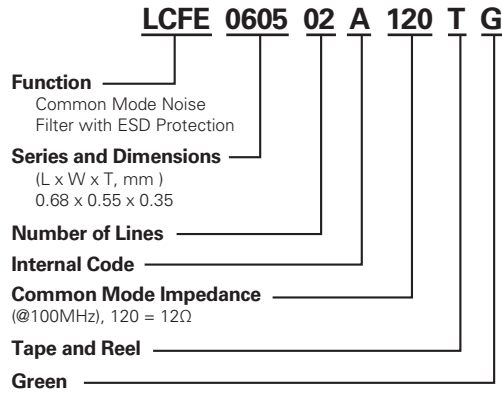
3008mm size



- (1) Reel Materials: Polystyrene (2) Label (3) Taping  
 - Standard Packing Quantity per Reel (Ø178)  
 - PE Tape: 4,000pcs

Code	A	B	C	D	E	W	T	R
Dimension	Ø178±2	Min. Ø50	Ø13±0.5	Ø21±0.8	3.0±0.5	10±1.5	1.3±0.2	1.0±0.2

### Part Numbering System



### Ordering Information

Part Number	Reel Quantity
LCFE0605xxxxxxx/LCFE0806xxxxxxx	10,000
LCFE1608xxxxxxx/LCFE1210xxxxxxx	4,000
LCFE2012xxxxxxx/LCFE3008xxxxxxx	4,000

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