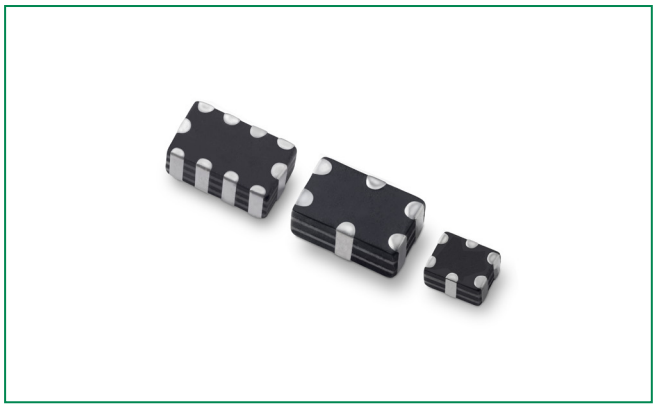
# Common Mode Noise Filter with ESD Protection
LCFEA Series

LCFEA Series

RoHS



## Description

This specification covers the engineering requirements for both Common Mode Noise Filter (CMF) and ESD Protection especially for high speed differential serial interfaces, such as USB 3.1 , USB 2.0 , MIPI D-PHY or HDMI, and RGB line, LVDS line.

AEC-Q200 qualified common mode noise filter will help to choke and attenuate the noise for the growing number of electronic applications in modern vehicles.

## Features

- AEC-Q200 qualified
- Effective for suppressing common mode noise and almost no effect for high speed differential data line
- Differential mode cut-off frequency up to 4.5GHz at -3dB
- Common mode filters and ESD suppression devices integrated
- Low profile package
- 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

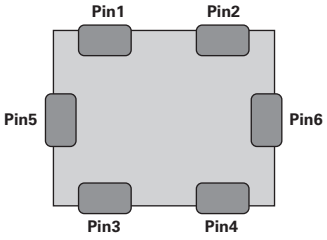
*– Automotive*
- Infotainment: Display, Car Navigation, Head Unit, USB Jack
- ADAS: Car Camera System
- Telematics Control Unit, E-Call system, Smart Keyless Entry system
- RGB line, LVDS line, HDMI for AVN, High-speed CAN BUS line

*– Consumer*
- PDP, LCD TV, DVD Player, PC, Audio player, DSC, Set top box, Laptop, SSD, Home Automation

*– Portable/Wearable Devices*
- Mobile phone, Tablet, Game console, POS, VR, Dongle

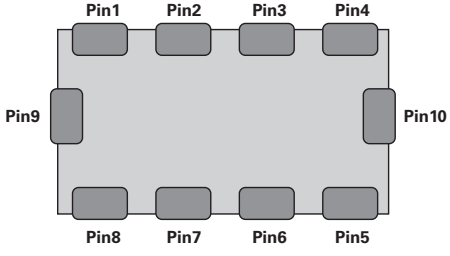
## Pinout

**Two Lines**




| Item | Description | Source | Equipment |
|---|---|---|---|
| Rdc | 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 |
| $IR_{CR}$ | Pin 1-2 or Pin 3-4 | 5V DC Source | Source Meter |

**Four Lines**




| 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)<br>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 |

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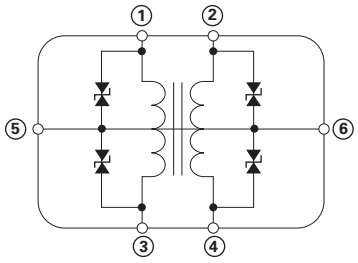
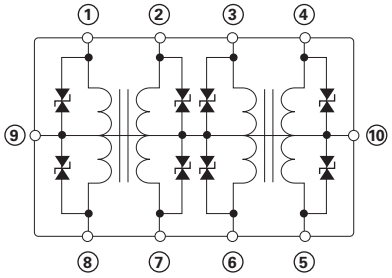
## Functional Block Diagram

LCFEA121002A900TG, LCFEA201202A900TG




①~④: Data Line; ⑤, ⑥: Ground

LCFEA201204A101TG




①~⑧: Data Line; ⑨, ⑩: 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. | Insulation Resistance (MΩ) Min. | Rated Voltage (V) |
|---|---|---|---|---|---|---|---|---|---|---|
| LCFEA121002A900TG | 1210 | 0504 | 90(±25%) | 100 | 4.65 | 4.0 | 2 | 1.0 | 10 | 5 |
| LCFEA201202A900TG | 1212 | 0805 | 90(±25%) | 150 | 4.65 | 4.0 | 2 | 1.0 | 10 | 5 |
| LCFEA201204A101TG | 2012 | 0805 | 90(±25%) | 100 | 3.38 | 4.0 | 4 | 1.0 | 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

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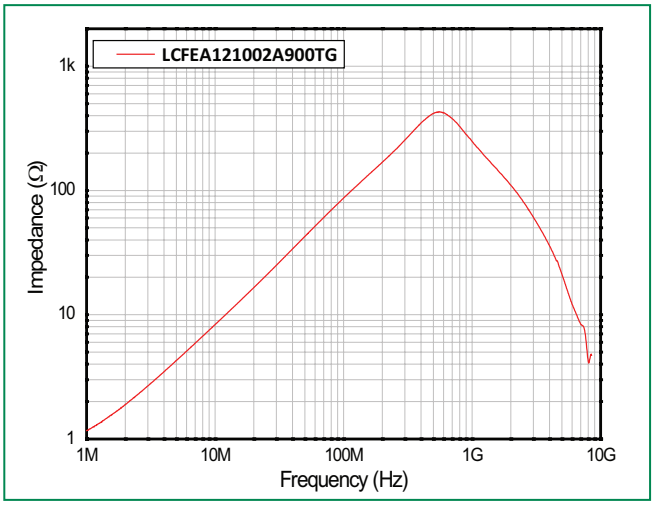
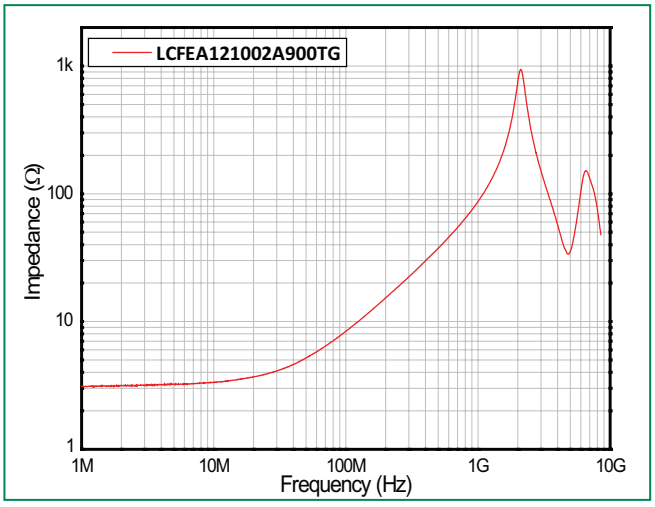
## Impedance Curves

### Common Mode

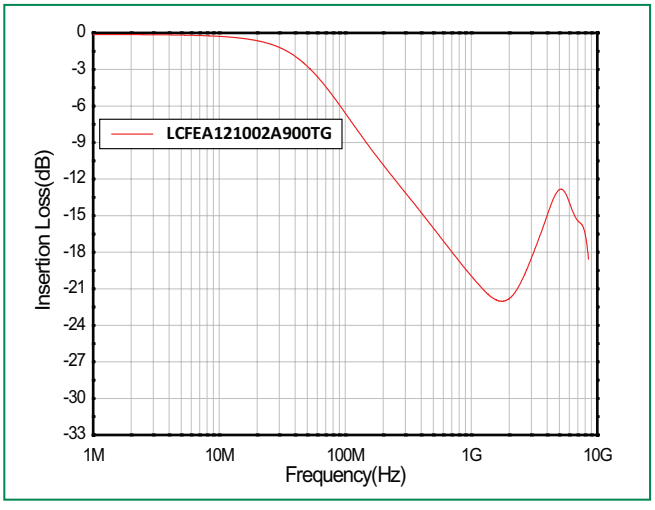



### Differencial Mode

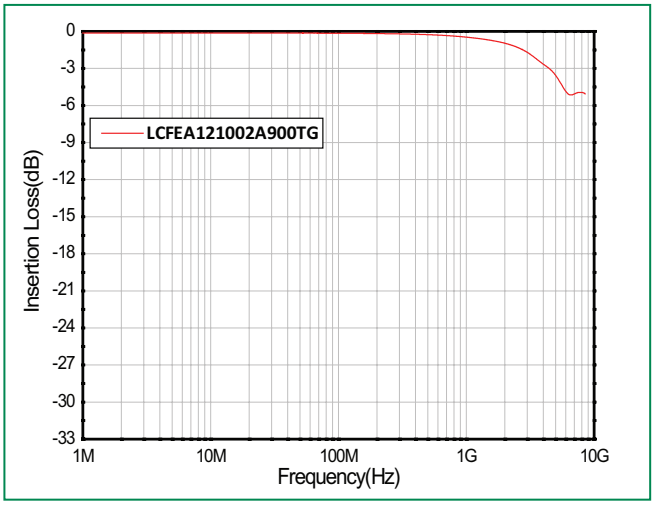



## Transmission Characteristics (S-parameter)

### Common Mode S21




### Differential Mode S21

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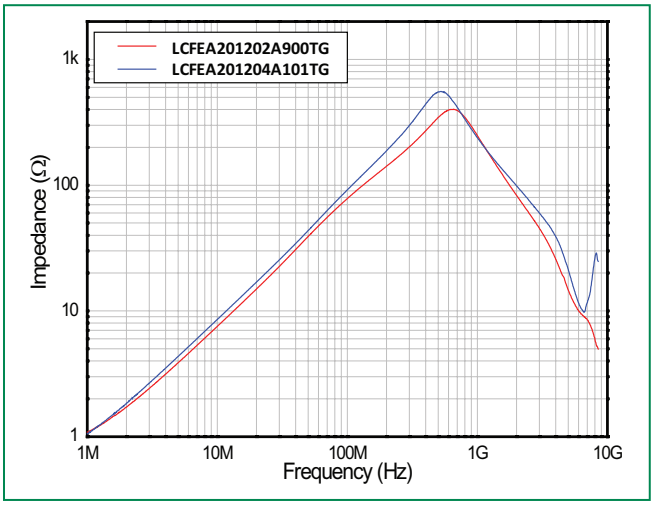
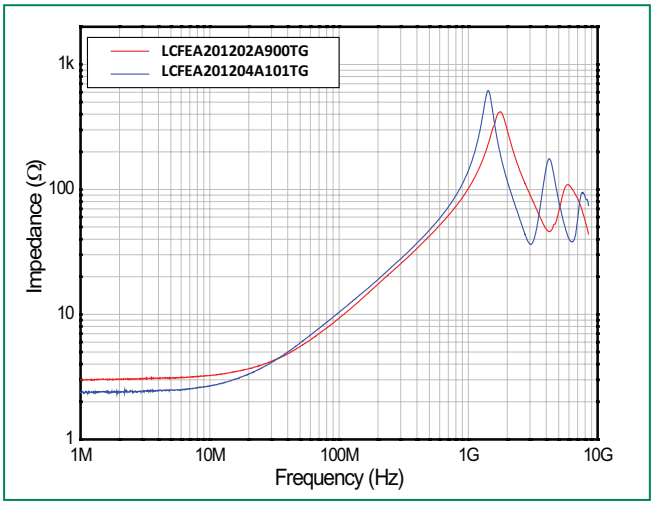
## Impedance Curves

### Common Mode

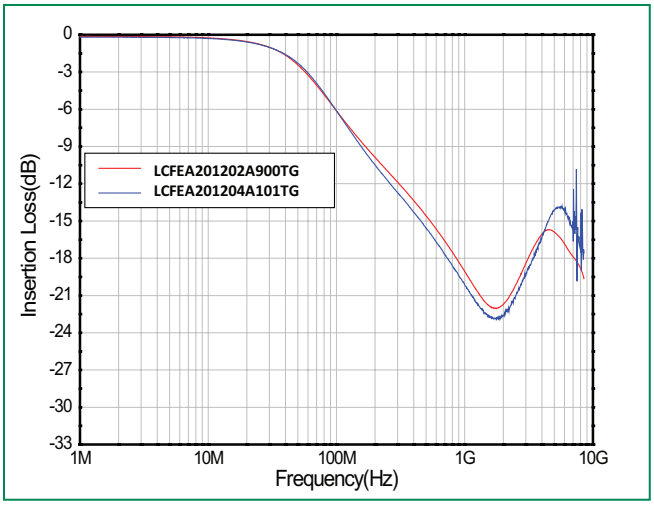



### Differencial Mode

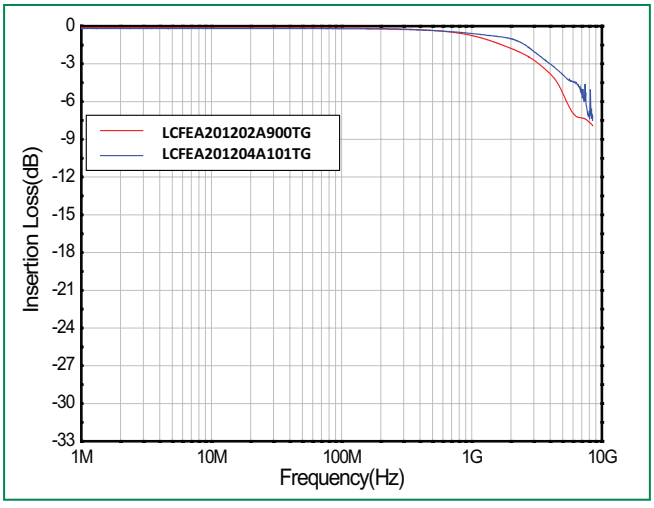



## Transmission Characteristics (S-parameter)

### Common Mode S21




### Differential Mode S21

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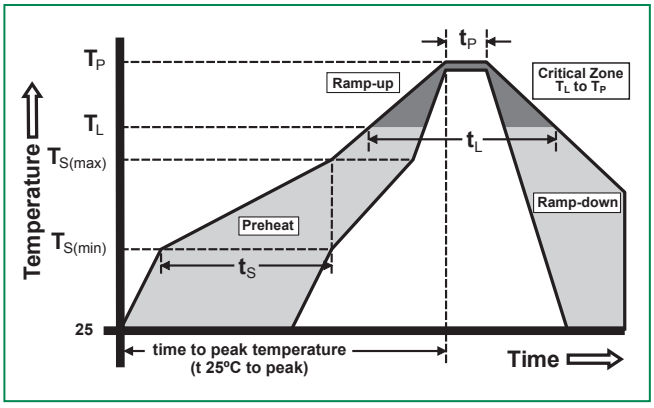
## Soldering Parameters

| | | |
|---|---|---|
| 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 TL - 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

| | |
|---|---|
| **Lead Pull Strength** | 5N |
| **Solderability** | 260°C, ≤10s (Reflow), Max 380°C,≤5s (Soldering iron) |
| **Soldering Heat Resistance** | Max 260°C 10sec (Wave), Max Temperature: Max 380°C (Max 5sec) |
| **Operating Temperature** | -40°C ~ + 125°C |
| **Climatic Category** | -40°C ~ + 85°C/8 days |
| **Stock Conditions** | -10°C ~ + 40°C RH, ≤ 70% |
| **Vibration Resistance** | 5 g's for 20 minutes, 12 cycles each of 3 orientations |

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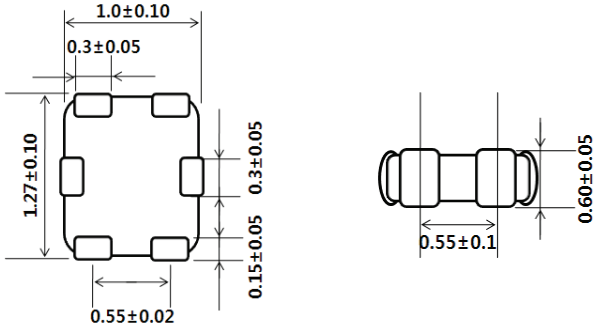
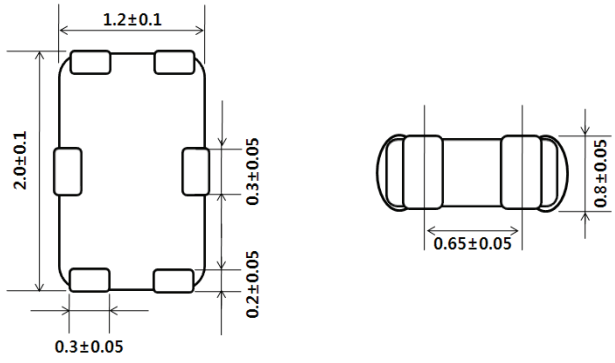
## Dimensions

Unit = mm

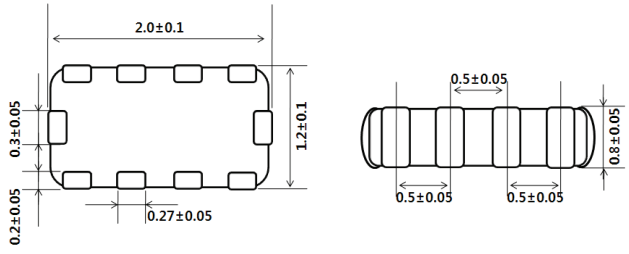
LCFEA121002A900TG




LCFEA201202A900TG

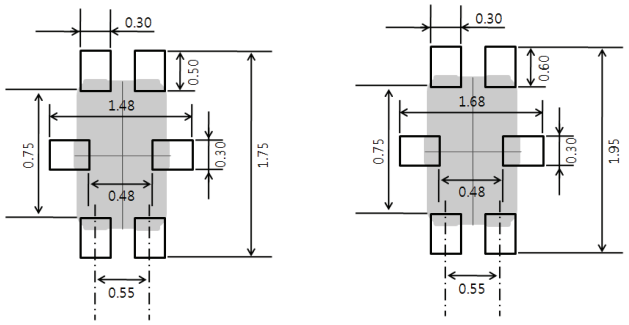


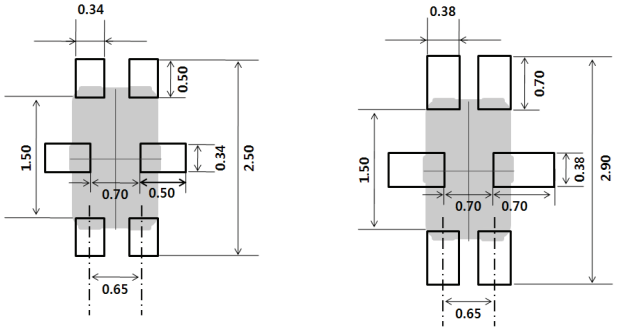

LCFEA201204A101TG

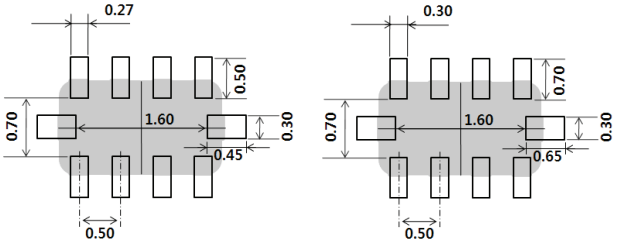



## Recommended Footprint and Stencil Mask

Unit = mm Stencil MaskT = 0.10mm



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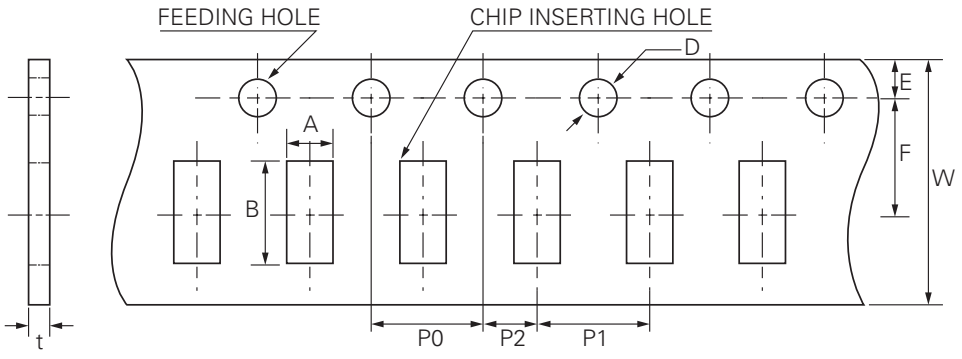
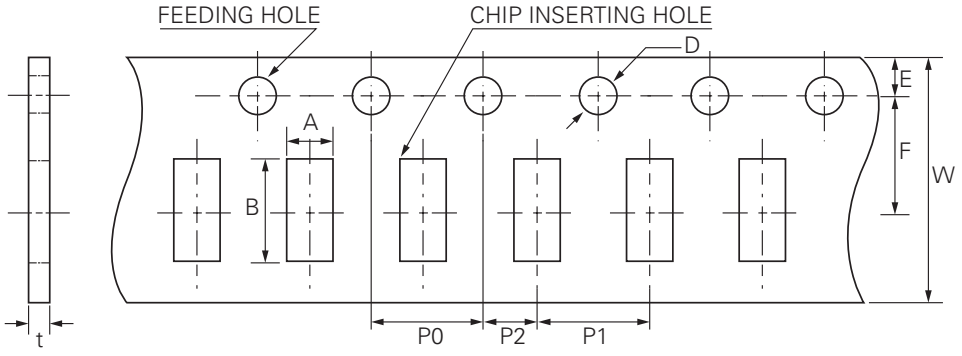
## Carrie Tape Dimensions

LCFEA121002A900TG



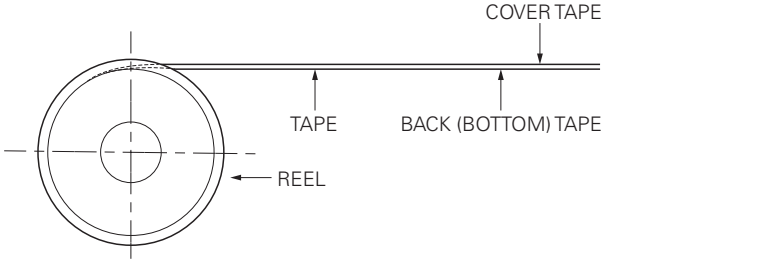

| Symbol | Dimensions Millimeters |
|---|---|
| A | 1.15±0.05 |
| B | 1.50±0.05 |
| W | 8.0+0.30, .0.10 |
| F | 3.50±0.05 |
| E | 1.75±0.05 |
| P1 | 4.00±0.10 |
| P2 | 2.00±0.05 |
| P0 | 4.00±0.10 |
| D | 1.55±0.03 |
| T | 0.75±0.05 |

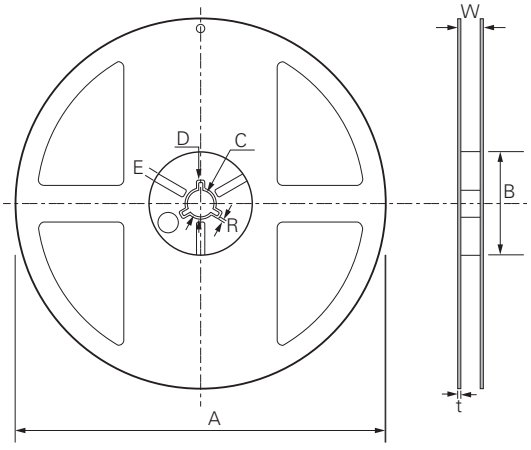
LCFEA201202A900TG, LCFEA201204A101TG




| 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




(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 | Ø20±0.8 | 3.0±0.5 | 10±1.5 | 1.3±0.2 | 1.0±0.2 |

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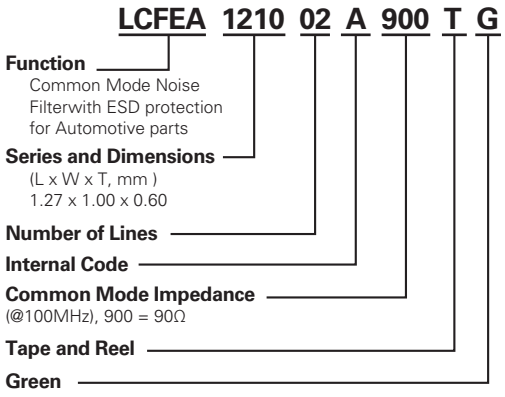
## Part Numbering System




## Ordering Information

| Part Number | Reel Quantity |
|---|---|
| | 4,000 |
| | |
| | |