



SANYO Semiconductors

## DATA SHEET

An ON Semiconductor Company

NPN Epitaxial Planar Silicon Transistor

# CPH6001A — High-Frequency Low-Noise Amplifier Applications

## Features

- High gain :  $|S_{21e}|^2 = 11\text{dB typ (f=1GHz)}$
- High cut-off frequency :  $f_T = 6.7\text{GHz typ}$
- Small and slim 6-pin package
- Large allowable collector dissipation (800mW max)

## Specifications

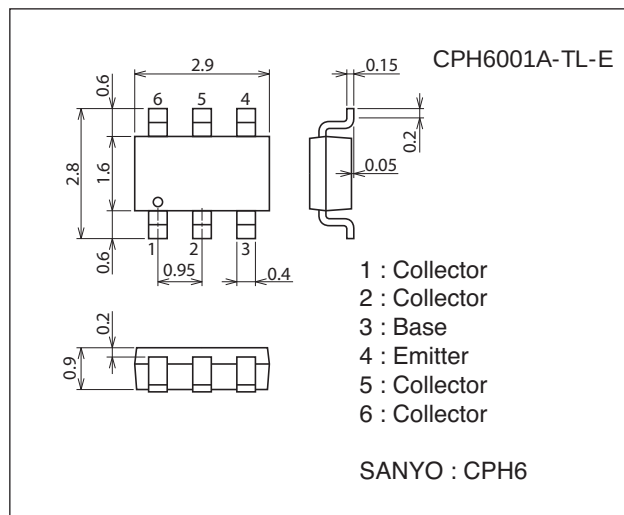
Absolute Maximum Ratings at  $T_a = 25^\circ\text{C}$ 

| Parameter                    | Symbol    | Conditions                                                    | Ratings     | Unit |
|------------------------------|-----------|---------------------------------------------------------------|-------------|------|
| Collector-to- Base Voltage   | $V_{CBO}$ |                                                               | 20          | V    |
| Collector-to-Emitter Voltage | $V_{CEO}$ |                                                               | 12          | V    |
| Emitter-to-Base Voltage      | $V_{EBO}$ |                                                               | 2           | V    |
| Collector Current            | $I_C$     |                                                               | 100         | mA   |
| Collector Dissipation        | $P_C$     | When mounted on ceramic substrate (250mm <sup>2</sup> ×0.8mm) | 800         | mW   |
| Junction Temperature         | $T_J$     |                                                               | 150         | °C   |
| Storage Temperature          | $T_{stg}$ |                                                               | -55 to +150 | °C   |

## Package Dimensions

unit : mm (typ)

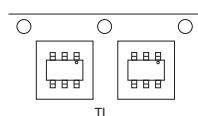
7018A-002



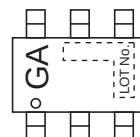
## Product & Package Information

- Package : CPH6
- JEITA, JEDEC : SC-74, SOT-26, SOT-457
- Minimum Packing Quantity : 3,000 pcs./reel

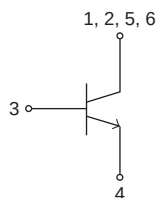
## Packing Type: TL



## Marking



## Electrical Connection



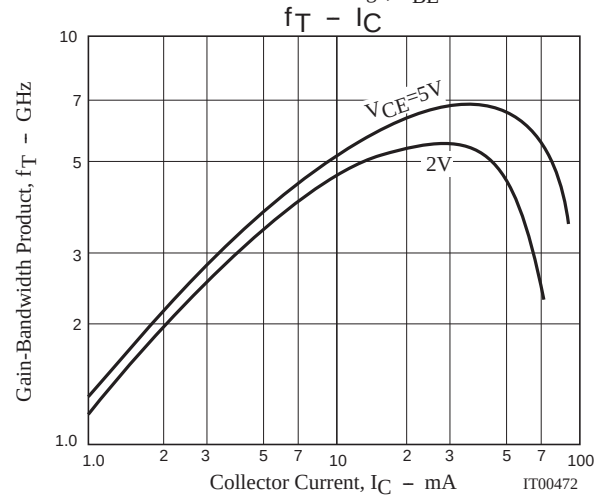
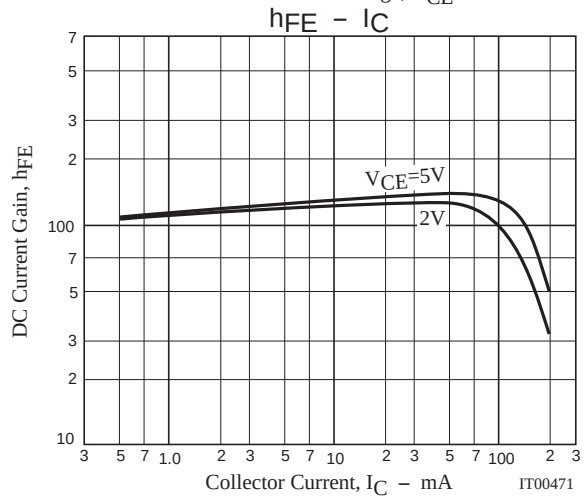
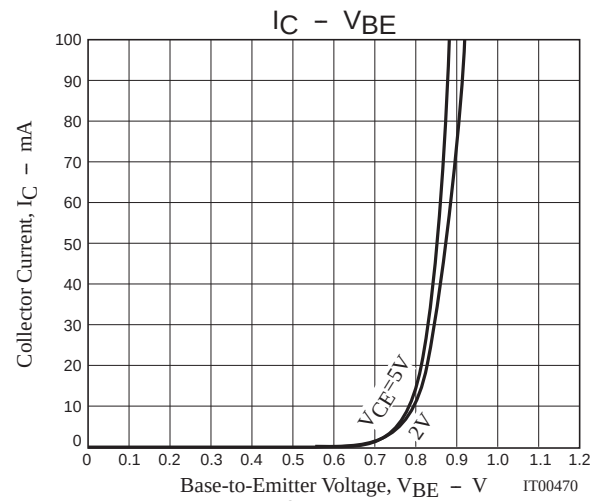
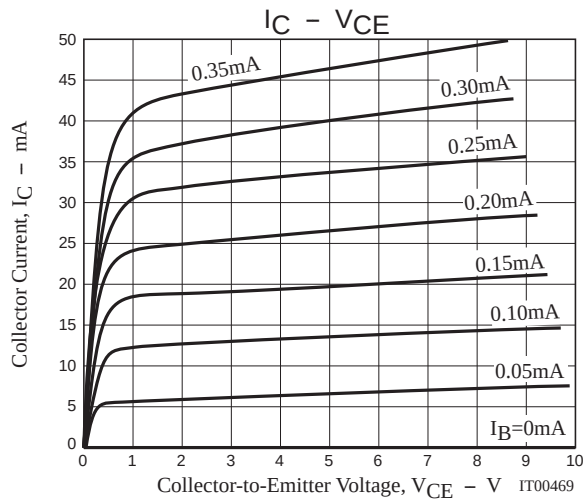
# CPH6001A

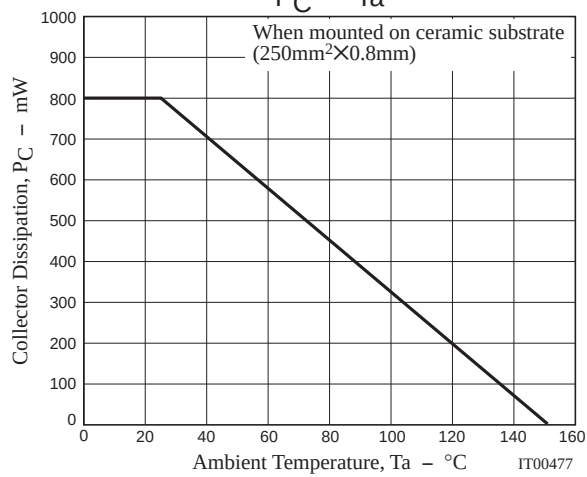
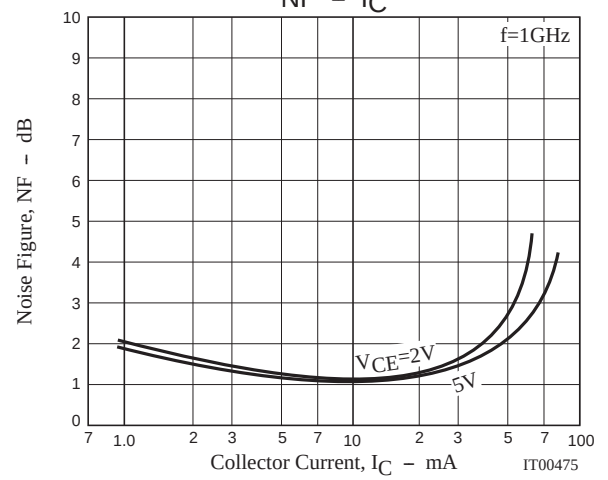
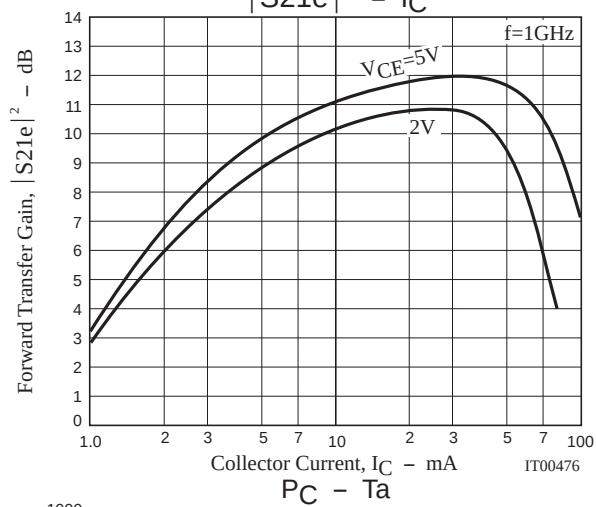
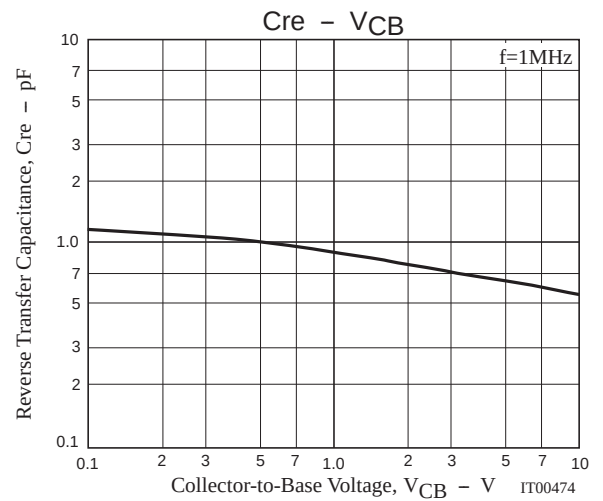
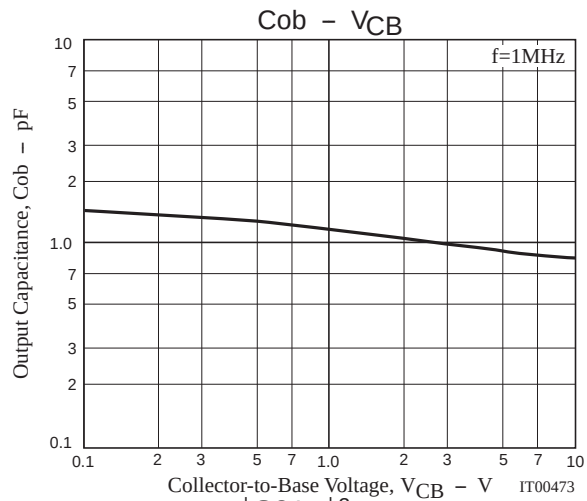
## Electrical Characteristics at Ta=25°C

| Parameter                    | Symbol        | Conditions                    | Ratings |      |     | Unit    |
|------------------------------|---------------|-------------------------------|---------|------|-----|---------|
|                              |               |                               | min     | typ  | max |         |
| Collector Cutoff Current     | $I_{CBO}$     | $V_{CB}=10V, I_E=0A$          |         |      | 1.0 | $\mu A$ |
| Emitter Cutoff Current       | $I_{EBO}$     | $V_{EB}=1V, I_C=0A$           |         |      | 10  | $\mu A$ |
| DC Current Gain              | $h_{FE1}$     | $V_{CE}=5V, I_C=30mA$         | 90      |      | 180 |         |
|                              | $h_{FE2}$     | $V_{CE}=5V, I_C=70mA$         | 70      |      |     |         |
| Gain-Bandwidth Product       | $f_T$         | $V_{CE}=5V, I_C=30mA$         | 5       | 6.7  |     | GHz     |
| Output Capacitance           | $C_{ob}$      | $V_{CB}=5V, f=1MHz$           |         | 0.95 | 1.5 | pF      |
| Reverse Transfer Capacitance | $C_{re}$      |                               |         | 0.6  |     | pF      |
| Forward Transfer Gain        | $ S_{21e} ^2$ | $V_{CE}=5V, I_C=30mA, f=1GHz$ | 9       | 11   |     | dB      |
| Noise Figure                 | NF            | $V_{CE}=5V, I_C=7mA, f=1GHz$  |         | 1.1  | 2.0 | dB      |

## Ordering Information

| Device        | Package | Shipping       | memo    |
|---------------|---------|----------------|---------|
| CPH6001A-TL-E | CPH6    | 3,000pcs./reel | Pb Free |





# CPH6001A

## S Parameters (Common emitter)

$V_{CE}=2V$ ,  $I_C=5mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.799           | -48.2            | 12.990          | 147.1            | 0.044           | 65.4             | 0.871           | -26.6            |
| 200       | 0.678           | -83.5            | 9.939           | 125.1            | 0.069           | 51.4             | 0.687           | -42.9            |
| 400       | 0.557           | -124.8           | 6.138           | 101.0            | 0.090           | 42.3             | 0.476           | -57.0            |
| 600       | 0.514           | -147.5           | 4.326           | 87.6             | 0.103           | 41.5             | 0.390           | -63.7            |
| 800       | 0.497           | -161.9           | 3.345           | 77.6             | 0.115           | 43.4             | 0.353           | -69.1            |
| 1000      | 0.488           | -173.8           | 2.740           | 68.9             | 0.129           | 45.3             | 0.337           | -74.6            |
| 1200      | 0.484           | 177.2            | 2.324           | 61.3             | 0.144           | 46.7             | 0.335           | -79.9            |
| 1400      | 0.484           | 169.3            | 2.030           | 54.5             | 0.150           | 47.8             | 0.340           | -85.1            |
| 1600      | 0.483           | 161.1            | 1.804           | 48.3             | 0.177           | 48.3             | 0.346           | -90.6            |
| 1800      | 0.482           | 153.5            | 1.638           | 42.3             | 0.196           | 48.1             | 0.355           | -96.6            |
| 2000      | 0.487           | 146.4            | 1.493           | 36.6             | 0.215           | 47.4             | 0.367           | -102.1           |

$V_{CE}=2V$ ,  $I_C=10mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.683           | -65.5            | 19.214          | 137.7            | 0.038           | 60.9             | 0.767           | -38.0            |
| 200       | 0.550           | -109.9           | 13.370          | 114.8            | 0.055           | 51.2             | 0.536           | -55.8            |
| 400       | 0.440           | -143.5           | 7.287           | 93.9             | 0.074           | 50.3             | 0.342           | -69.5            |
| 600       | 0.443           | -162.0           | 5.046           | 83.6             | 0.094           | 52.5             | 0.280           | -75.8            |
| 800       | 0.457           | -174.9           | 3.900           | 75.6             | 0.114           | 54.1             | 0.255           | -81.6            |
| 1000      | 0.445           | 172.3            | 3.214           | 67.3             | 0.135           | 55.0             | 0.243           | -87.7            |
| 1200      | 0.427           | 166.4            | 2.681           | 60.6             | 0.156           | 54.5             | 0.245           | -92.6            |
| 1400      | 0.418           | 162.9            | 2.309           | 54.1             | 0.177           | 53.7             | 0.251           | -97.6            |
| 1600      | 0.439           | 160.3            | 1.987           | 49.2             | 0.199           | 52.5             | 0.258           | -102.6           |
| 1800      | 0.486           | 149.1            | 1.850           | 46.2             | 0.221           | 50.6             | 0.269           | -107.7           |
| 2000      | 0.468           | 137.2            | 1.745           | 40.2             | 0.241           | 48.2             | 0.280           | -112.9           |

$V_{CE}=2V$ ,  $I_C=20mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.540           | -87.3            | 24.533          | 127.8            | 0.032           | 58.3             | 0.646           | -49.3            |
| 200       | 0.469           | -125.4           | 14.920          | 107.9            | 0.045           | 55.2             | 0.411           | -67.4            |
| 400       | 0.437           | -157.2           | 8.009           | 91.0             | 0.067           | 59.1             | 0.256           | -81.3            |
| 600       | 0.430           | -171.6           | 5.453           | 81.5             | 0.091           | 61.2             | 0.210           | -89.3            |
| 800       | 0.428           | 178.4            | 4.148           | 74.0             | 0.116           | 61.3             | 0.197           | -95.4            |
| 1000      | 0.427           | 170.3            | 3.373           | 67.4             | 0.140           | 60.3             | 0.196           | -100.5           |
| 1200      | 0.424           | 163.2            | 2.840           | 61.0             | 0.164           | 58.5             | 0.201           | -105.2           |
| 1400      | 0.424           | 156.9            | 2.484           | 55.3             | 0.189           | 56.7             | 0.208           | -109.8           |
| 1600      | 0.423           | 150.0            | 2.201           | 50.1             | 0.212           | 54.6             | 0.218           | -114.2           |
| 1800      | 0.420           | 144.2            | 1.999           | 44.8             | 0.236           | 52.0             | 0.228           | -119.0           |
| 2000      | 0.422           | 136.2            | 1.825           | 39.5             | 0.257           | 49.0             | 0.238           | -123.8           |

$V_{CE}=2V$ ,  $I_C=30mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.487           | -101.2           | 26.240          | 123.1            | 0.029           | 58.4             | 0.579           | -54.7            |
| 200       | 0.446           | -136.8           | 15.309          | 104.6            | 0.041           | 58.0             | 0.356           | -72.3            |
| 400       | 0.435           | -163.5           | 8.071           | 89.3             | 0.065           | 62.9             | 0.223           | -86.1            |
| 600       | 0.437           | -176.4           | 5.488           | 80.4             | 0.090           | 64.2             | 0.186           | -94.2            |
| 800       | 0.433           | 174.9            | 4.181           | 73.3             | 0.117           | 63.7             | 0.178           | -100.3           |
| 1000      | 0.435           | 166.8            | 3.388           | 66.7             | 0.142           | 62.3             | 0.180           | -105.7           |
| 1200      | 0.433           | 160.8            | 2.855           | 60.5             | 0.168           | 60.1             | 0.187           | -110.1           |
| 1400      | 0.427           | 154.6            | 2.491           | 54.8             | 0.192           | 57.9             | 0.195           | -114.4           |
| 1600      | 0.432           | 147.9            | 2.211           | 49.7             | 0.217           | 55.4             | 0.205           | -118.8           |
| 1800      | 0.428           | 141.8            | 2.002           | 44.3             | 0.241           | 52.7             | 0.217           | -123.3           |
| 2000      | 0.430           | 134.8            | 1.831           | 39.4             | 0.261           | 49.4             | 0.227           | -127.9           |

# CPH6001A

## S Parameters (Common emitter)

$V_{CE}=5V$ ,  $I_C=5mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.822           | -42.5            | 13.211          | 150.0            | 0.035           | 68.2             | 0.901           | -20.9            |
| 200       | 0.684           | -77.8            | 10.639          | 128.5            | 0.056           | 54.8             | 0.743           | -34.0            |
| 400       | 0.516           | -116.3           | 6.681           | 103.3            | 0.076           | 45.3             | 0.548           | -44.9            |
| 600       | 0.481           | -140.7           | 4.776           | 89.6             | 0.087           | 44.9             | 0.467           | -49.9            |
| 800       | 0.477           | -157.6           | 3.714           | 80.0             | 0.098           | 46.3             | 0.433           | -54.2            |
| 1000      | 0.454           | -172.9           | 3.055           | 71.0             | 0.110           | 48.5             | 0.419           | -58.8            |
| 1200      | 0.435           | 179.1            | 2.572           | 63.0             | 0.124           | 50.1             | 0.416           | -64.0            |
| 1400      | 0.431           | 173.9            | 2.213           | 56.2             | 0.138           | 51.7             | 0.419           | -68.9            |
| 1600      | 0.449           | 169.6            | 1.922           | 50.7             | 0.154           | 52.8             | 0.424           | -74.4            |
| 1800      | 0.495           | 157.8            | 1.789           | 46.3             | 0.171           | 52.8             | 0.431           | -80.3            |
| 2000      | 0.482           | 145.3            | 1.669           | 39.6             | 0.188           | 52.4             | 0.440           | -85.7            |

$V_{CE}=5V$ ,  $I_C=10mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.690           | -57.0            | 20.017          | 141.0            | 0.031           | 64.0             | 0.813           | -29.6            |
| 200       | 0.552           | -93.8            | 14.091          | 118.9            | 0.046           | 54.8             | 0.599           | -43.3            |
| 400       | 0.447           | -133.6           | 8.190           | 97.6             | 0.064           | 52.8             | 0.419           | -51.2            |
| 600       | 0.413           | -154.2           | 5.664           | 86.0             | 0.080           | 55.0             | 0.355           | -54.8            |
| 800       | 0.402           | -167.0           | 4.314           | 77.6             | 0.098           | 56.9             | 0.329           | -58.9            |
| 1000      | 0.399           | -177.7           | 3.519           | 70.1             | 0.116           | 57.8             | 0.320           | -63.5            |
| 1200      | 0.395           | 173.3            | 2.985           | 63.3             | 0.135           | 57.5             | 0.322           | -68.5            |
| 1400      | 0.390           | 165.6            | 2.590           | 57.2             | 0.154           | 57.1             | 0.325           | -73.5            |
| 1600      | 0.396           | 158.1            | 2.293           | 51.4             | 0.173           | 56.1             | 0.332           | -78.8            |
| 1800      | 0.398           | 150.8            | 2.069           | 45.7             | 0.193           | 54.6             | 0.341           | -84.4            |
| 2000      | 0.396           | 143.4            | 1.881           | 40.4             | 0.211           | 52.8             | 0.350           | -90.0            |

$V_{CE}=5V$ ,  $I_C=30mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.481           | -85.7            | 28.955          | 127.1            | 0.024           | 61.8             | 0.649           | -41.0            |
| 200       | 0.403           | -123.6           | 17.443          | 107.7            | 0.035           | 60.6             | 0.427           | -51.3            |
| 400       | 0.370           | -155.2           | 9.326           | 91.5             | 0.056           | 64.6             | 0.292           | -54.9            |
| 600       | 0.363           | -170.7           | 6.348           | 82.3             | 0.078           | 66.1             | 0.256           | -57.9            |
| 800       | 0.359           | 179.9            | 4.826           | 75.3             | 0.100           | 65.9             | 0.245           | -62.2            |
| 1000      | 0.360           | 171.2            | 3.907           | 68.5             | 0.123           | 64.8             | 0.244           | -67.4            |
| 1200      | 0.360           | 164.4            | 3.288           | 62.7             | 0.145           | 63.1             | 0.249           | -72.7            |
| 1400      | 0.356           | 157.3            | 2.871           | 57.0             | 0.167           | 61.2             | 0.256           | -78.0            |
| 1600      | 0.362           | 151.2            | 2.541           | 51.8             | 0.188           | 59.0             | 0.265           | -83.6            |
| 1800      | 0.361           | 143.6            | 2.290           | 46.5             | 0.210           | 56.5             | 0.274           | -89.4            |
| 2000      | 0.363           | 137.2            | 2.076           | 41.4             | 0.229           | 53.6             | 0.284           | -95.1            |

$V_{CE}=5V$ ,  $I_C=50mA$ ,  $Z_O=50\Omega$

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.426           | -101.6           | 29.939          | 122.4            | 0.021           | 62.6             | 0.587           | -42.4            |
| 200       | 0.389           | -137.3           | 17.324          | 104.3            | 0.032           | 63.2             | 0.385           | -49.1            |
| 400       | 0.379           | -163.4           | 9.137           | 89.5             | 0.053           | 67.9             | 0.277           | -50.5            |
| 600       | 0.378           | -176.3           | 6.195           | 80.8             | 0.076           | 68.9             | 0.252           | -53.4            |
| 800       | 0.375           | 175.0            | 4.700           | 74.0             | 0.098           | 68.3             | 0.245           | -58.2            |
| 1000      | 0.380           | 167.8            | 3.799           | 67.9             | 0.121           | 66.8             | 0.248           | -64.0            |
| 1200      | 0.379           | 161.2            | 3.196           | 61.8             | 0.143           | 64.9             | 0.255           | -69.8            |
| 1400      | 0.378           | 154.9            | 2.787           | 56.1             | 0.165           | 62.8             | 0.262           | -75.4            |
| 1600      | 0.382           | 148.6            | 2.469           | 50.9             | 0.187           | 60.5             | 0.271           | -81.4            |
| 1800      | 0.382           | 142.5            | 2.227           | 45.8             | 0.209           | 57.8             | 0.281           | -87.6            |
| 2000      | 0.385           | 135.6            | 2.027           | 40.7             | 0.228           | 55.0             | 0.291           | -93.3            |

# Embossed Taping Specification

CPH6001A-TL-E

## 1. Packing Format

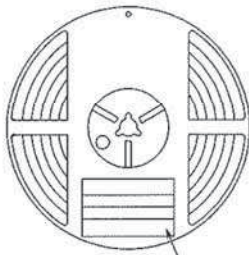
| Package Name | Carrier Tape Type | Maximum Number of devices contained (pcs) |           |           | Packing format                                              |                                                                    |
|--------------|-------------------|-------------------------------------------|-----------|-----------|-------------------------------------------------------------|--------------------------------------------------------------------|
|              |                   | Reel                                      | Inner box | Outer box | Inner BOX (C-1)                                             | Outer BOX (A-7)                                                    |
| CPH6         | CPH6              | 3,000                                     | 15,000    | 90,000    | 5 reels contained<br>Dimensions:mm (external)<br>183×72×185 | 6 inner boxes contained<br>Dimensions:mm (external)<br>440×195×210 |

Reel label, Inner box label  
(unit:mm)

Outer box label

It is a label at the time of factory shipments.  
The form of a label may change in physical distribution process.

### Packing method



Reel label

Type No.  
LOT No.  
Quantity  
Origin

|          |                       |
|----------|-----------------------|
| TYPE     | 000000000             |
| LOT      | 00                    |
| QTY      | 0,000 (1) LEAD FREE # |
| SPECIAL  | *20722005310C*        |
| ASSEMBLY | **** (DIFFUSION:****) |

NOTE (1)

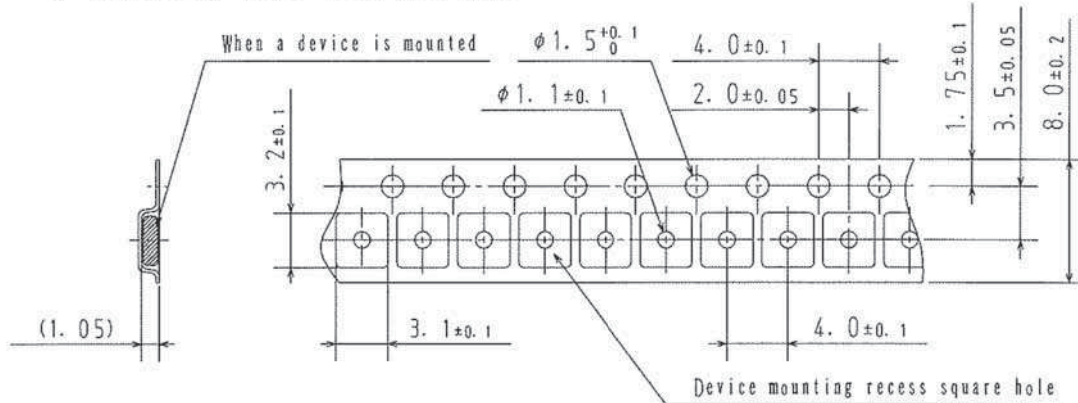
The LEAD FREE # description shows that the surface treatment of the terminal is lead free.

|           |                           |
|-----------|---------------------------|
| TYPE CODE | *****0*****               |
| TYPE      | 00000000                  |
| QTY       | 0,000 PCS (1) LEAD FREE # |
| LOT       | 00000000                  |
| PACKAGE   | 00000000                  |
| SPECIAL   | *20722005310C*            |
| ASSEMBLY  | **** (DIFFUSION:****)     |

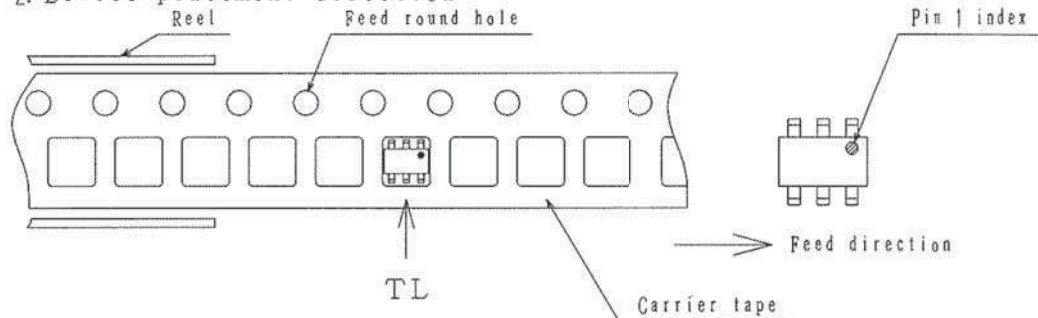
| Label       | JEITA Phase    |
|-------------|----------------|
| LEAD FREE 3 | JEITA Phase 3A |
| LEAD FREE 4 | JEITA Phase 3  |

## 2. Taping configuration

### 2-1. Carrier tape size (unit:mm)

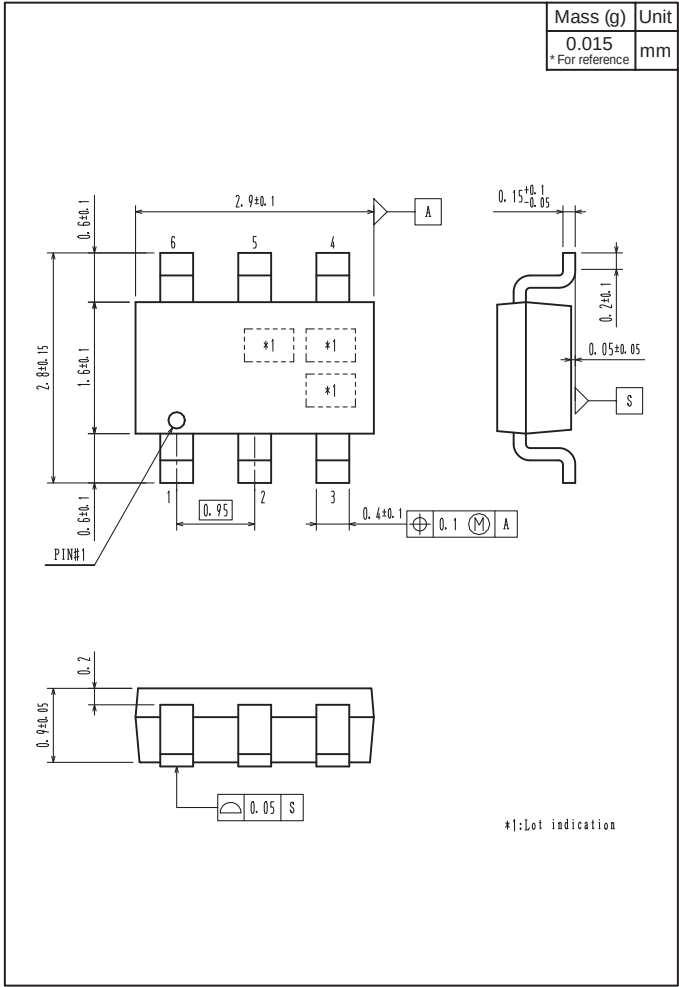


### 2-2. Device placement direction

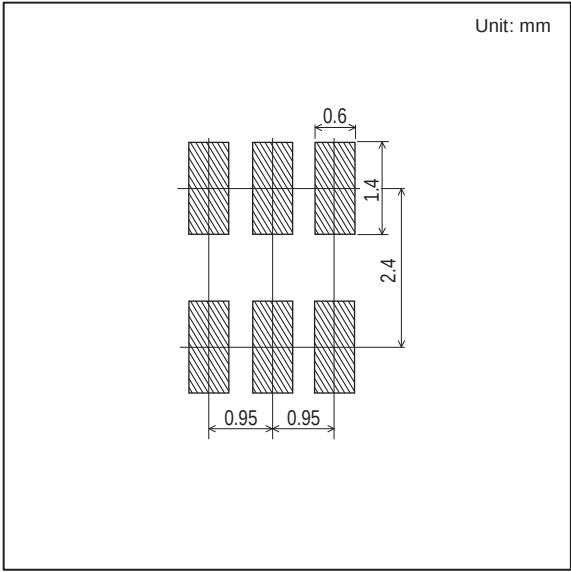


Those with pin 1 index on the feed hole side.....TL

Outline Drawing  
CPH6001A-TL-E



Land Pattern Example



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