



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## 2SC5231A — NPN Epitaxial Planar Silicon Transistor VHF to UHF Wide-Band Low-Noise Amplifier Applications

### Features

- Low-noise : NF=1.0dB typ (f=1GHz)
- High gain :  $|S_{21e}|^2=12\text{dB}$  typ (f=1GHz)
- High cut-off frequency :  $f_T=7\text{GHz}$  typ
- Ultrasmall-sized package permitting applied sets to be made small and slim

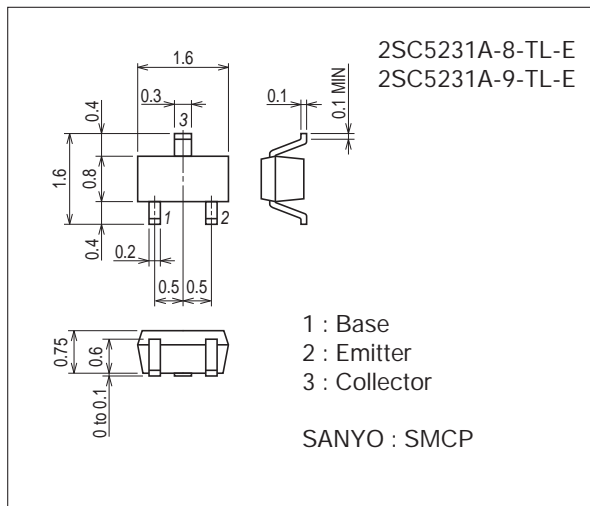
### Specifications

#### Absolute Maximum Ratings at Ta=25°C

| Parameter                    | Symbol           | Conditions | Ratings     | Unit |
|------------------------------|------------------|------------|-------------|------|
| Collector-to-Base Voltage    | V <sub>CB0</sub> |            | 20          | V    |
| Collector-to-Emitter Voltage | V <sub>CE0</sub> |            | 10          | V    |
| Emitter-to-Base Voltage      | V <sub>EB0</sub> |            | 2           | V    |
| Collector Current            | I <sub>C</sub>   |            | 70          | mA   |
| Collector Dissipation        | P <sub>C</sub>   |            | 100         | mW   |
| Junction Temperature         | T <sub>j</sub>   |            | 150         | °C   |
| Storage Temperature          | T <sub>stg</sub> |            | -55 to +150 | °C   |

### Package Dimensions

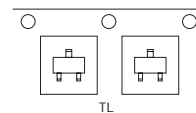
unit : mm (typ)  
7027A-002



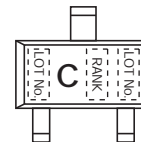
### Product & Package Information

- Package : SMCP
- JEITA, JEDEC : SC-75, SOT-416
- Minimum Packing Quantity : 3,000 pcs./reel

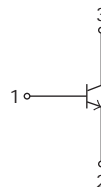
### Packing Type: TL



### Marking



### Electrical Connection



# 2SC5231A

## Electrical Characteristics at Ta=25°C

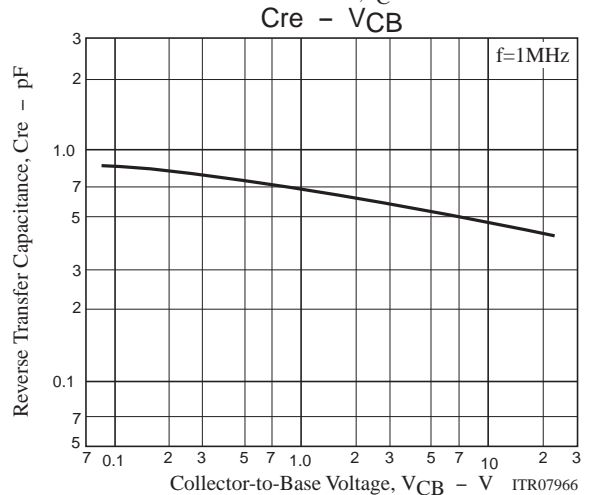
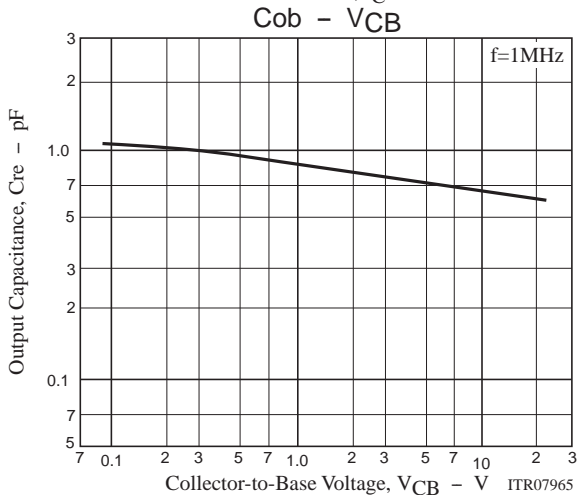
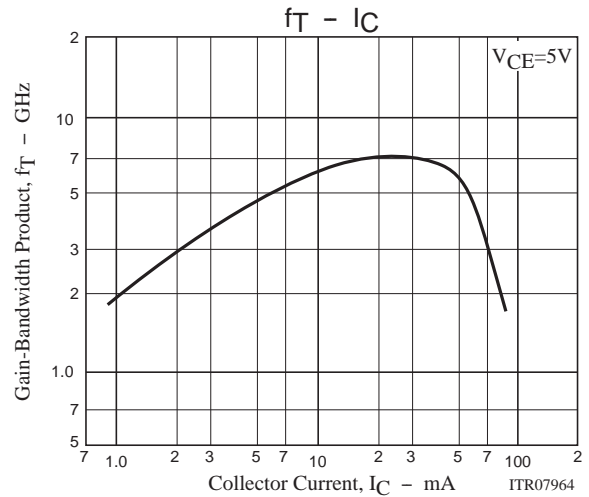
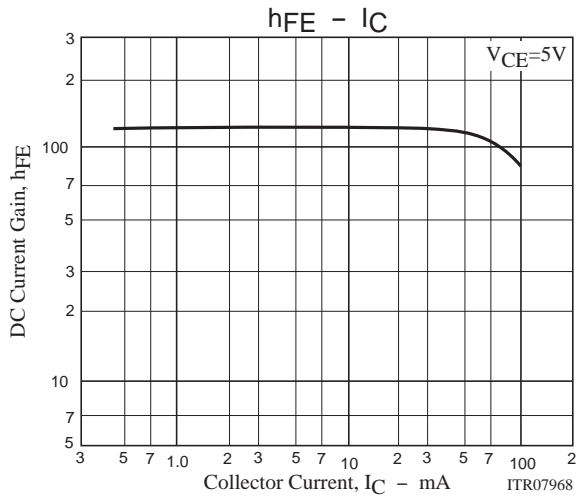
| Parameter                    | Symbol          | Conditions                    | Ratings |      |      | Unit    |
|------------------------------|-----------------|-------------------------------|---------|------|------|---------|
|                              |                 |                               | 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              | $h_{FE}$        | $V_{CE}=5V, I_C=20mA$         | 60*     |      | 270* |         |
| Gain-Bandwidth Product       | $f_T$           | $V_{CE}=5V, I_C=20mA$         | 5       | 7    |      | GHz     |
| Output Capacitance           | $C_{ob}$        | $V_{CB}=10V, f=1MHz$          |         | 0.7  | 1.2  | pF      |
| Reverse Transfer Capacitance | $C_{re}$        | $V_{CB}=10V, f=1MHz$          |         | 0.45 |      | pF      |
| Forward Transfer Gain        | $ S_{21e} ^2_1$ | $V_{CE}=5V, I_C=20mA, f=1GHz$ | 9       | 12   |      | dB      |
|                              | $ S_{21e} ^2_2$ | $V_{CE}=2V, I_C=3mA, f=1GHz$  |         | 8.5  |      | dB      |
| Noise Figure                 | NF              | $V_{CE}=5V, I_C=7mA, f=1GHz$  |         | 1.0  | 1.8  | dB      |

\* : The 2SC5231A is classified by 20mA  $h_{FE}$  as follows :

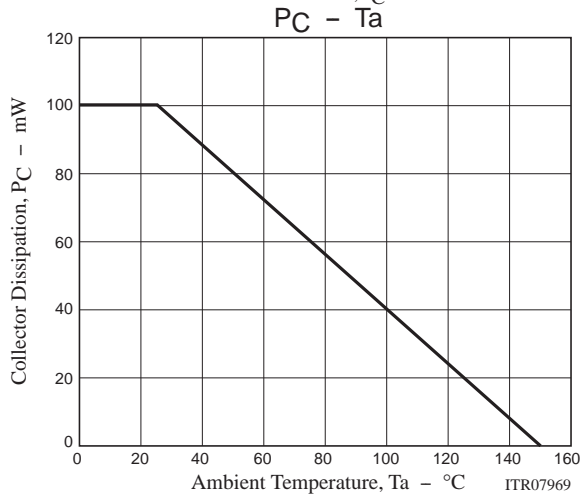
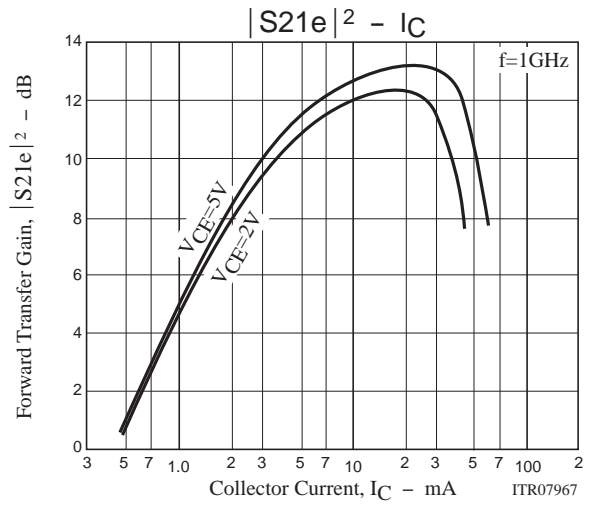
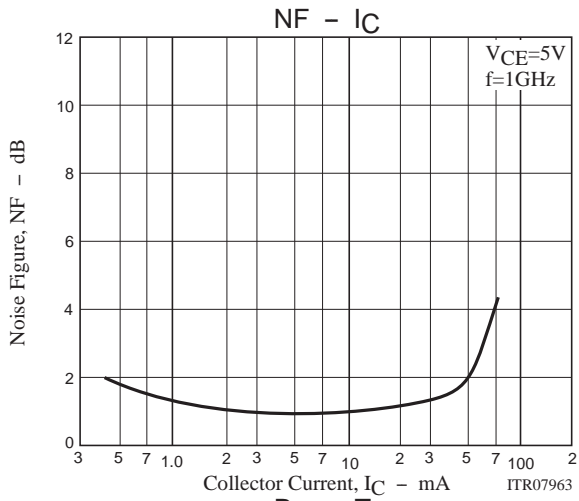
| Rank     | 7         | 8         | 9          |
|----------|-----------|-----------|------------|
| $h_{FE}$ | 60 to 120 | 90 to 180 | 135 to 270 |

## Ordering Information

| Device          | Package | Shipping       | memo    |
|-----------------|---------|----------------|---------|
| 2SC5231A-8-TL-E | SMCP    | 3,000pcs./reel | Pb Free |
| 2SC5231A-9-TL-E | SMCP    | 3,000pcs./reel |         |



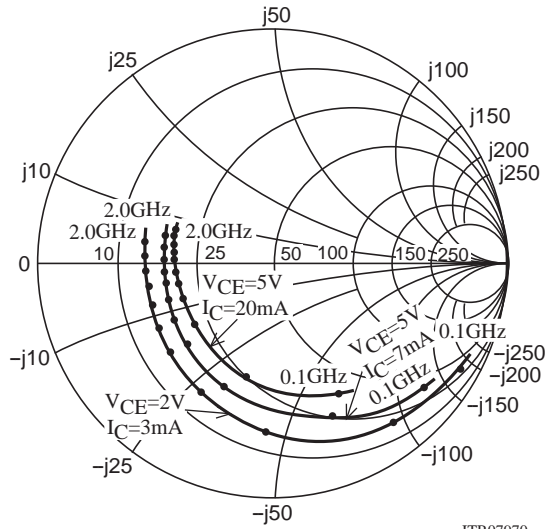
# 2SC5231A



# 2SC5231A

S11e

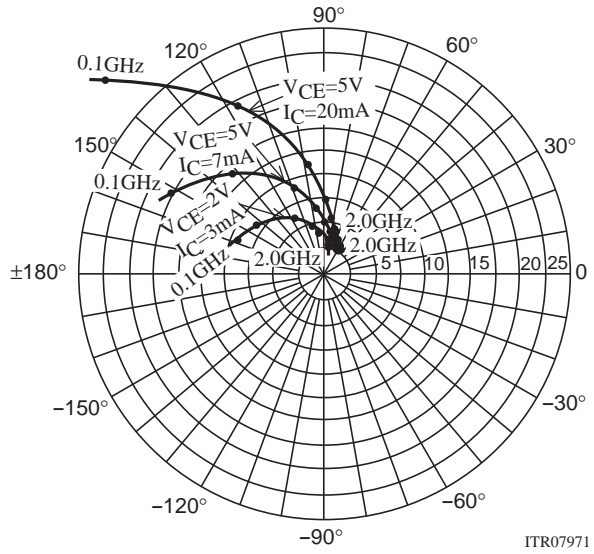
f=100MHz, f=200MHz to 2000MHz(200MHz Step)



ITR07970

S21e

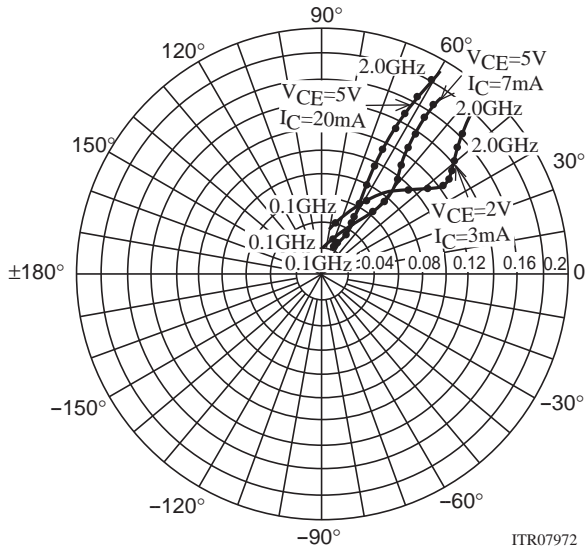
f=100MHz, f=200MHz to 2000MHz(200MHz Step)



ITR07971

S12e

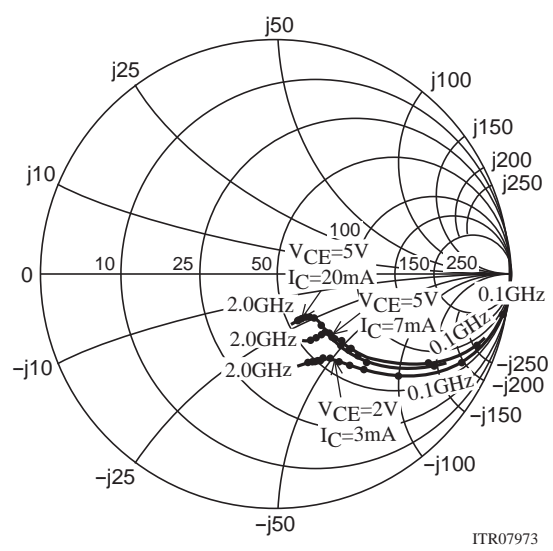
f=100MHz, f=200MHz to 2000MHz(200MHz Step)



ITR07972

S22e

f=100MHz, f=200MHz to 2000MHz(200MHz Step)



ITR07973

## 2SC5231A

### S Parameters (Common emitter)

$V_{CE}=5V, I_C=7mA, Z_O=50\Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.786 | -40.7        | 17.507 | 151.3        | 0.028 | 70.1         | 0.898 | -20.4        |
| 200       | 0.677 | -72.4        | 13.998 | 131.4        | 0.046 | 58.0         | 0.739 | -33.4        |
| 400       | 0.546 | -112.7       | 9.061  | 108.6        | 0.064 | 49.6         | 0.525 | -43.7        |
| 600       | 0.492 | -135.2       | 6.442  | 96.1         | 0.076 | 49.3         | 0.423 | -46.7        |
| 800       | 0.473 | -150.0       | 5.005  | 87.3         | 0.087 | 50.8         | 0.374 | -44.4        |
| 1000      | 0.465 | -160.0       | 4.073  | 80.4         | 0.099 | 52.6         | 0.346 | -49.7        |
| 1200      | 0.457 | -169.5       | 3.449  | 74.0         | 0.111 | 54.0         | 0.332 | -51.6        |
| 1400      | 0.451 | -176.2       | 2.989  | 68.6         | 0.124 | 55.2         | 0.321 | -54.1        |
| 1600      | 0.449 | 177.8        | 2.658  | 63.8         | 0.138 | 56.6         | 0.319 | -56.2        |
| 1800      | 0.454 | 172.5        | 2.378  | 58.4         | 0.151 | 56.7         | 0.313 | -60.0        |
| 2000      | 0.460 | 167.1        | 2.154  | 54.0         | 0.166 | 56.7         | 0.311 | -63.2        |

$V_{CE}=5V, I_C=20mA, Z_O=50\Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.601 | -65.8        | 28.967 | 137.1        | 0.023 | 64.1         | 0.757 | -32.9        |
| 200       | 0.497 | -103.7       | 19.309 | 116.6        | 0.035 | 57.0         | 0.534 | -50.3        |
| 400       | 0.435 | -139.6       | 10.891 | 98.6         | 0.050 | 58.7         | 0.345 | -50.3        |
| 600       | 0.419 | -156.6       | 7.461  | 89.3         | 0.065 | 61.3         | 0.280 | -50.7        |
| 800       | 0.414 | -166.6       | 5.695  | 82.5         | 0.081 | 63.1         | 0.251 | -51.3        |
| 1000      | 0.413 | -174.0       | 4.613  | 77.0         | 0.098 | 63.8         | 0.235 | -52.9        |
| 1200      | 0.413 | 178.6        | 3.870  | 71.8         | 0.114 | 63.9         | 0.226 | -55.1        |
| 1400      | 0.411 | 173.8        | 3.345  | 66.9         | 0.131 | 63.6         | 0.221 | -57.7        |
| 1600      | 0.413 | 169.6        | 2.960  | 62.7         | 0.148 | 63.2         | 0.220 | -60.2        |
| 1800      | 0.416 | 165.1        | 2.655  | 58.0         | 0.165 | 61.8         | 0.219 | -64.8        |
| 2000      | 0.422 | 160.3        | 2.406  | 54.0         | 0.182 | 60.6         | 0.218 | -68.3        |

$V_{CE}=2V, I_C=3mA, Z_O=50\Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21   | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|
| 100       | 0.888 | -30.2        | 9.280 | 158.6        | 0.038 | 73.6         | 0.949 | -15.1        |
| 200       | 0.815 | -56.4        | 8.218 | 141.3        | 0.067 | 60.5         | 0.849 | -26.9        |
| 400       | 0.690 | -96.0        | 6.074 | 116.7        | 0.098 | 45.1         | 0.657 | -41.1        |
| 600       | 0.616 | -120.7       | 4.517 | 101.4        | 0.112 | 38.4         | 0.539 | -47.6        |
| 800       | 0.584 | -138.0       | 3.610 | 90.4         | 0.120 | 35.8         | 0.475 | -51.2        |
| 1000      | 0.566 | -150.7       | 2.995 | 81.9         | 0.125 | 35.7         | 0.434 | -54.5        |
| 1200      | 0.555 | -161.2       | 2.540 | 74.2         | 0.131 | 36.5         | 0.410 | -57.5        |
| 1400      | 0.546 | -169.3       | 2.213 | 67.5         | 0.137 | 38.4         | 0.393 | -60.7        |
| 1600      | 0.541 | -176.4       | 1.982 | 62.0         | 0.143 | 40.7         | 0.391 | -64.0        |
| 1800      | 0.545 | 177.1        | 1.774 | 55.9         | 0.152 | 42.5         | 0.382 | -67.8        |
| 2000      | 0.547 | 170.9        | 1.614 | 50.9         | 0.163 | 44.7         | 0.381 | -72.1        |

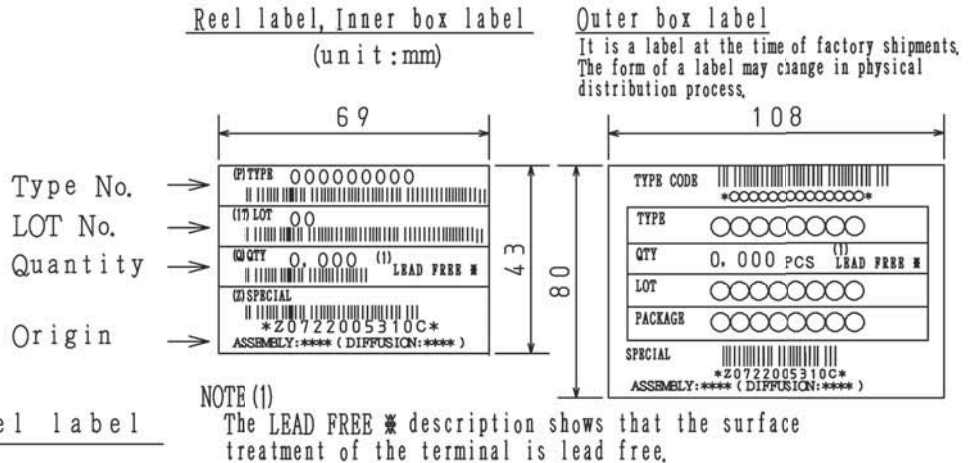
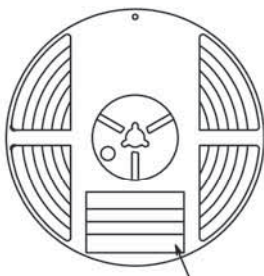
Embossed Taping Specification

2SC5231A-8-TL-E, 2SC5231A-9-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)  |
| SMCP         | SMCP              | 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 |

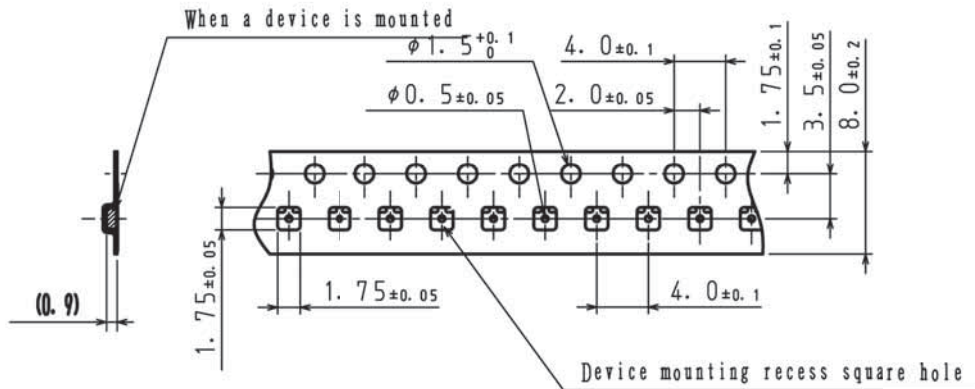
Packing method



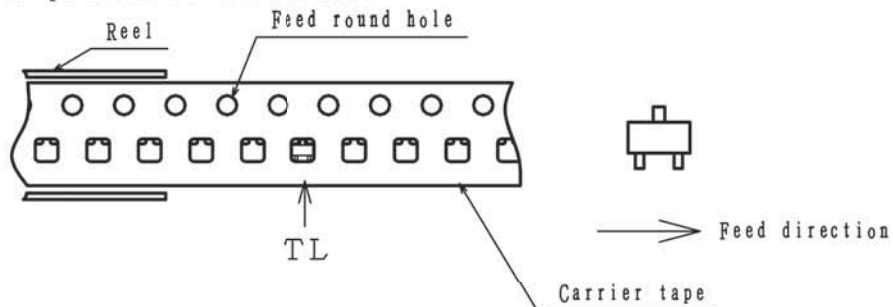
| Label | JEITA Phase   |
|-------|---------------|
| ..... | JEITA Phase 3 |

2. Taping configuration

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



2-2. Device placement direction

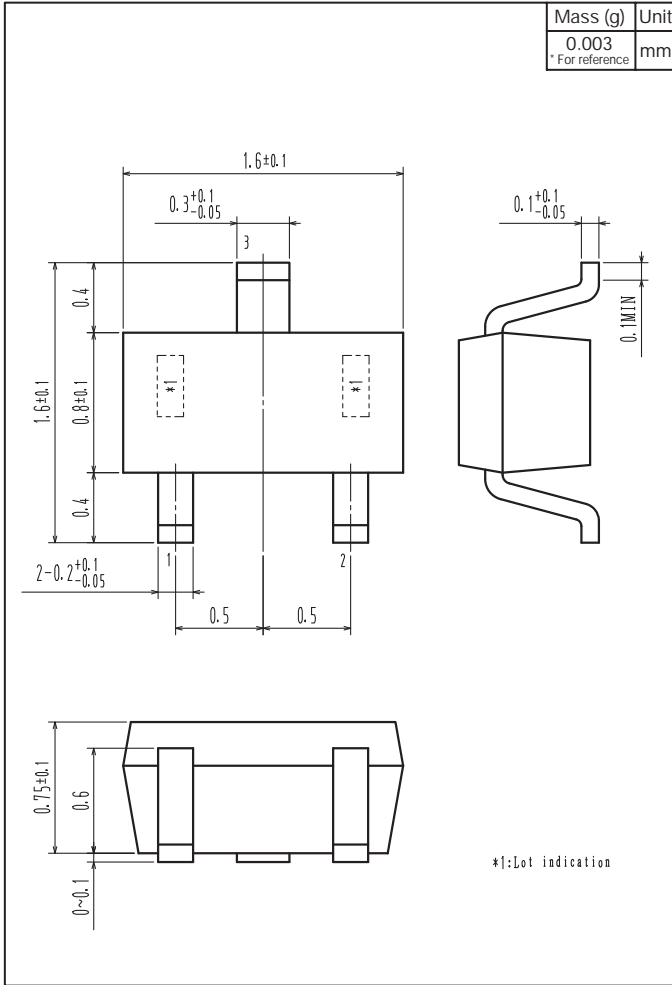


Those with one electrode terminal on the feed hole side.....TL

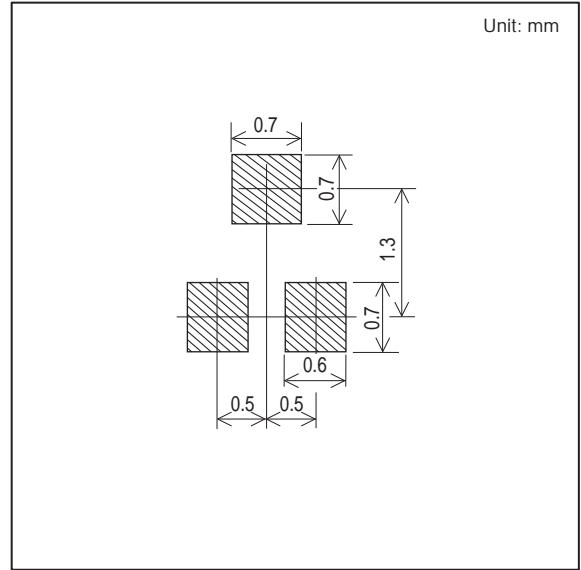
# 2SC5231A

## Outline Drawing

2SC5231A-8-TL-E, 2SC5231A-9-TL-E



## Land Pattern Example



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