Ordering number : ENA1077A

# 2SC5231A

## RF Transistor
## 10V, 70mA, fT=7GHz, NPN Single SMCP

ON Semiconductor®
http://onsemi.com

### Features

- Low-noise : NF=1.0dB typ (f=1GHz)
- High gain : $|S21e|^2$=12dB typ (f=1GHz)
- High cut-off frequency : $f_T$=7GHz typ
- Ultrasmall-sized package permitting applied sets to be made small and slim

### Specifications

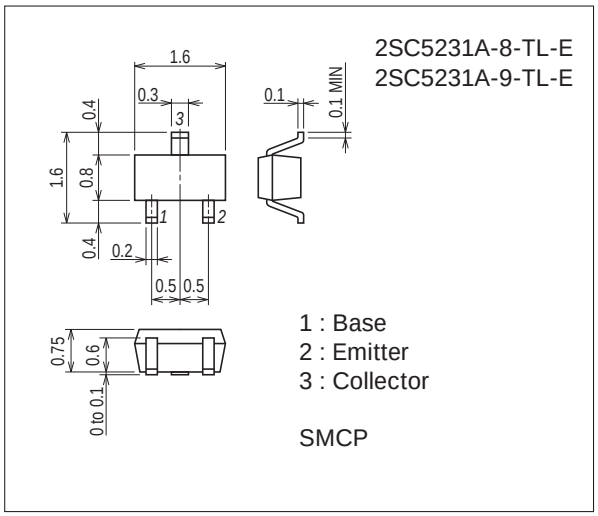
**Absolute Maximum Ratings** at Ta=25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Collector-to-Base Voltage | $V_{CBO}$ | | 20 | V |
| Collector-to-Emitter Voltage | $V_{CEO}$ | | 10 | V |
| Emitter-to-Base Voltage | $V_{EBO}$ | | 2 | V |
| Collector Current | $I_C$ | | 70 | mA |
| Collector Dissipation | $P_C$ | | 100 | mW |
| Junction Temperature | Tj | | 150 | °C |
| Storage Temperature | Tstg | | −55 to +150 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### Package Dimensions

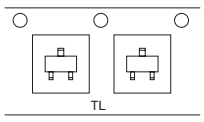
unit : mm (typ)
7027A-002



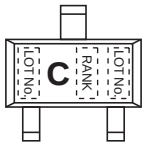

### Product & Package Information

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

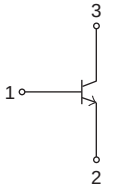
### Packing Type: TL




### Marking




### Electrical Connection



## Electrical Characteristics at Ta=25°C

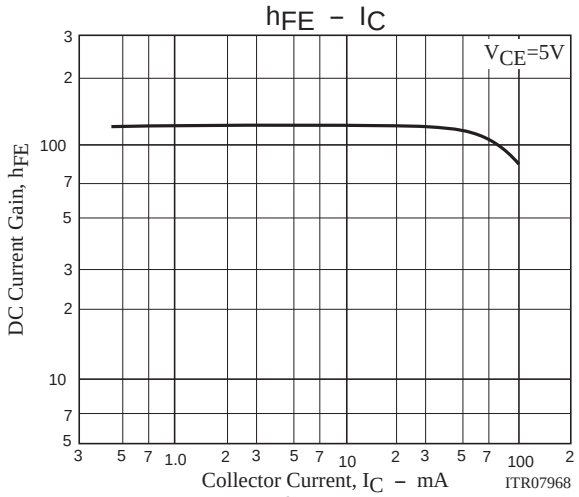
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$=10V, $I_E$=0A | | | 1.0 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$=1V, $I_C$=0A | | | 10 | μA |
| DC Current Gain | $h_{FE}$ | $V_{CE}$=5V, $I_C$=20mA | 60* | | 270* | |
| Gain-Bandwidth Product | $f_T$ | $V_{CE}$=5V, $I_C$=20mA | 5 | 7 | | GHz |
| Output Capacitance | Cob | $V_{CB}$=10V, f=1MHz | | 0.7 | 1.2 | pF |
| Reverse Transfer Capacitance | Cre | | | 0.45 | | pF |
| Forward Transfer Gain | $\|S21e\|^2$1 | $V_{CE}$=5V, $I_C$=20mA, f=1GHz | 9 | 12 | | dB |
| | $\|S21e\|^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 |

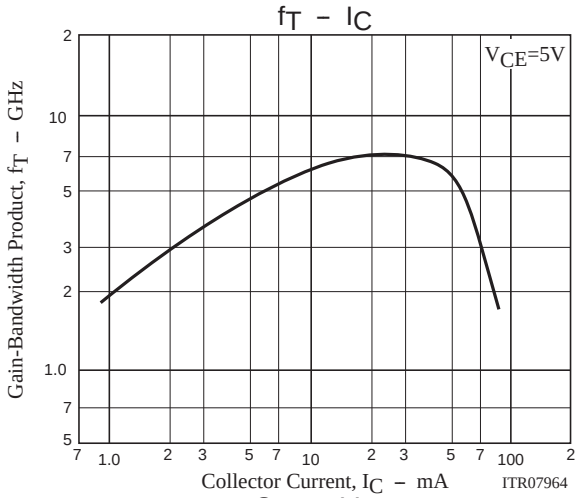
* : The 2SC5231A is classified by 20mA $h_{FE}$ as follows :

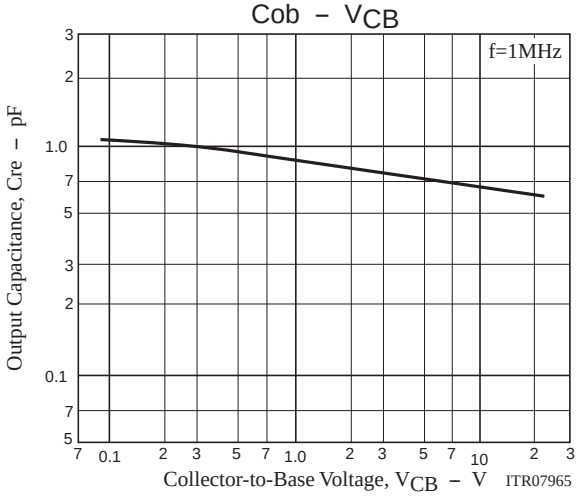
| Rank | 7 | 8 | 9 |
|---|---|---|---|
| $h_{FE}$ | 60 to 120 | 90 to 180 | 135 to 270 |

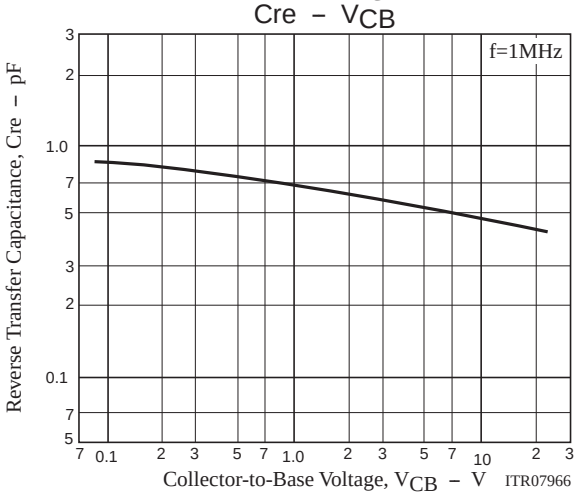
## Ordering Information

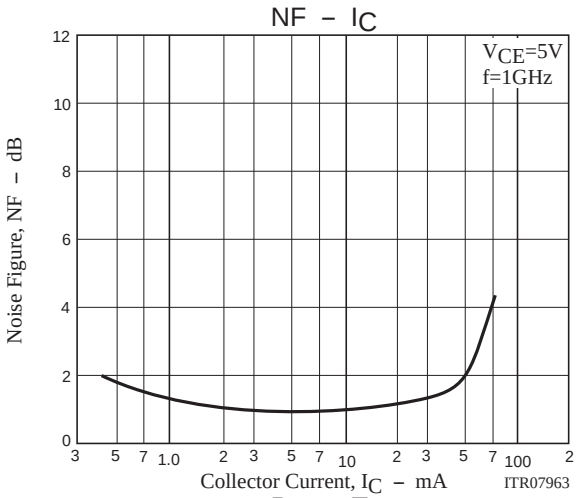
| Device | Package | Shipping | memo |
|---|---|---|---|
| 2SC5231A-8-TL-E | SMCP | 3,000pcs./reel | Pb Free |
| 2SC5231A-9-TL-E | SMCP | 3,000pcs./reel | |

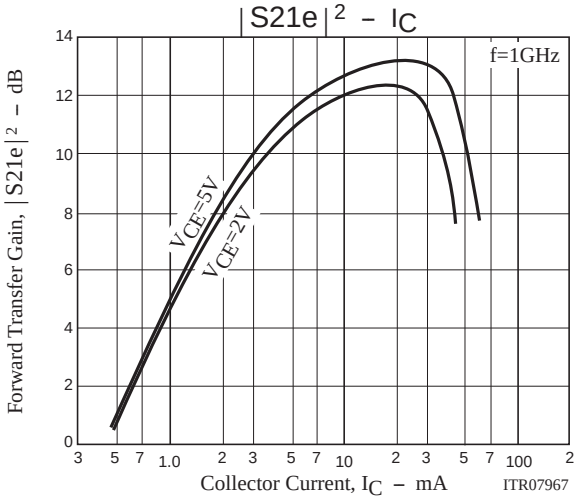


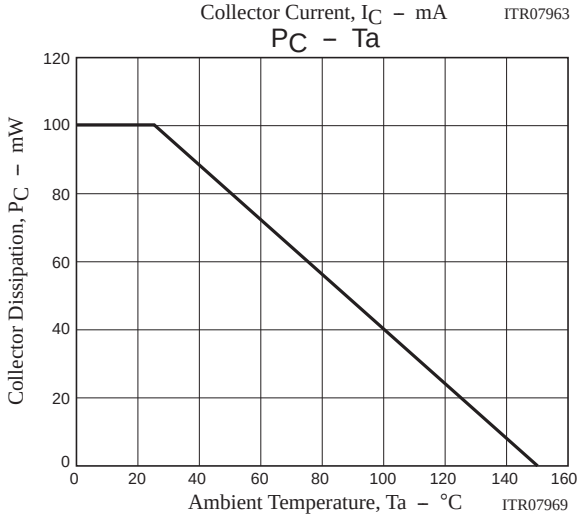



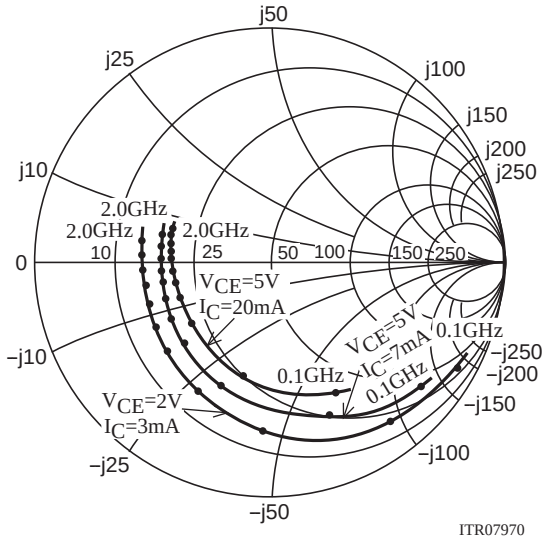




NF – IC
VCE=5V
f=1GHz
Noise Figure, NF – dB
Collector Current, IC – mA
ITR07963

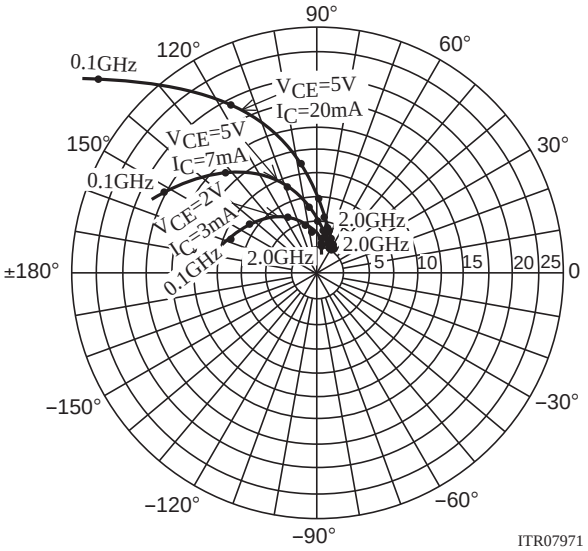

|S21e|2 – IC
f=1GHz
VCE=5V
VCE=2V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
ITR07967


PC – Ta
Collector Dissipation, PC – mW
Ambient Temperature, Ta – °C
ITR07969

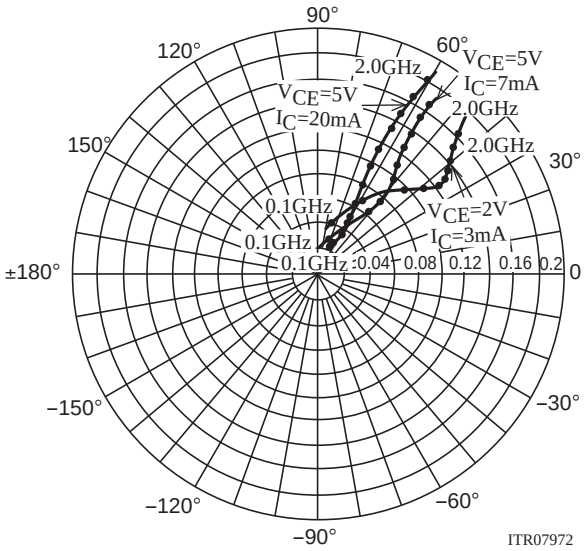
S11e
f=100MHz, f=200MHz to 2000MHz(200MHz Step)



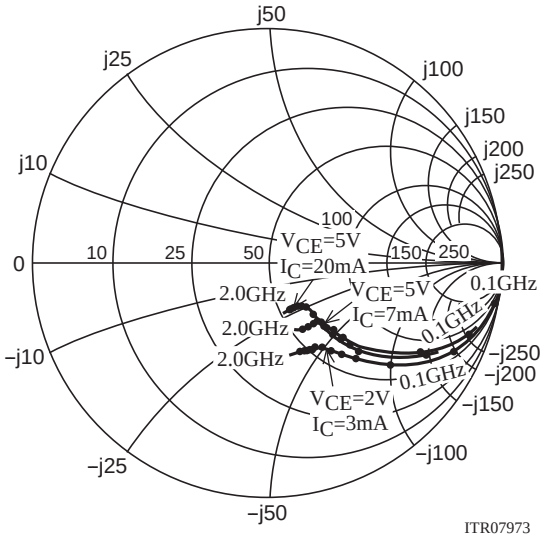

S21e
f=100MHz, f=200MHz to 2000MHz(200MHz Step)




S12e
f=100MHz, f=200MHz to 2000MHz(200MHz Step)




S22e
f=100MHz, f=200MHz to 2000MHz(200MHz Step)



**S Parameters (Common emitter)**

$V_{CE}$=5V, $I_C$=7mA, $Z_O$=50Ω

| Freq(MHz) | \|S11\| | ∠S11 | \|S21\| | ∠S21 | \|S12\| | ∠S12 | \|S22\| | ∠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, $Z_O$=50Ω

| Freq(MHz) | \|S11\| | ∠S11 | \|S21\| | ∠S21 | \|S12\| | ∠S12 | \|S22\| | ∠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, $Z_O$=50Ω

| Freq(MHz) | \|S11\| | ∠S11 | \|S21\| | ∠S21 | \|S12\| | ∠S12 | \|S22\| | ∠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 |

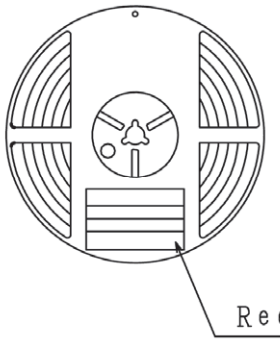
**Embossed Taping Specification**

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 |

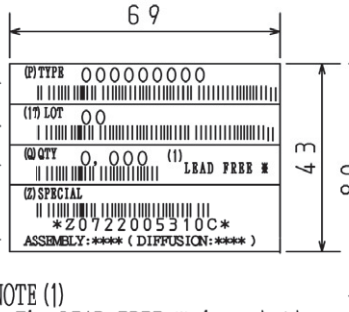
Packing method



Reel label

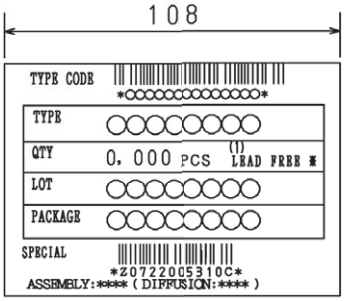
Reel label, Inner box label

(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.

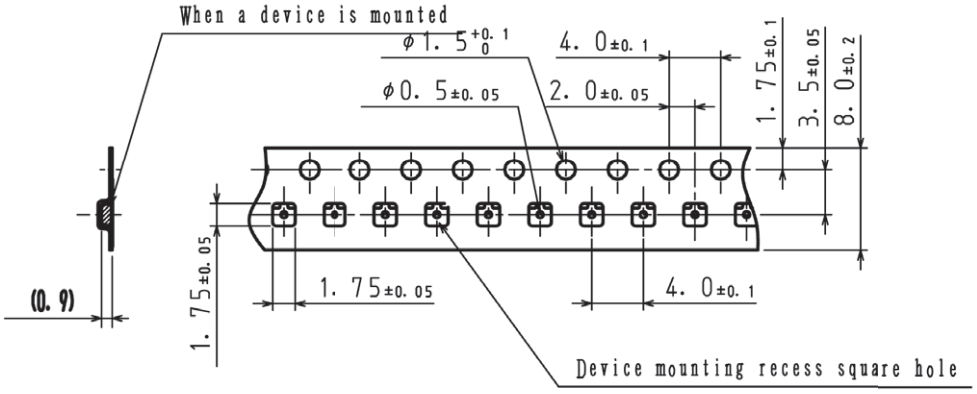



NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

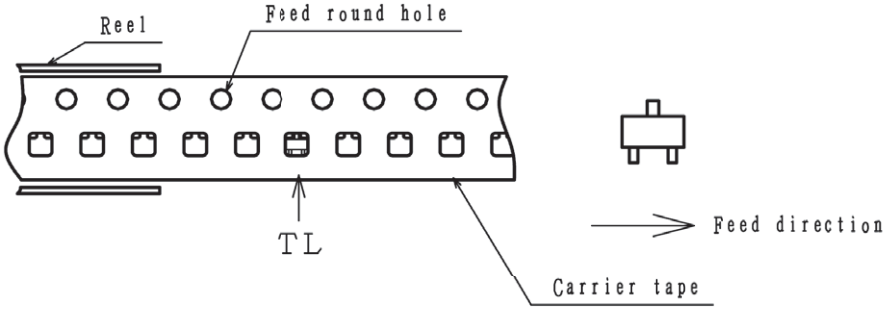
| Label | JEITA Phase |
|---|---|
| •••••••••• | JEITA Phase 3 |

## 2. Taping configuration

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



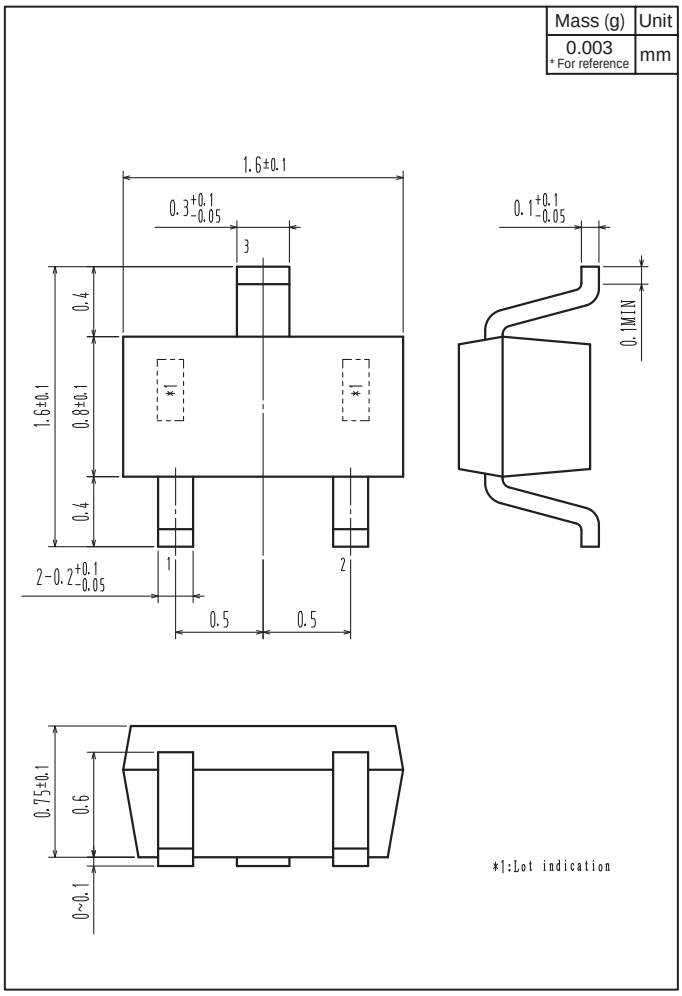

### 2-2. Device placement direction




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

## Outline Drawing

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




## Land Pattern Example