

Rail-to-Rail Input, Push-Pull Output Low power CMOS Comparators

FEATURES ($V^+ = 3V, V^- = 0V, T_a = 25^\circ C$)

- Rail-to-Rail Input
- Push Pull Output
- Supply Current 6 μA /ch typ.
- Propagation Delay 780ns typ.
- Operating Voltage 1.8 to 5.5V
- Input Offset Voltage 6mV max.
- Operating Temperature -40 to 125 $^\circ C$
- Integrated EMI filter
- Package

| | |
|----------|---------------------------------------|
| NJU77230 | SOT-23-5, SC88A |
| NJU77231 | SOT-23-5, SC88A, DFN6-G1(ESON6-G1) |
| NJU77232 | MSOP8(TVSP8)* |

*meet JEDEC MO-187-DA / thin type,
DFN8-U1(ESON8-U1)

GENERAL DESCRIPTION

The NJU77230/NJU77231/NJU77232 are Rail-to-Rail Input CMOS comparators featuring Low-power and Push-Pull output.

These comparators operate from 1.8V to 5.5V and low supply current of 6 μA /ch.typ. This feature is suitable for battery powered application.

The NJU77231/NJU77232 are available in small size Package, DFN6-G1(1616), DFN8-U1(2020), significantly reducing the required portable application's board area.

APPLICATION

- Portable and Battery-Powered Applications
- Alarm and Surveillance Circuits
- Industrial Instruments
- Sensor Applications

RELATED PRODUCTS

| Features | Single | Dual |
|--|----------------------|----------|
| Rail-to-Rail Input Open-Drain Output Low power CMOS Comparators | NJU77240 NJU77241 | NJU77242 |

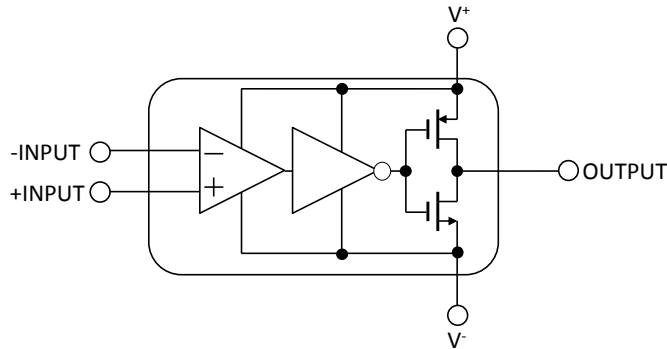
PIN CONFIGURATION

| Parts Number | NJU77230F | NJU77230F3 | NJU77231F | NJU77231F3 |
|-----------------|-----------|------------|-----------|------------|
| Package Outline | SOT-23-5 | SC-88A | SOT-23-5 | SC-88A |
| Pin Function | | | | |

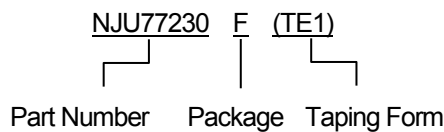
| Parts Number | NJU77231KG1 | NJU77232RB1 | NJU77232KU1 |
|-----------------|----------------------|--------------|-----------------------|
| Package Outline | DFN6-G1(ESON6-G1)(*) | MSOP8(TVSP8) | DFN8-U1(ESON8-U1) (*) |
| Pin Function | | | |

(*)Connect to exposed pad to V^-

■BLOCK DIAGRAM



■PRODUCT NAME INFORMATION



■ORDERING INFORMATION

| PART NUMBER | PACKAGE OUTLINE | RoHS | HALOGEN-FREE | TERMINAL FINISH | MARKING | WEIGHT (mg) | MOQ (pcs) |
|-------------|-----------------|------|--------------|-----------------|---------|-------------|-----------|
| NJU77230F | SOT-23-5 | yes | yes | Sn2Bi | 1H | 15 | 3,000 |
| NJU77230F3 | SC-88A | yes | yes | Sn2Bi | F1 | 7.5 | 3,000 |
| NJU77231F | SOT-23-5 | yes | yes | Sn2Bi | 1J | 15 | 3,000 |
| NJU77231F3 | SC-88A | yes | yes | Sn2Bi | F2 | 7.5 | 3,000 |
| NJU77231KG1 | DFN6-G1 | yes | yes | Sn2Bi | 77231 | 3.5 | 3,000 |
| NJU77232RB1 | MSOP8(TVSP8) | yes | yes | Sn2Bi | 77232 | 18 | 2,000 |
| NJU77232KU1 | DFN8-U1 | yes | yes | Sn2Bi | 77232 | 5.3 | 3,000 |

■ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|--|-------------|----------------------------|------------------|
| Supply Voltage | $V^+ - V^-$ | 7 | V |
| Input Voltage ^(1,2) | V_{IN} | $V^- - 0.3$ to $V^+ + 0.3$ | V |
| Input Current ⁽²⁾ | I_{IN} | 10 | mA |
| Differential Input Voltage ⁽³⁾ | V_{ID} | ± 7 | V |
| Output Terminal Input Voltage ⁽¹⁾ | V_o | $V^- - 0.3$ to $V^+ + 0.3$ | V |
| Power Dissipation($T_a=25^\circ\text{C}$) | P_D | (2-layer / 4-layer) | mW |
| SOT-23-5 ⁽⁴⁾ | | 480 / 650 | |
| SC-88A ⁽⁴⁾ | | 360 / 490 | |
| DFN6-G1 ⁽⁵⁾ | | 330 / 1200 | |
| MSOP8(TVSP8) ⁽⁴⁾ | | 510 / 680 | |
| DFN8-U1 ⁽⁵⁾ | 450 / 1200 | | |
| Junction Temperature | T_{jmax} | +150 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | - 55 to +150 | $^\circ\text{C}$ |

(1) Voltage values are limited at 7V.

(2) Input voltages outside the supply voltage will be clamped by ESD protection diodes. If the input voltage exceeds the supply voltage, the input current must be limited 10mA or less by using a restriction resistance.

(3) Differential voltage is the voltage difference between +INPUT and - INPUT.

For supply voltage less than +7V, the absolute maximum rating is equal to the supply voltage.

(4) Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JDEC standard, 2Layers FR4)

Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JDEC standard, 4Layers FR4), internal Cu area: 74.2 x 74.2mm

(5) Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 2Layers FR-4, with Exposed Pad)

Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4, with Exposed Pad)

*For 4Layers: Applying 99.5×99.5mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5

■ THERMAL CHARACTERISTICS

| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---------------|---------------------|----------------------|
| Junction-to-ambient thermal resistance | θ_{ja} | (2-layer / 4-layer) | $^{\circ}\text{C/W}$ |
| SOT-23-5 ⁽⁶⁾ | | 259 / 193 | |
| SC-88A ⁽⁶⁾ | | 352 / 256 | |
| DFN6-G1 ⁽⁷⁾ | | 381 / 106 | |
| MSOP8(TVSP8) ⁽⁶⁾ | | 244 / 185 | |
| DFN8-U1 ⁽⁷⁾ | 278 / 107 | | |
| Junction-to-Top of package characterization parameter | ψ_{jt} | (2-layer/ 4-layer) | $^{\circ}\text{C/W}$ |
| SOT-23-5 ⁽⁶⁾ | | 67 / 58 | |
| SC-88A ⁽⁶⁾ | | 91 / 73 | |
| DFN6-G1 ⁽⁷⁾ | | 64 / 26 | |
| MSOP8(TVSP8) ⁽⁶⁾ | | 51 / 45 | |
| DFN8-U1 ⁽⁷⁾ | 42 / 25 | | |

(6) Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JDEC standard, 2Layers FR4)

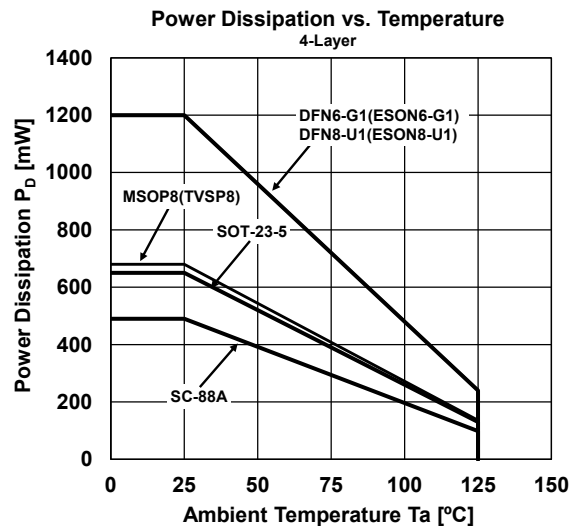
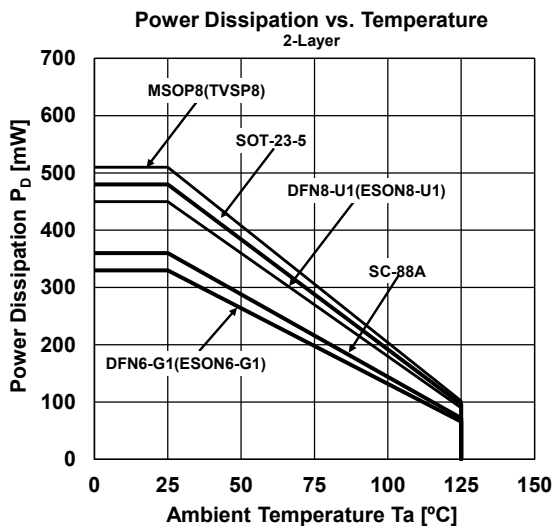
Mounted on glass epoxy board. (76.2×114.3×1.6mm:based on EIA/JDEC standard, 4Layers FR4), internal Cu area: 74.2 x 74.2mm

(7) Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 2Layers FR-4, with Exposed Pad)

Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4, with Exposed Pad)

*For 4Layers: Applying 99.5×99.5mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|-------------------------------|-------------|-------------------------|--------------------|
| Supply Voltage | | | |
| Single Supply | $V^+ - V^-$ | +1.8 to +5.5 | V |
| Dual Supply | V^+ / V^- | ± 0.9 to ± 2.75 | |
| Operating Ambient Temperature | T_{opr} | - 40 to +125 | $^{\circ}\text{C}$ |

■ ELECTRICAL CHARACTERISTICS

● DC CHARACTERISTICS

(Unless otherwise specified, $V^+=3V$, $V^-=0V$, $R_L=OPEN$, $T_a=25^\circ C$)

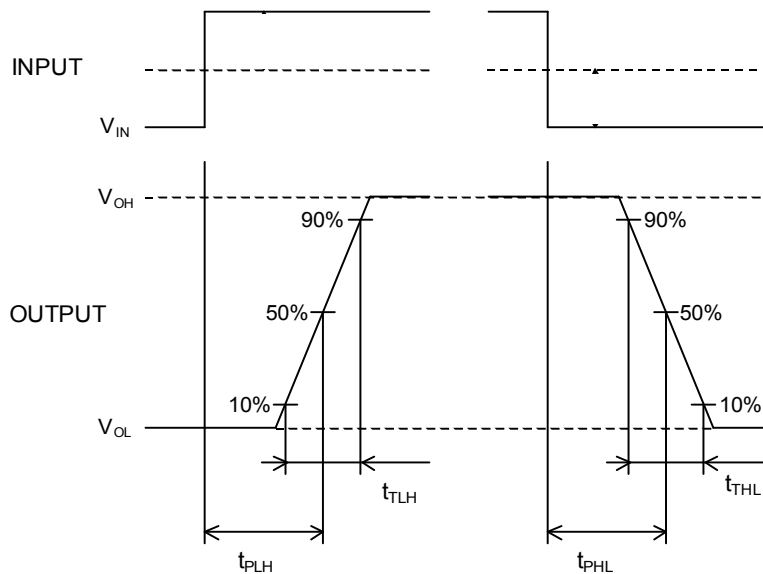
| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------------------|--------------|---------------------------------------|------|------|------|---------|
| Supply Current (per comparator) | I_{SUPPLY} | $V_{ID}=100mV, V_{com}=0V$ | — | 6 | 10 | μA |
| | | $V_{ID}=100mV, V_{com}=3V$ | — | 9 | 14 | μA |
| Input Offset Voltage | V_{IO} | $V_{COM}=0V$ | — | 1 | 6 | mV |
| | | $V_{COM}=3V$ | — | 1 | 7 | mV |
| Input Offset Current | I_{IO} | | — | 1 | — | μA |
| Input Bias Current | I_B | | — | 1 | — | μA |
| Common Mode Input Voltage Range | V_{ICM} | $CMR \geq 50dB$ | 0 | — | 3 | V |
| Open-Loop Voltage Gain | A_v | $R_L=5.1k\Omega$ | — | 100 | — | dB |
| Common Mode Rejection Ratio | CMR | $V_{ICM}=0$ to $3V$ | 50 | 70 | — | dB |
| Supply Voltage Rejection Ratio | SVR | $V_{COM}=0V$, $V^+=1.8$ to $5.5V$ | 65 | 85 | — | dB |
| High-level Output Voltage | V_{OH} | $I_{SOURCE}=3mA$ | 2.7 | 2.8 | — | V |
| Low-level Output Voltage | V_{OL} | $I_{SINK}=3mA$ | — | 0.2 | 0.3 | V |

● SWITCHING CHARACTERISTICS

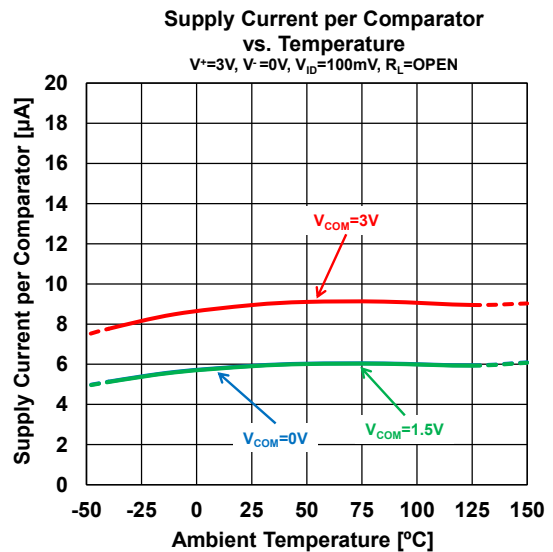
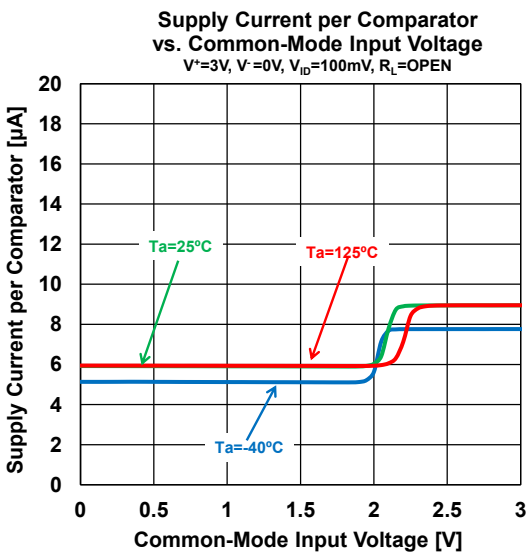
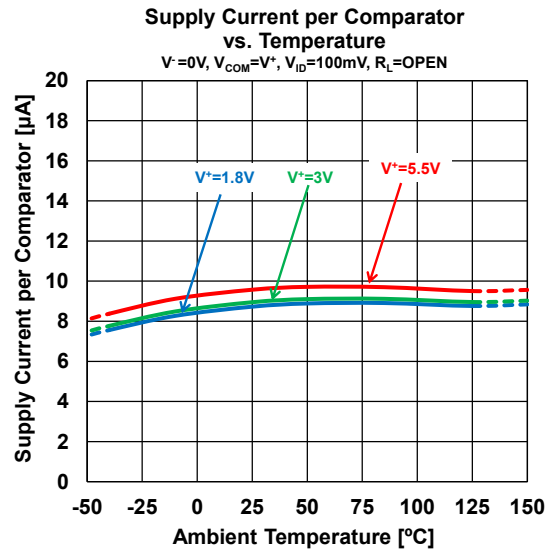
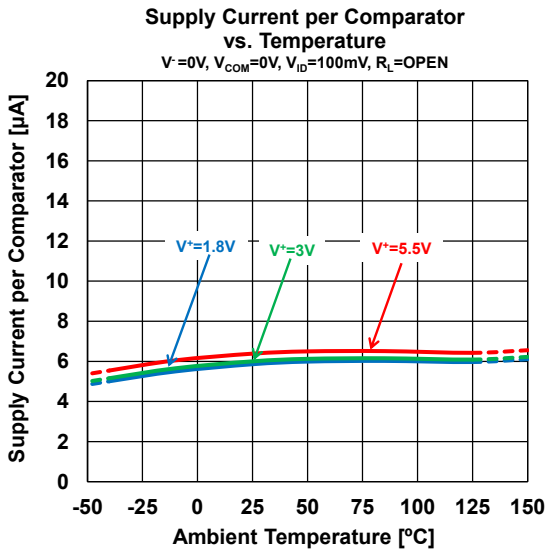
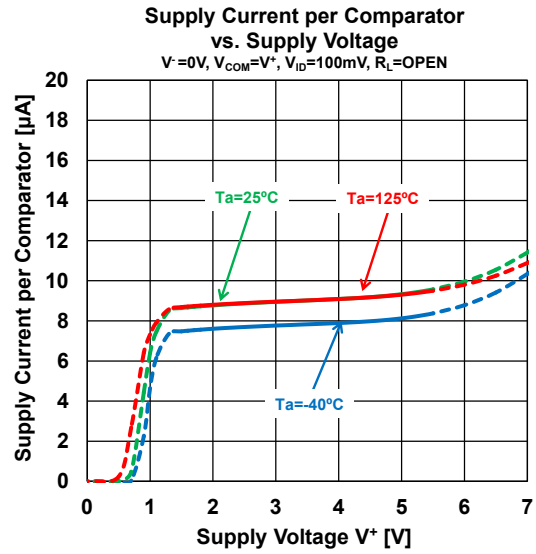
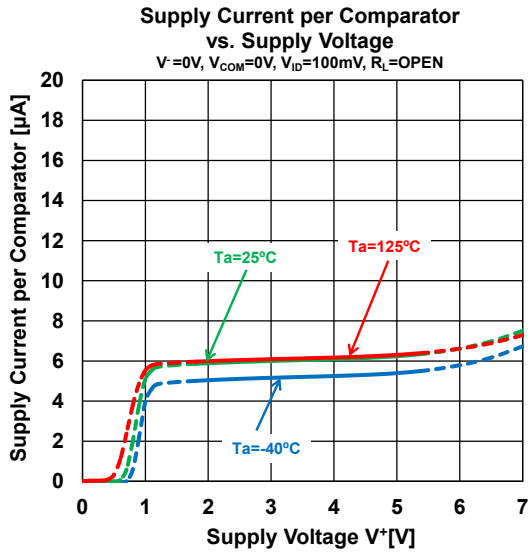
(Unless otherwise specified, $V^+=+3V$, $V^-=0V$, $T_a=25^\circ C$, $C_L=15pF$, $R_L=5.1k\Omega$)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-------------------------------|-----------|--------------------|------|------|------|------|
| Propagation Delay Low to High | t_{PLH} | Overdrive= $100mV$ | — | 780 | — | ns |
| Propagation Delay High to Low | t_{PHL} | Overdrive= $100mV$ | — | 480 | — | ns |
| Output Signal Rising Time | t_{TLH} | Overdrive= $100mV$ | — | 20 | — | ns |
| Output Signal Falling Time | t_{THL} | Overdrive= $100mV$ | — | 11 | — | ns |

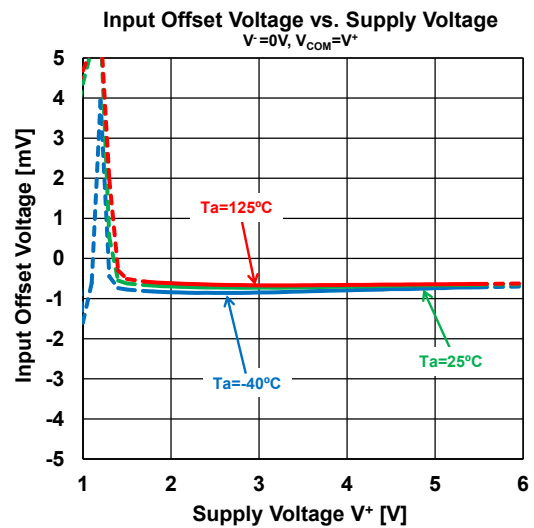
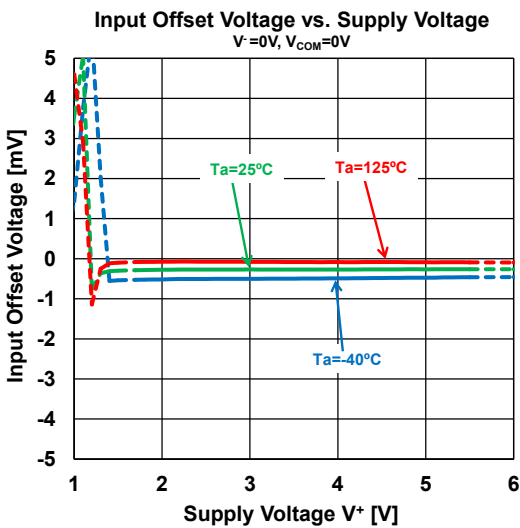
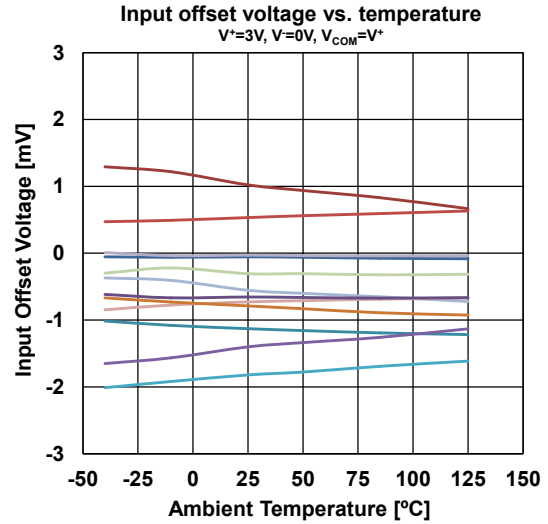
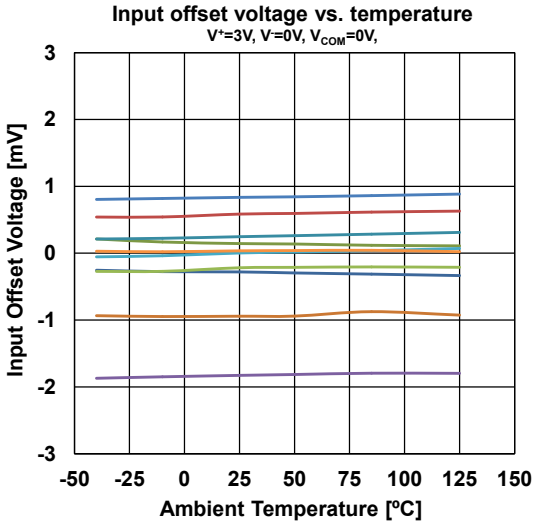
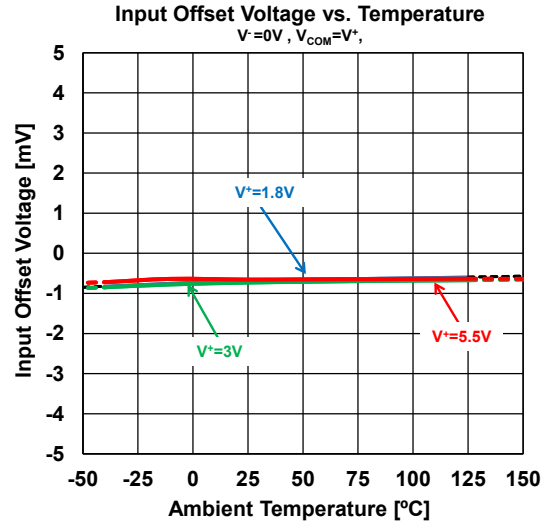
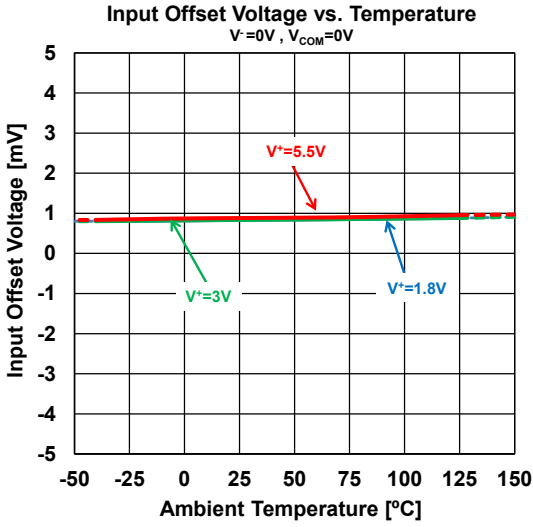
■ TIMING WAVEFORM



■ TYPICAL CHARACTERISTICS

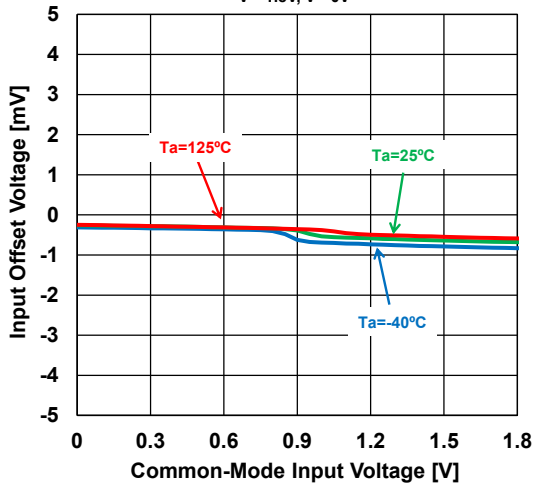


■ TYPICAL CHARACTERISTICS

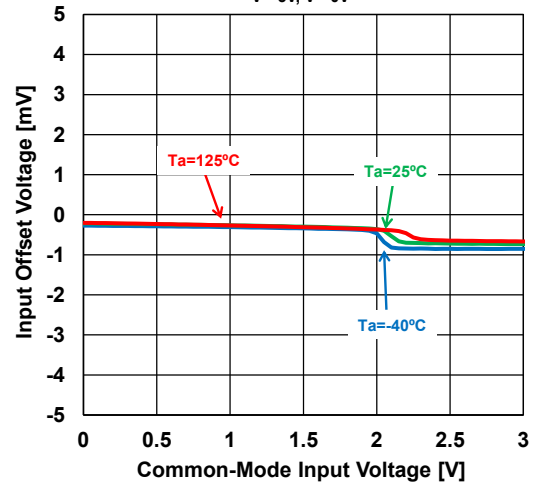


■ TYPICAL CHARACTERISTICS

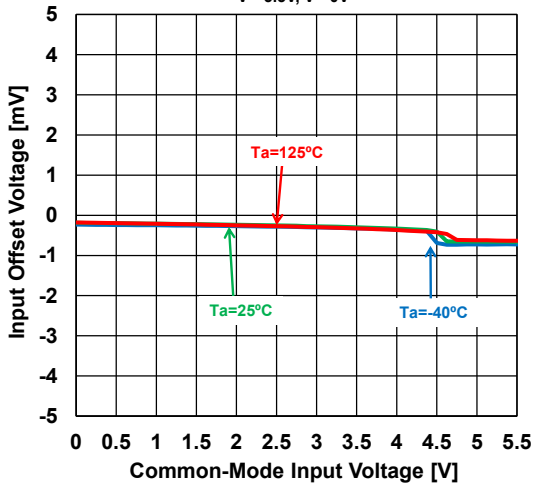
Input Offset Voltage
vs. Common-Mode Input Voltage
 $V^+=1.8V, V^-=0V$



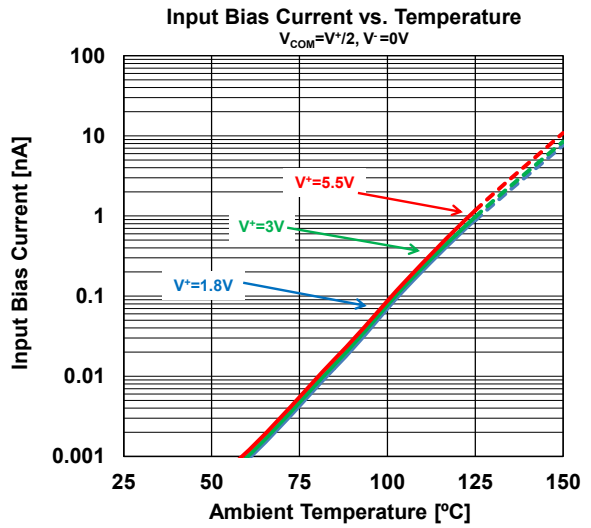
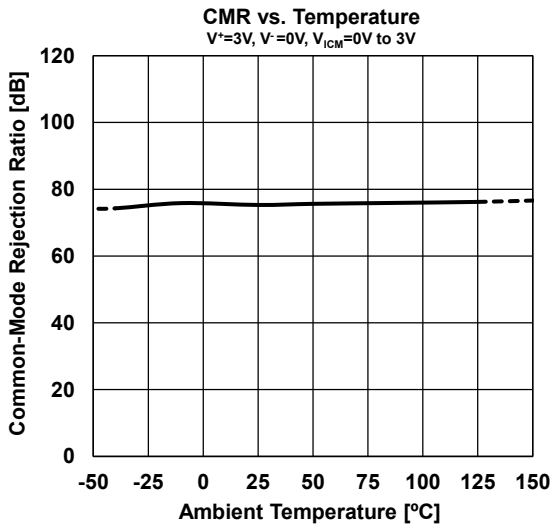
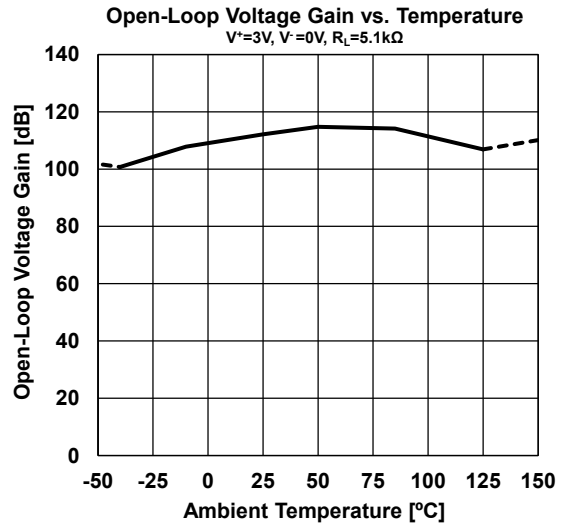
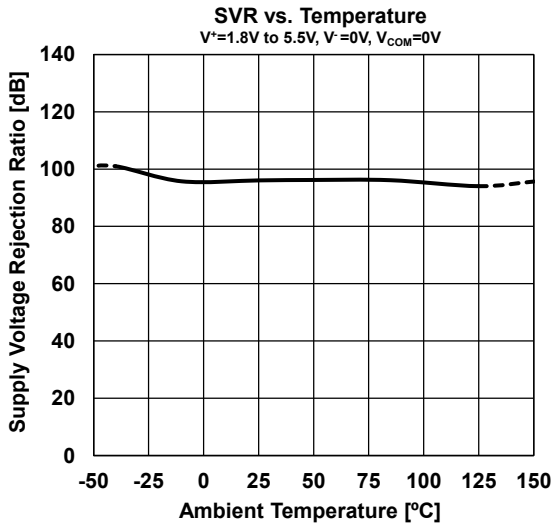
Input Offset Voltage
vs. Common-Mode Input Voltage
 $V^+=3V, V^-=0V$



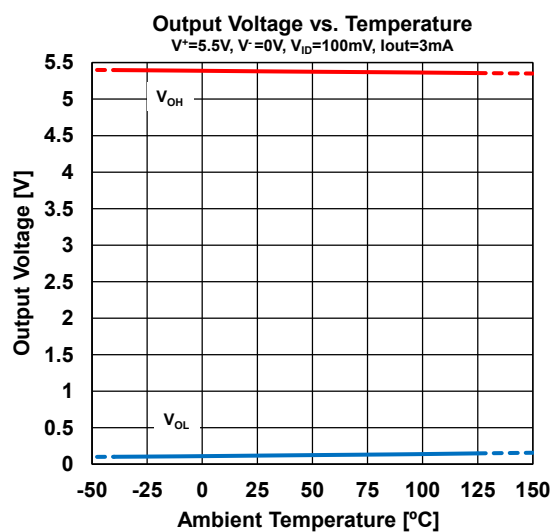
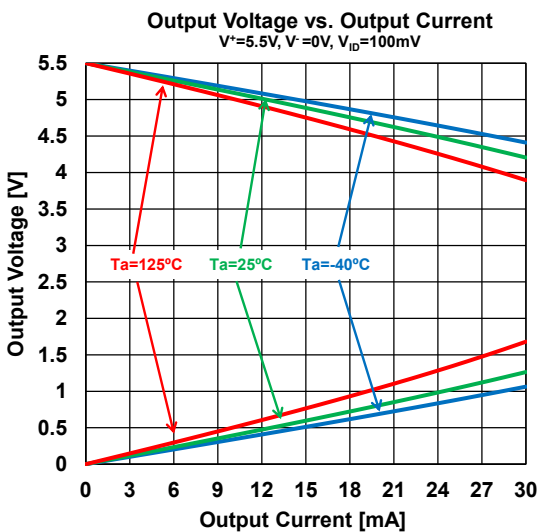
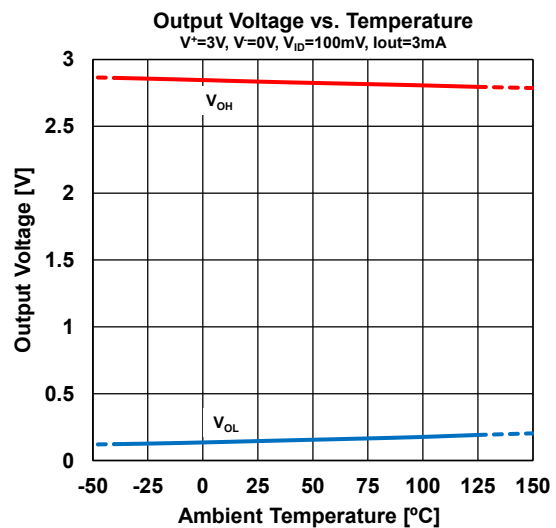
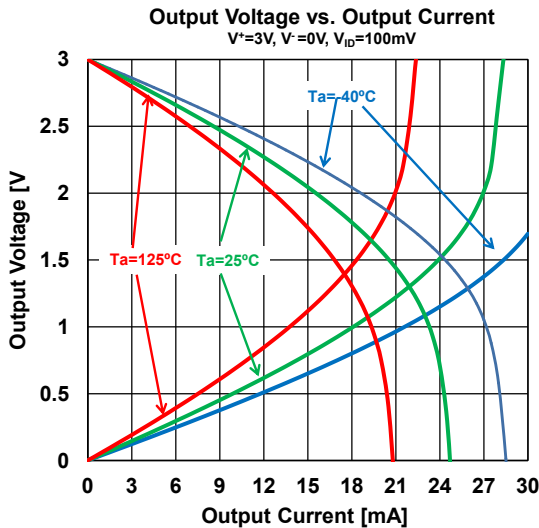
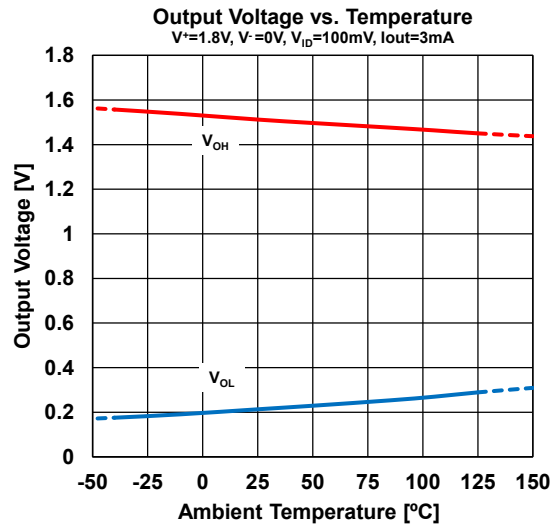
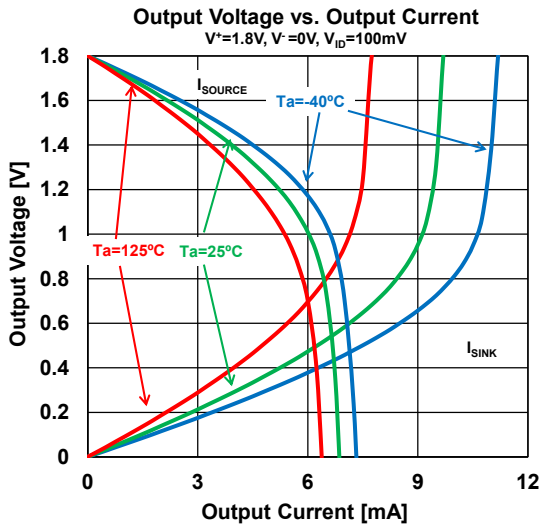
Input Offset Voltage
vs. Common-Mode Input Voltage
 $V^+=5.5V, V^-=0V$



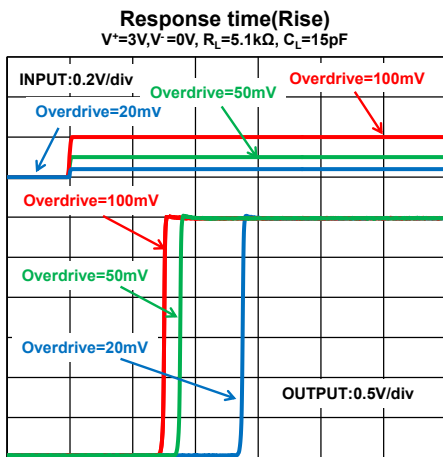
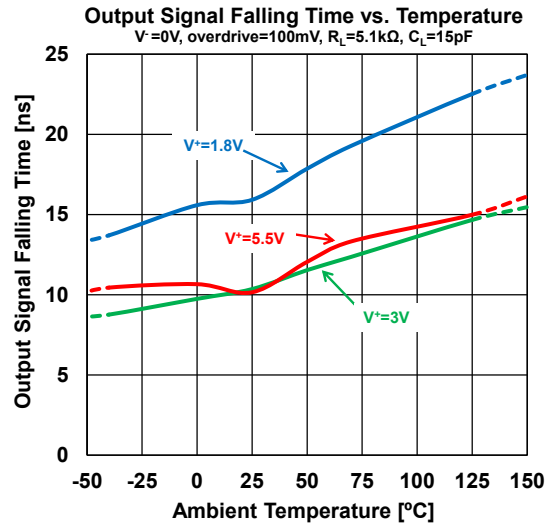
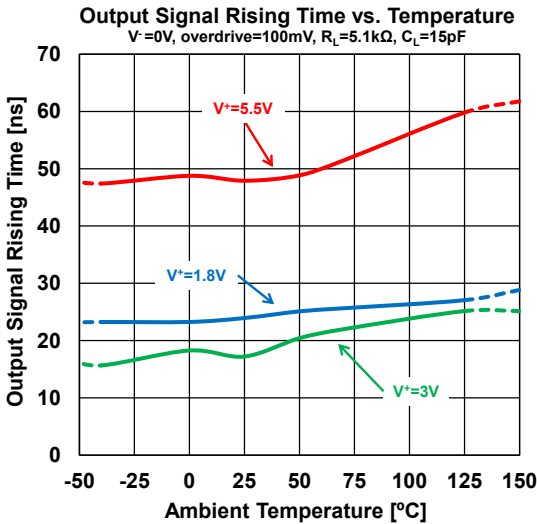
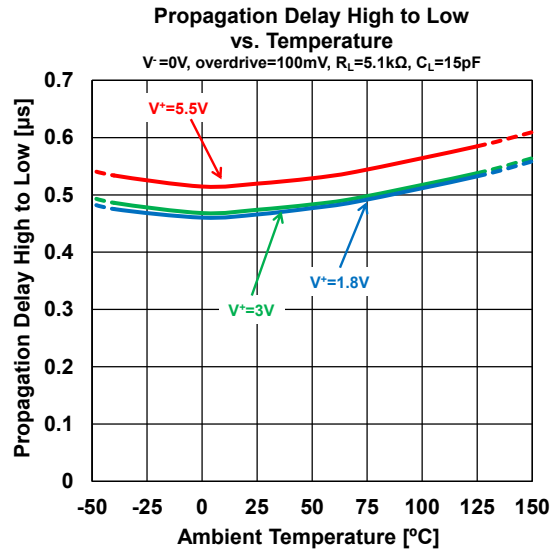
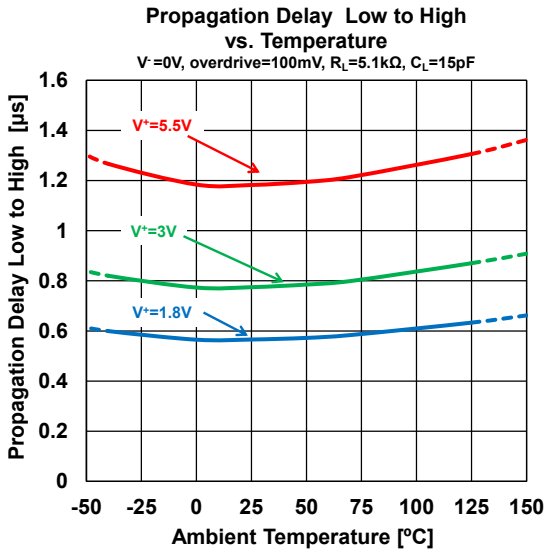
■ TYPICAL CHARACTERISTICS



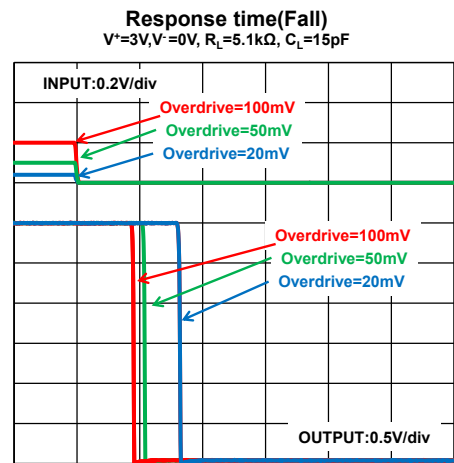
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



500ns/div

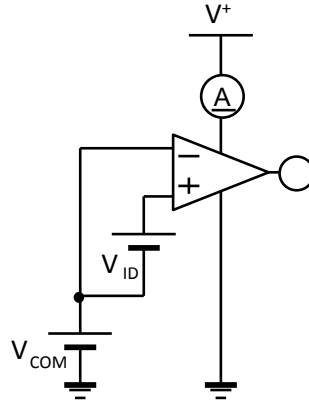


500ns/div

■ TYPICAL TEST CIRCUIT

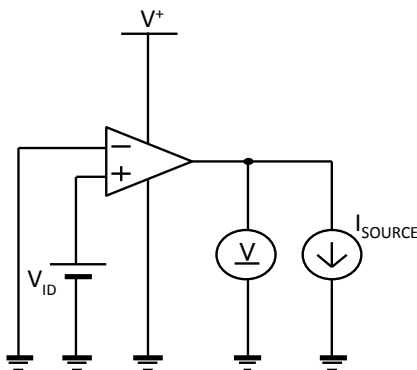
● Supply Current (I_{SUPPLY})

- $V^+ = 3V, V^- = 0V, V_{COM} = 0V, V_{ID} = 100mV$
- $V^+ = 3V, V^- = 0V, V_{COM} = 3V, V_{ID} = 100mV$



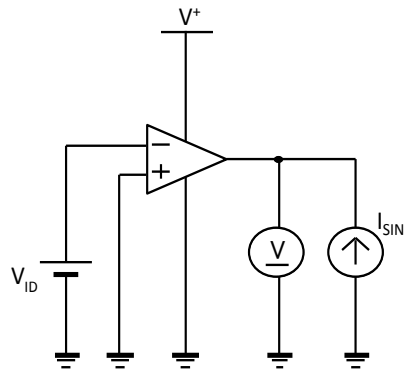
● High-level Output Voltage (V_{OH})

- $V^+ = 3V, V^- = 0V, I_{SOURCE} = 3mA, V_{ID} = 100mV$



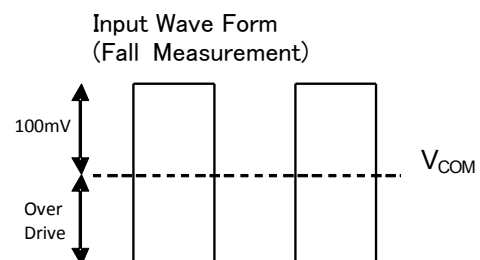
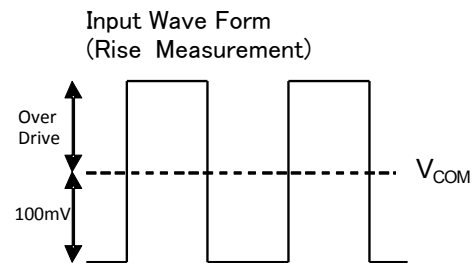
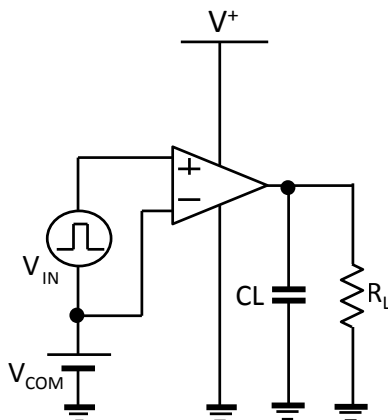
● Low-level Output Voltage (V_{OL})

- $V^+ = 3V, V^- = 0V, I_{SINK} = 3mA, V_{ID} = 100mV$



● Propagation Delay (t_{PLH}, t_{PHL}), Output Signal Rising Time (t_{RLH}), Output Signal Falling Time (t_{RTL})

- $V^+ = 3V, V^- = 0V, V_{COM} = 0V, R_L = 5.1k\Omega, C_L = 15pF, \text{Over drive} = 100mV$



APPLICATION NOTE

Input Voltage Exceeding the Supply Voltage

Inputs of the NJU77230/ NJU77231/ NJU77232 are protected by ESD diodes (shown in Figure1) that will conduct if the input voltages exceed the power supplies by more than approximately 300mV. Momentary voltages greater than 300mV beyond the power supply, inputs can be tolerated if the current is limited to 10mA. Figure2 is easily accomplished with an input resistor. If the input voltage exceeds the supply voltage, the input current must be limited 10mA or less by using a restriction resistance (R_{LIMIT}) as shown in figure2.

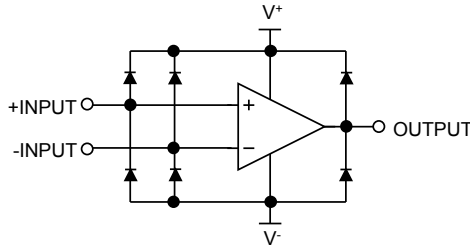


Figure1. Simplified Schematic

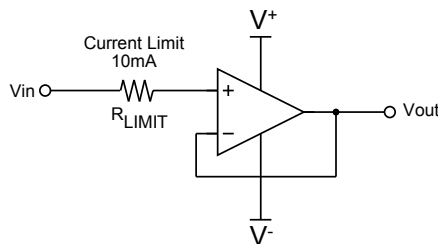


Figure2. Input Current Protection for Voltages exceeding the Supply Voltage.

Bypass Capacitor

It is advised to add a bypass capacitor between the supply voltage and ground as close as possible to device.

• EMIRR(EMI Rejection Ratio) Definition

EMIRR is a parameter indicating the EMI robustness of an OP-Amp. The definition of EMIRR is given by the following formula (1). We can grasp the tolerance of the RF signal by measuring an RF signal and offset voltage shift quantity.

$$EMIRR = 20 \cdot \log \left(\frac{V_{RF_PEAK}}{|\Delta V_{IO}|} \right) \quad \dots(1)$$

V_{RF_PEAK} : RF Signal Amplitude [V_P]

ΔV_{IO} : Input offset voltage shift quantity [V]

Offset voltage shift is small so that a value of EMIRR is big. And it understands that the tolerance for the RF signal is high. In addition, about the input offset voltage shift with the RF signal, there is the thinking that influence applied to the input terminal is dominant. Therefore, generally the EMIRR becomes value that applied an RF signal to +INPUT terminal.

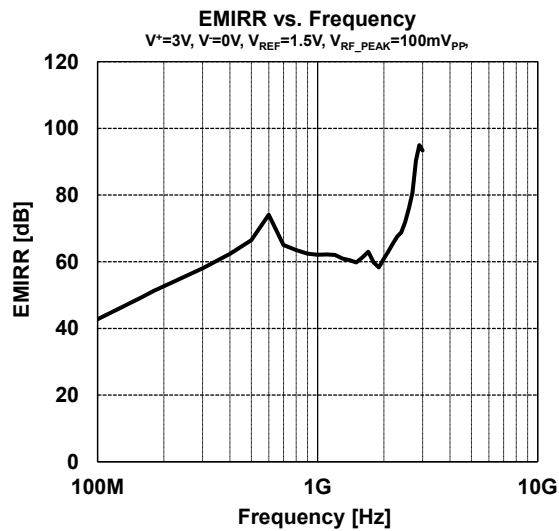
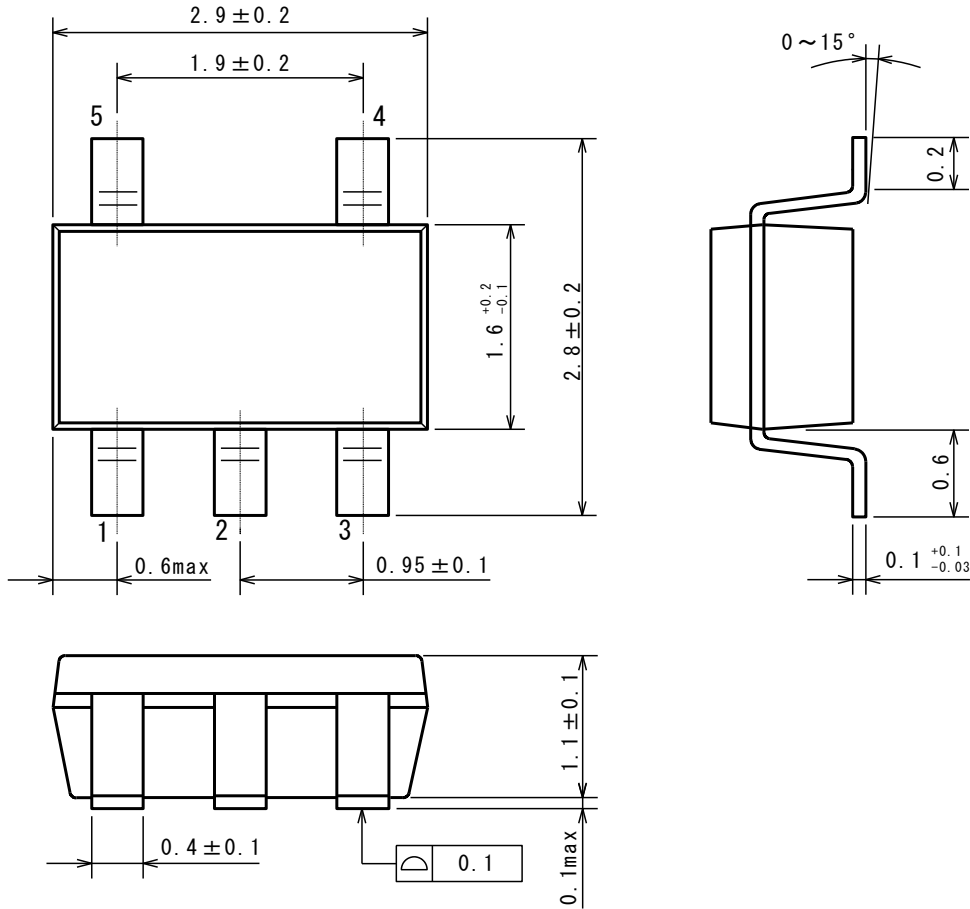


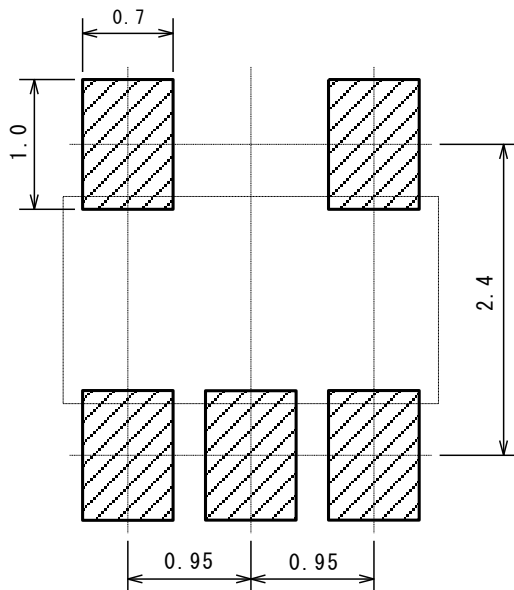
Figure3. EMIRR vs. Frequency

*For details, refer to " Application Note for EMI Immunity" in our HP: <http://www.njr.com/>

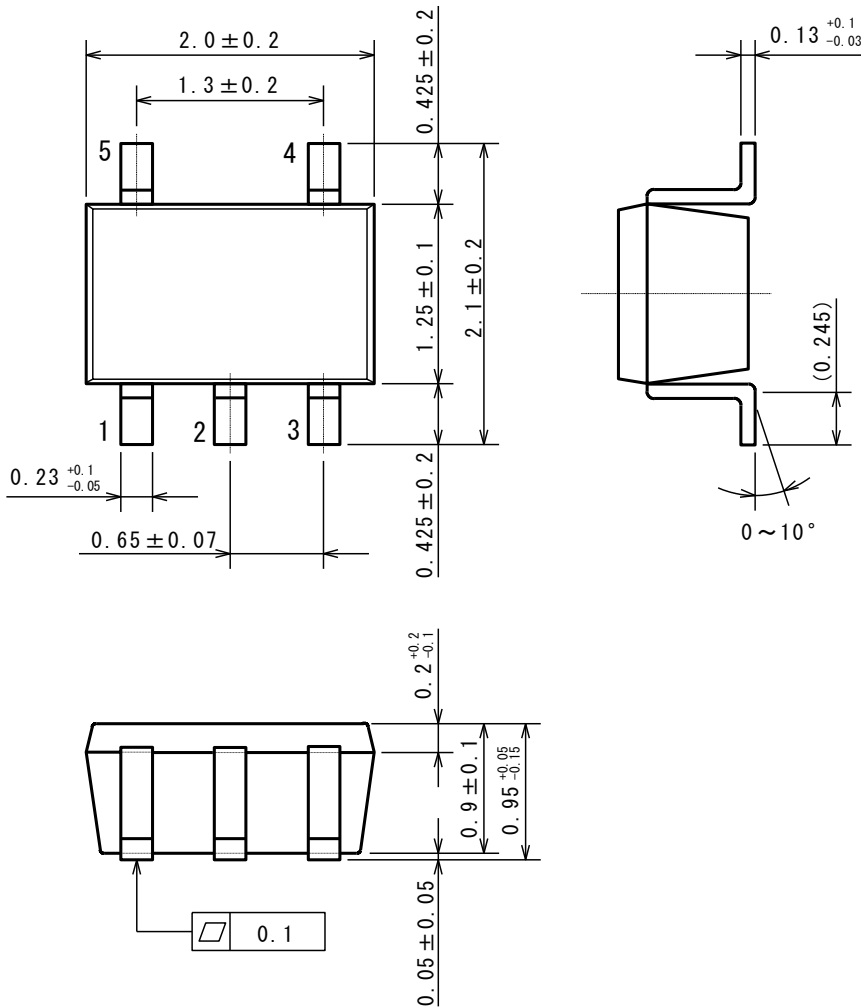
PACKAGE DIMENSIONS



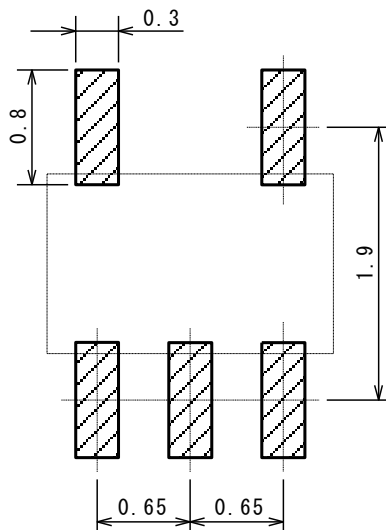
EXAMPLE OF SOLDER PADS DIMENSIONS



PACKAGE DIMENSIONS

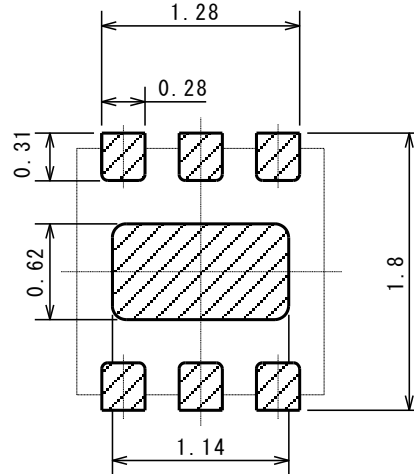
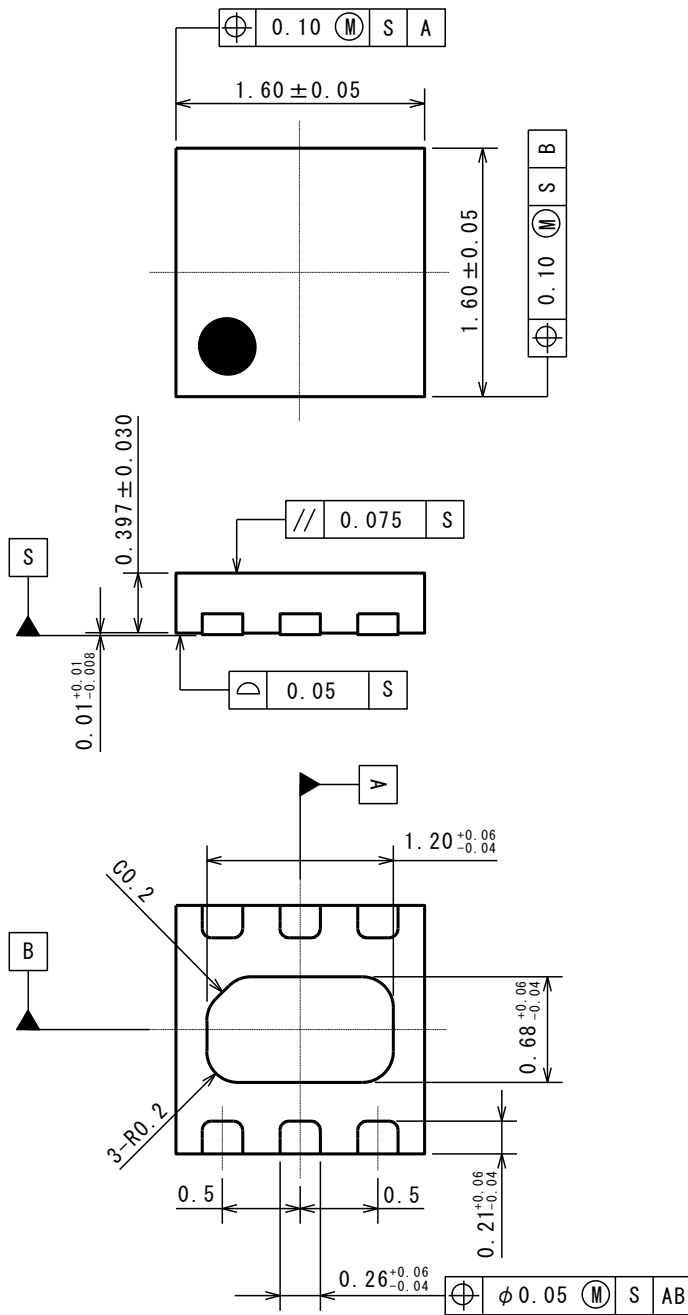


EXAMPLE OF SOLDER PADS DIMENSIONS

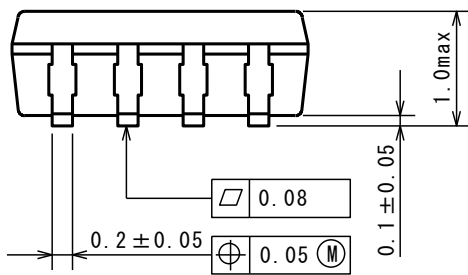
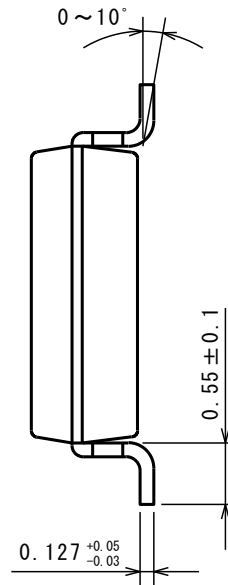
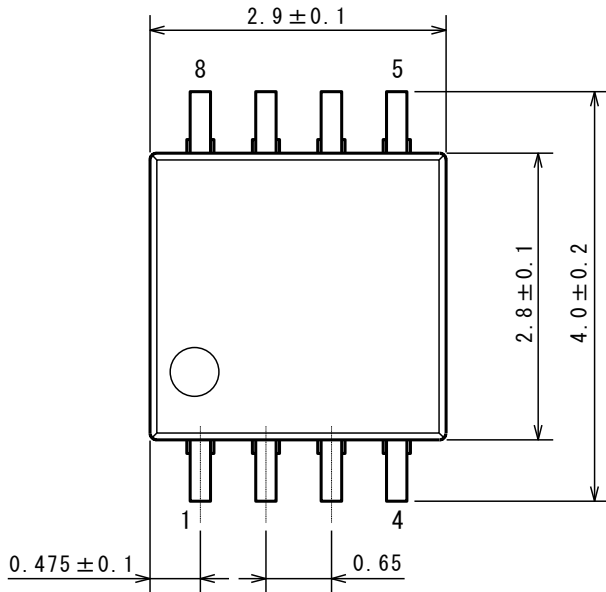


PACKAGE DIMENSIONS

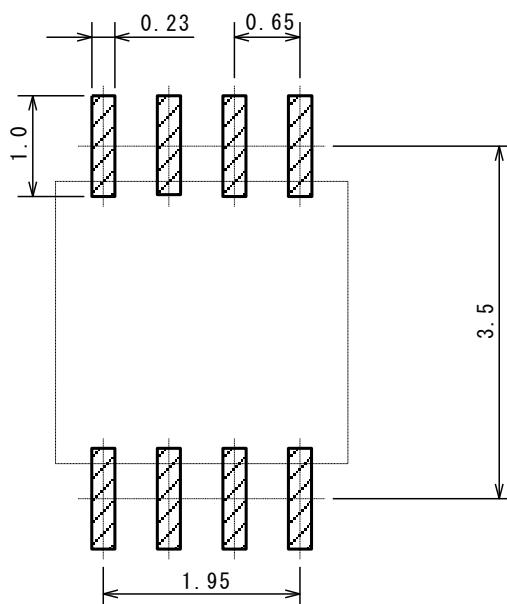
EXAMPLE OF SOLDER PADS DIMENSIONS



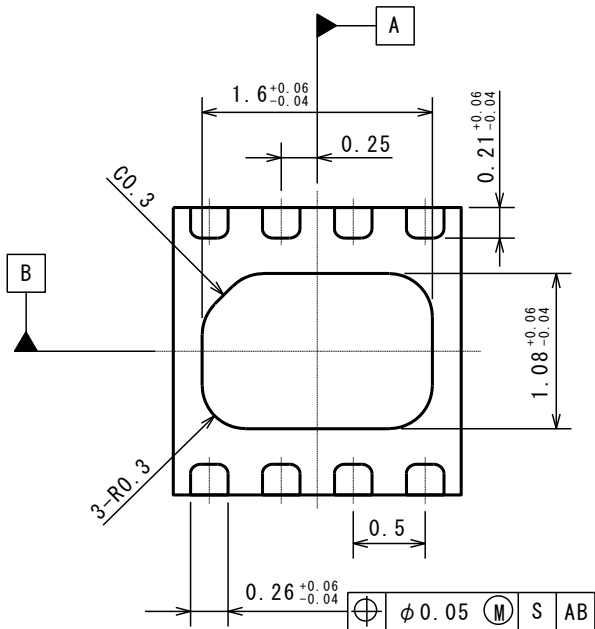
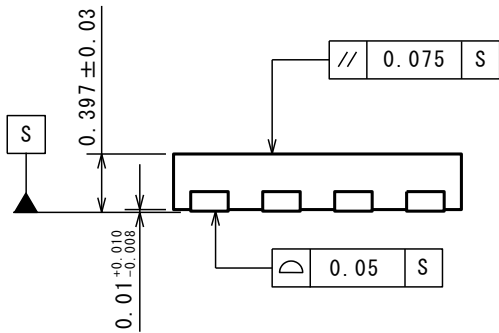
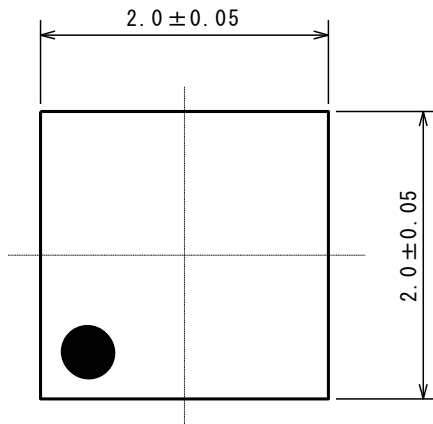
PACKAGE DIMENSIONS



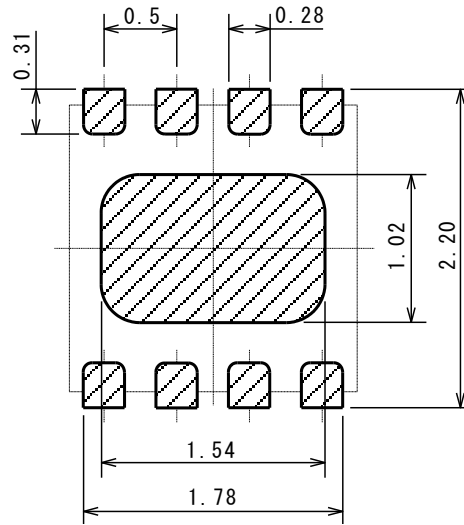
EXAMPLE OF SOLDER PADS DIMENSIONS



PACKAGE DIMENSIONS

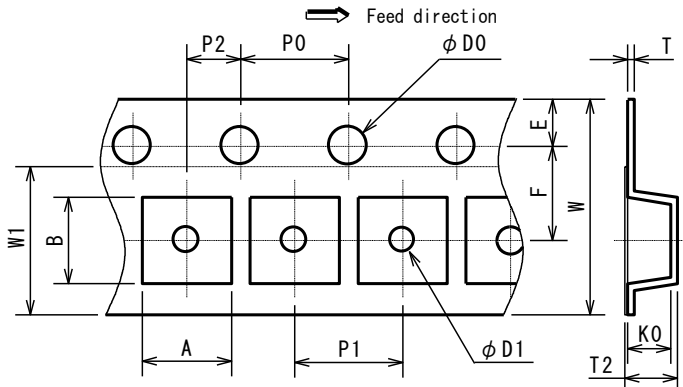


EXAMPLE OF SOLDER PADS DIMENSIONS



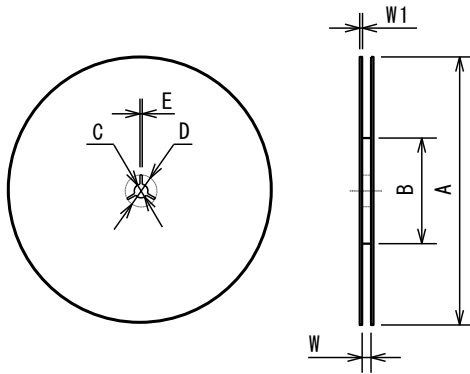
PACKING SPEC

TAPING DIMENSIONS



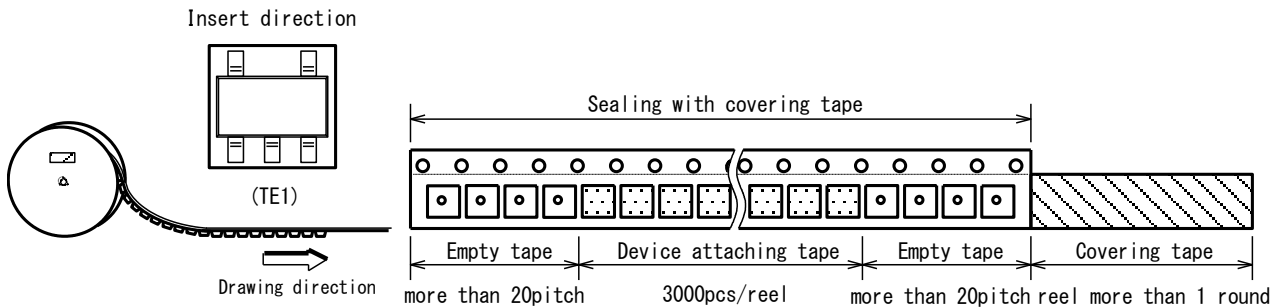
| SYMBOL | DIMENSION | REMARKS |
|--------|-----------|------------------|
| A | 3.3±0.1 | BOTTOM DIMENSION |
| B | 3.2±0.1 | BOTTOM DIMENSION |
| D0 | 1.55 | |
| D1 | 1.05 | |
| E | 1.75±0.1 | |
| F | 3.5±0.05 | |
| P0 | 4.0±0.1 | |
| P1 | 4.0±0.1 | |
| P2 | 2.0±0.05 | |
| T | 0.25±0.05 | |
| T2 | 1.82 | |
| K0 | 1.5±0.1 | |
| W | 8.0±0.3 | |
| W1 | 5.5 | THICKNESS 0.1MAX |

REEL DIMENSIONS

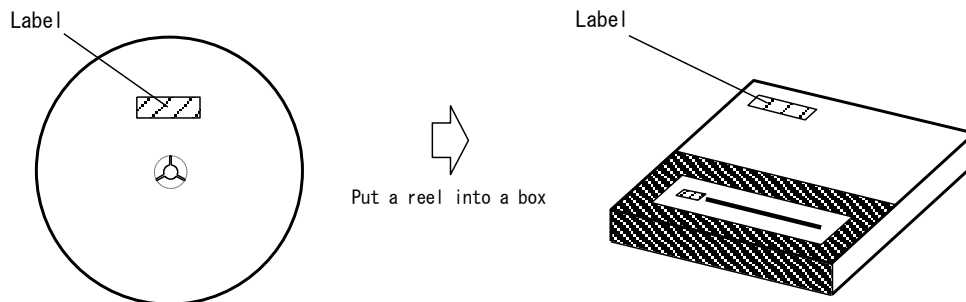


| SYMBOL | DIMENSION |
|--------|-----------|
| A | φ 180±1 |
| B | φ 60±1 |
| C | φ 13±0.2 |
| D | φ 21±0.8 |
| E | 2±0.5 |
| W | 9±0.5 |
| W1 | 1.2±0.2 |

TAPING STATE

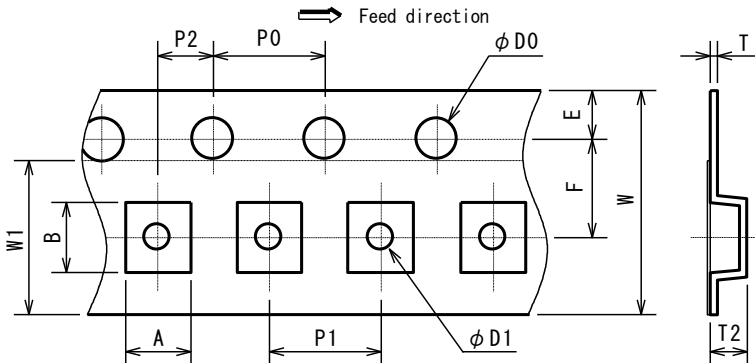


PACKING STATE



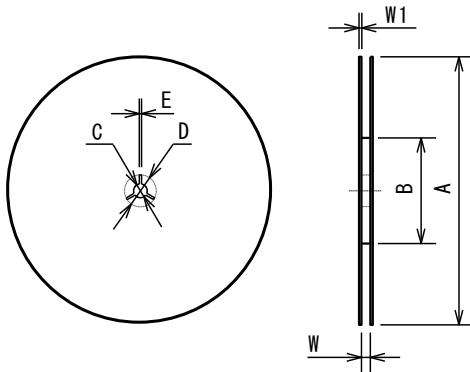
PACKING SPEC

TAPING DIMENSIONS



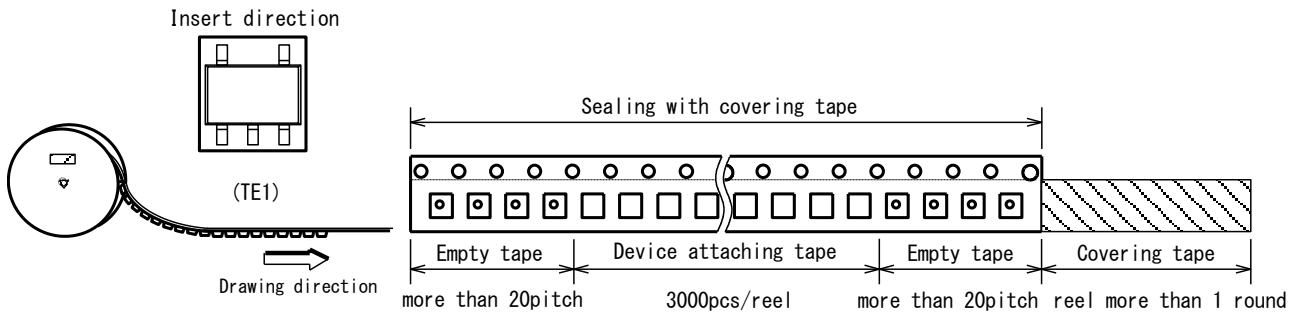
| SYMBOL | DIMENSION | REMARKS |
|--------|-----------|------------------|
| A | 2.3±0.1 | BOTTOM DIMENSION |
| B | 2.5±0.1 | BOTTOM DIMENSION |
| D0 | 1.55±0.05 | |
| D1 | 1.05±0.05 | |
| E | 1.75±0.1 | |
| F | 3.5±0.05 | |
| P0 | 4.0±0.1 | |
| P1 | 4.0±0.1 | |
| P2 | 2.0±0.05 | |
| T | 0.25±0.05 | |
| T2 | 1.3±0.1 | |
| W | 8.0±0.2 | |
| W1 | 5.5 | THICKNESS 0.1max |

REEL DIMENSIONS

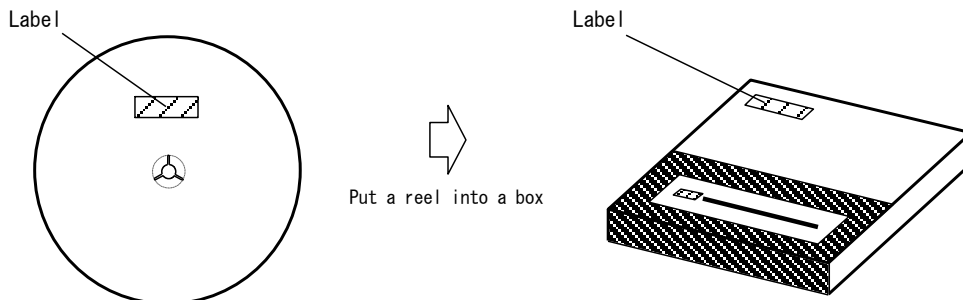


| SYMBOL | DIMENSION |
|--------|-----------|
| A | φ 180±1 |
| B | φ 60±1 |
| C | φ 13±0.2 |
| D | φ 21±0.8 |
| E | 2±0.5 |
| W | 9±0.5 |
| W1 | 1.2±0.2 |

TAPING STATE

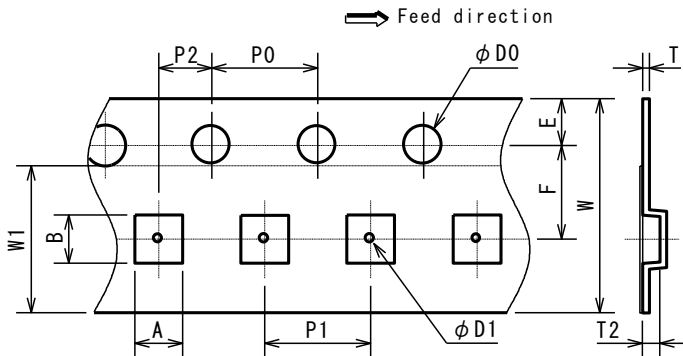


PACKING STATE



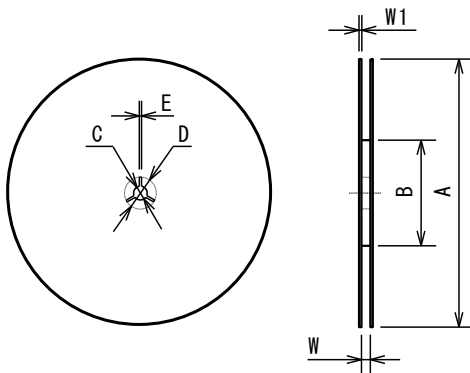
PACKING SPEC

TAPING DIMENSIONS



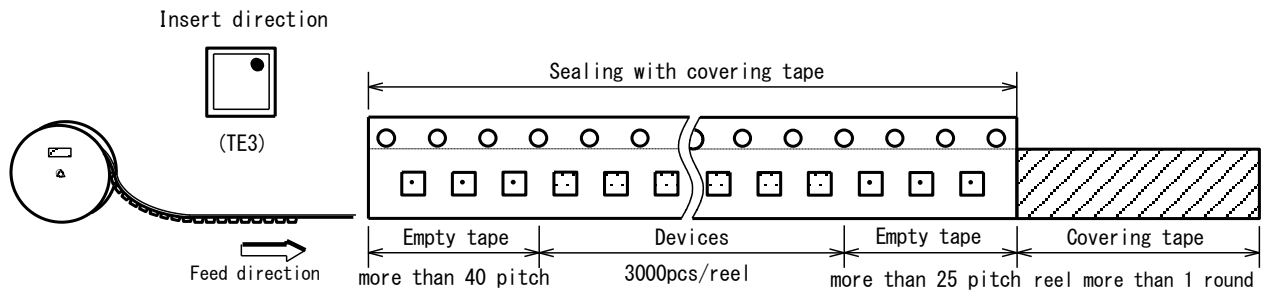
| SYMBOL | DIMENSION | REMARKS |
|--------|----------------------------------|------------------|
| A | 1.85±0.05 | BOTTOM DIMENSION |
| B | 1.85±0.05 | BOTTOM DIMENSION |
| D0 | 1.5 ^{+0.1} ₀ | |
| D1 | 0.5±0.1 | |
| E | 1.75±0.1 | |
| F | 3.5±0.05 | |
| P0 | 4.0±0.1 | |
| P1 | 4.0±0.1 | |
| P2 | 2.0±0.05 | |
| T | 0.25±0.05 | |
| T2 | 0.65±0.05 | |
| W | 8.0±0.2 | |
| W1 | 5.5 | THICKNESS 0.1max |

REEL DIMENSIONS

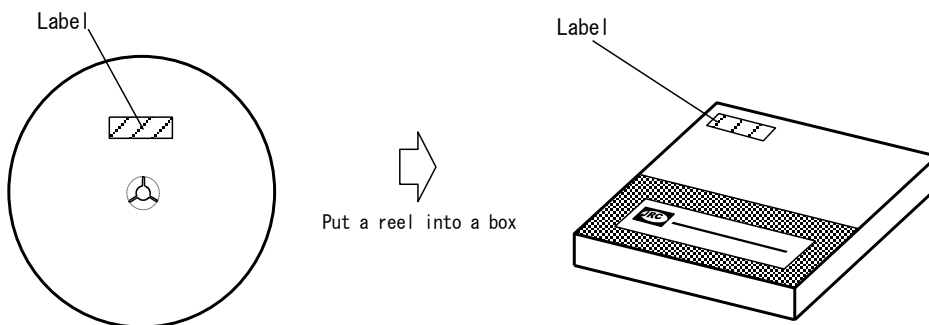


| SYMBOL | DIMENSION |
|--------|------------------------------------|
| A | φ 180 ⁰ _{-1.5} |
| B | φ 60 ⁺¹ ₀ |
| C | φ 13±0.2 |
| D | φ 21±0.8 |
| E | 2±0.5 |
| W | 9 ^{+0.3} ₀ |
| W1 | 1.2 |

TAPING STATE

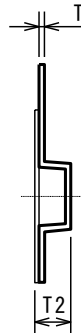
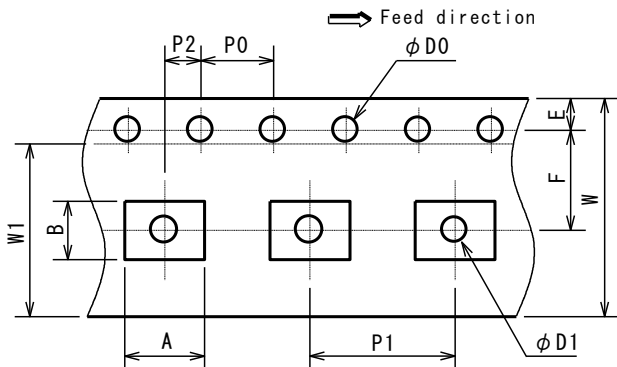


PACKING STATE



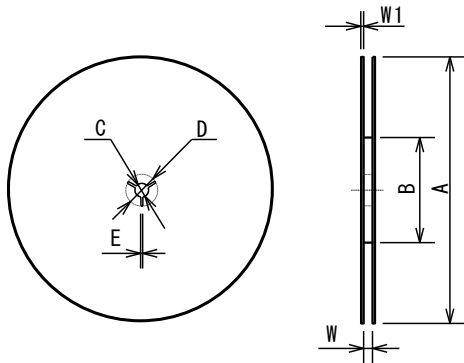
PACKING SPEC

TAPING DIMENSIONS



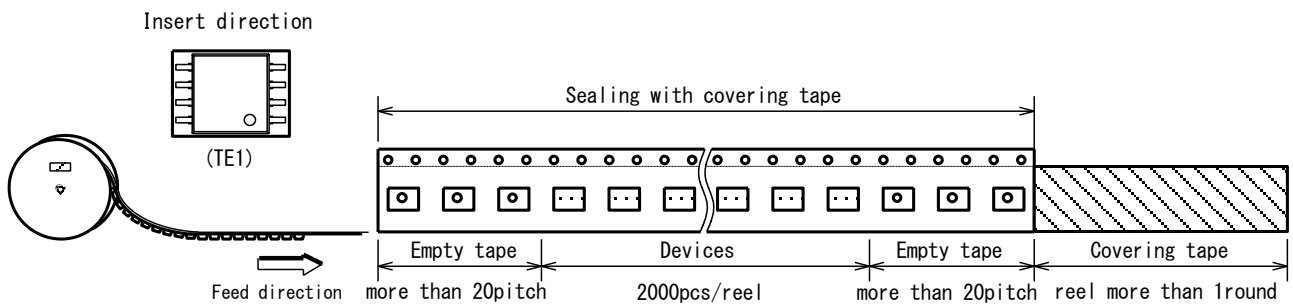
| SYMBOL | DIMENSION | REMARKS |
|--------|----------------------------------|------------------|
| A | 4.4 | BOTTOM DIMENSION |
| B | 3.2 | BOTTOM DIMENSION |
| D0 | 1.5 ^{+0.1} ₀ | |
| D1 | 1.5 ^{+0.1} ₀ | |
| E | 1.75±0.1 | |
| F | 5.5±0.05 | |
| P0 | 4.0±0.1 | |
| P1 | 8.0±0.1 | |
| P2 | 2.0±0.05 | |
| T | 0.30±0.05 | |
| T2 | 1.75 (MAX.) | |
| W | 12.0±0.3 | |
| W1 | 9.5 | THICKNESS 0.1max |

REEL DIMENSIONS

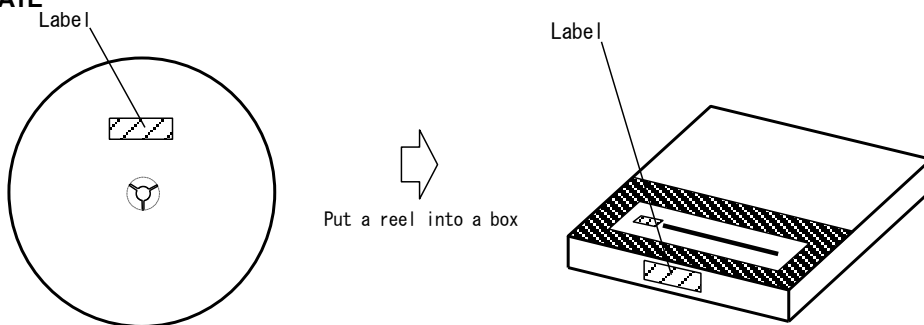


| SYMBOL | DIMENSION |
|--------|-----------|
| A | φ254±2 |
| B | φ100±1 |
| C | φ13±0.2 |
| D | φ21±0.8 |
| E | 2±0.5 |
| W | 13.5±0.5 |
| W1 | 2.0±0.2 |

TAPING STATE

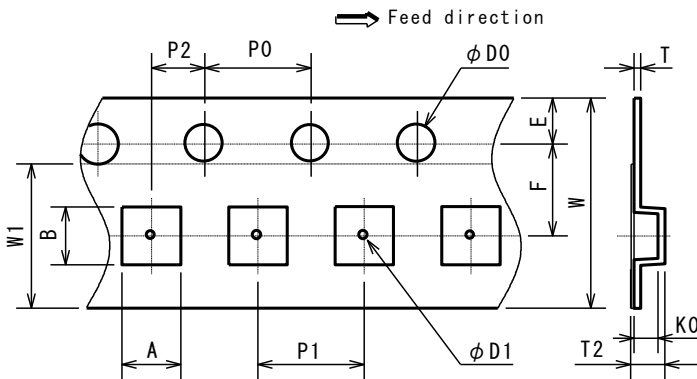


PACKING STATE



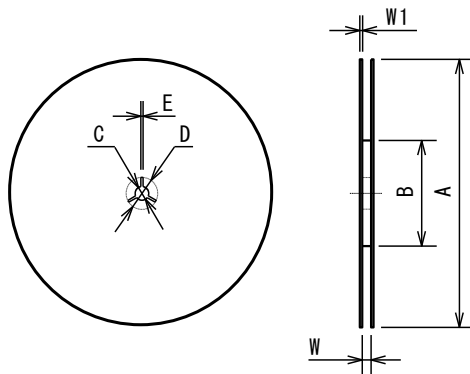
PACKING SPEC

TAPING DIMENSIONS



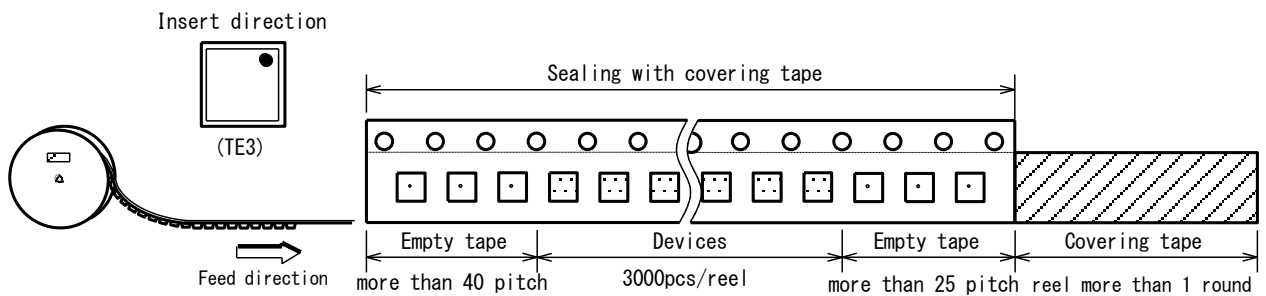
| SYMBOL | DIMENSION | REMARKS |
|--------|----------------------------------|------------------|
| A | 2.25±0.05 | BOTTOM DIMENSION |
| B | 2.25±0.05 | BOTTOM DIMENSION |
| D0 | 1.5 ^{+0.1} ₀ | |
| D1 | 0.5±0.1 | |
| E | 1.75±0.1 | |
| F | 3.5±0.05 | |
| P0 | 4.0±0.1 | |
| P1 | 4.0±0.1 | |
| P2 | 2.0±0.05 | |
| T | 0.25±0.05 | |
| T2 | 1.00±0.07 | |
| K0 | 0.65±0.05 | |
| W | 8.0±0.2 | |
| W1 | 5.5 | THICKNESS 0.1max |

REEL DIMENSIONS

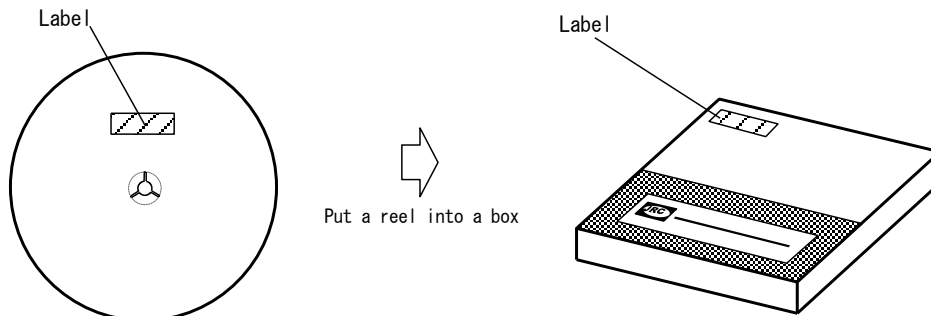


| SYMBOL | DIMENSION |
|--------|------------------------------------|
| A | φ 180 ⁰ _{-1.5} |
| B | φ 60 ⁺¹ ₀ |
| C | φ 13±0.2 |
| D | φ 21±0.8 |
| E | 2±0.5 |
| W | 9 ^{+0.3} ₀ |
| W1 | 1.2 |

TAPING STATE

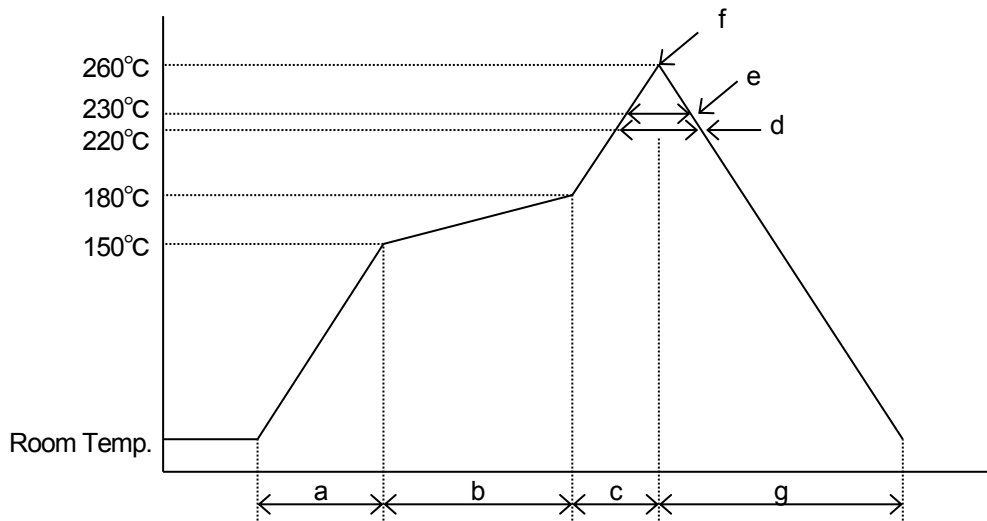


PACKING STATE



RECOMMENDED MOUNTING METHOD

*Recommended reflow soldering procedure



- a: Temperature ramping rate : 1 to 4°C/s
- b: Pre-heating temperature : 150 to 180°C
time : 60 to 120s
- c: Temperature ramp rate : 1 to 4°C/s
- d: 220°C or higher time : Shorter than 60s
- e: 230°C or higher time : Shorter than 40s
- f: Peak temperature : Lower than 260°C
- g: Temperature ramping rate : 1 to 6°C/s

*The temperature indicates at the surface of mold package.

REVISION HISTORY

| Date | Revision | Changes |
|------------|----------|---|
| 2016/11/30 | Ver.0 | First edition |
| 2017/5/24 | Ver.1 | Added information of NJU77232. |
| 2017/10/12 | Ver.2 | Changed GENERAL DESCRIPTION and APPLICATION |
| 2017/11/10 | Ver.3 | Corrected ELECTRICAL CHARACTERISTICS |

[CAUTION]

1. New JRC strives to produce reliable and high quality semiconductors. New JRC's semiconductors are intended for specific applications and require proper maintenance and handling. To enhance the performance and service of New JRC's semiconductors, the devices, machinery or equipment into which they are integrated should undergo preventative maintenance and inspection at regularly scheduled intervals. Failure to properly maintain equipment and machinery incorporating these products can result in catastrophic system failures
2. The specifications on this datasheet are only given for information without any guarantee as regards either mistakes or omissions. The application circuits in this datasheet are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.
All other trademarks mentioned herein are property of their respective companies.
3. To ensure the highest levels of reliability, New JRC products must always be properly handled.
The introduction of external contaminants (e.g. dust, oil or cosmetics) can result in failures of semiconductor products.
4. New JRC offers a variety of semiconductor products intended for particular applications. It is important that you select the proper component for your intended application. You may contact New JRC's Sale's Office if you are uncertain about the products listed in this catalog.
5. Special care is required in designing devices, machinery or equipment which demand high levels of reliability. This is particularly important when designing critical components or systems whose failure can foreseeably result in situations that could adversely affect health or safety. In designing such critical devices, equipment or machinery, careful consideration should be given to amongst other things, their safety design, fail-safe design, back-up and redundancy systems, and diffusion design.
6. The products listed in the catalog may not be appropriate for use in certain equipment where reliability is critical or where the products may be subjected to extreme conditions. You should consult our sales office before using the products in any of the following types of equipment.
 - Aerospace Equipment
 - Equipment Used in the Deep sea
 - Power Generator Control Equipment (Nuclear, Steam, Hydraulic)
 - Life Maintenance Medical Equipment
 - Fire Alarm/Intruder Detector
 - Vehicle Control Equipment (airplane, railroad, ship, etc.)
 - Various Safety devices
7. New JRC's products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this catalog. Failure to employ New JRC products in the proper applications can lead to deterioration, destruction or failure of the products. New JRC shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of its products. Products are sold without warranty of any kind, either express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose.
8. Warning for handling Gallium and Arsenic(GaAs) Products (Applying to GaAs MMIC, Photo Reflector). This Products uses Gallium(Ga) and Arsenic(As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed, please follow the related regulation and do not mix this with general industrial waste or household waste.
9. The product specifications and descriptions listed in this catalog are subject to change at any time, without notice.

