

HIGH FREQUENCY LOW NOISE AMPLIFIER  
NPN SILICON EPITAXIAL TRANSISTOR  
SUPER MINI MOLD

DESCRIPTION

The 2SC4227 is a low supply voltage transistor designed for VHF, UHF low noise amplifier.

It is suitable for a high density surface mount assembly since the transistor has been applied small mini mold package.

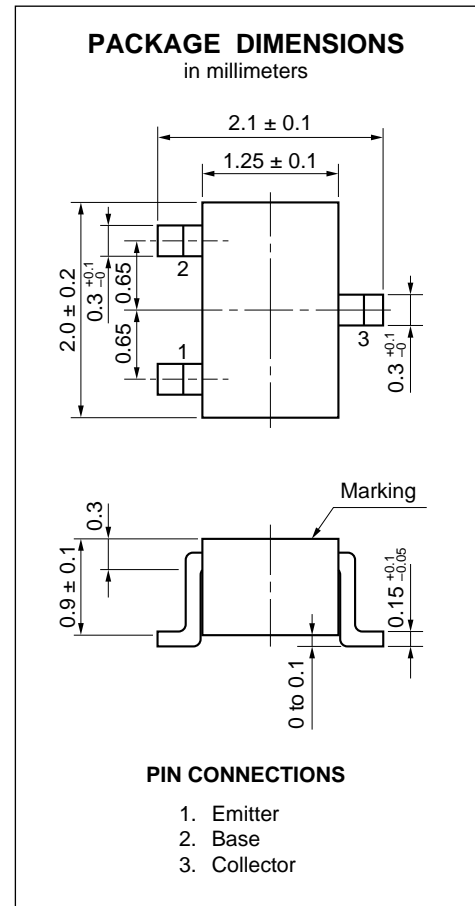
FEATURES

- Low Noise  
NF = 1.4 dB TYP. @ f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA
- High Gain  
|S<sub>21e</sub>|<sup>2</sup> = 12 dB TYP. @ f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA
- Small Mini Mold Package  
EIAJ: SC-70

ORDERING INFORMATION

| PART NUMBER | QUANTITY     | PACKING STYLE   |
|-------------|--------------|---|
| 2SC4227-T1  | 3 Kpcs/Reel. | Embossed tape 8 mm wide.<br>Pin3 (Collector) face to perforation side of the tape.            |
| 2SC4227-T2  | 3 Kpcs/Reel. | Embossed tape 8 mm wide.<br>Pin1 (Emitter), Pin2 (Base) face to perforation side of the tape. |

\* Please contact with responsible NEC person, if you require evaluation sample. Unit sample quantity shall be 50 pcs. (Part No.: 2SC4227)



**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)**

|                              |                  |             |    |
|------------------------------|------------------|-------------|----|
| Collector to Base Voltage    | V <sub>CB0</sub> | 20          | V  |
| Collector to Emitter Voltage | V <sub>CEO</sub> | 10          | V  |
| Emitter to Base Voltage      | V <sub>EBO</sub> | 1.5         | V  |
| Collector Current            | I <sub>c</sub>   | 65          | mA |
| Total Power Dissipation      | P <sub>T</sub>   | 150         | mW |
| Junction Temperature         | T <sub>j</sub>   | 150         | °C |
| Storage Temperature          | T <sub>stg</sub> | -65 to +150 | °C |

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

| CHARACTERISTIC           | SYMBOL                          | MIN. | TYP. | MAX. | UNIT | TEST CONDITION   |
|--------------------------|---------------------------------|------|------|------|------|--|
| Collector Cutoff Current | I <sub>CB0</sub>                |      |      | 0.8  | μA   | V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0                         |
| Emitter Cutoff Current   | I <sub>EBO</sub>                |      |      | 0.8  | μA   | V <sub>EB</sub> = 1 V, I <sub>c</sub> = 0                          |
| DC Current Gain          | h <sub>FE</sub>                 | 40   |      | 240  |      | V <sub>CE</sub> = 3 V, I <sub>c</sub> = 7 mA* <sup>1</sup>         |
| Gain Bandwidth Product   | f <sub>T</sub>                  | 4.5  | 7.0  |      | GHz  | V <sub>CE</sub> = 3 V, I <sub>c</sub> = 7 mA                       |
| Feedback Capacitance     | C <sub>re</sub>                 |      | 0.45 | 0.9  | pF   | V <sub>CE</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz* <sup>2</sup> |
| Insertion Power Gain     | S <sub>21e</sub>   <sup>2</sup> | 10   | 12   |      | dB   | V <sub>CE</sub> = 3 V, I <sub>c</sub> = 7 mA, f = 1 GHz            |
| Noise Figure             | NF                              |      | 1.4  | 2.7  | dB   | V <sub>CE</sub> = 3 V, I <sub>c</sub> = 7 mA, f = 1 GHz            |

\*1 Pulse Measurement ; PW ≤ 350 μs, Duty Cycle ≤ 2 % Pulsed.

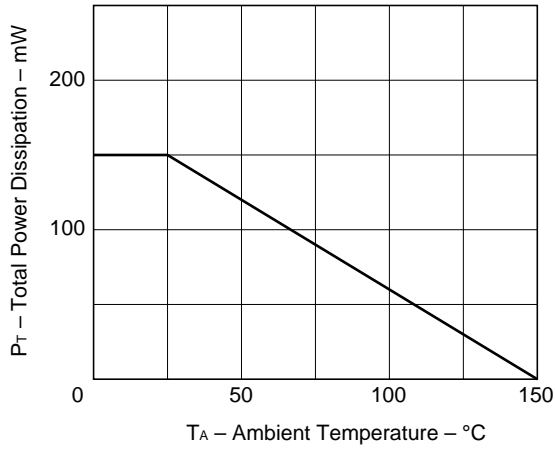
\*2 Measured with 3 terminals bridge, Emitter and Case should be grounded.

**h<sub>FE</sub> Classification**

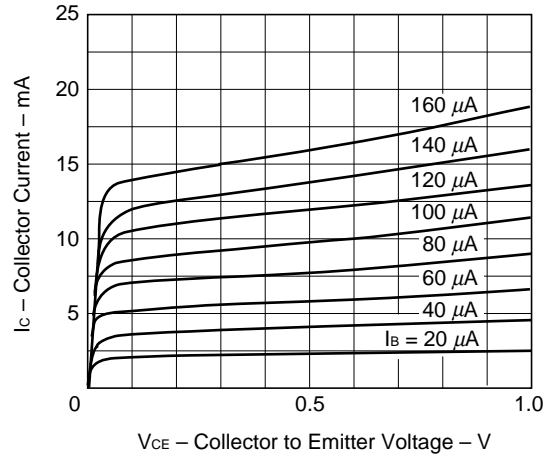
|                 |          |           |            |
|-----------------|----------|-----------|------------|
| Rank            | R33      | R34       | R35        |
| Marking         | R33      | R34       | R35        |
| h <sub>FE</sub> | 40 to 90 | 70 to 150 | 110 to 240 |

TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)

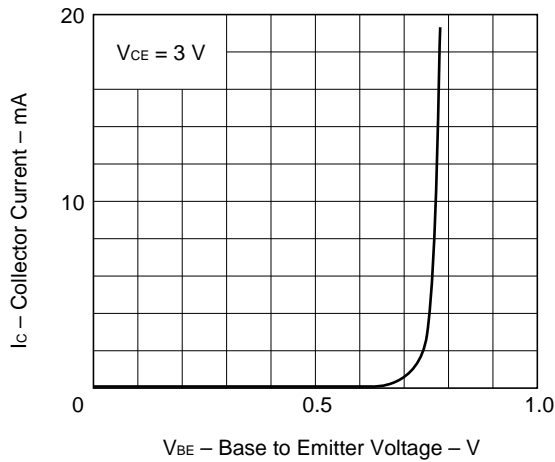
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



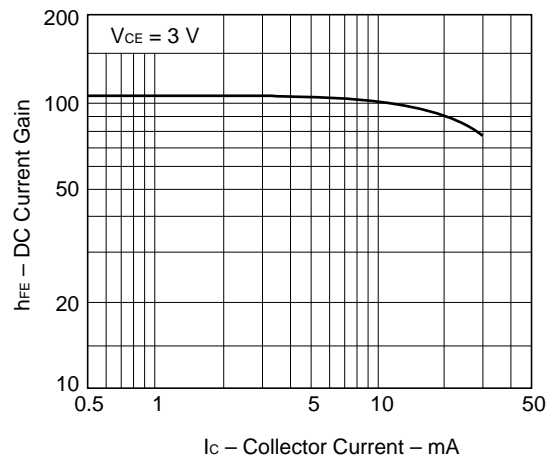
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



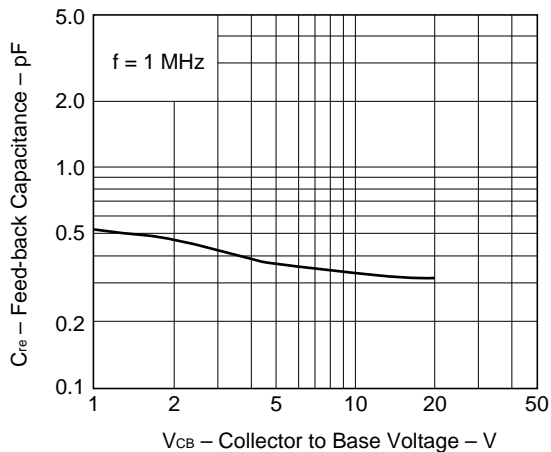
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



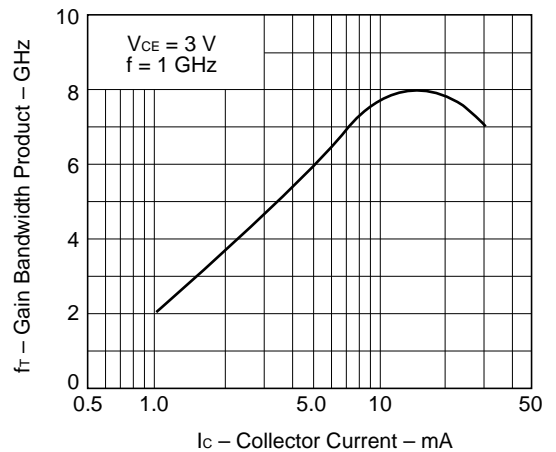
DC CURRENT GAIN vs. COLLECTOR CURRENT



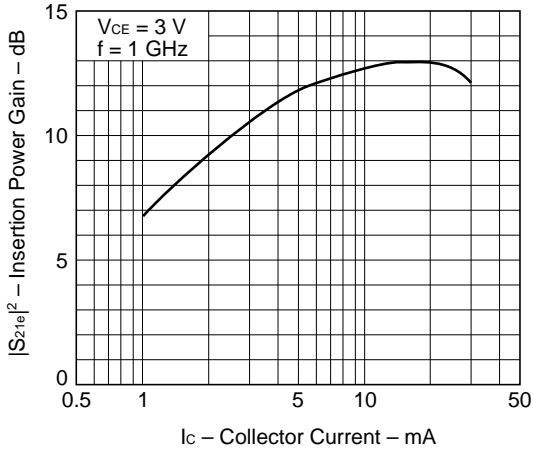
FEED-BACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



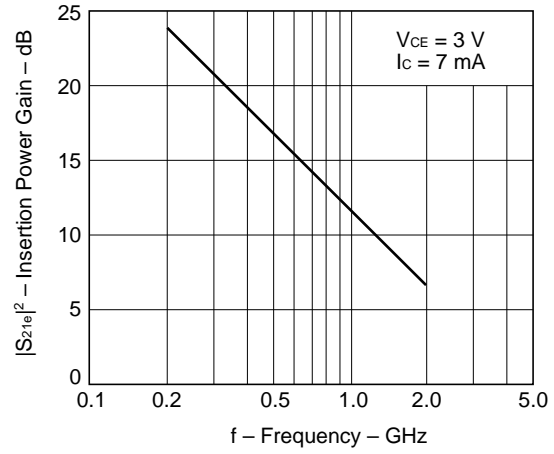
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



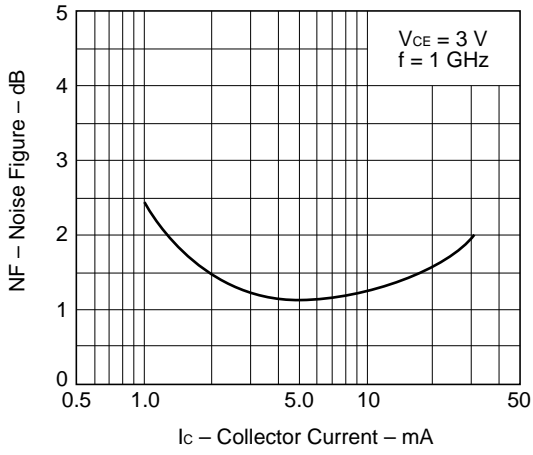
INSERTION POWER GAIN vs. COLLECTOR CURRENT



INSERTION POWER GAIN vs. FREQUENCY



NOISE FIGURE vs. COLLECTOR CURRENT



S-PARAMETER

(V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>o</sub> = 50 Ω)

| FREQUENCY | S11  |        | S21    |       | S12  |      | S22  |       |
|-----------|------|--------|--------|-------|------|------|------|-------|
|           | MHz  | MAG    | ANG    | MAG   | ANG  | MAG  | ANG  | MAG   |
| 100.00    | .804 | -23.8  | 11.631 | 154.8 | .023 | 74.8 | .920 | -16.5 |
| 200.00    | .692 | -48.6  | 10.839 | 137.5 | .040 | 64.1 | .791 | -27.7 |
| 300.00    | .581 | -70.3  | 9.722  | 123.8 | .050 | 59.9 | .675 | -33.5 |
| 400.00    | .489 | -89.0  | 8.519  | 112.9 | .060 | 56.7 | .597 | -37.0 |
| 500.00    | .419 | -104.9 | 7.434  | 104.1 | .067 | 55.9 | .538 | -38.7 |
| 600.00    | .376 | -117.1 | 6.468  | 97.5  | .075 | 55.6 | .497 | -40.0 |
| 700.00    | .342 | -128.6 | 5.729  | 91.8  | .082 | 55.7 | .467 | -41.0 |
| 800.00    | .321 | -138.4 | 5.115  | 86.7  | .089 | 56.3 | .443 | -41.7 |
| 900.00    | .305 | -147.3 | 4.630  | 82.5  | .096 | 56.1 | .427 | -42.5 |
| 1000.00   | .296 | -155.2 | 4.207  | 78.5  | .104 | 56.4 | .412 | -43.6 |
| 1100.00   | .289 | -162.2 | 3.879  | 74.8  | .111 | 56.0 | .401 | -44.6 |
| 1200.00   | .284 | -169.3 | 3.595  | 71.4  | .119 | 56.4 | .393 | -45.8 |
| 1300.00   | .282 | -175.3 | 3.349  | 68.1  | .127 | 56.2 | .384 | -47.3 |
| 1400.00   | .281 | 179.0  | 3.133  | 64.8  | .136 | 56.0 | .379 | -48.8 |
| 1500.00   | .283 | 173.8  | 2.945  | 61.9  | .143 | 55.4 | .372 | -50.1 |
| 1600.00   | .283 | 168.6  | 2.780  | 58.8  | .151 | 55.0 | .367 | -51.8 |
| 1700.00   | .285 | 163.8  | 2.631  | 56.2  | .160 | 54.4 | .363 | -53.7 |
| 1800.00   | .286 | 159.9  | 2.514  | 53.3  | .168 | 53.9 | .359 | -55.4 |
| 1900.00   | .289 | 155.4  | 2.390  | 50.5  | .177 | 53.3 | .354 | -57.3 |
| 2000.00   | .293 | 151.8  | 2.293  | 47.8  | .186 | 52.5 | .351 | -59.2 |

(V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω)

| FREQUENCY | S11  |        | S21    |       | S12  |      | S22  |       |
|-----------|------|--------|--------|-------|------|------|------|-------|
|           | MHz  | MAG    | ANG    | MAG   | ANG  | MAG  | ANG  | MAG   |
| 100.00    | .818 | -29.4  | 14.580 | 156.2 | .023 | 79.9 | .932 | -14.4 |
| 200.00    | .689 | -54.3  | 12.120 | 137.5 | .040 | 65.1 | .824 | -23.4 |
| 300.00    | .594 | -73.1  | 10.142 | 124.6 | .052 | 55.0 | .716 | -30.3 |
| 400.00    | .500 | -89.8  | 8.340  | 114.4 | .063 | 58.5 | .620 | -32.2 |
| 500.00    | .457 | -102.8 | 7.300  | 107.5 | .069 | 56.4 | .577 | -34.2 |
| 600.00    | .404 | -115.0 | 6.211  | 101.0 | .081 | 54.9 | .525 | -35.1 |
| 700.00    | .377 | -124.4 | 5.496  | 96.8  | .084 | 59.5 | .511 | -36.1 |
| 800.00    | .359 | -134.3 | 4.908  | 91.4  | .091 | 58.4 | .471 | -36.2 |
| 900.00    | .342 | -141.5 | 4.450  | 88.1  | .097 | 58.4 | .458 | -35.3 |
| 1000.00   | .335 | -150.3 | 4.018  | 84.7  | .100 | 61.2 | .440 | -36.5 |
| 1100.00   | .326 | -155.9 | 3.750  | 81.4  | .112 | 61.8 | .442 | -36.8 |
| 1200.00   | .321 | -162.4 | 3.410  | 78.1  | .115 | 61.4 | .417 | -37.8 |
| 1300.00   | .317 | -167.2 | 3.181  | 75.6  | .124 | 62.3 | .412 | -38.5 |
| 1400.00   | .321 | -173.4 | 2.995  | 72.5  | .131 | 63.9 | .411 | -39.9 |
| 1500.00   | .318 | -177.5 | 2.802  | 69.8  | .138 | 63.6 | .407 | -40.4 |
| 1600.00   | .320 | 176.6  | 2.665  | 67.3  | .149 | 66.4 | .400 | -41.1 |
| 1700.00   | .323 | 173.2  | 2.533  | 66.1  | .156 | 65.3 | .394 | -43.7 |
| 1800.00   | .326 | 167.8  | 2.369  | 63.0  | .162 | 65.9 | .394 | -44.3 |
| 1900.00   | .331 | 165.6  | 2.275  | 61.0  | .177 | 65.4 | .390 | -45.5 |
| 2000.00   | .333 | 161.4  | 2.196  | 59.2  | .183 | 64.5 | .384 | -47.6 |

**S-PARAMETER**

(V<sub>CE</sub> = 3 V, I<sub>c</sub> = 3 mA, Z<sub>o</sub> = 50 Ω)

| FREQUENCY | S11  |        | S21   |       | S12  |      | S22  |       |
|-----------|------|--------|-------|-------|------|------|------|-------|
|           | MHz  | MAG    | ANG   | MAG   | ANG  | MAG  | ANG  | MAG   |
| 100.00    | .906 | -22.7  | 9.710 | 161.6 | .026 | 82.5 | .962 | -10.6 |
| 200.00    | .810 | -43.7  | 8.541 | 145.3 | .049 | 63.8 | .895 | -18.3 |
| 300.00    | .742 | -60.6  | 7.695 | 133.4 | .062 | 58.7 | .811 | -25.8 |
| 400.00    | .638 | -76.6  | 6.580 | 122.4 | .073 | 56.0 | .732 | -27.7 |
| 500.00    | .587 | -89.8  | 5.934 | 114.1 | .082 | 53.4 | .680 | -31.2 |
| 600.00    | .524 | -102.2 | 5.148 | 107.1 | .091 | 49.7 | .624 | -33.5 |
| 700.00    | .490 | -111.4 | 4.627 | 102.2 | .094 | 51.8 | .603 | -34.4 |
| 800.00    | .460 | -121.4 | 4.181 | 96.0  | .099 | 51.2 | .568 | -35.0 |
| 900.00    | .435 | -129.9 | 3.827 | 92.6  | .101 | 52.9 | .540 | -35.7 |
| 1000.00   | .427 | -138.2 | 3.443 | 88.1  | .107 | 50.9 | .523 | -36.7 |
| 1100.00   | .404 | -144.9 | 3.199 | 84.2  | .115 | 53.7 | .512 | -36.8 |
| 1200.00   | .399 | -151.7 | 2.989 | 79.8  | .113 | 56.6 | .500 | -38.6 |
| 1300.00   | .392 | -157.9 | 2.779 | 77.4  | .121 | 54.9 | .489 | -39.2 |
| 1400.00   | .392 | -163.6 | 2.638 | 73.5  | .126 | 56.4 | .483 | -40.4 |
| 1500.00   | .386 | -169.1 | 2.443 | 71.3  | .135 | 56.4 | .477 | -41.8 |
| 1600.00   | .380 | -174.5 | 2.344 | 68.0  | .137 | 60.0 | .477 | -42.4 |
| 1700.00   | .382 | -179.7 | 2.239 | 65.3  | .143 | 59.5 | .466 | -44.4 |
| 1800.00   | .389 | 176.1  | 2.113 | 63.0  | .151 | 59.4 | .461 | -44.9 |
| 1900.00   | .383 | 172.5  | 2.025 | 61.4  | .154 | 62.6 | .456 | -46.9 |
| 2000.00   | .387 | 168.3  | 1.922 | 58.2  | .163 | 62.0 | .464 | -48.3 |

(V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>o</sub> = 50 Ω)

| FREQUENCY | S11   |        | S21   |       | S12  |      | S22  |       |
|-----------|-------|--------|-------|-------|------|------|------|-------|
|           | MHz   | MAG    | ANG   | MAG   | ANG  | MAG  | ANG  | MAG   |
| 100.00    | 1.009 | -14.5  | 3.544 | 168.8 | .027 | 78.6 | .994 | -5.6  |
| 200.00    | .955  | -29.7  | 3.359 | 156.3 | .055 | 73.6 | .969 | -10.1 |
| 300.00    | .937  | -42.6  | 3.277 | 147.1 | .073 | 63.4 | .947 | -15.9 |
| 400.00    | .864  | -56.2  | 3.034 | 136.6 | .091 | 57.7 | .898 | -18.8 |
| 500.00    | .838  | -67.3  | 2.891 | 128.6 | .107 | 51.1 | .865 | -22.1 |
| 600.00    | .775  | -79.3  | 2.674 | 120.0 | .116 | 46.6 | .824 | -25.8 |
| 700.00    | .745  | -88.5  | 2.485 | 114.2 | .125 | 45.2 | .803 | -27.5 |
| 800.00    | .708  | -99.1  | 2.338 | 106.8 | .127 | 41.2 | .776 | -29.7 |
| 900.00    | .670  | -107.9 | 2.177 | 101.4 | .132 | 40.2 | .740 | -31.5 |
| 1000.00   | .649  | -116.8 | 2.052 | 96.0  | .135 | 37.2 | .723 | -33.7 |
| 1100.00   | .621  | -124.0 | 1.914 | 90.8  | .131 | 36.6 | .719 | -34.2 |
| 1200.00   | .608  | -131.8 | 1.819 | 86.0  | .129 | 35.4 | .700 | -36.3 |
| 1300.00   | .587  | -138.5 | 1.713 | 82.4  | .130 | 35.2 | .691 | -37.6 |
| 1400.00   | .587  | -144.5 | 1.628 | 77.7  | .128 | 36.1 | .681 | -39.2 |
| 1500.00   | .573  | -152.6 | 1.533 | 73.4  | .127 | 36.0 | .662 | -40.7 |
| 1600.00   | .559  | -157.1 | 1.464 | 70.3  | .124 | 37.5 | .660 | -42.7 |
| 1700.00   | .562  | -164.2 | 1.421 | 67.2  | .120 | 39.1 | .658 | -44.0 |
| 1800.00   | .557  | -168.9 | 1.350 | 64.7  | .122 | 43.3 | .658 | -46.0 |
| 1900.00   | .557  | -173.9 | 1.296 | 61.1  | .122 | 45.2 | .641 | -47.8 |
| 2000.00   | .551  | -178.6 | 1.240 | 58.0  | .124 | 48.5 | .643 | -50.1 |

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customer must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.