

## RD2.0ES to RD39ES

## 400 mW DHD ZENER DIODE

(DO-34)

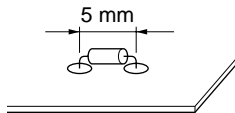
## DESCRIPTION

NEC Type RD2.0ES to RD39ES Series are planar type diodes into DO-34 Package (Body length 2.4 mm MAX.) with DHD (Double Heatsink Diode) construction having allowable power dissipation of 400 mW.

## FEATURES

- DO-34 Glass sealed package

This diode can be inserted into a PC board with a shorter pitch (5 mm)



- Planar process
- DHD (Double Heatsink Diode) construction
- Vz Applied E24 standard

## ORDERING INFORMATION

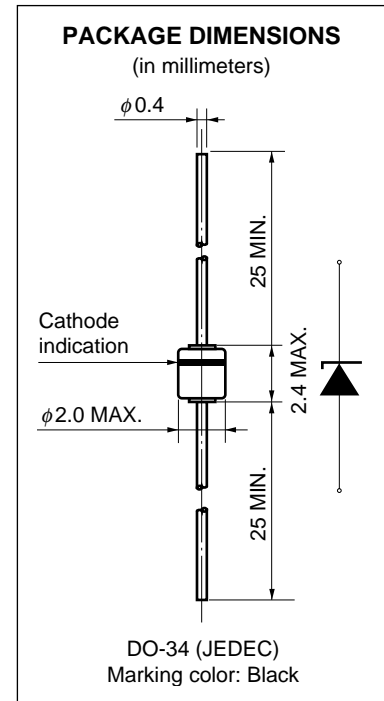
RD2.0ES to RD39ES with suffix "AB1", "AB2", or "AB3" should be applied for orders for suffix "AB".

## APPLICATIONS

Circuits for Constant Voltage, Constant Current, Waveform clipper, Surge absorber, etc.

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^\circ\text{C}$ )

|                      |           |                                 |                |
|----------------------|-----------|---------------------------------|----------------|
| Forward Current      | $I_F$     | 150 mA                          |                |
| Power Dissipation    | $P$       | 400 mW                          | to see Fig. 6  |
| Surge Reverse Power  | $P_{RSM}$ | 100 W ( $t = 10\ \mu\text{s}$ ) | to see Fig. 10 |
| Junction Temperature | $T_j$     | 175 $^\circ\text{C}$            |                |
| Storage Temperature  | $T_{stg}$ | -65 to +175 $^\circ\text{C}$    |                |



The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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

| Type Number | Suffix | Zener Voltage<br>V <sub>Z</sub> (V) <sup>Note 1</sup> |       |                     | Dynamic Impedance<br>Z <sub>Z</sub> (Ω) <sup>Note 2</sup> |                     | Knee Dynamic Impedance<br>Z <sub>ZK</sub> (Ω) <sup>Note 2</sup> |                     | Reverse Current<br>I <sub>R</sub> (μA) |                    |
|-------------|--------|-------------------------------------------------------|-------|---------------------|-----------------------------------------------------------|---------------------|-----------------------------------------------------------------|---------------------|----------------------------------------|--------------------|
|             |        | MIN.                                                  | MAX.  | I <sub>Z</sub> (mA) | MAX.                                                      | I <sub>Z</sub> (mA) | MAX.                                                            | I <sub>Z</sub> (mA) | MAX.                                   | V <sub>R</sub> (V) |
| RD2.0ES     | AB     | 1.88                                                  | 2.24  | 5                   | 100                                                       | 5                   | 1000                                                            | 0.5                 | 120                                    | 0.5                |
|             | AB1    | 1.88                                                  | 2.12  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 2.01                                                  | 2.24  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD2.2ES     | AB     | 2.11                                                  | 2.44  | 5                   | 100                                                       | 5                   | 1000                                                            | 0.5                 | 120                                    | 0.7                |
|             | AB1    | 2.11                                                  | 2.34  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 2.22                                                  | 2.44  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD2.4ES     | AB     | 2.32                                                  | 2.65  | 5                   | 100                                                       | 5                   | 1000                                                            | 0.5                 | 120                                    | 1.0                |
|             | AB1    | 2.32                                                  | 2.54  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 2.41                                                  | 2.65  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD2.7ES     | AB     | 2.52                                                  | 2.93  | 5                   | 110                                                       | 5                   | 1000                                                            | 0.5                 | 100                                    | 1.0                |
|             | AB1    | 2.52                                                  | 2.77  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 2.68                                                  | 2.93  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD3.0ES     | AB     | 2.84                                                  | 3.24  | 5                   | 120                                                       | 5                   | 1000                                                            | 0.5                 | 50                                     | 1.0                |
|             | AB1    | 2.84                                                  | 3.08  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 2.99                                                  | 3.24  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD3.3ES     | AB     | 3.15                                                  | 3.54  | 5                   | 120                                                       | 5                   | 1000                                                            | 0.5                 | 20                                     | 1.0                |
|             | AB1    | 3.15                                                  | 3.39  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 3.31                                                  | 3.54  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD3.6ES     | AB     | 3.46                                                  | 3.84  | 5                   | 120                                                       | 5                   | 1100                                                            | 0.5                 | 10                                     | 1.0                |
|             | AB1    | 3.46                                                  | 3.69  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 3.60                                                  | 3.84  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD3.9ES     | AB     | 3.74                                                  | 4.16  | 5                   | 120                                                       | 5                   | 1200                                                            | 0.5                 | 5                                      | 1.0                |
|             | AB1    | 3.74                                                  | 4.01  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 3.89                                                  | 4.16  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD4.3ES     | AB     | 4.04                                                  | 4.57  | 5                   | 120                                                       | 5                   | 1200                                                            | 0.5                 | 5                                      | 1.0                |
|             | AB1    | 4.04                                                  | 4.29  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 4.17                                                  | 4.43  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 4.30                                                  | 4.57  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD4.7ES     | AB     | 4.44                                                  | 4.93  | 5                   | 100                                                       | 5                   | 1200                                                            | 0.5                 | 5                                      | 1.0                |
|             | AB1    | 4.44                                                  | 4.68  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 4.55                                                  | 4.80  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 4.68                                                  | 4.93  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD5.1ES     | AB     | 4.81                                                  | 5.37  | 5                   | 70                                                        | 5                   | 1200                                                            | 0.5                 | 5                                      | 1.5                |
|             | AB1    | 4.81                                                  | 5.07  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 4.94                                                  | 5.20  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 5.09                                                  | 5.37  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD5.6ES     | AB     | 5.28                                                  | 5.91  | 5                   | 40                                                        | 5                   | 900                                                             | 0.5                 | 5                                      | 2.5                |
|             | AB1    | 5.28                                                  | 5.55  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 5.45                                                  | 5.73  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 5.61                                                  | 5.91  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD6.2ES     | AB     | 5.78                                                  | 6.44  | 5                   | 30                                                        | 5                   | 500                                                             | 0.5                 | 5                                      | 3.0                |
|             | AB1    | 5.78                                                  | 6.09  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 5.96                                                  | 6.27  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 6.12                                                  | 6.44  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD6.8ES     | AB     | 6.29                                                  | 7.01  | 5                   | 25                                                        | 5                   | 150                                                             | 0.5                 | 2                                      | 3.5                |
|             | AB1    | 6.29                                                  | 6.63  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 6.49                                                  | 6.83  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 6.66                                                  | 7.01  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD7.5ES     | AB     | 6.85                                                  | 7.67  | 5                   | 25                                                        | 5                   | 120                                                             | 0.5                 | 0.5                                    | 4.0                |
|             | AB1    | 6.85                                                  | 7.22  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 7.07                                                  | 7.45  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 7.29                                                  | 7.67  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD8.2ES     | AB     | 7.53                                                  | 8.45  | 5                   | 20                                                        | 5                   | 120                                                             | 0.5                 | 0.5                                    | 5.0                |
|             | AB1    | 7.53                                                  | 7.92  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 7.78                                                  | 8.19  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 8.03                                                  | 8.45  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD9.1ES     | AB     | 8.29                                                  | 9.30  | 5                   | 20                                                        | 5                   | 120                                                             | 0.5                 | 0.5                                    | 6.0                |
|             | AB1    | 8.29                                                  | 8.73  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 8.57                                                  | 9.01  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 8.83                                                  | 9.30  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
| RD10ES      | AB     | 9.12                                                  | 10.39 | 5                   | 20                                                        | 5                   | 120                                                             | 0.5                 | 0.2                                    | 7.0                |
|             | AB1    | 9.12                                                  | 9.65  |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB2    | 9.46                                                  | 10.02 |                     |                                                           |                     |                                                                 |                     |                                        |                    |
|             | AB3    | 9.82                                                  | 10.39 |                     |                                                           |                     |                                                                 |                     |                                        |                    |

| Type Number | Suffix | Zener Voltage<br>$V_z$ (V) <sup>Note 1</sup> |       |            | Dynamic Impedance<br>$Z_z$ ( $\Omega$ ) <sup>Note 2</sup> |            | Knee Dynamic Impedance<br>$Z_{zk}$ ( $\Omega$ ) <sup>Note 2</sup> |            | Reverse Current<br>$I_R$ ( $\mu A$ ) |           |
|-------------|--------|----------------------------------------------|-------|------------|-----------------------------------------------------------|------------|-------------------------------------------------------------------|------------|--------------------------------------|-----------|
|             |        | MIN.                                         | MAX.  | $I_z$ (mA) | MAX.                                                      | $I_z$ (mA) | MAX.                                                              | $I_z$ (mA) | MAX.                                 | $V_R$ (V) |
| RD11ES      | AB     | 10.18                                        | 11.38 | 5          | 20                                                        | 5          | 120                                                               | 0.5        | 0.2                                  | 8.0       |
|             | AB1    | 10.18                                        | 10.71 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 10.50                                        | 11.05 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 10.82                                        | 11.38 |            |                                                           |            |                                                                   |            |                                      |           |
| RD12ES      | AB     | 11.13                                        | 12.35 | 5          | 25                                                        | 5          | 110                                                               | 0.5        | 0.2                                  | 9.0       |
|             | AB1    | 11.13                                        | 11.71 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 11.44                                        | 12.03 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 11.74                                        | 12.35 |            |                                                           |            |                                                                   |            |                                      |           |
| RD13ES      | AB     | 12.11                                        | 13.66 | 5          | 25                                                        | 5          | 110                                                               | 0.5        | 0.2                                  | 10        |
|             | AB1    | 12.11                                        | 12.75 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 12.55                                        | 13.21 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 12.99                                        | 13.66 |            |                                                           |            |                                                                   |            |                                      |           |
| RD15ES      | AB     | 13.44                                        | 15.09 | 5          | 25                                                        | 5          | 110                                                               | 0.5        | 0.2                                  | 11        |
|             | AB1    | 13.44                                        | 14.13 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 13.89                                        | 14.62 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 14.35                                        | 15.09 |            |                                                           |            |                                                                   |            |                                      |           |
| RD16ES      | AB     | 14.80                                        | 16.51 | 5          | 25                                                        | 5          | 150                                                               | 0.5        | 0.2                                  | 12        |
|             | AB1    | 14.80                                        | 15.57 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 15.25                                        | 16.04 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 15.69                                        | 16.51 |            |                                                           |            |                                                                   |            |                                      |           |
| RD18ES      | AB     | 16.22                                        | 18.33 | 5          | 30                                                        | 5          | 150                                                               | 0.5        | 0.2                                  | 13        |
|             | AB1    | 16.22                                        | 17.06 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 16.82                                        | 17.70 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 17.42                                        | 18.33 |            |                                                           |            |                                                                   |            |                                      |           |
| RD20ES      | AB     | 18.14                                        | 20.45 | 5          | 30                                                        | 5          | 200                                                               | 0.5        | 0.2                                  | 15        |
|             | AB1    | 18.14                                        | 19.07 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 18.80                                        | 19.76 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 19.45                                        | 20.45 |            |                                                           |            |                                                                   |            |                                      |           |
| RD22ES      | AB     | 20.15                                        | 22.63 | 5          | 30                                                        | 5          | 200                                                               | 0.5        | 0.2                                  | 17        |
|             | AB1    | 20.15                                        | 21.20 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 20.64                                        | 21.71 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 21.08                                        | 22.17 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 21.52                                        | 22.63 |            |                                                           |            |                                                                   |            |                                      |           |
| RD24ES      | AB     | 22.05                                        | 24.85 | 5          | 35                                                        | 5          | 200                                                               | 0.5        | 0.2                                  | 19        |
|             | AB1    | 22.05                                        | 23.18 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 22.61                                        | 23.77 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 23.12                                        | 24.31 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 23.63                                        | 24.85 |            |                                                           |            |                                                                   |            |                                      |           |
| RD27ES      | AB     | 24.26                                        | 27.64 | 5          | 45                                                        | 5          | 250                                                               | 0.5        | 0.2                                  | 21        |
|             | AB1    | 24.26                                        | 25.52 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 24.97                                        | 26.26 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 25.63                                        | 26.95 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 26.29                                        | 27.64 |            |                                                           |            |                                                                   |            |                                      |           |
| RD30ES      | AB     | 26.99                                        | 30.51 | 5          | 55                                                        | 5          | 250                                                               | 0.5        | 0.2                                  | 23        |
|             | AB1    | 26.99                                        | 28.39 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 27.70                                        | 29.13 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 28.36                                        | 29.82 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 29.02                                        | 30.51 |            |                                                           |            |                                                                   |            |                                      |           |
| RD33ES      | AB     | 29.68                                        | 33.11 | 5          | 65                                                        | 5          | 250                                                               | 0.5        | 0.2                                  | 25        |
|             | AB1    | 29.68                                        | 31.22 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 30.32                                        | 31.88 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 30.90                                        | 32.50 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 31.49                                        | 33.11 |            |                                                           |            |                                                                   |            |                                      |           |
| RD36ES      | AB     | 32.14                                        | 35.77 | 5          | 75                                                        | 5          | 250                                                               | 0.5        | 0.2                                  | 27        |
|             | AB1    | 32.14                                        | 33.79 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 32.79                                        | 34.49 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 33.40                                        | 35.13 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 34.01                                        | 35.77 |            |                                                           |            |                                                                   |            |                                      |           |
| RD39ES      | AB     | 34.68                                        | 38.52 | 5          | 85                                                        | 5          | 250                                                               | 0.5        | 0.2                                  | 30        |
|             | AB1    | 34.68                                        | 36.47 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB2    | 35.36                                        | 37.19 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB3    | 36.00                                        | 37.85 |            |                                                           |            |                                                                   |            |                                      |           |
|             | AB4    | 36.63                                        | 38.52 |            |                                                           |            |                                                                   |            |                                      |           |

Notes 1. tested with pulse (40 ms)

2.  $Z_z$  and  $Z_{zk}$  are measured at  $I_z$  by given a very small A.C. current signal.

3. Suffix AB is Suffix AB1, AB2, AB3 or AB4.

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

Fig. 1 ZENER CURRENT vs. ZENER VOLTAGE

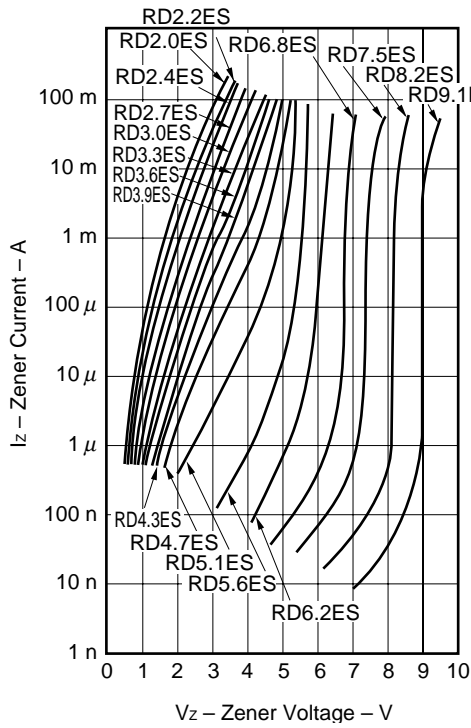


Fig. 2 ZENER CURRENT vs. ZENER VOLTAGE

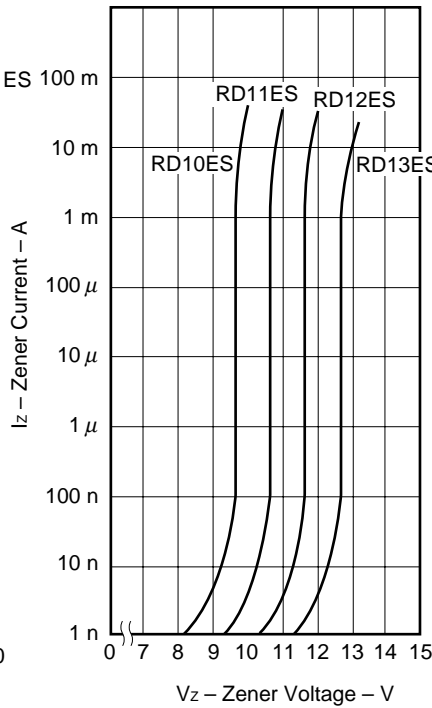


Fig. 3 ZENER CURRENT vs. ZENER VOLTAGE

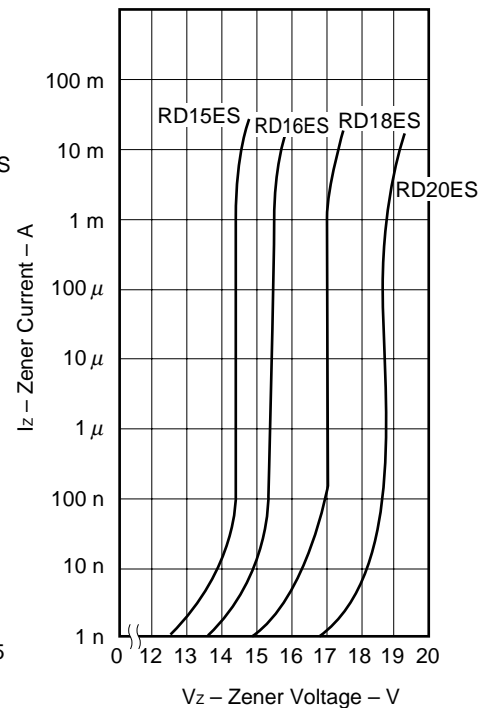


Fig. 4 ZENER CURRENT vs. ZENER VOLTAGE

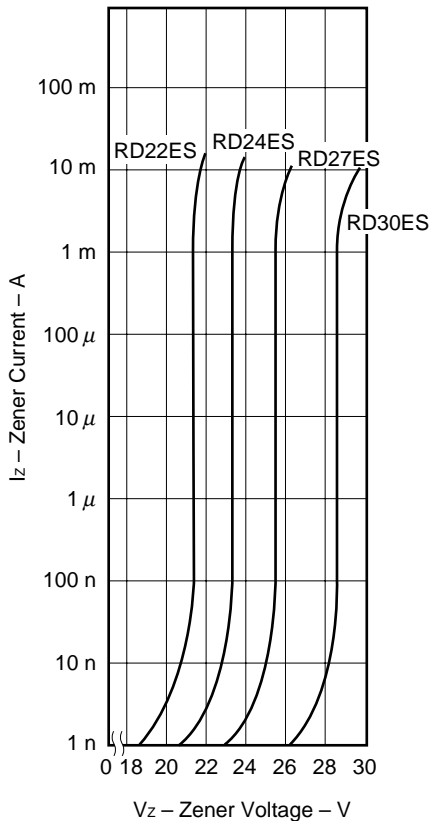
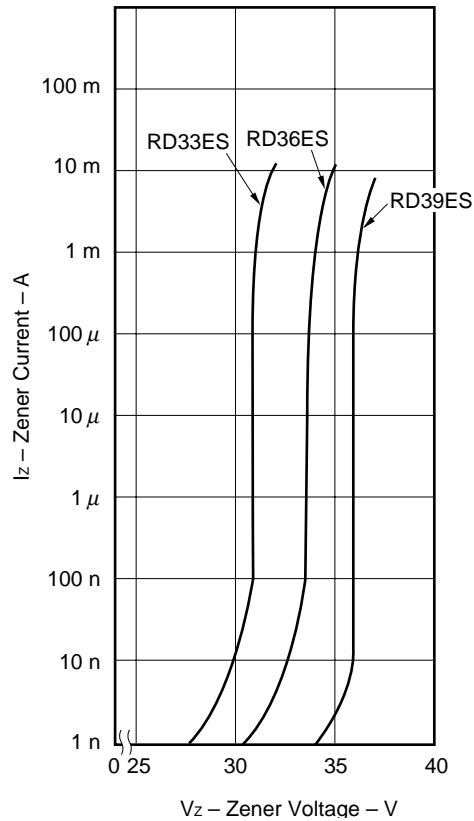
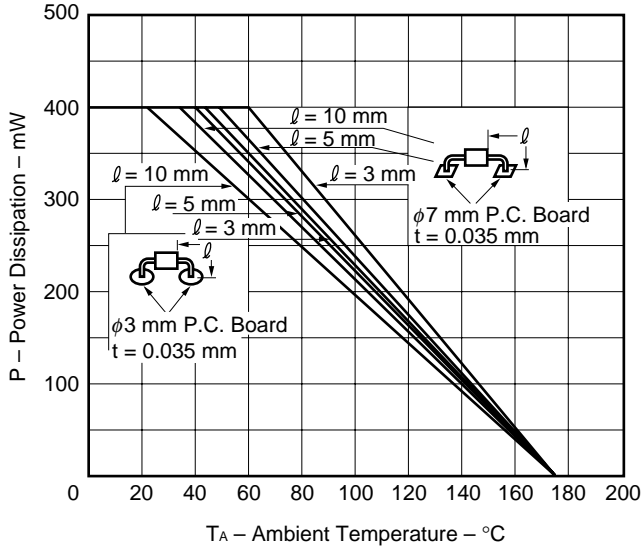


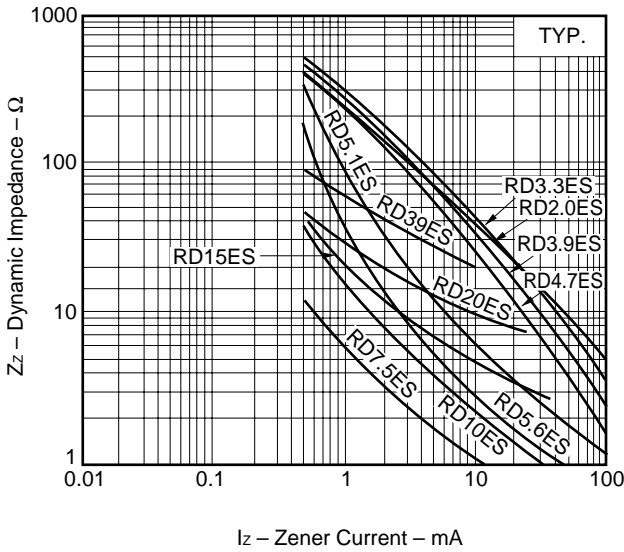
Fig. 5 ZENER CURRENT vs. ZENER VOLTAGE



**Fig. 6 POWER DISSIPATION vs. AMBIENT TEMPERATURE**

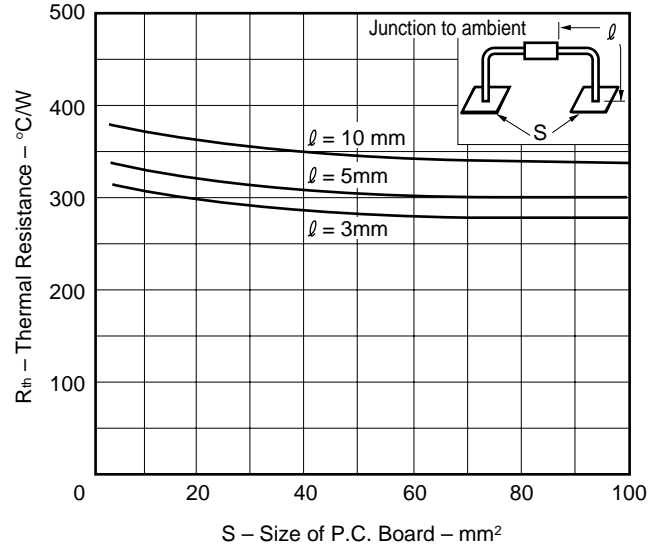


**Fig. 8 DYNAMIC IMPEDANCE vs. ZENER CURRENT**

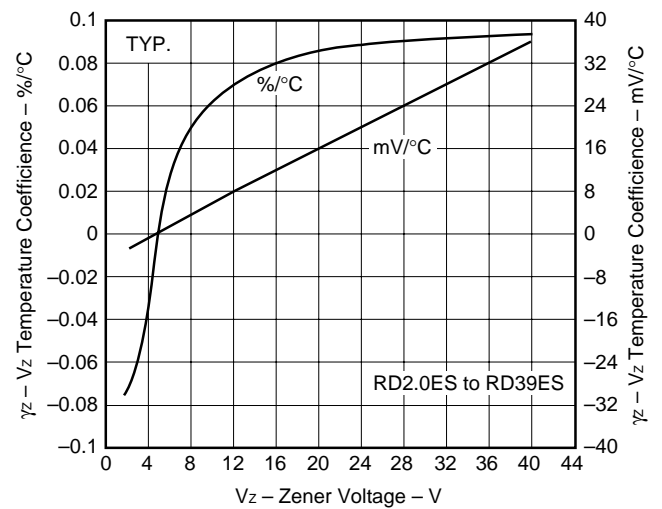


I<sub>z</sub> – Zener Current – mA

**Fig. 7 THERMAL RESISTANCE vs. SIZE OF P.C BOARD**



**Fig. 9 ZENER VOLTAGE TEMPERATURE COEFFICIENT vs. ZENER VOLTAGE**



**Fig. 10 SURGE REVERSE POWER RATINGS**

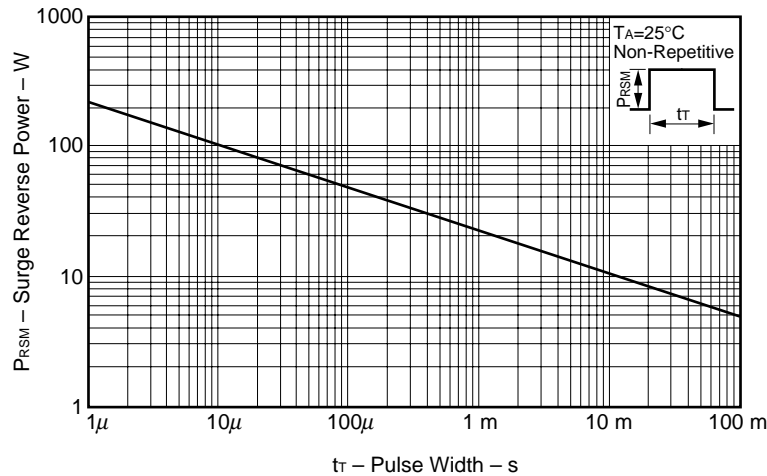
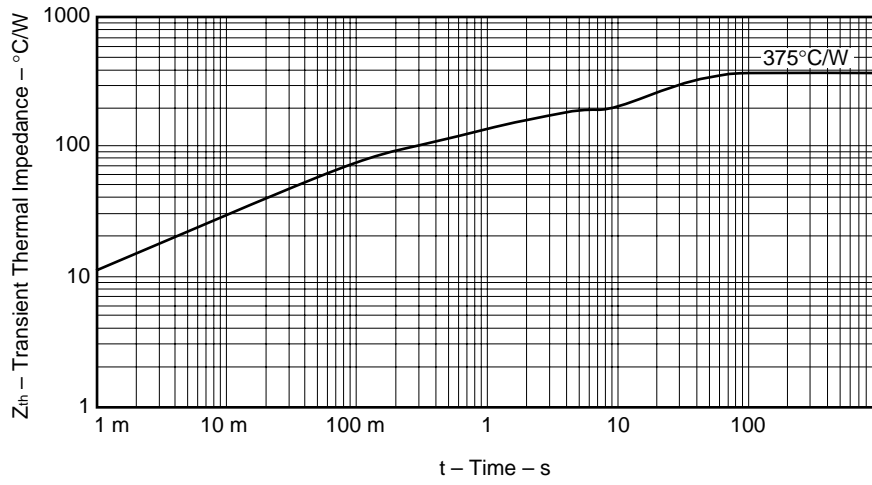


Fig. 11 TRANSIENT THERMAL IMPEDANCE CHARACTERISTIC



[MEMO]

[MEMO]

• **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**

- 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.
- Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- 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, customers 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: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "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 an NEC sales representative in advance.