# MMBV2101LT1 Series, MV2105, MV2101, MV2109, LV2209

**Preferred Device**

# Silicon Tuning Diodes

These devices are designed in popular plastic packages for the high volume requirements of FM Radio and TV tuning and AFC, general frequency control and tuning applications. They provide solid−state reliability in replacement of mechanical tuning methods. Also available in a Surface Mount Package up to 33 pF.

### Features

- High Q
- Controlled and Uniform Tuning Ratio
- Standard Capacitance Tolerance − 10%
- Complete Typical Design Curves
- Pb−Free Packages are Available

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Reverse Voltage | $V_R$ | 30 | Vdc |
| Forward Current | $I_F$ | 200 | mAdc |
| Forward Power Dissipation<br>@ $T_A$ = 25°C MMBV21xx<br>Derate above 25°C<br><br>@ $T_A$ = 25°C MV21xx<br>Derate above 25°C LV2209 | $P_D$ | <br>225<br>1.8<br><br>280<br>2.8 | <br>mW<br>mW/°C<br><br>mW<br>mW/°C |
| Junction Temperature | $T_J$ | +150 | °C |
| Storage Temperature Range | $T_{stg}$ | −55 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Reverse Breakdown Voltage ($I_R$ = 10 μAdc)<br>MMBV21xx, MV21xx<br>LV2209 | $V_{(BR)R}$ | <br>30<br>25 | <br>−<br>− | <br>−<br>− | Vdc |
| Reverse Voltage Leakage Current ($V_R$ = 25 Vdc, $T_A$ = 25°C) | $I_R$ | − | − | 0.1 | μAdc |
| Diode Capacitance Temperature Coefficient ($V_R$ = 4.0 Vdc, f = 1.0 MHz) | $TC_C$ | − | 280 | − | ppm/°C |

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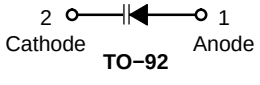
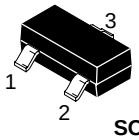
## 6.8−100 pF, 30 VOLTS VOLTAGE VARIABLE CAPACITANCE DIODES

**SOT−23**

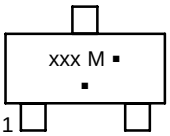



**TO−92**

### MARKING DIAGRAMS

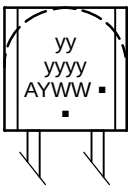



**SOT−23 (TO−236)**
**CASE 318−08**
**STYLE 8**




xxx = Specific Device Code
M = Date Code*
▪ = Pb−Free Package
(Note: Microdot may be in either location)
*Date Code orientation and/or overbar may vary depending upon manufacturing location.

**TO−92 (TO−226AC)**
**CASE 182**
**STYLE 1**




yyyyyy = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

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| Device | Marking | Package | Shipping† | $C_T$, Diode Capacitance $V_R$ = 4.0 Vdc, f = 1.0 MHz pF | | | Q, Figure of Merit $V_R$ = 4.0 Vdc, f = 50 MHz | TR, Tuning Ratio $C_2/C_{30}$ f = 1.0 MHz | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Nom | Max | Typ | Min | Typ | Max |
| MMBV2101LT1 | M4G | SOT−23 | 3,000 / Tape & Reel | 6.1 | 6.8 | 7.5 | 450 | 2.5 | 2.7 | 3.2 |
| MMBV2101LT1G | M4G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel | 6.1 | 6.8 | 7.5 | 450 | 2.5 | 2.7 | 3.2 |
| MMBV2101L | M4G | SOT−23 | Bulk (Note 1) | 6.1 | 6.8 | 7.5 | 450 | 2.5 | 2.7 | 3.2 |
| MV2101 | MV2101 | TO−92 | 1,000 per Box | 6.1 | 6.8 | 7.5 | 450 | 2.5 | 2.7 | 3.2 |
| MV2101G | MV2101 | TO−92 (Pb−Free) | 1,000 per Box | 6.1 | 6.8 | 7.5 | 450 | 2.5 | 2.7 | 3.2 |
| MMBV2103LT1 | 4H | SOT−23 | 3,000 / Tape & Reel | 9.0 | 10 | 11 | 400 | 2.5 | 2.9 | 3.2 |
| MMBV2105LT1 | 4U | SOT−23 | 3,000 / Tape & Reel | 13.5 | 15 | 16.5 | 400 | 2.5 | 2.9 | 3.2 |
| MMBV2105LT1G | 4U | SOT−23 (Pb−Free) | 3,000 / Tape & Reel | 13.5 | 15 | 16.5 | 400 | 2.5 | 2.9 | 3.2 |
| MMBV2105L | 4U | SOT−23 | Bulk (Note 1) | 13.5 | 15 | 16.5 | 400 | 2.5 | 2.9 | 3.2 |
| MV2105 | MV2105 | TO−92 | 1,000 per Box | 13.5 | 15 | 16.5 | 400 | 2.5 | 2.9 | 3.2 |
| MV2105G | MV2105 | TO−92 (Pb−Free) | 1,000 per Box | 13.5 | 15 | 16.5 | 400 | 2.5 | 2.9 | 3.2 |
| MMBV2107LT1 | 4W | SOT−23 | 3,000 / Tape & Reel | 19.8 | 22 | 24.2 | 350 | 2.5 | 2.9 | 3.2 |
| MMBV2107LT1G | 4W | SOT−23 (Pb−Free) | 3,000 / Tape & Reel | 19.8 | 22 | 24.2 | 350 | 2.5 | 2.9 | 3.2 |
| MMBV2107L | 4W | SOT−23 | Bulk (Note 1) | 19.8 | 22 | 24.2 | 350 | 2.5 | 2.9 | 3.2 |
| MMBV2108LT1 | 4X | SOT−23 | 3,000 / Tape & Reel | 24.3 | 27 | 29.7 | 300 | 2.5 | 3.0 | 3.2 |
| MMBV2108LT1G | 4X | SOT−23 (Pb−Free) | 3,000 / Tape & Reel | 24.3 | 27 | 29.7 | 300 | 2.5 | 3.0 | 3.2 |
| LV2209 | LV2209 | TO−92 | 1,000 per Box | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |
| MMBV2109LT1 | 4J | SOT−23 | 3,000 / Tape & Reel | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |
| MMBV2109LT1G | 4J | SOT−23 (Pb−Free) | 3,000 / Tape & Reel | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |
| MMBV2109L | 4J | SOT−23 | Bulk (Note 1) | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |
| MV2109 | MV2109 | TO−92 | 1,000 per Box | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |
| MV2109G | MV2109 | TO−92 (Pb−Free) | 1,000 per Box | 29.7 | 33 | 36.3 | 200 | 2.5 | 3.0 | 3.2 |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

1. **MMBV2101LT1, MMBV2105LT1, MMBV2107LT1 thru MMBV2109LT1,** are also available in bulk. Use the device title and drop the "T1" suffix when ordering any of these devices in bulk.

## PARAMETER TEST METHODS

### 1. $C_T$, DIODE CAPACITANCE

($C_T = C_C + C_J$). $C_T$ is measured at 1.0 MHz using a capacitance bridge (Boonton Electronics Model 75A or equivalent).

### 2. TR, TUNING RATIO

TR is the ratio of $C_T$ measured at 2.0 Vdc divided by $C_T$ measured at 30 Vdc.

### 3. Q, FIGURE OF MERIT

Q is calculated by taking the G and C readings of an admittance bridge at the specified frequency and substituting in the following equations:

$$Q = \frac{2\pi fC}{G}$$

(Boonton Electronics Model 33AS8 or equivalent). Use Lead Length $\approx$ 1/16″.

### 4. $TC_C$, DIODE CAPACITANCE TEMPERATURE COEFFICIENT

$TC_C$ is guaranteed by comparing $C_T$ at $V_R$ = 4.0 Vdc, f = 1.0 MHz, $T_A$ = −65°C with $C_T$ at $V_R$ = 4.0 Vdc, f = 1.0 MHz, $T_A$ = +85°C in the following equation, which defines $TC_C$:

$$TC_C = \left|\frac{C_T(+85°C) - C_T(-65°C)}{85 + 65}\right| \cdot \frac{10^6}{C_T(25°C)}$$

Accuracy limited by measurement of $C_T$ to ±0.1 pF.

## TYPICAL DEVICE CHARACTERISTICS

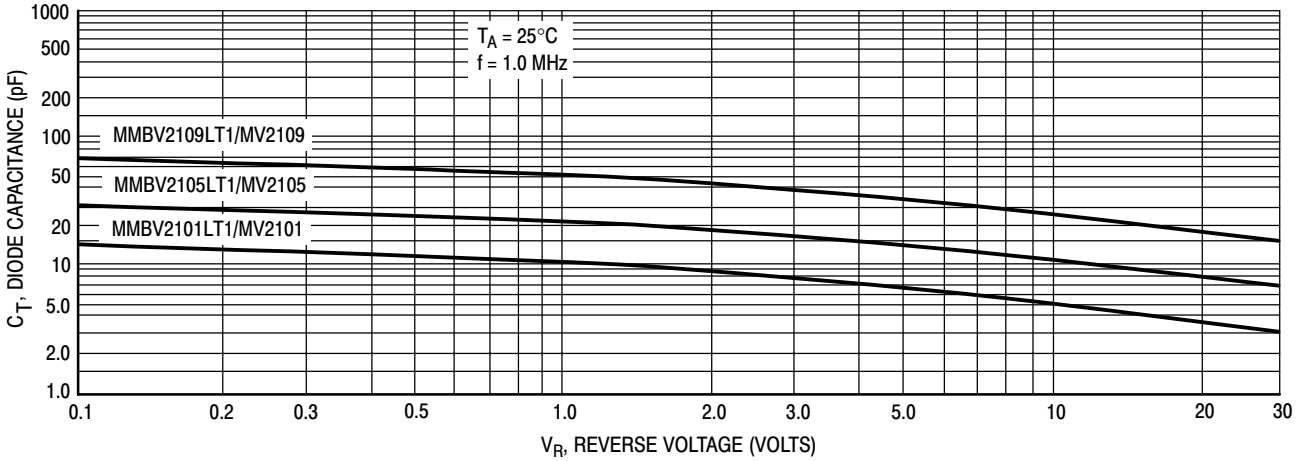



**Figure 1. Diode Capacitance versus Reverse Voltage**

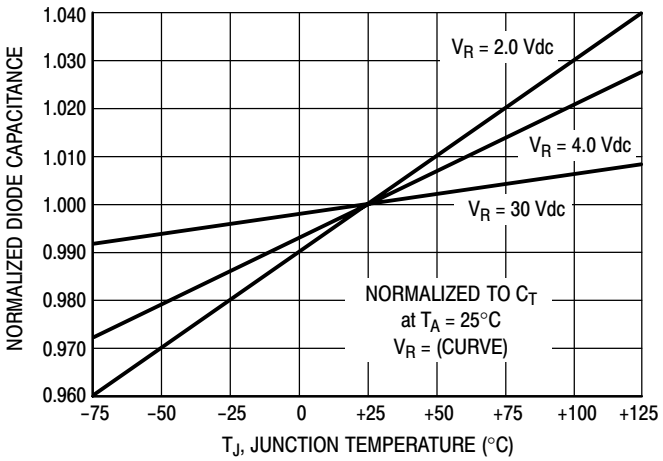



**Figure 2. Normalized Diode Capacitance versus Junction Temperature**

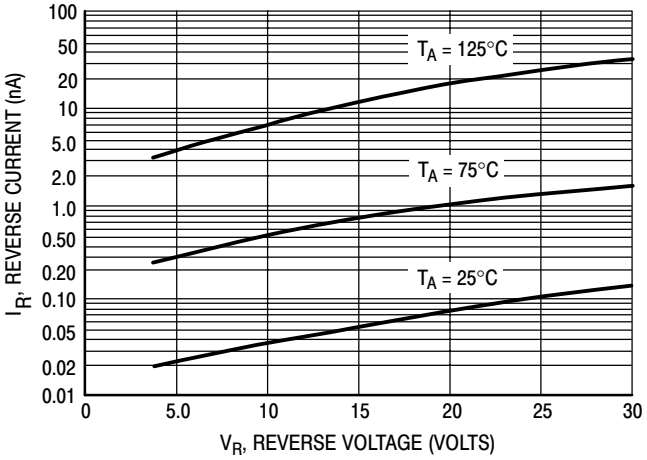



**Figure 3. Reverse Current versus Reverse Bias Voltage**

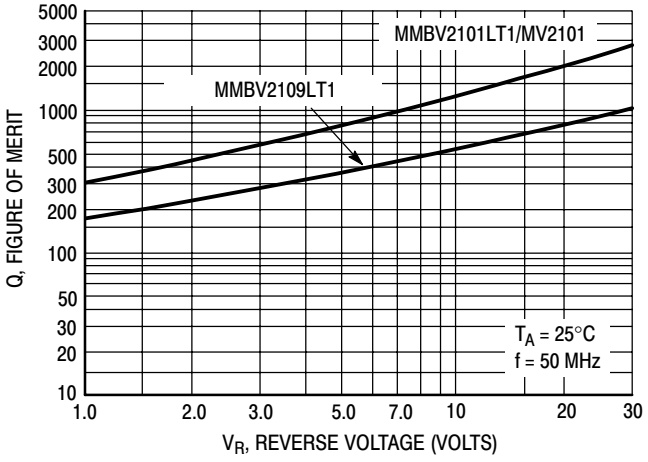



**Figure 4. Figure of Merit versus Reverse Voltage**

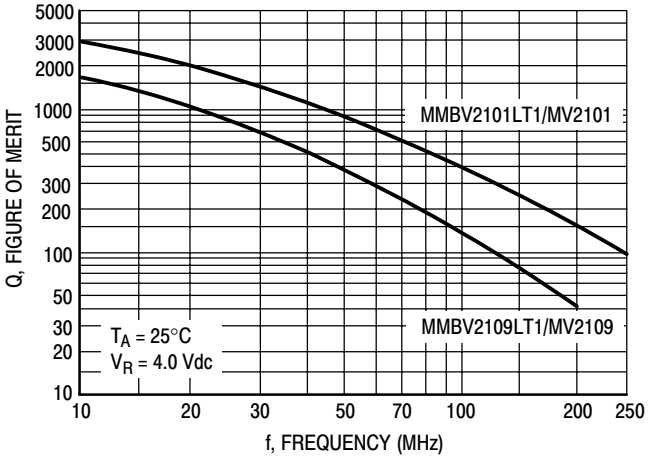
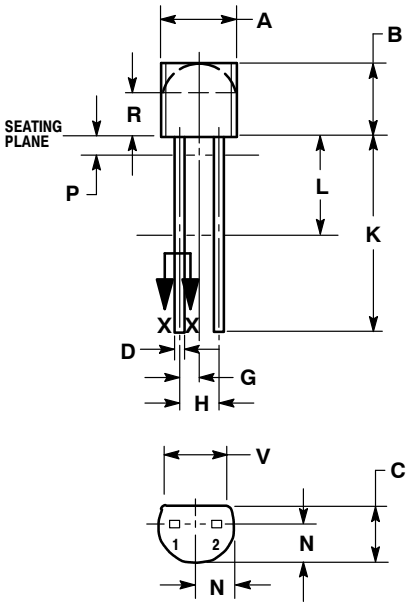


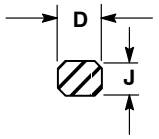

**Figure 5. Figure of Merit versus Frequency**

# TO−92 (TO−226)
# CASE 182−06
# ISSUE L

**DATE 04/18/1998**

**SCALE 1:1**




**SECTION X−X**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND ZONE R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.175 | 0.205 | 4.45 | 5.21 |
| B | 0.170 | 0.210 | 4.32 | 5.33 |
| C | 0.125 | 0.165 | 3.18 | 4.19 |
| D | 0.016 | 0.021 | 0.407 | 0.533 |
| G | 0.050 BSC | | 1.27 BSC | |
| H | 0.100 BSC | | 2.54 BSC | |
| J | 0.014 | 0.016 | 0.36 | 0.41 |
| K | 0.500 | --- | 12.70 | --- |
| L | 0.250 | --- | 6.35 | --- |
| N | 0.080 | 0.105 | 2.03 | 2.66 |
| P | --- | 0.050 | --- | 1.27 |
| R | 0.115 | --- | 2.93 | --- |
| V | 0.135 | --- | 3.43 | --- |

STYLE 1:
PIN 1. ANODE
2. CATHODE

STYLE 2:
PIN 1. CATHODE
2. ANODE

STYLE 3:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2

STYLE 4:
CANCELLED

STYLE 5:
PIN 1. INPUT
2. OUTPUT

| | | | |
|---|---|---|---|
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| **DESCRIPTION:** | **TO−92 (TO−226)** | | **PAGE 1 OF 1** |

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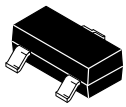
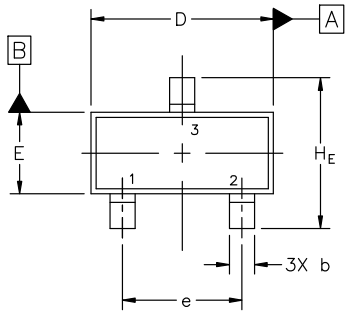


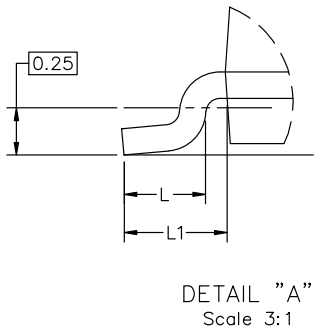
**SCALE 4:1**

**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**
CASE 318
ISSUE AU

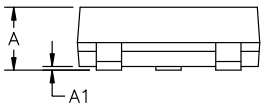
DATE 14 AUG 2024



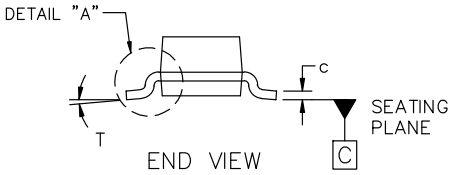

TOP VIEW




DETAIL "A"
Scale 3:1




SIDE VIEW

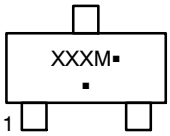



END VIEW

| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.37 | 0.44 | 0.50 |
| c | 0.08 | 0.14 | 0.20 |
| D | 2.80 | 2.90 | 3.04 |
| E | 1.20 | 1.30 | 1.40 |
| e | 1.78 | 1.90 | 2.04 |
| L | 0.30 | 0.43 | 0.55 |
| L1 | 0.35 | 0.54 | 0.69 |
| $H_E$ | 2.10 | 2.40 | 2.64 |
| T | 0° | −−− | 10° |

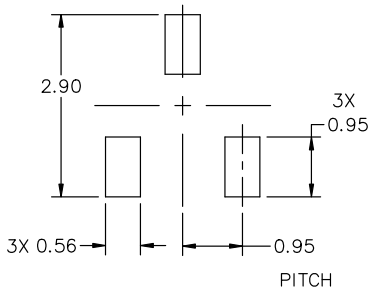
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

**GENERIC**
**MARKING DIAGRAM***




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.




RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**



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**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**
CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE




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