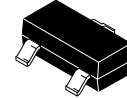


Low Noise Transistors

NPN Silicon

MMBT5088L, MMBT5089L



SOT-23 (TO-236)
 CASE 318
 STYLE 6

Features

- S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

MAXIMUM RATINGS

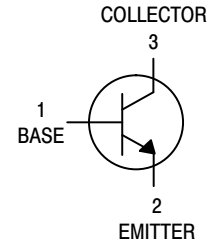
| Rating | Symbol | Value | Unit |
|---|-----------|----------|------|
| Collector - Emitter Voltage MMBT5088L MMBT5089L | V_{CEO} | 30 25 | Vdc |
| Collector - Base Voltage MMBT5088L MMBT5089L | V_{CBO} | 35 30 | Vdc |
| Emitter - Base Voltage | V_{EBO} | 4.5 | Vdc |
| Collector Current - Continuous | I_C | 50 | mAdc |

THERMAL CHARACTERISTICS

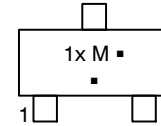
| Characteristic | Symbol | Max | Unit |
|---|-----------------|-------------|----------------------------|
| Total Device Dissipation FR-5 Board, (Note 1) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 225 1.8 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation Alumina Substrate, (Note 2) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 300 2.4 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 417 | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.



MARKING DIAGRAM



1x = Device Code
 x = Q for MMBT5088L
 SMMBT5088L
 x = R for MMBT5089L
 SMMBT5089L

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.

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|--------------------------------|---------------------|-------------------------|
| MMBT5088LT1G, SMMBT5088LT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |
| NSVMMBT5088LT3G | SOT-23 (Pb-Free) | 10,000 / Tape & Reel |
| MMBT5089LT1G, SMMBT5089LT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |

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

MMBT5088L, MMBT5089L

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|------------------------|---------------|------------|--------------|------|
| OFF CHARACTERISTICS | | | | | |
| Collector – Emitter Breakdown Voltage ($I_C = 1.0\text{ mA}$, $I_B = 0$) | MMBT5088L MMBT5089L | $V_{(BR)CEO}$ | 30 25 | – – | Vdc |
| Collector – Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{A}$, $I_E = 0$) | MMBT5088L MMBT5089L | $V_{(BR)CBO}$ | 35 30 | – – | Vdc |
| Collector Cutoff Current ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 15\text{ Vdc}$, $I_E = 0$) | MMBT5088L MMBT5089L | I_{CBO} | – – | 50 50 | nAdc |
| Emitter Cutoff Current ($V_{EB(off)} = 3.0\text{ Vdc}$, $I_C = 0$) ($V_{EB(off)} = 4.5\text{ Vdc}$, $I_C = 0$) | MMBT5088L MMBT5089L | I_{EBO} | – – | 50 100 | nAdc |
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$) | MMBT5088L MMBT5089L | h_{FE} | 300 400 | 900 1200 | – |
| ($I_C = 1.0\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$) | MMBT5088L MMBT5089L | | 350 450 | – – | |
| ($I_C = 10\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$) | MMBT5088L MMBT5089L | | 300 400 | – – | |
| Collector – Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) | | $V_{CE(sat)}$ | – | 0.5 | Vdc |
| Base – Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) | | $V_{BE(sat)}$ | – | 0.8 | Vdc |
| SMALL – SIGNAL CHARACTERISTICS | | | | | |
| Current – Gain — Bandwidth Product ($I_C = 500\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$, $f = 20\text{ MHz}$) | | f_T | 50 | – | MHz |
| Collector – Base Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$ emitter guarded) | | C_{cb} | – | 4.0 | pF |
| Emitter – Base Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$ collector guarded) | | C_{eb} | – | 10 | pF |
| Small Signal Current Gain ($I_C = 1.0\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$, $f = 1.0\text{ kHz}$) | MMBT5088L MMBT5089L | h_{fe} | 350 450 | 1400 1800 | – |
| Noise Figure ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$, $R_S = 10\text{ k}\Omega$, $f = 1.0\text{ kHz}$) | MMBT5088L MMBT5089L | NF | – – | 3.0 2.0 | dB |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

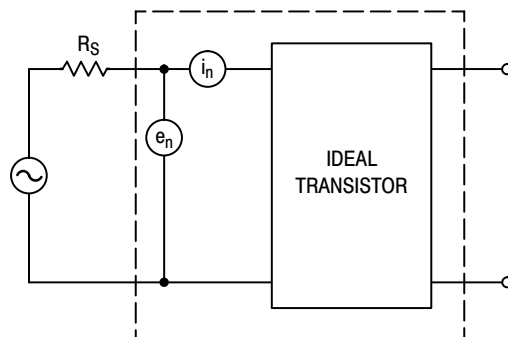


Figure 1. Transistor Noise Model

MMBT5088L, MMBT5089L

NOISE CHARACTERISTICS

($V_{CE} = 5.0 \text{ Vdc}$, $T_A = 25^\circ\text{C}$)

NOISE VOLTAGE

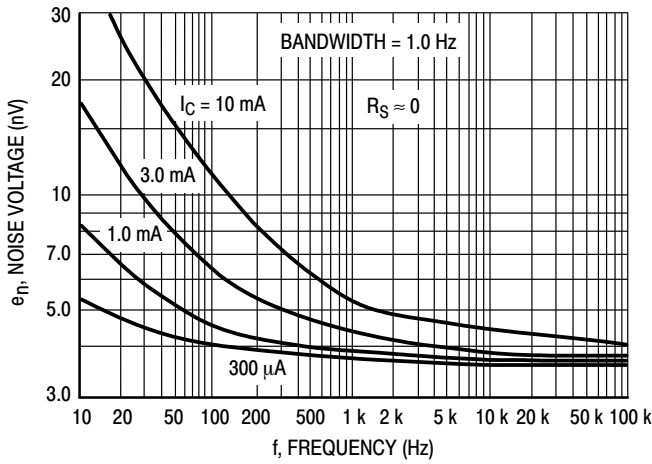


Figure 2. Effects of Frequency

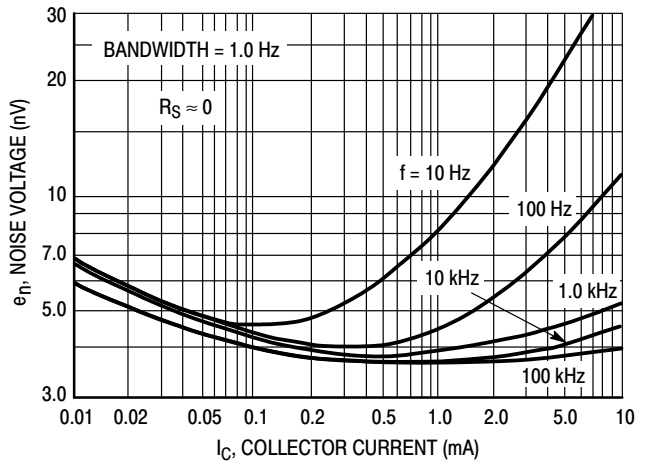


Figure 3. Effects of Collector Current

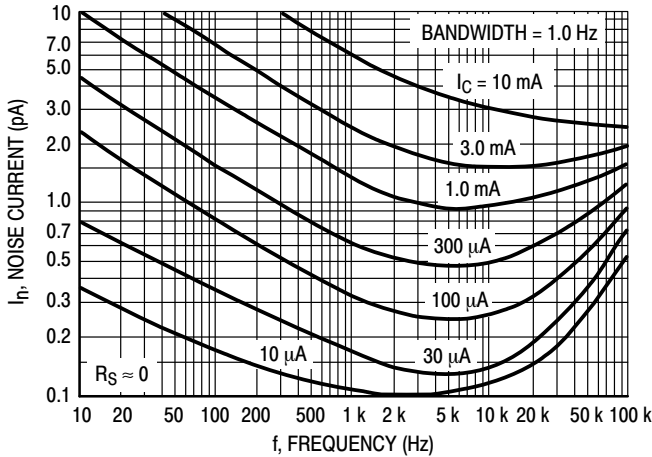


Figure 4. Noise Current

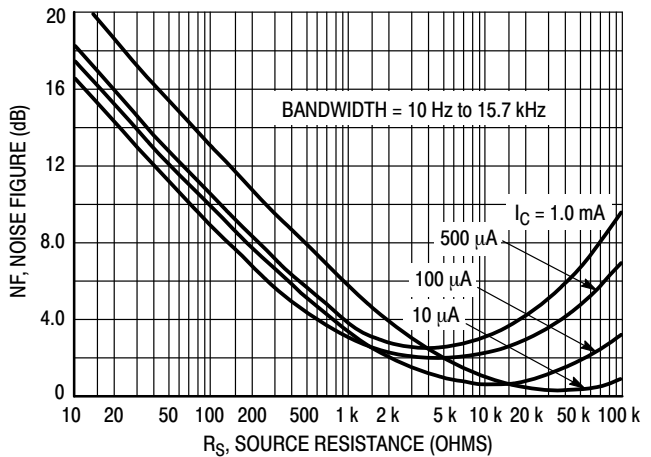


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

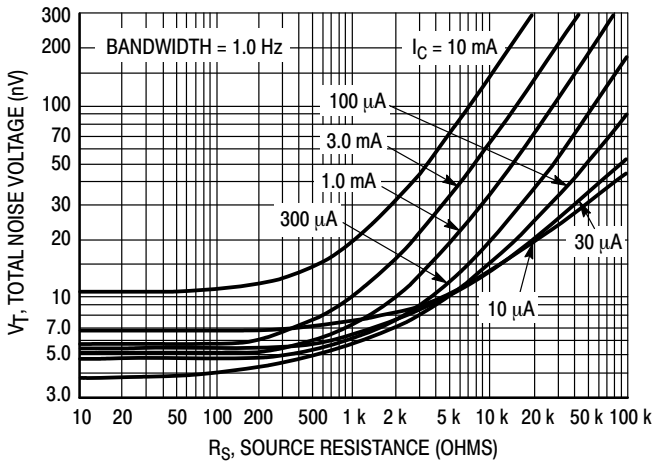


Figure 6. Total Noise Voltage

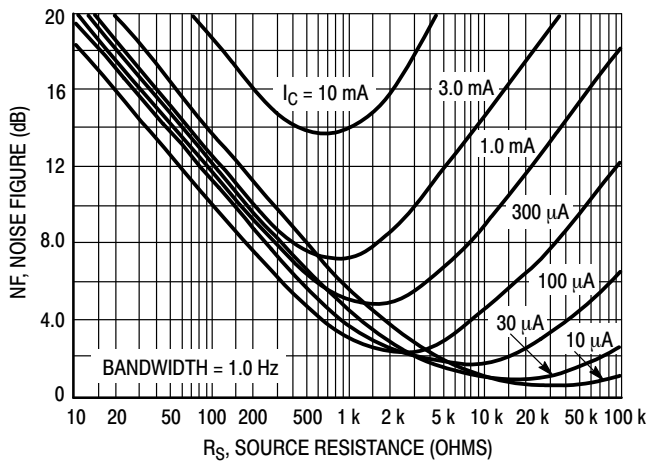


Figure 7. Noise Figure

MMBT5088L, MMBT5089L

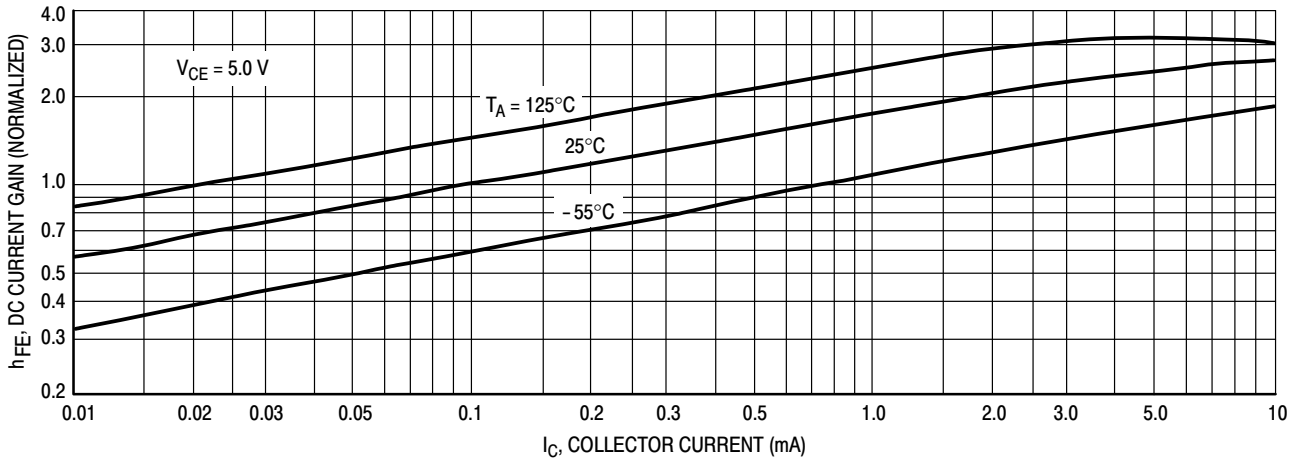


Figure 8. DC Current Gain

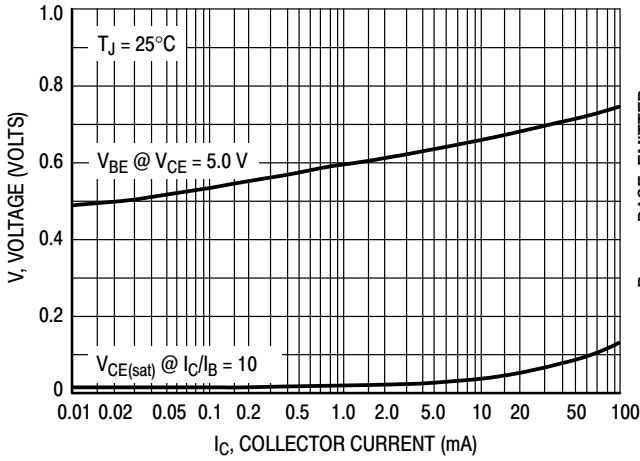


Figure 11. "On" Voltages

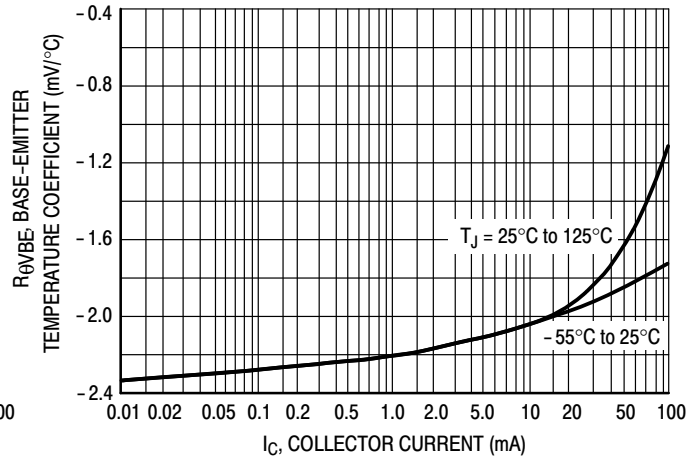


Figure 9. Temperature Coefficients

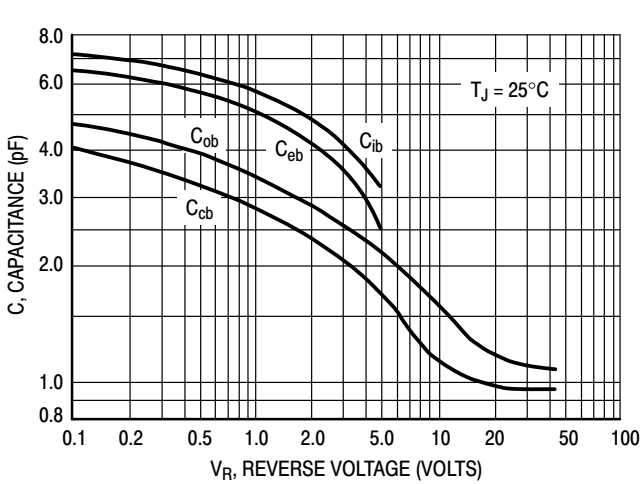


Figure 12. Capacitance

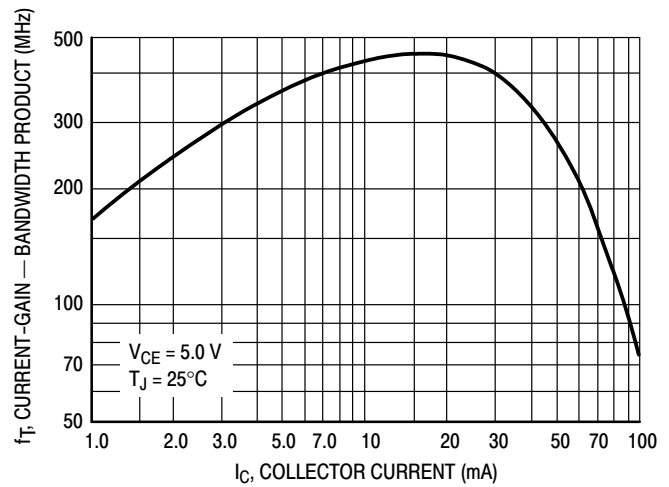


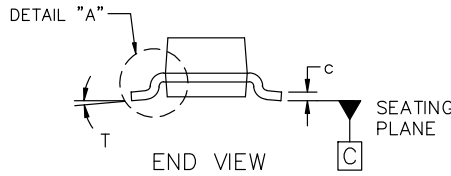
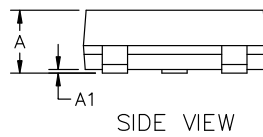
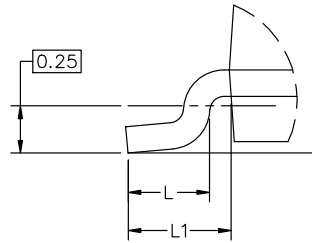
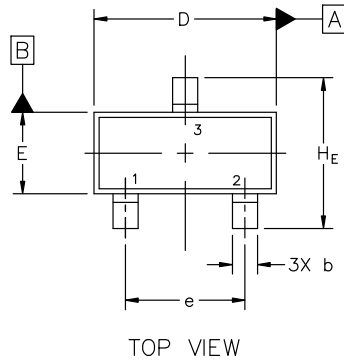
Figure 10. Current-Gain — Bandwidth Product



SCALE 4:1

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

DATE 14 AUG 2024

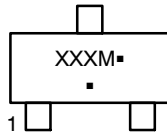


| MILLIMETERS | | | |
|-------------|------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.37 | 0.44 | 0.50 |
| c | 0.08 | 0.14 | 0.20 |
| D | 2.80 | 2.90 | 3.04 |
| E | 1.20 | 1.30 | 1.40 |
| e | 1.78 | 1.90 | 2.04 |
| L | 0.30 | 0.43 | 0.55 |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

NOTES:

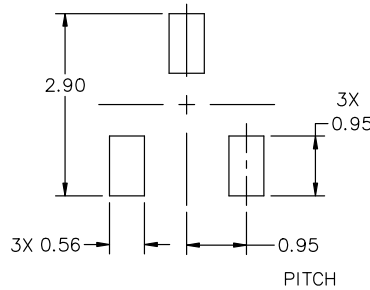
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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.



* 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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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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