

MMBT2369L, MMBT2369AL

Switching Transistors

NPN Silicon

Features

- S 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 | V_{CEO} | 15 | Vdc |
| Collector-Emitter Voltage | V_{CES} | 40 | Vdc |
| Collector-Base Voltage | V_{CBO} | 40 | Vdc |
| Emitter-Base Voltage | V_{EBO} | 4.5 | Vdc |
| Collector Current - Continuous | I_C | 200 | 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.

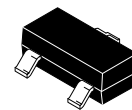
1. FR-5 = $1.0 \times 0.75 \times 0.062$ in.
2. Alumina = $0.4 \times 0.3 \times 0.024$ in. 99.5% alumina.

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



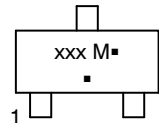
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SOT-23
CASE 318
STYLE 6

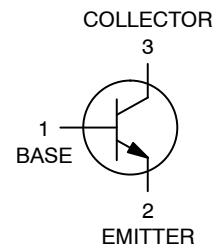
MARKING DIAGRAM



xxx = M1J or 1JA
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† |
|----------------|---------------------|-------------------------|
| MMBT2369LT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |
| MMBT2369LT3G | SOT-23 (Pb-Free) | 10,000 / Tape & Reel |
| SMMBT2369LT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |
| MMBT2369ALT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |
| SMMBT2369ALT1G | 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.

MMBT2369L, MMBT2369AL

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|----------------------|-----|-----|-----------|------------------|
| OFF CHARACTERISTICS | | | | | |
| Collector – Emitter Breakdown Voltage (Note 3) (I _C = 10 mA _{dc} , I _B = 0) | V _{(BR)CEO} | 15 | – | – | V _{dc} |
| Collector – Emitter Breakdown Voltage (I _C = 10 μA _{dc} , V _{BE} = 0) | V _{(BR)CES} | 40 | – | – | V _{dc} |
| Collector – Base Breakdown Voltage (I _C = 10 μA _{dc} , I _E = 0) | V _{(BR)CBO} | 40 | – | – | V _{dc} |
| Emitter – Base Breakdown Voltage (I _E = 10 μA _{dc} , I _C = 0) | V _{(BR)EBO} | 4.5 | – | – | V _{dc} |
| Collector Cutoff Current (V _{CB} = 20 V _{dc} , I _E = 0) (V _{CB} = 20 V _{dc} , I _E = 0, T _A = 150°C) | I _{CBO} | – | – | 0.4 30 | μA _{dc} |
| Collector Cutoff Current MMBT2369A (V _{CE} = 20 V _{dc} , V _{BE} = 0) | I _{CES} | – | – | 0.4 | μA _{dc} |

ON CHARACTERISTICS

| | | | | | |
|---|----------------------|---------------------------------------|---------------------------------|--------------------------------------|-----------------|
| DC Current Gain (Note 3) MMBT2369 (I _C = 10 mA _{dc} , V _{CE} = 1.0 V _{dc}) MMBT2369A (I _C = 10 mA _{dc} , V _{CE} = 1.0 V _{dc}) MMBT2369A (I _C = 10 mA _{dc} , V _{CE} = 0.35 V _{dc}) MMBT2369A (I _C = 10 mA _{dc} , V _{CE} = 0.35 V _{dc} , T _A = –55°C) MMBT2369A (I _C = 30 mA _{dc} , V _{CE} = 0.4 V _{dc}) MMBT2369 (I _C = 100 mA _{dc} , V _{CE} = 2.0 V _{dc}) MMBT2369A (I _C = 100 mA _{dc} , V _{CE} = 1.0 V _{dc}) | h _{FE} | 40 – 40 20 30 20 20 | – – – – – – – | 120 120 – – – – – | – |
| Collector – Emitter Saturation Voltage (Note 3) MMBT2369 (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc}) MMBT2369A (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc}) MMBT2369A (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc} , T _A = +125°C) MMBT2369A (I _C = 30 mA _{dc} , I _B = 3.0 mA _{dc}) MMBT2369A (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) | V _{CE(sat)} | – – – – – | – – – – – | 0.25 0.20 0.30 0.25 0.50 | V _{dc} |
| Base – Emitter Saturation Voltage (Note 3) MMBT2369/A (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc}) MMBT2369A (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc} , T _A = –55°C) MMBT2369A (I _C = 30 mA _{dc} , I _B = 3.0 mA _{dc}) MMBT2369A (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) | V _{BE(sat)} | 0.7 – – – | – – – – | 0.85 1.02 1.15 1.60 | V _{dc} |

SMALL-SIGNAL CHARACTERISTICS

| | | | | | |
|--|------------------|-----|---|-----|----|
| Output Capacitance (V _{CB} = 5.0 V _{dc} , I _E = 0, f = 1.0 MHz) | C _{obo} | – | – | 4.0 | pF |
| Small Signal Current Gain (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , f = 100 MHz) | h _{fe} | 5.0 | – | – | – |

SWITCHING CHARACTERISTICS

| | | | | | |
|--|------------------|---|-----|----|----|
| Storage Time (I _{B1} = I _{B2} = I _C = 10 mA _{dc}) | t _s | – | 5.0 | 13 | ns |
| Turn-On Time (V _{CC} = 3.0 V _{dc} , I _C = 10 mA _{dc} , I _{B1} = 3.0 mA _{dc}) | t _{on} | – | 8.0 | 12 | ns |
| Turn-Off Time (V _{CC} = 3.0 V _{dc} , I _C = 10 mA _{dc} , I _{B1} = 3.0 mA _{dc} , I _{B2} = 1.5 mA _{dc}) | t _{off} | – | 10 | 18 | ns |

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.

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

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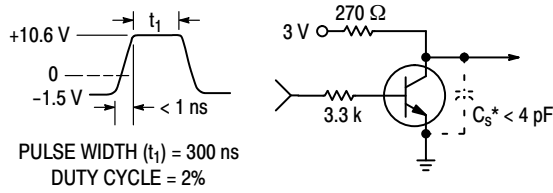


Figure 1. t_{on} Circuit – 10 mA

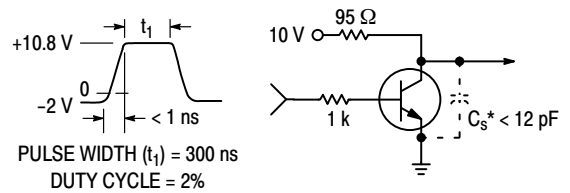


Figure 2. t_{on} Circuit – 100 mA

*Total shunt capacitance of test jig and connectors.

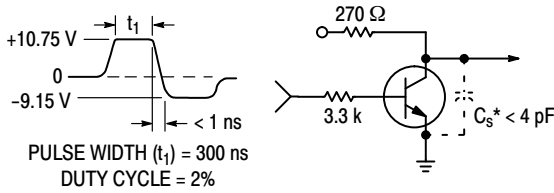


Figure 3. t_{off} Circuit – 10 mA

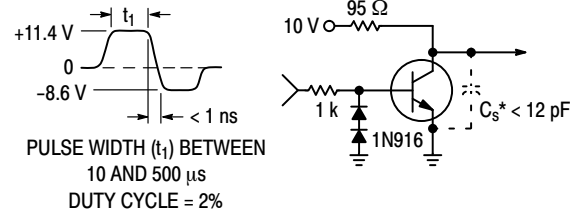
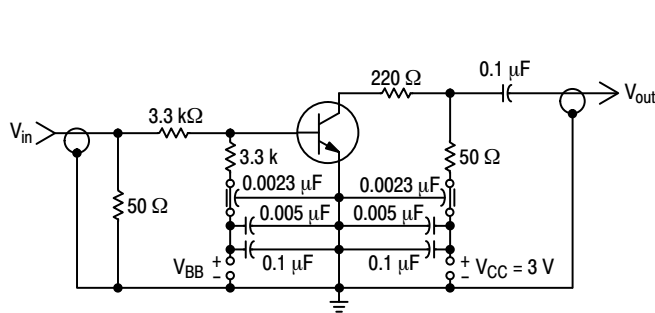
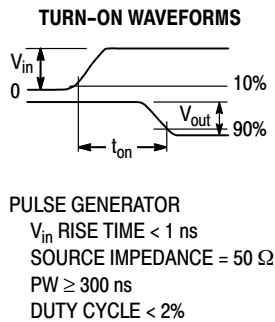


Figure 4. t_{off} Circuit – 100 mA

*Total shunt capacitance of test jig and connectors.



TO OSCILLOSCOPE
INPUT IMPEDANCE = 50 Ω
RISE TIME = 1 ns

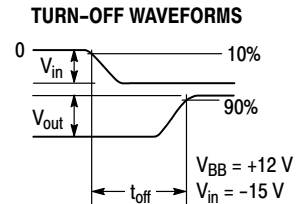


Figure 5. Turn-On and Turn-Off Time Test Circuit

MMBT2369L, MMBT2369AL

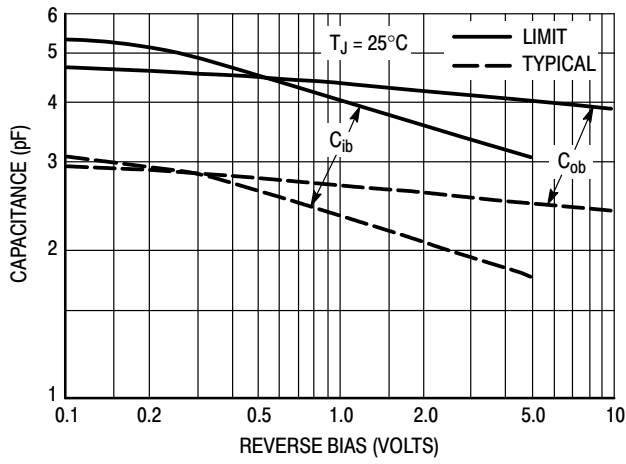


Figure 6. Junction Capacitance Variations

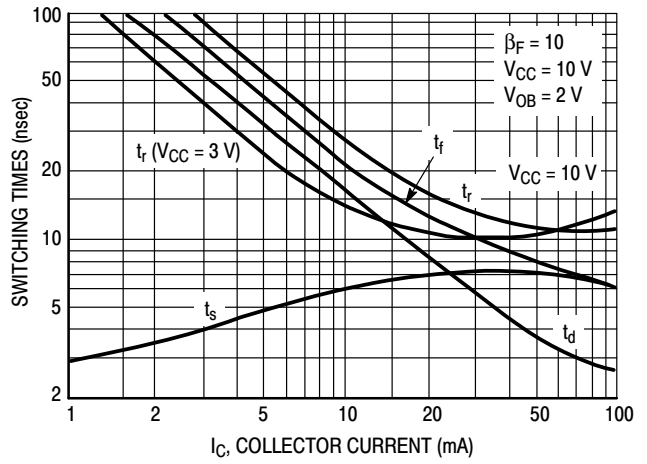


Figure 7. Typical Switching Times

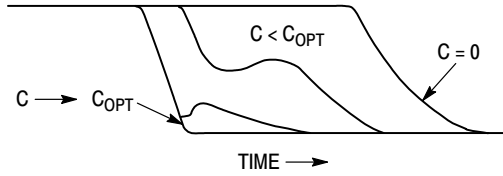


Figure 8. Turn-Off Waveform

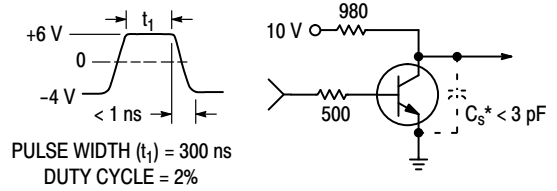


Figure 9. Storage Time Equivalent Test Circuit

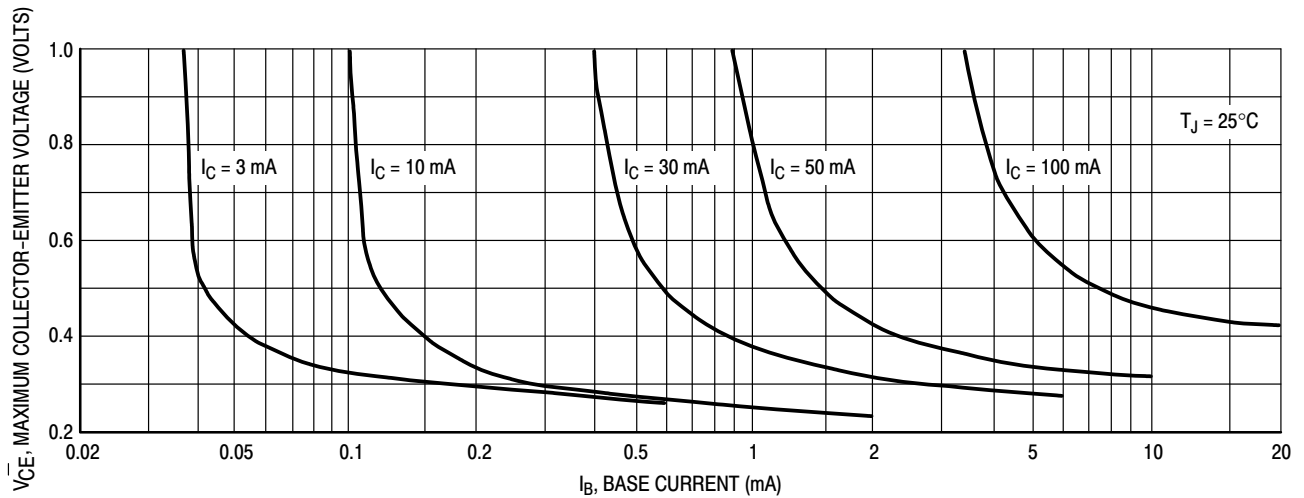


Figure 10. Maximum Collector Saturation Voltage Characteristics

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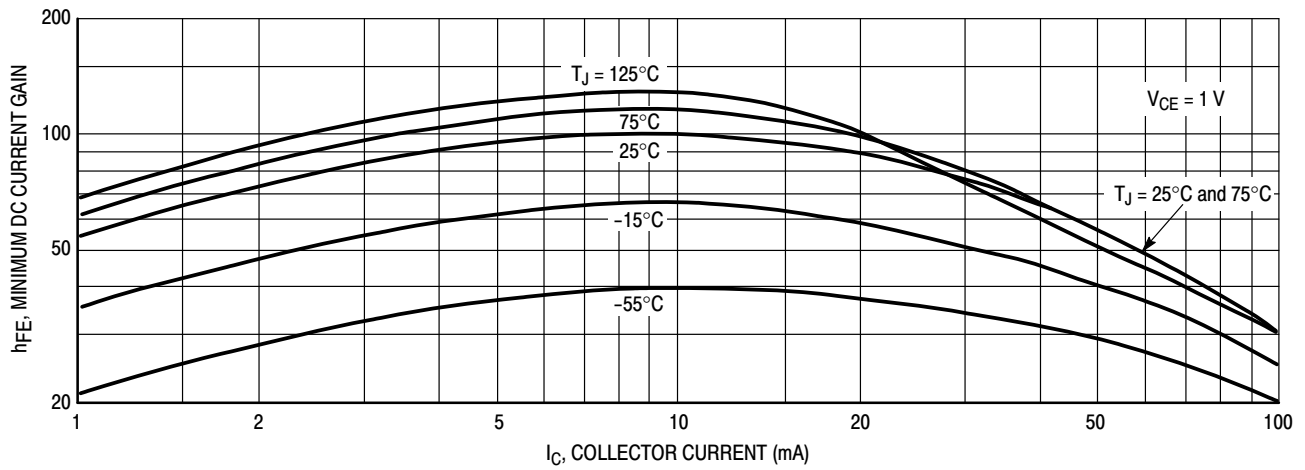


Figure 11. Minimum Current Gain Characteristics

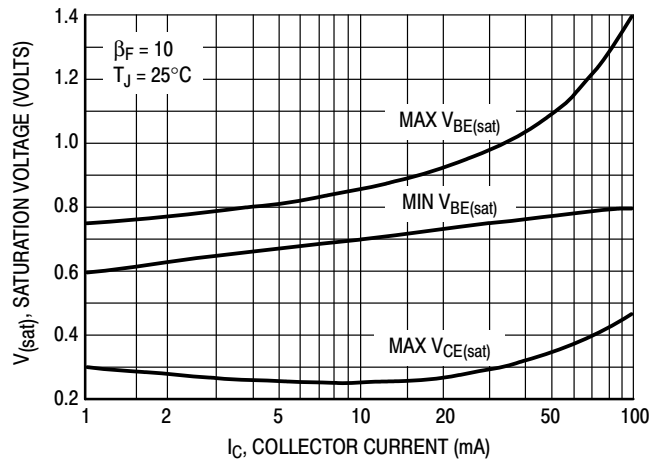


Figure 12. Saturation Voltage Limits

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS



SOT-23 (TO-236)
CASE 318
ISSUE AT

DATE 01 MAR 2023

SCALE 4:1



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: 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.

| DIM | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|--------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| E | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| H _E | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

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 ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



SOT-23 (TO-236)
CASE 318
ISSUE AT

DATE 01 MAR 2023

- | | | | | | |
|---|---|---|---|---|---|
| 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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