

Switching Transistors

NPN Silicon

MMBT2369L, MMBT2369AL

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

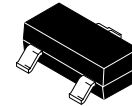
Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V_{CEO}	15	Vdc
Collector – Emitter Voltage	V_{CES}	40	Vdc
Collector – Base Voltage	V_{CBO}	40	Vdc
Emitter – Base Voltage	V_{EBO}	4.5	Vdc
Collector Current – Continuous	I_C	200	mAdc

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	$^\circ\text{C/W}$
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	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

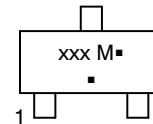
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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



SOT-23
CASE 318
STYLE 6

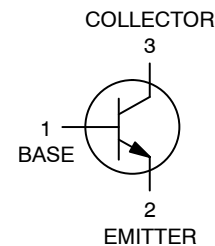
MARKING DIAGRAM



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†
MMBT2369ALT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
SMMBT2369ALT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel

DISCONTINUED (Note 1)

MMBT2369LT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
MMBT2369LT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
SMMBT2369LT1G	SOT-23 (Pb-Free)	3000 / 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.

- DISCONTINUED:** This device is not recommended for new design. Please contact your onsemi representative for information. The most current information on this device may be available on www.onsemi.com.

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

MMBT2369L, MMBT2369AL

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (Note 3) ($I_C = 10\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	15	–	–	Vdc
Collector – Emitter Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $V_{BE} = 0$)	$V_{(BR)CES}$	40	–	–	Vdc
Collector – Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	40	–	–	Vdc
Emitter – Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	4.5	–	–	Vdc
Collector Cutoff Current ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$, $T_A = 150^\circ\text{C}$)	I_{CBO}	– –	– –	0.4 30	μA
Collector Cutoff Current MMBT2369A ($V_{CE} = 20\text{ Vdc}$, $V_{BE} = 0$)	I_{CES}	–	–	0.4	μA

ON CHARACTERISTICS

DC Current Gain (Note 3) MMBT2369 ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) MMBT2369A ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) MMBT2369A ($I_C = 10\text{ mA}$, $V_{CE} = 0.35\text{ Vdc}$) MMBT2369A ($I_C = 10\text{ mA}$, $V_{CE} = 0.35\text{ Vdc}$, $T_A = -55^\circ\text{C}$) MMBT2369A ($I_C = 30\text{ mA}$, $V_{CE} = 0.4\text{ Vdc}$) MMBT2369 ($I_C = 100\text{ mA}$, $V_{CE} = 2.0\text{ Vdc}$) MMBT2369A ($I_C = 100\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	h_{FE}	40 – 40 20 30 20 20	– – – – – – –	120 120 – – – – –	–
Collector – Emitter Saturation Voltage (Note 3) MMBT2369 ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) MMBT2369A ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) MMBT2369A ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = +125^\circ\text{C}$) MMBT2369A ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$) MMBT2369A ($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$)	$V_{CE(sat)}$	– – – – –	– – – – –	0.25 0.20 0.30 0.25 0.50	Vdc
Base – Emitter Saturation Voltage (Note 3) MMBT2369/A ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) MMBT2369A ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = -55^\circ\text{C}$) MMBT2369A ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$) MMBT2369A ($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$)	$V_{BE(sat)}$	0.7 – – –	– – – –	0.85 1.02 1.15 1.60	Vdc

SMALL-SIGNAL CHARACTERISTICS

Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{obo}	–	–	4.0	pF
Small Signal Current Gain ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 100\text{ MHz}$)	h_{fe}	5.0	–	–	–

SWITCHING CHARACTERISTICS

Storage Time ($I_{B1} = I_{B2} = I_C = 10\text{ mA}$)	t_s	–	5.0	13	ns
Turn-On Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$)	t_{on}	–	8.0	12	ns
Turn-Off Time ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $I_{B2} = 1.5\text{ mA}$)	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 $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

MMBT2369L, MMBT2369AL

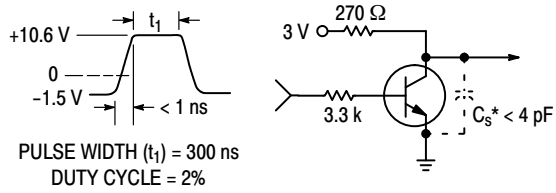


Figure 1. t_{on} Circuit – 10 mA

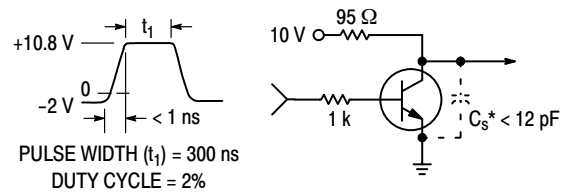


Figure 2. t_{on} Circuit – 100 mA

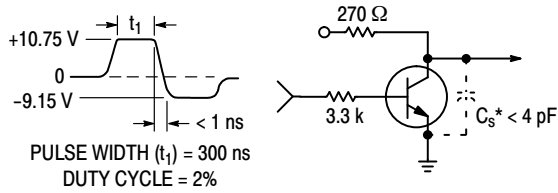


Figure 3. t_{off} Circuit – 10 mA

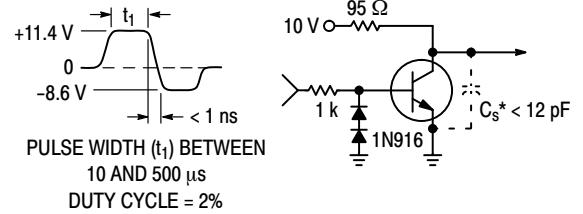
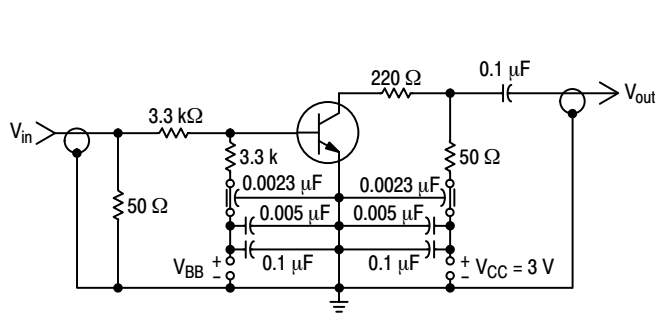
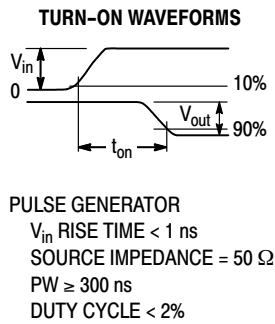


Figure 4. t_{off} Circuit – 100 mA



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

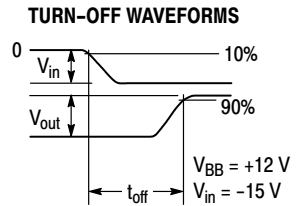


Figure 5. Turn-On and Turn-Off Time Test Circuit

MMBT2369L, MMBT2369AL

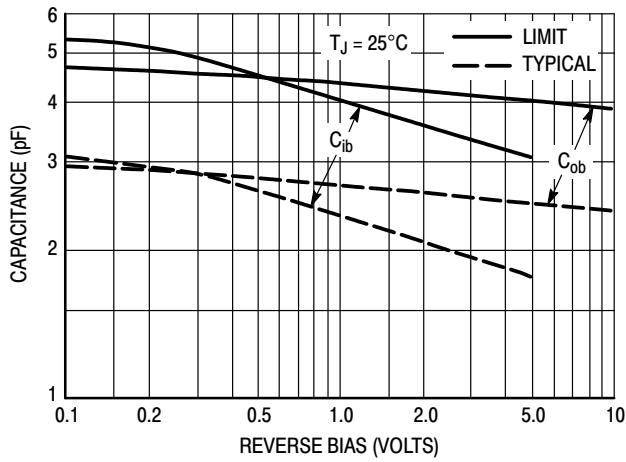


Figure 6. Junction Capacitance Variations

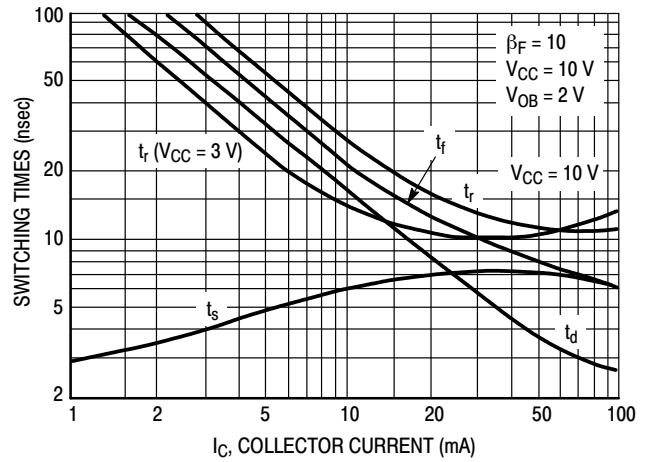


Figure 7. Typical Switching Times

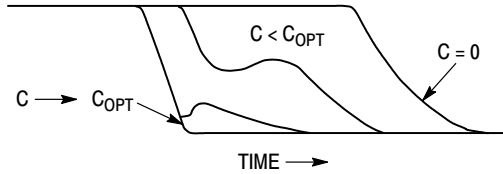


Figure 8. Turn-Off Waveform

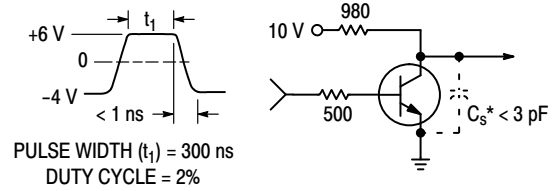


Figure 9. Storage Time Equivalent Test Circuit

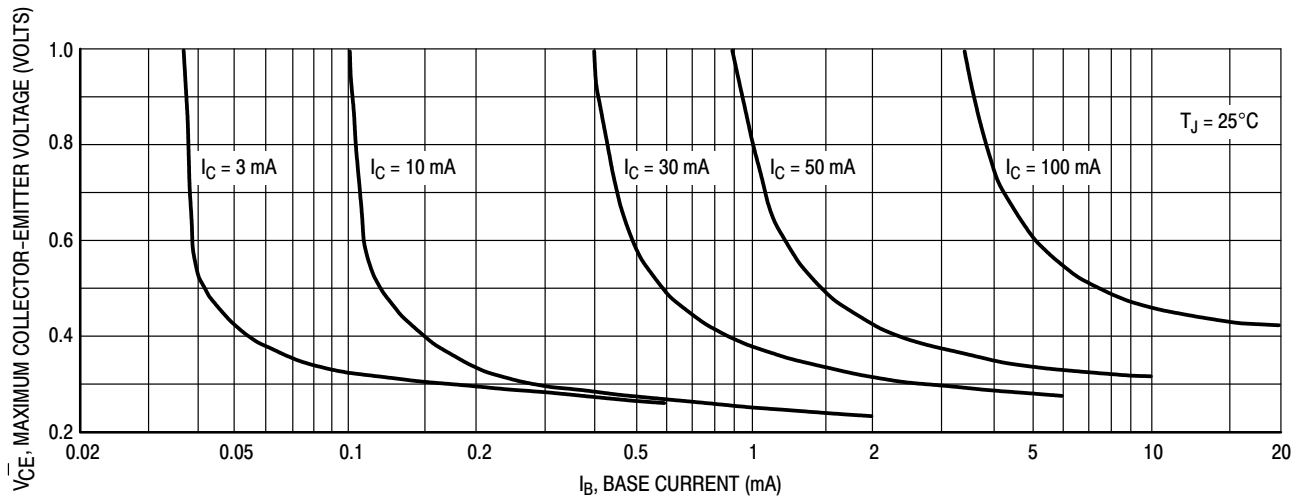


Figure 10. Maximum Collector Saturation Voltage Characteristics

MMBT2369L, MMBT2369AL

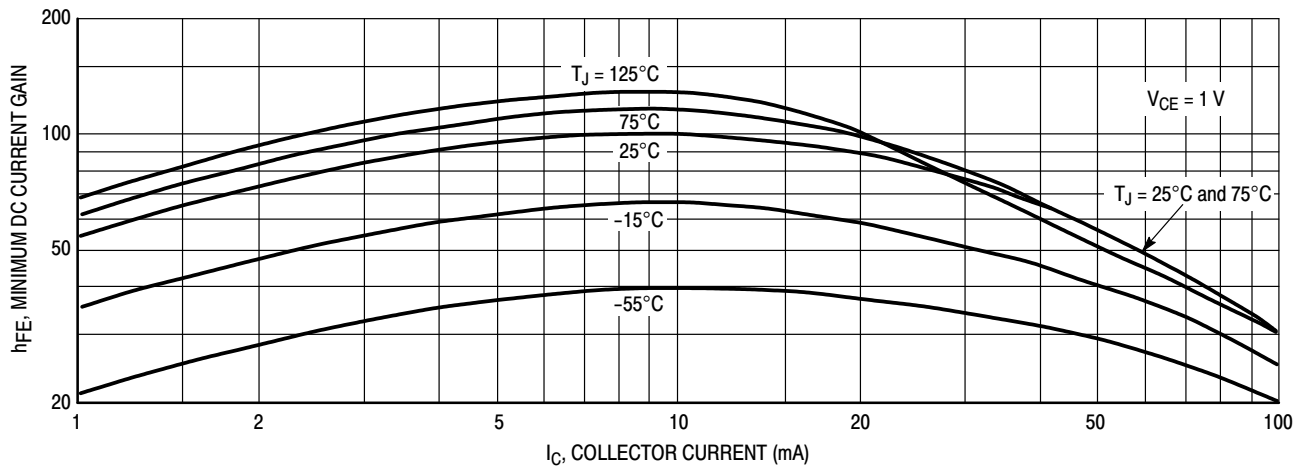


Figure 11. Minimum Current Gain Characteristics

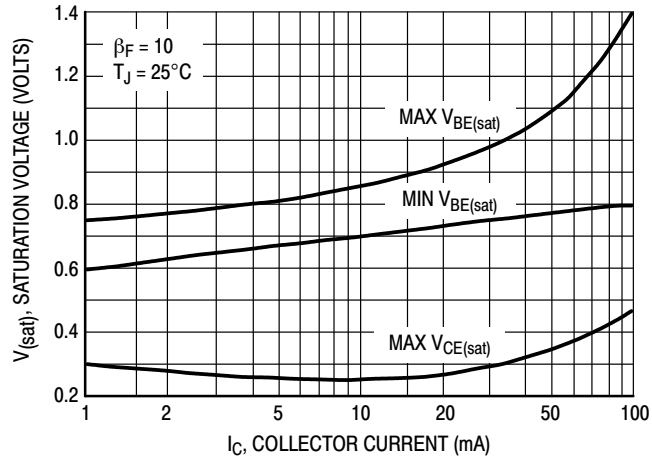
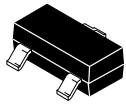


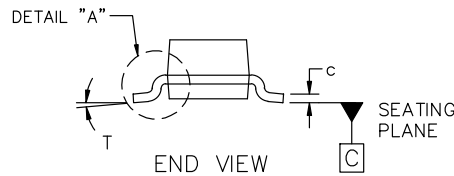
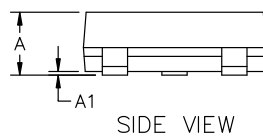
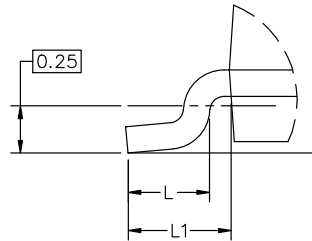
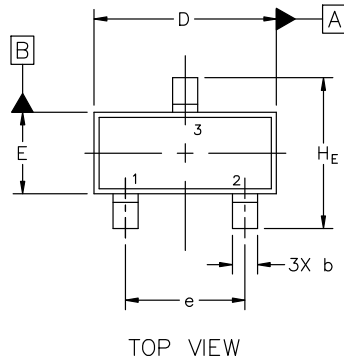
Figure 12. Saturation Voltage Limits



SCALE 4:1

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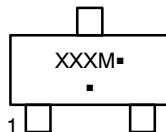


MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

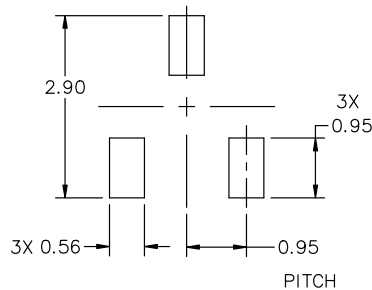
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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.



RECOMMENDED
MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

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DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 1 OF 2

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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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