# BAS19L, BAS20L, BAS21L, BAS21DW5

# High Voltage Switching Diode

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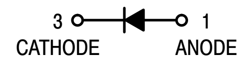
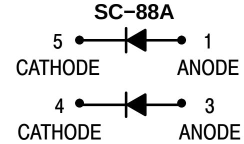
## HIGH VOLTAGE SWITCHING DIODE

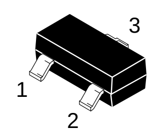
**SOT−23**

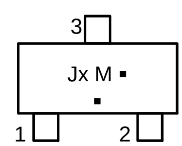



**SC−88A**

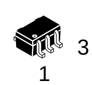


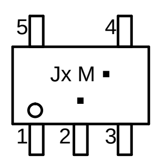

### MARKING DIAGRAMS




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




**SC−88A (SOT−353)**
**CASE 419A**

| | | |
|---|---|---|
| x | = P, R, or S | |
| P | = BAS19L | |
| R | = BAS20L | |
| S | = BAS21L or BAS21DW5 | |
| M | = Date Code | |
| ▪ | = Pb−Free Package | |

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon the manufacturing location.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

### Features

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

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Continuous Reverse Voltage<br>BAS19<br>BAS20<br>BAS21 | $V_R$ | <br>120<br>200<br>250 | Vdc |
| Repetitive Peak Reverse Voltage<br>BAS19<br>BAS20<br>BAS21 | $V_{RRM}$ | <br>120<br>200<br>250 | Vdc |
| Continuous Forward Current | $I_F$ | 200 | mAdc |
| Peak Forward Surge Current (1/2 Cycle, Sine Wave, 60 Hz) | $I_{FSM}$ | 2 | A |
| Repetitive Peak Forward Current (Pulse Train: $T_{ON}$ = 1 s, $T_{OFF}$ = 0.5 s) | $I_{FRM}$ | 0.6 | A |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| Power Dissipation (Note 1) | $P_D$ | 385 | mW |
| Electrostatic Discharge | ESD | HM < 500<br>MM < 400 | V<br>V |

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. Mounted on FR−5 Board = 1.0 x 0.75 x 0.062 in.

### THERMAL CHARACTERISTICS (SOT−23)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board (Note 2) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 225<br>1.8 | mW<br>mW/°C |
| Thermal Resistance Junction−to−Ambient (SOT−23) | $R_{\theta JA}$ | 556 | °C/W |
| Total Device Dissipation Alumina Substrate (Note 3) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 300<br>2.4 | mW<br>mW/°C |
| Thermal Resistance Junction−to−Ambient | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

### THERMAL CHARACTERISTICS (SC−88A)

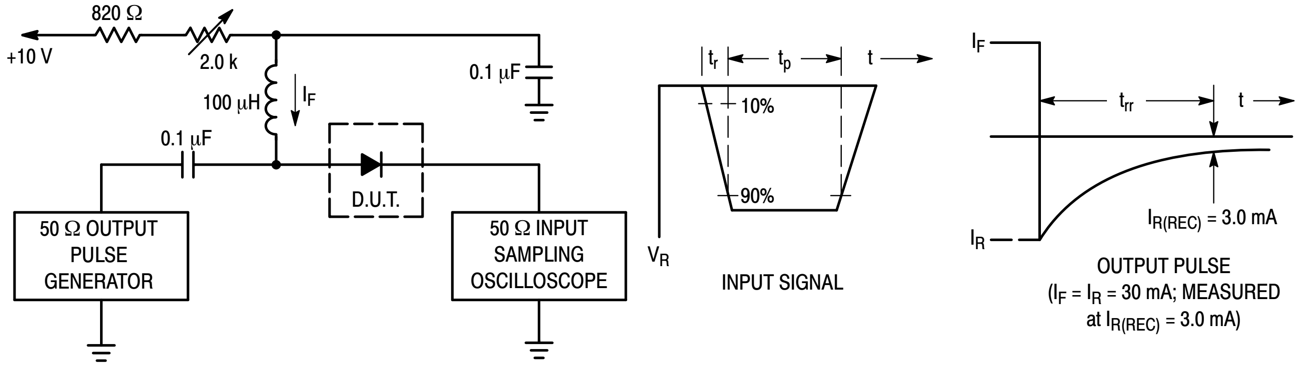
| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Power Dissipation (Note 4) | $P_D$ | 385 | mW |
| Thermal Resistance − Junction−to−Ambient<br>Derate Above 25°C | $R_{\theta JA}$ | 328<br>3.0 | °C/W<br>mW/°C |
| Maximum Junction Temperature | $T_{Jmax}$ | 150 | °C |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

2. FR−5 = 1.0 × 0.75 × 0.062 in.
3. Alumina = 0.4 × 0.3 × 0.024 in. 99.5% alumina.
4. Mounted on FR−5 Board = 1.0 x 0.75 x 0.062 in.

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

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Reverse Voltage Leakage Current | | $I_R$ | | | μAdc |
| ($V_R$ = 100 Vdc) | BAS19 | | − | 0.1 | |
| ($V_R$ = 150 Vdc) | BAS20 | | − | 0.1 | |
| ($V_R$ = 200 Vdc) | BAS21 | | − | 0.1 | |
| ($V_R$ = 100 Vdc, $T_J$ = 150°C) | BAS19 | | − | 100 | |
| ($V_R$ = 150 Vdc, $T_J$ = 150°C) | BAS20 | | − | 100 | |
| ($V_R$ = 200 Vdc, $T_J$ = 150°C) | BAS21 | | − | 100 | |
| Reverse Breakdown Voltage | | $V_{(BR)}$ | | | Vdc |
| ($I_{BR}$ = 100 μAdc) | BAS19 | | 120 | − | |
| ($I_{BR}$ = 100 μAdc) | BAS20 | | 200 | − | |
| ($I_{BR}$ = 100 μAdc) | BAS21 | | 250 | − | |
| Forward Voltage | | $V_F$ | | | Vdc |
| ($I_F$ = 100 mAdc) | | | − | 1.0 | |
| ($I_F$ = 200 mAdc) | | | − | 1.25 | |
| Diode Capacitance ($V_R$ = 0, f = 1.0 MHz) | | $C_D$ | − | 5.0 | pF |
| Reverse Recovery Time ($I_F$ = $I_R$ = 30 mAdc, $I_{R(REC)}$ = 3.0 mAdc, $R_L$ = 100) | | $t_{rr}$ | − | 50 | 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.




Notes: 1. A 2.0 kΩ variable resistor adjusted for a Forward Current ($I_F$) of 30 mA.
2. Input pulse is adjusted so $I_{R(peak)}$ is equal to 30 mA.
3. $t_p \gg t_{rr}$

**Figure 1. Recovery Time Equivalent Test Circuit**

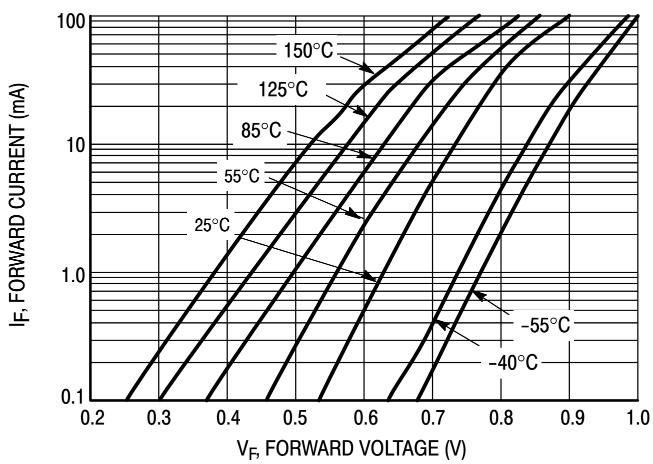



**Figure 2. $V_F$ vs. $I_F$**

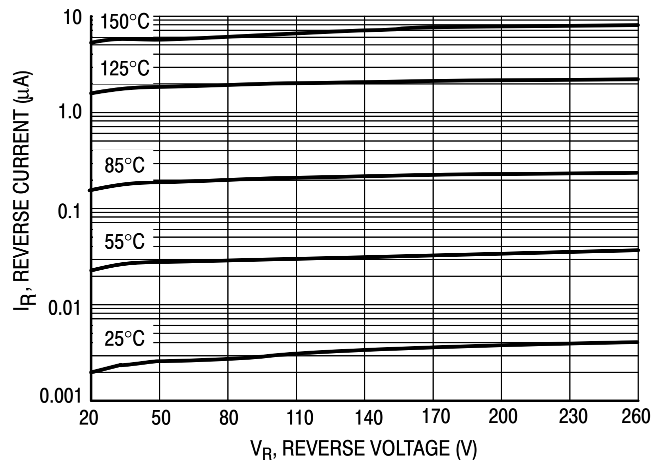



**Figure 3. $I_R$ vs. $V_R$**

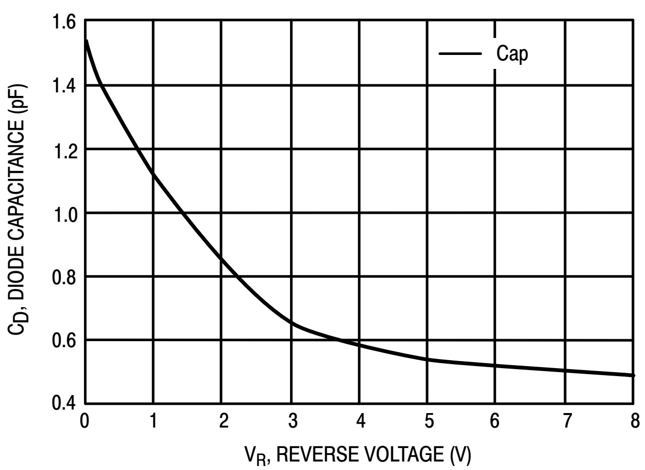



**Figure 4. Capacitance**

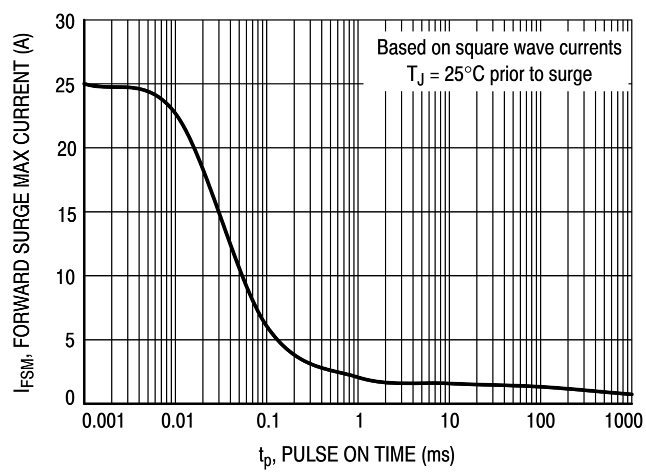
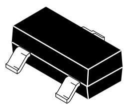



**Figure 5. Forward Surge Current**

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| BAS19LT1G | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| BAS19LT3G | SOT−23 (Pb−Free) | 10000 / Tape & Reel |
| NSVBAS19LT1G* | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| BAS20LT1G | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| BAS20LT3G | SOT−23 (Pb−Free) | 10000 / Tape & Reel |
| NSVBAS20LT3G* | SOT−23 (Pb−Free) | 10000 / Tape & Reel |
| SBAS20LT1G* | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| BAS21LT1G | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| SBAS21LT1G* | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| BAS21LT3G | SOT−23 (Pb−Free) | 10000 / Tape & Reel |
| SBAS21LT3G* | SOT−23 (Pb−Free) | 10000 / Tape & Reel |
| BAS21DW5T1G | SC−88A (Pb−Free) | 3000 / Tape & Reel |
| SBAS21DW5T1G* | SC−88A (Pb−Free) | 3000 / Tape & Reel |
| SBAS21DW5T3G* | SC−88A (Pb−Free) | 10000 / Tape & Reel |

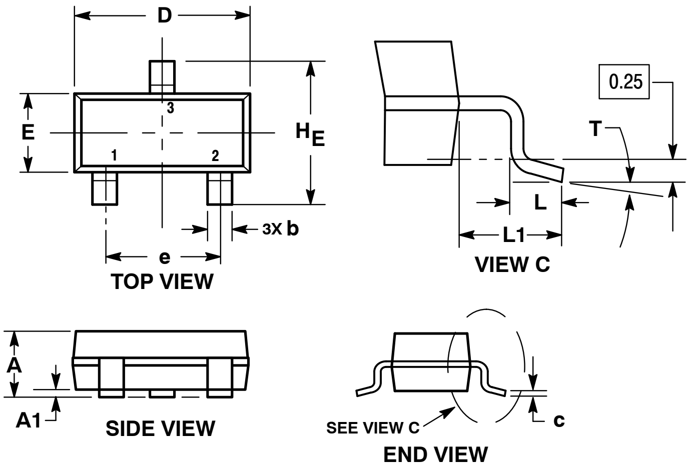
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*S and NSV Prefixes for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.



SCALE 4:1

**SOT−23 (TO−236)**
CASE 318−08
ISSUE AS

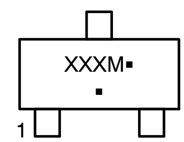
DATE 30 JAN 2018




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.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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° |

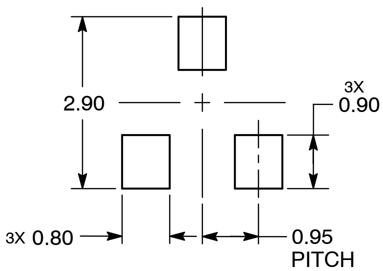
**GENERIC**
**MARKING DIAGRAM***




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.

**RECOMMENDED**
**SOLDERING FOOTPRINT**




DIMENSIONS: MILLIMETERS

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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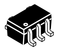
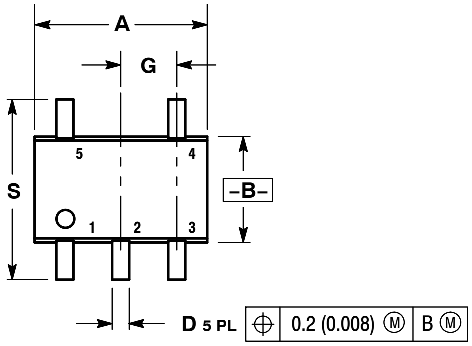
|---|---|---|
| **DESCRIPTION:** | **SOT−23 (TO−236)** | **PAGE 1 OF 1** |

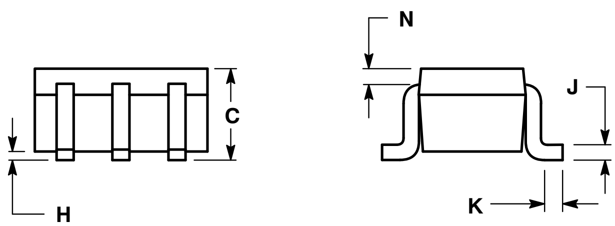


**SC−88A (SC−70−5/SOT−353)**
CASE 419A−02
ISSUE L

**SCALE 2:1**

DATE 17 JAN 2013

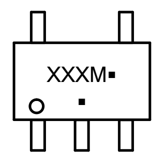



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

## GENERIC MARKING DIAGRAM*

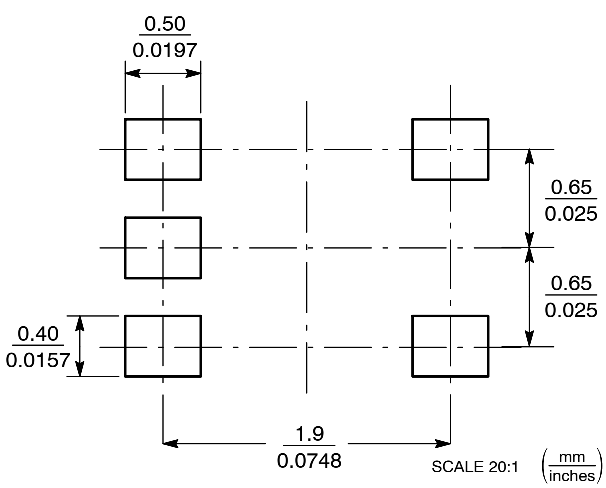



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This infomration is generic. Please refer to device data sheet for actual part marking.

## SOLDER FOOTPRINT




STYLE 1:
PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:
PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:
PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:
PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:
PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

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

STYLE 8:
PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

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

| ISSUE | REVISION | DATE |
|---|---|---|
| C | CONVERTED FROM PAPER DOCUMENT TO ELECTRONIC. REQ. BY N LAFEBRE. | 20 JUN 1998 |
| D | CONVERTED FROM MOTOROLA TO ON SEMICONDUCTOR. ADDED STYLE 5. REQ. BY E. KIM. | 24 JUL 2000 |
| E | ADDED STYLES 6 & 7. REQ. BY S. BACHMAN. | 03 AUG 2000 |
| F | DELETED DIMENSION V, WAS 0.3−0.44MM/0.012−0.016IN. REQ. BY G. KWONG. | 14 JUN 2001 |
| G | ADDED STYLE 8, REQ. BY S. CHANG; ADDED STYLE 9, REQ. BY S. BACHMAN; ADDED NOTE 4, REQ. BY S. RIGGS | 25 JUN 2003 |
| H | CHANGED STYLE 6. REQ. BY C. LIM | 28 APR 2005 |
| J | CHANGED TITLE DESCRIPTION. REQ. BY B. LOFTS. | 31 AUG 2005 |
| K | CORRECTED TITLE AND DESCRIPTION TO SC−88A (SC−70−5/SOT−353). CORRECTED MARKING DIAGRAM. REQ. BY D. TRUHITTE. | 13 JUL 2010 |
| L | ADDED SOLDER FOOTPRINT. REQ. BY I. MARIANO. | 17 JAN 2013 |
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