

# NPN Small-Signal Darlington Transistor

## BSP52T1G, BSP52T3G, SBSP52T1G

This NPN small signal Darlington transistor is designed for use in switching applications, such as print hammer, relay, solenoid and lamp drivers. The device is housed in the SOT-223 package, which is designed for medium power surface mount applications.

### Features

- The SOT-223 Package can be soldered using wave or reflow. The formed leads absorb thermal stress during soldering, eliminating the possibility of damage to the die
- Available in 12 mm Tape and Reel  
Use BSP52T1 to Order the 7 Inch/1000 Unit Reel
- PNP Complement is BSP62T1
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

### MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CES}$	80	V
Collector-Base Voltage	$V_{CBO}$	90	V
Emitter-Base Voltage	$V_{EBO}$	5.0	V
Collector Current	$I_C$	1.0	A
Total Power Dissipation (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	0.8 6.4	W mW/ $^\circ\text{C}$
Total Power Dissipation (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.25 10	W mW/ $^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-65 to 150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance (Note 1) Junction-to-Ambient	$R_{\theta JA}$	156	$^\circ\text{C}/\text{W}$
Thermal Resistance (Note 2) Junction-to-Ambient	$R_{\theta JA}$	100	$^\circ\text{C}/\text{W}$
Maximum Temperature for Soldering Purposes Time in Solder Bath	$T_L$	260 10	$^\circ\text{C}$ Sec

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.

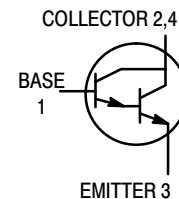
1. Device mounted on a FR-4 glass epoxy printed circuit board using minimum recommended footprint.
2. Device mounted on a FR-4 glass epoxy printed circuit board using 1 cm<sup>2</sup> pad.



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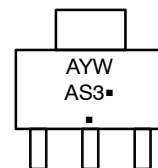
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## MEDIUM POWER NPN SILICON SURFACE MOUNT DARLINGTON TRANSISTOR



SOT-223  
CASE 318E  
STYLE 1

### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
W = Work Week  
AS3 = Specific Device Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
BSP52T1G, SBSP52T1G	SOT-223 (Pb-Free)	1000 / Tape & Reel
BSP52T3G	SOT-223 (Pb-Free)	4000 / Tape & Reel

<sup>†</sup>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.

# BSP52T1G, BSP52T3G, SBSP52T1G

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

Characteristics	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Base Breakdown Voltage ( $I_C = 100\ \mu\text{A}$ , $I_E = 0$ )	$V_{(BR)CBO}$	90	–	–	V
Emitter-Base Breakdown Voltage ( $I_E = 10\ \mu\text{A}$ , $I_C = 0$ )	$V_{(BR)EBO}$	5.0	–	–	V
Collector-Emitter Cutoff Current ( $V_{CE} = 80\ \text{V}$ , $V_{BE} = 0$ )	$I_{CES}$	–	–	10	$\mu\text{A}$
Emitter-Base Cutoff Current ( $V_{EB} = 4.0\ \text{V}$ , $I_C = 0$ )	$I_{EBO}$	–	–	10	$\mu\text{A}$

### ON CHARACTERISTICS (Note 3)

DC Current Gain ( $I_C = 150\ \text{mA}$ , $V_{CE} = 10\ \text{V}$ ) ( $I_C = 500\ \text{mA}$ , $V_{CE} = 10\ \text{V}$ )	$h_{FE}$	1000 2000	– –	– –	–
Collector-Emitter Saturation Voltage ( $I_C = 500\ \text{mA}$ , $I_B = 0.5\ \text{mA}$ )	$V_{CE(sat)}$	–	–	1.3	V
Base-Emitter Saturation Voltage ( $I_C = 500\ \text{mA}$ , $I_B = 0.5\ \text{mA}$ )	$V_{BE(sat)}$	–	–	1.9	V

### SWITCHING CHARACTERISTICS

Rise Time ( $V_{CC} = 10\ \text{V}$ , $I_C = 150\ \text{mA}$ , $I_{B1} = 0.15\ \text{mA}$ )	$t_r$	–	155	–	ns
Delay Time ( $V_{CC} = 10\ \text{V}$ , $I_C = 150\ \text{mA}$ , $I_{B1} = 0.15\ \text{mA}$ )	$t_d$	–	205	–	ns
Storage Time ( $V_{CC} = 10\ \text{V}$ , $I_C = 150\ \text{mA}$ , $I_{B1} = 0.15\ \text{mA}$ , $I_{B2} = 0.15\ \text{mA}$ )	$t_s$	–	420	–	ns
Fall Time ( $V_{CC} = 10\ \text{V}$ , $I_C = 150\ \text{mA}$ , $I_{B1} = 0.15\ \text{mA}$ , $I_{B2} = 0.15\ \text{mA}$ )	$t_f$	–	365	–	ns

3. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

# BSP52T1G, BSP52T3G, SBSP52T1G

## TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

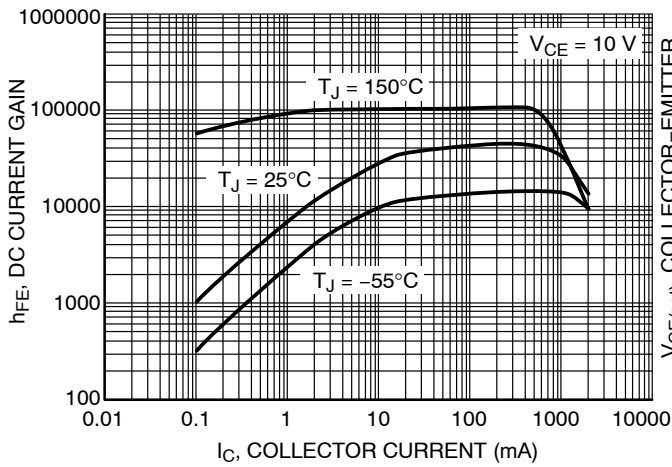


Figure 1. DC Current Gain

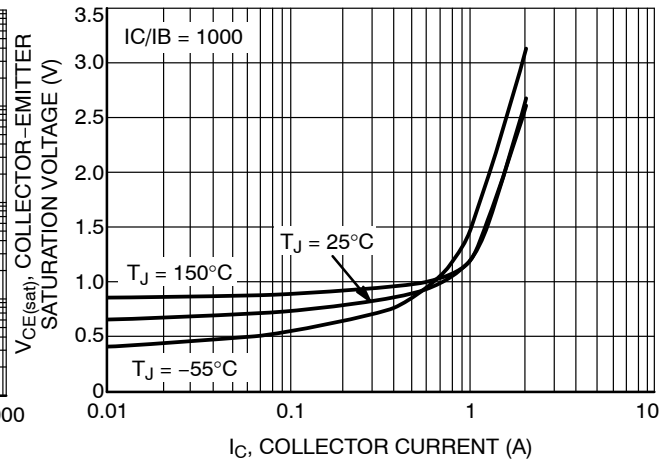


Figure 2. Collector-Emitter Saturation Voltage

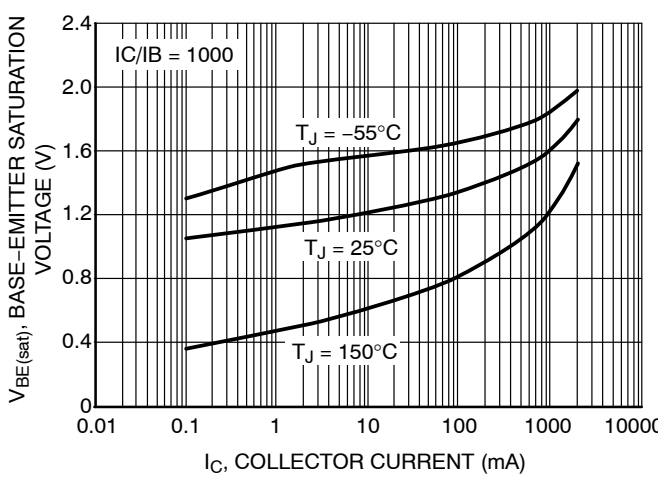


Figure 3. Base-Emitter Saturation Voltage

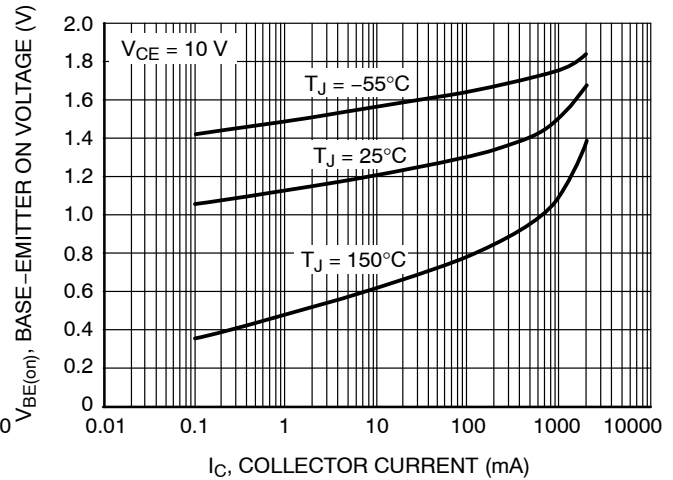


Figure 4. Base-Emitter ON Voltage

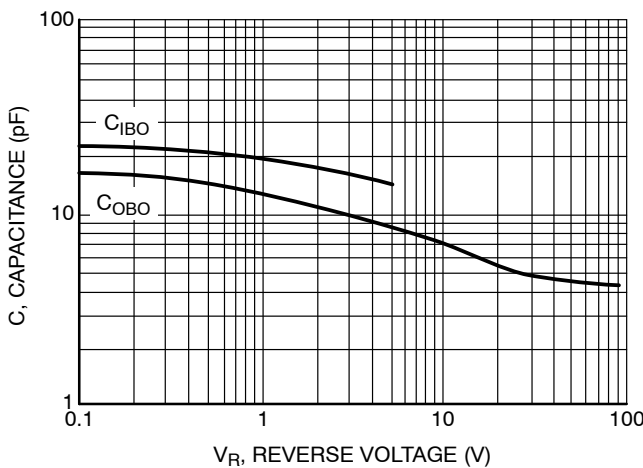


Figure 5. Capacitance

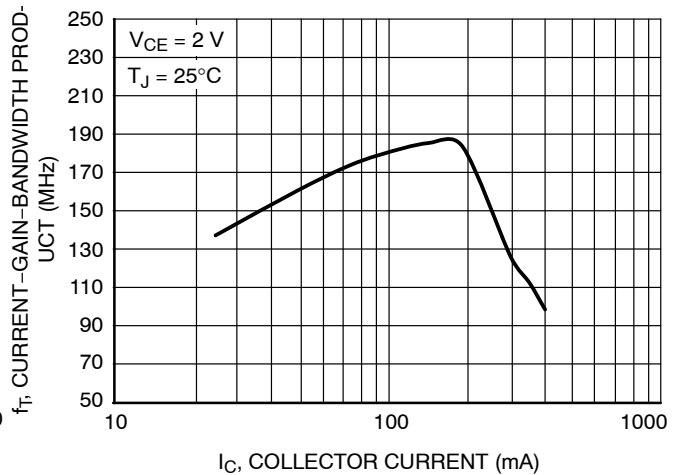


Figure 6. Current Gain Bandwidth Product vs. Collector Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

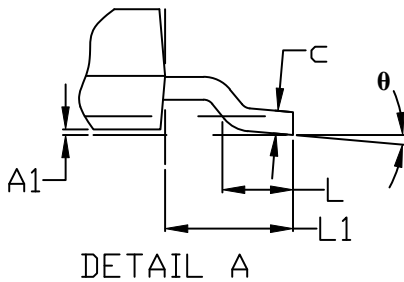
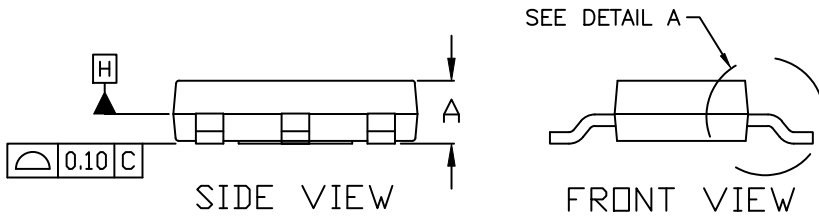
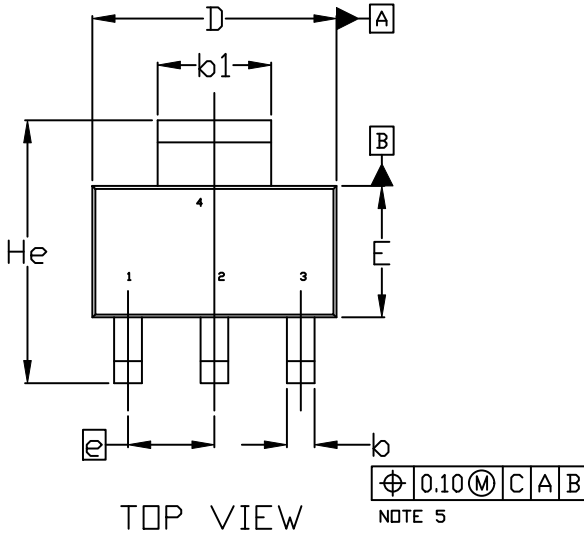
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SCALE 1:1

SOT-223 (TO-261)  
CASE 318E-04  
ISSUE R

DATE 02 OCT 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

MILLIMETERS			
DIM	MIN.	NOM.	MAX.
A	1.50	1.63	1.75
A1	0.02	0.06	0.10
b	0.60	0.75	0.89
b1	2.90	3.06	3.20
c	0.24	0.29	0.35
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.30 BSC		
L	0.20	---	---
L1	1.50	1.75	2.00
He	6.70	7.00	7.30
$\theta$	0°	---	10°



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**SOT-223 (TO-261)**  
**CASE 318E-04**  
**ISSUE R**

DATE 02 OCT 2018

- |                                                                              |                                                                             |                                                                               |                                                                       |                                                                       |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>STYLE 1:</b><br>PIN 1. BASE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR | <b>STYLE 2:</b><br>PIN 1. ANODE<br>2. CATHODE<br>3. NC<br>4. CATHODE        | <b>STYLE 3:</b><br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE<br>4. DRAIN           | <b>STYLE 4:</b><br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE<br>4. DRAIN   | <b>STYLE 5:</b><br>PIN 1. DRAIN<br>2. GATE<br>3. SOURCE<br>4. GATE    |
| <b>STYLE 6:</b><br>PIN 1. RETURN<br>2. INPUT<br>3. OUTPUT<br>4. INPUT        | <b>STYLE 7:</b><br>PIN 1. ANODE 1<br>2. CATHODE<br>3. ANODE 2<br>4. CATHODE | <b>STYLE 8:</b><br>CANCELLED                                                  | <b>STYLE 9:</b><br>PIN 1. INPUT<br>2. GROUND<br>3. LOGIC<br>4. GROUND | <b>STYLE 10:</b><br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE<br>4. ANODE |
| <b>STYLE 11:</b><br>PIN 1. MT 1<br>2. MT 2<br>3. GATE<br>4. MT 2             | <b>STYLE 12:</b><br>PIN 1. INPUT<br>2. OUTPUT<br>3. NC<br>4. OUTPUT         | <b>STYLE 13:</b><br>PIN 1. GATE<br>2. COLLECTOR<br>3. EMITTER<br>4. COLLECTOR |                                                                       |                                                                       |

**GENERIC  
 MARKING DIAGRAM\***




- A = Assembly Location
- Y = Year
- W = Work Week
- XXXXX = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

\*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.

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