

# NSB9435T1

Preferred Device

## High Current Bias Resistor Transistor

### PNP Silicon

#### Features

- Collector–Emitter Sustaining Voltage –  
 $V_{CEO(sus)} = 30 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain –  
 $h_{FE} = 125 \text{ (Min) @ } I_C = 0.8 \text{ Adc}$   
 $= 90 \text{ (Min) @ } I_C = 3.0 \text{ Adc}$
- Low Collector–Emitter Saturation Voltage –  
 $V_{CE(sat)} = 0.275 \text{ Vdc (Max) @ } I_C = 1.2 \text{ Adc}$   
 $= 0.55 \text{ Vdc (Max) @ } I_C = 3.0 \text{ Adc}$
- SOT–223 Surface Mount Packaging
- ESD Rating – Human Body Model: Class 1B  
 – Machine Model: Class B
- Pb–Free Package is Available

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

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	30	Vdc
Collector–Base Voltage	$V_{CB}$	45	Vdc
Emitter–Base Voltage	$V_{EB}$	$\pm 6.0$	Vdc
Base Current – Continuous	$I_B$	1.0	Adc
Collector Current – Continuous – Peak	$I_C$	3.0 5.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	3.0 24	W mW/°C
Total $P_D$ @ $T_A = 25^\circ\text{C}$ mounted on 1" sq. (645 sq. mm) Collector pad on FR–4 bd material		1.56	W
Total $P_D$ @ $T_A = 25^\circ\text{C}$ mounted on 0.012" sq. (7.6 sq. mm) Collector pad on FR–4 bd material		0.72	W
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	$-55$ to $+150$	°C

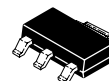
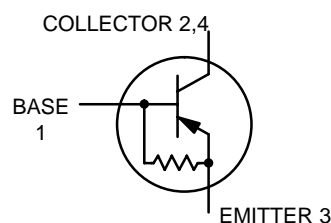
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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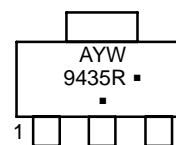
<http://onsemi.com>

**POWER BJT**  
 $I_C = 3.0 \text{ AMPERES}$   
 $BV_{CEO} = 30 \text{ VOLTS}$   
 $V_{CE(sat)} = 0.275 \text{ VOLTS}$



SOT–223  
CASE 318E  
STYLE 1

#### MARKING DIAGRAM



A = Assembly Location  
 Y = Year  
 W = Work Week  
 9435R = Device Code  
 ■ = Pb–Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
NSB9435T1	SOT–223	1000/Tape & Reel
NSB9435T1G	SOT–223 (Pb–Free)	1000/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.

Preferred devices are recommended choices for future use and best overall value.

# NSB9435T1

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	42	°C/W
Junction-to-Ambient on 1" sq. (645 sq. mm) Collector pad on FR-4 board material	$R_{\theta JA}$	80	
Junction-to-Ambient on 0.012" sq. (7.6 sq. mm) Collector pad on FR-4 board material	$R_{\theta JA}$	174	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 s	$T_L$	260	°C

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

Characteristics	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 0 \text{ Adc}$ )	$V_{CE(sus)}$	30	-	-	Vdc
Emitter-Base Voltage ( $I_E = 50 \mu\text{Adc}$ , $I_C = 0 \text{ Adc}$ )	$V_{EBO}$	6.0	-	-	Vdc
Collector Cutoff Current ( $V_{CE} = 25 \text{ Vdc}$ ) ( $V_{CE} = 25 \text{ Vdc}$ , $T_J = 125^\circ\text{C}$ )	$I_{CER}$	-	-	20 200	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{BE} = 5.0 \text{ Vdc}$ )	$I_{EBO}$	-	-	700	$\mu\text{Adc}$

### ON CHARACTERISTICS (Note 1)

Collector-Emitter Saturation Voltage ( $I_C = 0.8 \text{ Adc}$ , $I_B = 20 \text{ mAdc}$ ) ( $I_C = 1.2 \text{ Adc}$ , $I_B = 20 \text{ mAdc}$ ) ( $I_C = 3.0 \text{ Adc}$ , $I_B = 0.3 \text{ Adc}$ )	$V_{CE(sat)}$	-	0.155	0.210 0.275 0.550	Vdc
Base-Emitter Saturation Voltage ( $I_C = 3.0 \text{ Adc}$ , $I_B = 0.3 \text{ Adc}$ )	$V_{BE(sat)}$	-	-	1.25	Vdc
Base-Emitter On Voltage ( $I_C = 1.2 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ )	$V_{BE(on)}$	-	-	1.10	Vdc
DC Current Gain ( $I_C = 0.8 \text{ Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 1.2 \text{ Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 3.0 \text{ Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )	$h_{FE}$	125 110 90	220 - -	- - -	-
Resistor	R1	7.5	10	12.5	k $\Omega$

### DYNAMIC CHARACTERISTICS

Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0 \text{ Adc}$ , $f = 1.0 \text{ MHz}$ )	$C_{ob}$	-	100	150	pF
Input Capacitance ( $V_{EB} = 8.0 \text{ Vdc}$ )	$C_{ib}$	-	135	-	pF
Current-Gain - Bandwidth Product (Note 2) ( $I_C = 500 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $F_{test} = 1.0 \text{ MHz}$ )	$f_T$	-	110	-	MHz

1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

2.  $f_T = |h_{FE}| \cdot f_{test}$

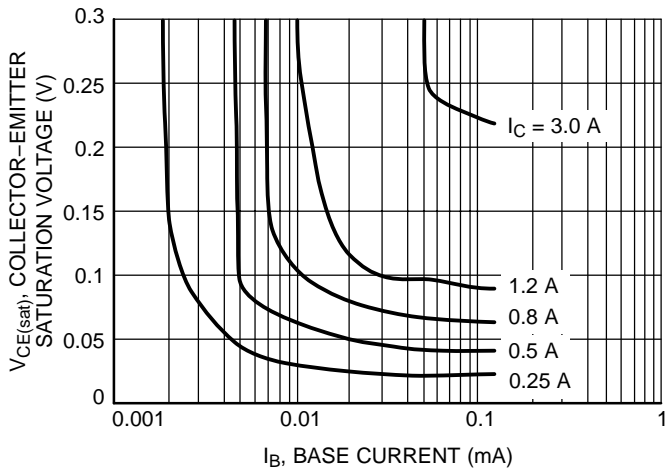


Figure 1. Collector Saturation Region

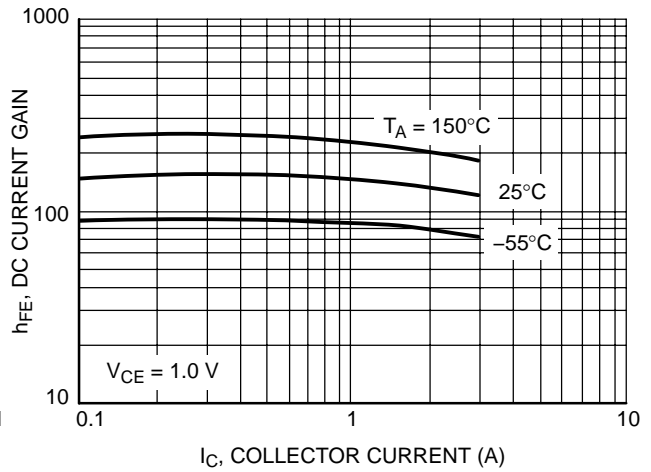


Figure 2. DC Current Gain

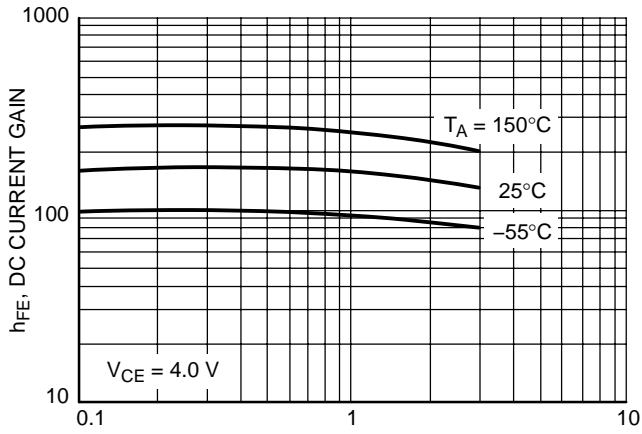


Figure 3. DC Current Gain

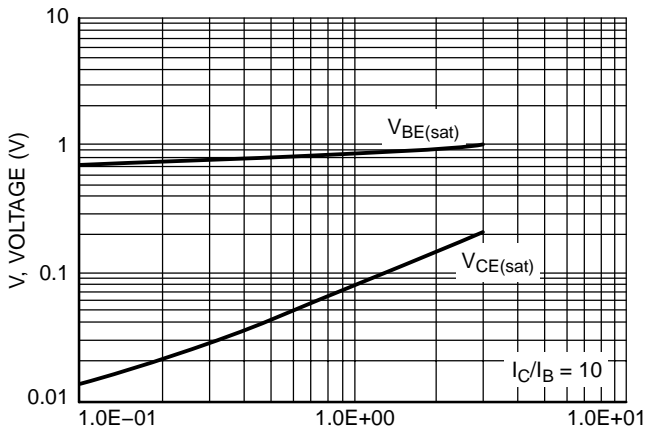


Figure 4. "ON" Voltages

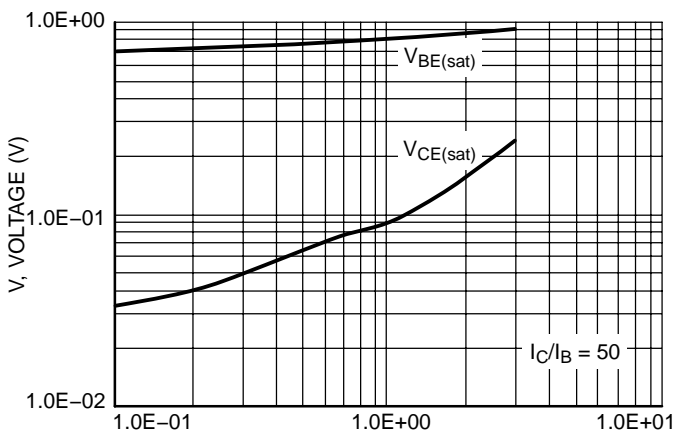


Figure 5. "ON" Voltages

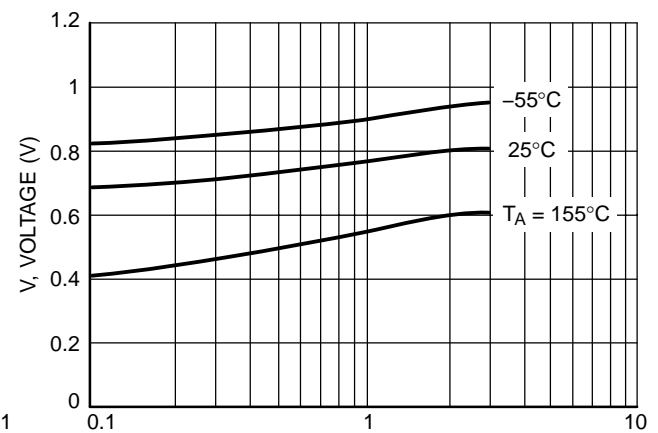


Figure 6.  $V_{BE(on)}$  Voltage

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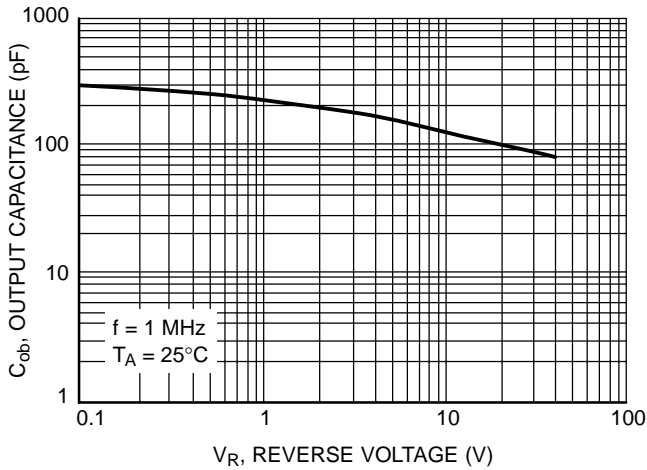


Figure 7. Output Capacitance

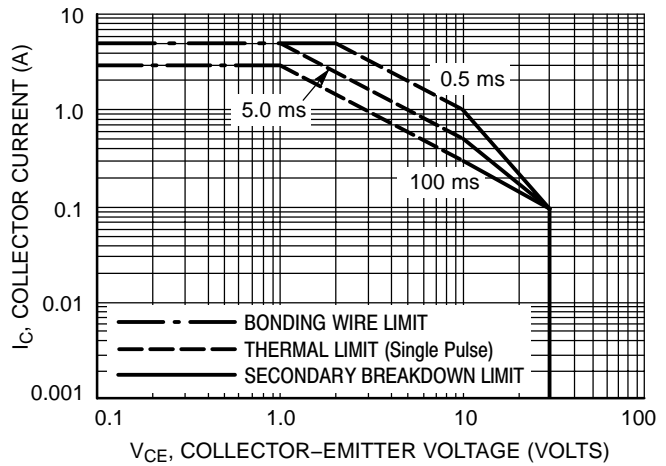


Figure 8. Active Region Safe Operating Area

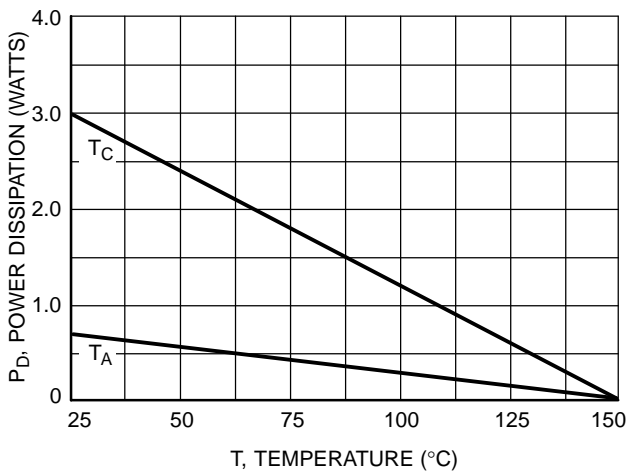


Figure 9. Power Derating

There are two limitations on the power handling ability of a transistor: average junction temperature and secondary breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 8 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Secondary breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 10. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

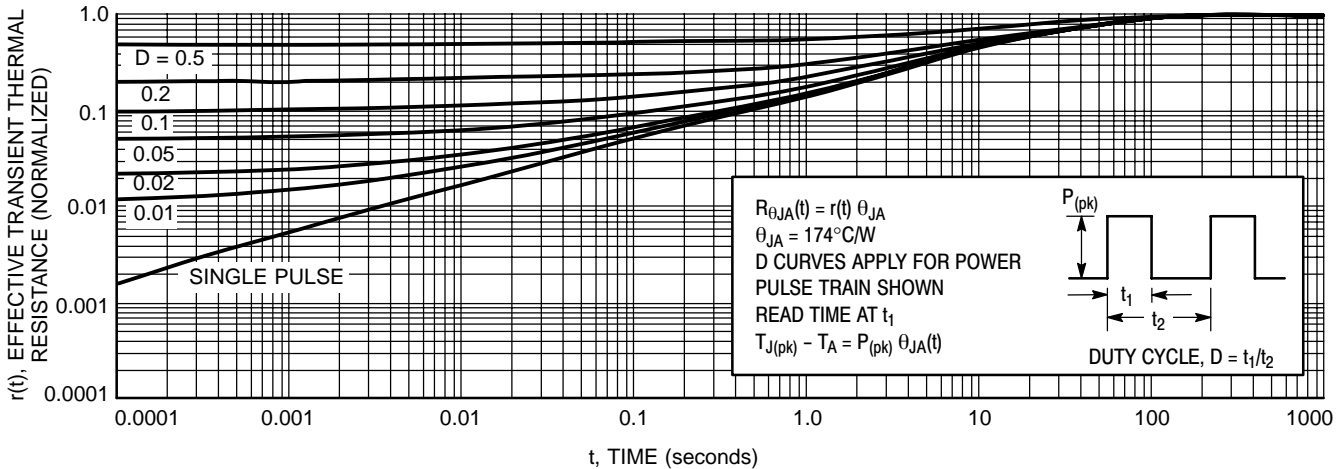
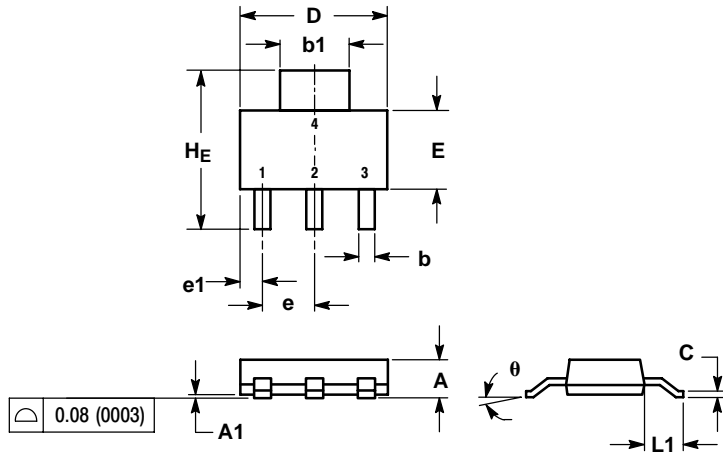


Figure 10. Thermal Response

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## PACKAGE DIMENSIONS

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

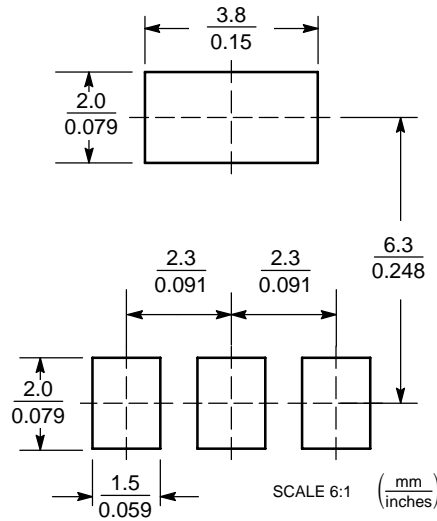


- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.50	1.63	1.75	0.060	0.064	0.068
A1	0.02	0.06	0.10	0.001	0.002	0.004
b	0.60	0.75	0.89	0.024	0.030	0.035
b1	2.90	3.06	3.20	0.115	0.121	0.126
c	0.24	0.29	0.35	0.009	0.012	0.014
D	6.30	6.50	6.70	0.249	0.256	0.263
E	3.30	3.50	3.70	0.130	0.138	0.145
e	2.20	2.30	2.40	0.087	0.091	0.094
e1	0.85	0.94	1.05	0.033	0.037	0.041
L1	1.50	1.75	2.00	0.060	0.069	0.078
HE	6.70	7.00	7.30	0.264	0.276	0.287
θ	0°	-	10°	0°	-	10°

- STYLE 1:
- PIN 1. BASE
  - COLLECTOR
  - EMITTER
  - COLLECTOR

### SOLDERING 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.

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