

# NSB1011XV6T5

Preferred Device

## Dual Bias Resistor Transistors

### NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the NSB1011XV6T5, two BRT devices are housed in the SOT-563 package which is ideal for low power surface mount applications where board space is at a premium.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- This device is manufactured with a Pb-Free external lead finish only.

#### MAXIMUM RATINGS

( $T_A = 25^\circ\text{C}$  unless otherwise noted, common for  $Q_1$  and  $Q_2$ )

Rating	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	50	Vdc
Collector-Emitter Voltage	$V_{CEO}$	50	Vdc
Collector Current	$I_C$	100	mAdc

#### THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	357 (Note 1) 2.9 (Note 1)	mW mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	350 (Note 1)	$^\circ\text{C}/\text{W}$
Characteristic (Both Junctions Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	500 (Note 1) 4.0 (Note 1)	mW mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	250 (Note 1)	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

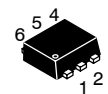
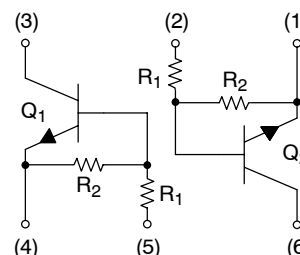
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. FR-4 @ Minimum Pad.



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SOT-563  
CASE 463A  
PLASTIC

#### MARKING DIAGRAM



UT = Specific Device Code  
(see table on following page)  
D = Date Code

#### ORDERING INFORMATION

Device	Package	Shipping†
NSB1011XV6T5	SOT-563 (Pb-Free)	8000 / 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.

# NSB1011XV6T5

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
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### Q1

#### OFF CHARACTERISTICS

Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	-	-	100	nA <sub>dc</sub>
Collector-Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)	I <sub>CEO</sub>	-	-	500	nA <sub>dc</sub>
Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)	I <sub>EBO</sub>	-	-	0.5	mA <sub>dc</sub>
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	-	-	V <sub>dc</sub>
Collector-Emitter Breakdown Voltage (Note 2) (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	-	-	V <sub>dc</sub>

#### ON CHARACTERISTICS (Note 2)

DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)	h <sub>FE</sub>	35	60	-	-
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)	V <sub>CE(sat)</sub>	-	-	0.25	V <sub>dc</sub>
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>	-	-	0.2	V <sub>dc</sub>
Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OH</sub>	4.9	-	-	V <sub>dc</sub>
Input Resistor	R1	7.0	10	13	kΩ
Resistor Ratio	R1/R2	0.8	1.0	1.2	-

### Q2

#### OFF CHARACTERISTICS

Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	-	-	100	nA <sub>dc</sub>
Collector-Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)	I <sub>CEO</sub>	-	-	500	nA <sub>dc</sub>
Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)	I <sub>EBO</sub>	-	-	0.2	mA <sub>dc</sub>
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	-	-	V <sub>dc</sub>
Collector-Emitter Breakdown Voltage (Note 2) (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	-	-	V <sub>dc</sub>

#### ON CHARACTERISTICS (Note 2)

DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)	h <sub>FE</sub>	80	140	-	-
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)	V <sub>CE(sat)</sub>	-	-	0.25	V <sub>dc</sub>
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>	-	-	0.2	V <sub>dc</sub>
Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OH</sub>	4.9	-	-	V <sub>dc</sub>
Input Resistor	R1	1.54	2.2	2.86	kΩ
Resistor Ratio	R1/R2	0.038	0.047	0.056	-

2. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

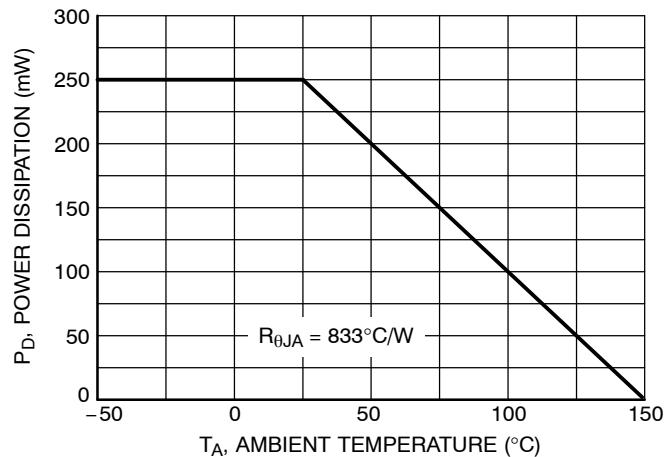


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS — Q1

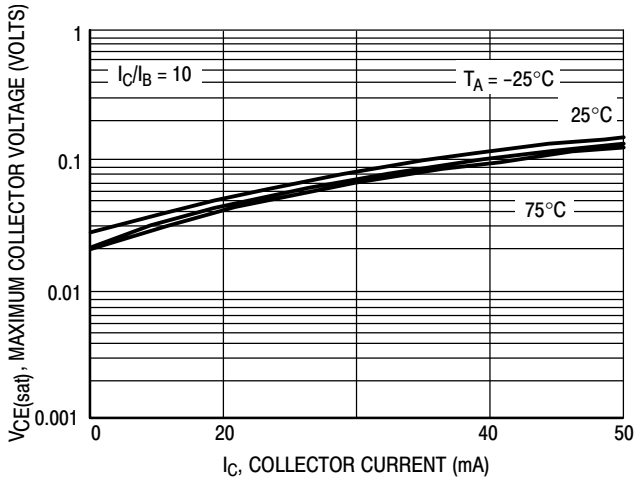


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

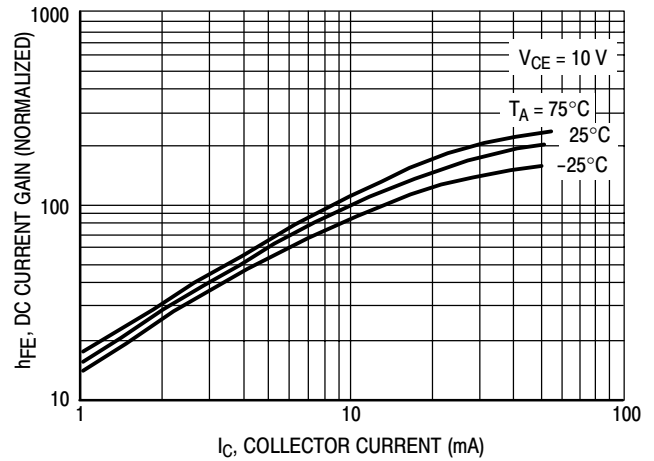


Figure 3. DC Current Gain

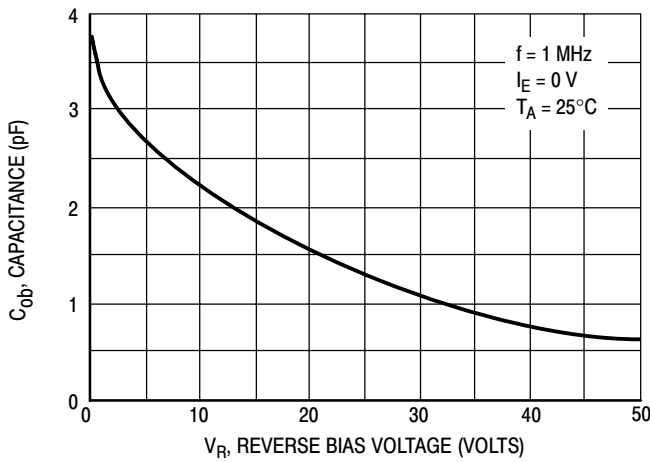


Figure 4. Output Capacitance

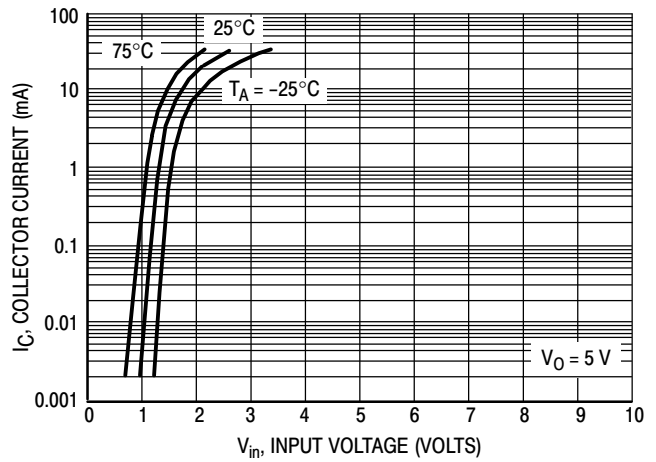


Figure 5. Output Current versus Input Voltage

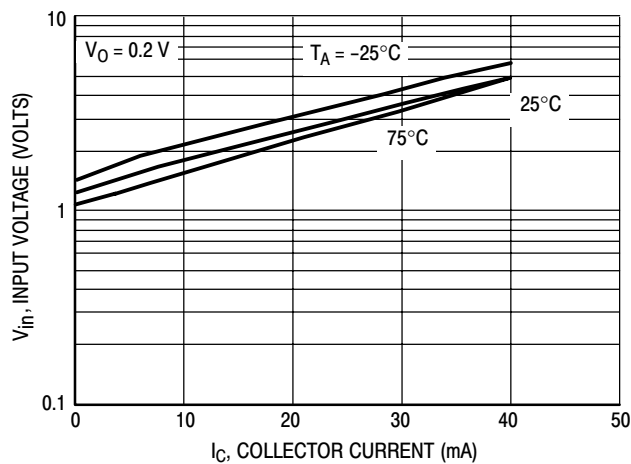


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — Q2

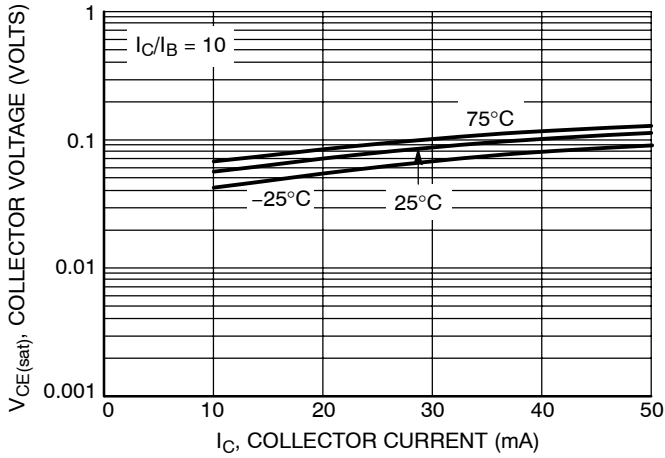


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

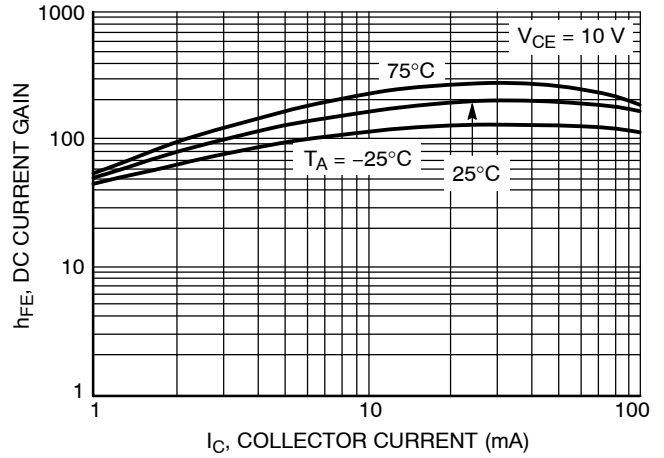


Figure 8. DC Current Gain

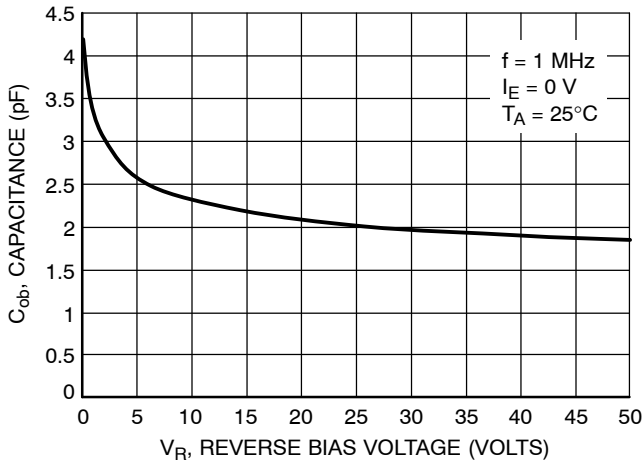


Figure 9. Output Capacitance

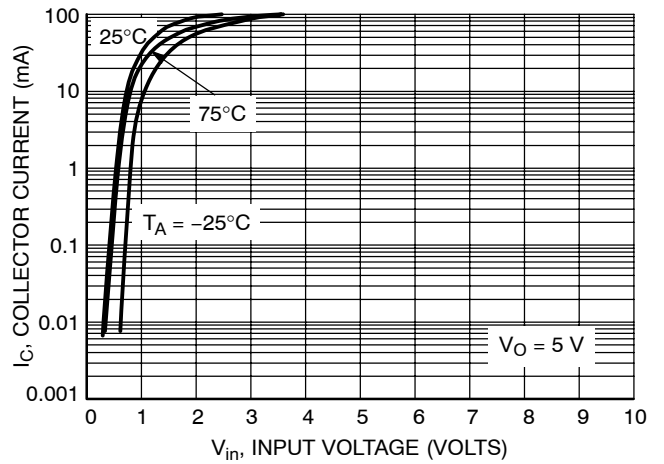


Figure 10. Output Current versus Input Voltage

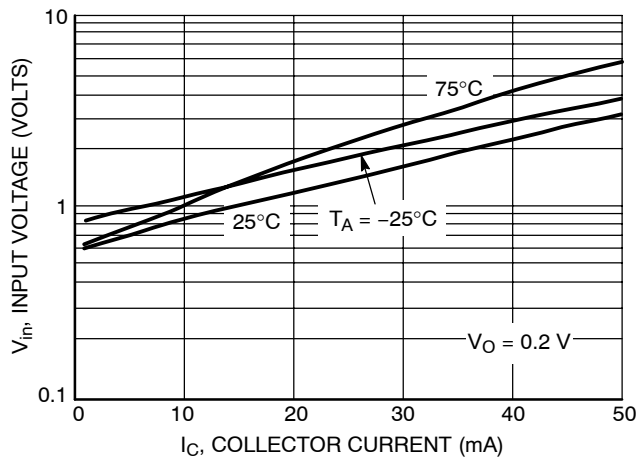


Figure 11. Input Voltage versus Output Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

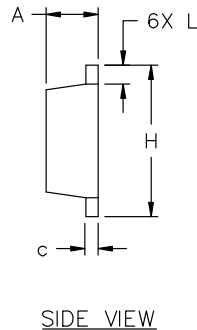
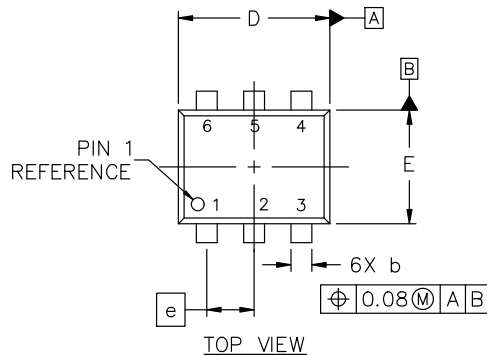


**SOT-563-6 1.60x1.20x0.55, 0.50P**  
**CASE 463A**  
**ISSUE J**

DATE 15 FEB 2024

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.50	0.55	0.60
b	0.17	0.22	0.27
c	0.08	0.13	0.18
D	1.50	1.60	1.70
E	1.10	1.20	1.30
e	0.50 BSC		
H	1.50	1.60	1.70
L	0.10	0.20	0.30

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

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

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

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

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

STYLE 6:  
 PIN 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. CATHODE  
 6. CATHODE

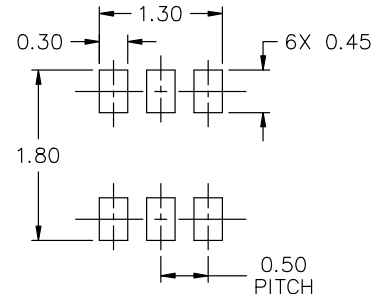
STYLE 7:  
 PIN 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. ANODE  
 6. CATHODE

STYLE 8:  
 PIN 1. DRAIN  
 2. DRAIN  
 3. GATE  
 4. SOURCE  
 5. DRAIN  
 6. DRAIN

STYLE 9:  
 PIN 1. SOURCE 1  
 2. GATE 1  
 3. DRAIN 2  
 4. SOURCE 2  
 5. GATE 2  
 6. DRAIN 1

STYLE 10:  
 PIN 1. CATHODE 1  
 2. N/C  
 3. CATHODE 2  
 4. ANODE 2  
 5. N/C  
 6. ANODE 1

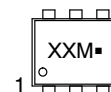
STYLE 11:  
 PIN 1. EMITTER 2  
 2. BASE 2  
 3. COLLECTOR 1  
 4. EMITTER 1  
 5. BASE 1  
 6. COLLECTOR 2



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.

**GENERIC MARKING DIAGRAM\***



XX = Specific Device Code  
 M = Month 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.

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