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[ON Semiconductor](#)  
[NSBC123JPDXV6T1G](#)

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# MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6

## Complementary Bias Resistor Transistors R1 = 2.2 kΩ, R2 = 47 kΩ

### NPN and PNP Transistors with Monolithic Bias Resistor Network

This series of digital transistors is designed to replace a single device and its external resistor bias network. The Bias Resistor Transistor (BRT) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- S and NSV 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

(T<sub>A</sub> = 25°C both polarities Q<sub>1</sub> (PNP) & Q<sub>2</sub> (NPN), unless otherwise noted)

Rating	Symbol	Max	Unit
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>	50	Vdc
Collector Current – Continuous	I <sub>C</sub>	100	mAdc
Input Forward Voltage	V <sub>IN(fwd)</sub>	12	Vdc
Input Reverse Voltage	V <sub>IN(rev)</sub>	5	Vdc

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.

#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MUN5335DW1T1G, SMUN5335DW1T1G	SOT-363	3,000/Tape & Reel
MUN5335DW1T2G, SMUN5335DW1T2G	SOT-363	3,000/Tape & Reel
NSBC123JPDXV6T1G, NSVBC123JPDXV6T1G*	SOT-563	4,000/Tape & Reel
NSBC123JPDXV6T5G	SOT-563	8,000/Tape & Reel
NSBC123JPDP6T5G	SOT-963	8,000/Tape & Reel

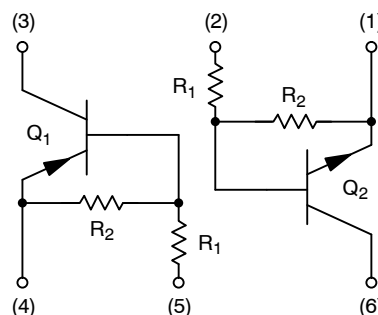
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



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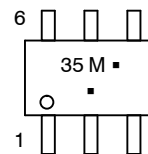
#### PIN CONNECTIONS



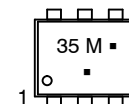
#### MARKING DIAGRAMS



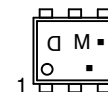
SOT-363  
CASE 419B



SOT-563  
CASE 463A



SOT-963  
CASE 527AD



35/D = Specific Device Code  
 M = Date Code\*  
 ▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

**MUN5335DW1, NSBC123JPD XV6, NSBC123JPD P6**
**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
<b>MUN5335DW1 (SOT-363) ONE JUNCTION HEATED</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 1) (Note 2) Derate above $25^\circ\text{C}$ (Note 1) (Note 2)	$P_D$	187 256 1.5 2.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 1) (Note 2)	$R_{\theta JA}$	670 490	$^\circ\text{C}/\text{W}$
<b>MUN5335DW1 (SOT-363) BOTH JUNCTION HEATED (Note 3)</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 1) (Note 2) Derate above $25^\circ\text{C}$ (Note 1) (Note 2)	$P_D$	250 385 2.0 3.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 1) (Note 2)	$R_{\theta JA}$	493 325	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Lead (Note 1) (Note 2)	$R_{\theta JL}$	188 208	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
<b>NSBC123JPD XV6 (SOT-563) ONE JUNCTION HEATED</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 1) Derate above $25^\circ\text{C}$ (Note 1)	$P_D$	357 2.9	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 1)	$R_{\theta JA}$	350	$^\circ\text{C}/\text{W}$
<b>NSBC123JPD XV6 (SOT-563) BOTH JUNCTION HEATED (Note 3)</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 1) Derate above $25^\circ\text{C}$ (Note 1)	$P_D$	500 4.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 1)	$R_{\theta JA}$	250	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
<b>NSBC123JPD P6 (SOT-963) ONE JUNCTION HEATED</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 4) (Note 5) Derate above $25^\circ\text{C}$ (Note 4) (Note 5)	$P_D$	231 269 1.9 2.2	MW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 4) (Note 5)	$R_{\theta JA}$	540 464	$^\circ\text{C}/\text{W}$
<b>NSBC123JPD P6 (SOT-963) BOTH JUNCTION HEATED (Note 3)</b>			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 4) (Note 5) Derate above $25^\circ\text{C}$ (Note 4) (Note 5)	$P_D$	339 408 2.7 3.3	MW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 4) (Note 5)	$R_{\theta JA}$	369 306	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

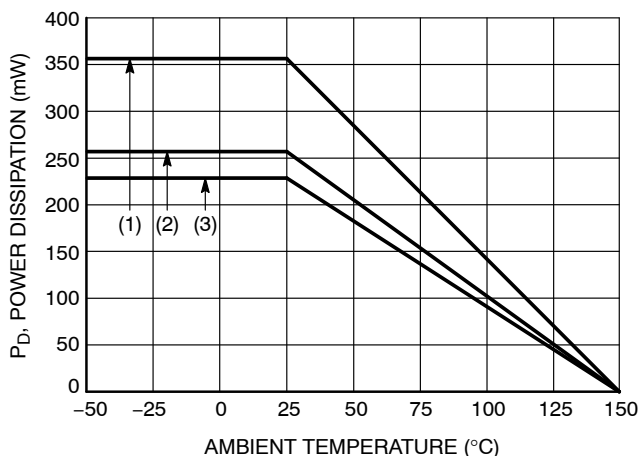
- FR-4 @ Minimum Pad.
- FR-4 @  $1.0 \times 1.0$  Inch Pad.
- Both junction heated values assume total power is sum of two equally powered channels.
- FR-4 @  $100 \text{ mm}^2$ , 1 oz. copper traces, still air.
- FR-4 @  $500 \text{ mm}^2$ , 1 oz. copper traces, still air.

### MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  both polarities  $Q_1$  (PNP) &  $Q_2$  (NPN), unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Base Cutoff Current ( $V_{CB} = 50\text{ V}, I_E = 0$ )	$I_{CBO}$	-	-	100	nA <sub>dc</sub>
Collector-Emitter Cutoff Current ( $V_{CE} = 50\text{ V}, I_B = 0$ )	$I_{CEO}$	-	-	500	nA <sub>dc</sub>
Emitter-Base Cutoff Current ( $V_{EB} = 6.0\text{ V}, I_C = 0$ )	$I_{EBO}$	-	-	0.2	mA <sub>dc</sub>
Collector-Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}, I_E = 0$ )	$V_{(BR)CBO}$	50	-	-	V <sub>dc</sub>
Collector-Emitter Breakdown Voltage (Note 6) ( $I_C = 2.0\text{ mA}, I_B = 0$ )	$V_{(BR)CEO}$	50	-	-	V <sub>dc</sub>
<b>ON CHARACTERISTICS</b>					
DC Current Gain (Note 6) ( $I_C = 5.0\text{ mA}, V_{CE} = 10\text{ V}$ )	$h_{FE}$	80	140	-	
Collector-Emitter Saturation Voltage (Note 6) ( $I_C = 10\text{ mA}, I_B = 0.3\text{ mA}$ )	$V_{CE(sat)}$	-	-	0.25	V
Input Voltage (Off) ( $V_{CE} = 5.0\text{ V}, I_C = 100\ \mu\text{A}$ ) (NPN) ( $V_{CE} = 5.0\text{ V}, I_C = 100\ \mu\text{A}$ ) (PNP)	$V_{i(off)}$	-	0.6	-	V <sub>dc</sub>
Input Voltage (On) ( $V_{CE} = 0.2\text{ V}, I_C = 5.0\text{ mA}$ ) (NPN) ( $V_{CE} = 0.2\text{ V}, I_C = 5.0\text{ mA}$ ) (PNP)	$V_{i(on)}$	-	0.8	-	V <sub>dc</sub>
Output Voltage (On) ( $V_{CC} = 5.0\text{ V}, V_B = 2.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )	$V_{OL}$	-	-	0.2	V <sub>dc</sub>
Output Voltage (Off) ( $V_{CC} = 5.0\text{ V}, V_B = 0.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )	$V_{OH}$	4.9	-	-	V <sub>dc</sub>
Input Resistor	R1	1.5	2.2	2.9	k $\Omega$
Resistor Ratio	$R_1/R_2$	0.038	0.047	0.056	

6. Pulsed Condition: Pulse Width = 300 ms, Duty Cycle  $\leq$  2%.

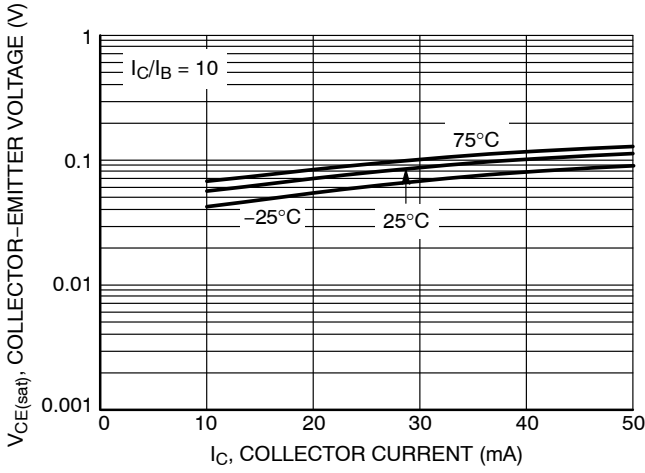


- (1) SOT-363; 1.0 x 1.0 Inch Pad
- (2) SOT-563; Minimum Pad
- (3) SOT-963; 100 mm<sup>2</sup>, 1 oz. Copper Trace

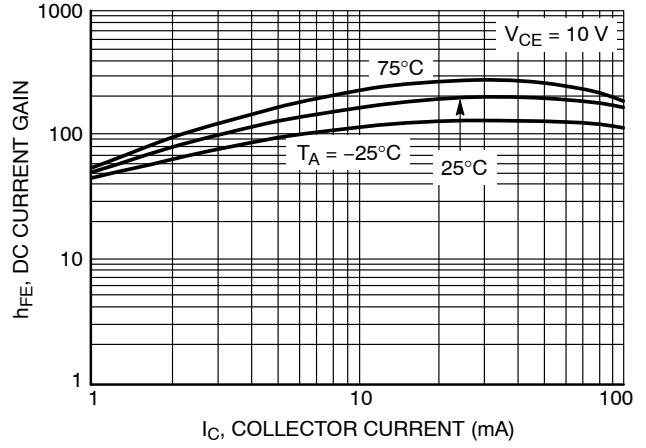
Figure 1. Derating Curve

**MUN5335DW1, NSBC123JPD XV6, NSBC123JPD P6**

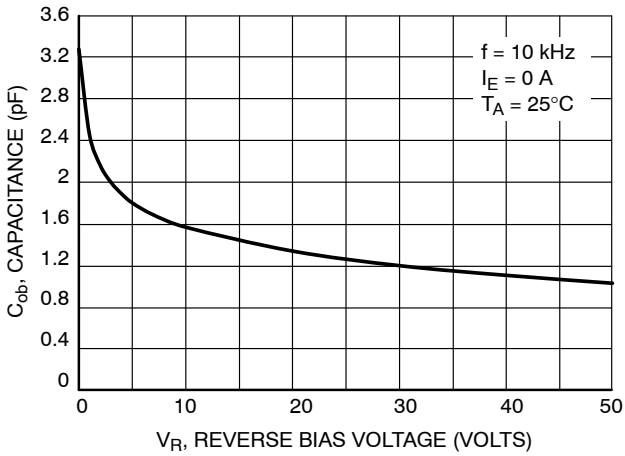
**TYPICAL CHARACTERISTICS – NPN TRANSISTOR  
 MUN5335DW1, NSBC123JPD XV6**



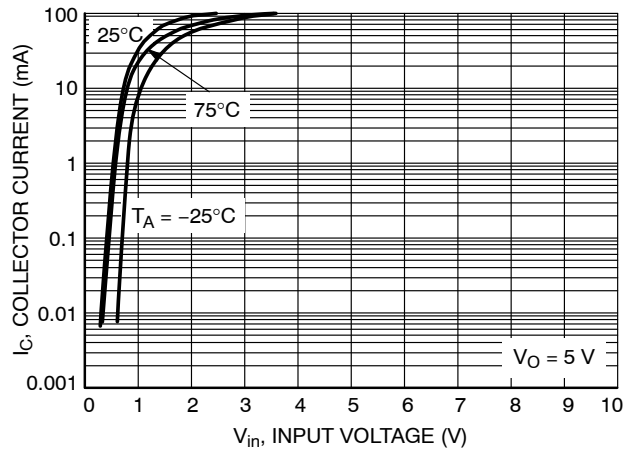
**Figure 2.  $V_{CE(sat)}$  vs.  $I_C$**



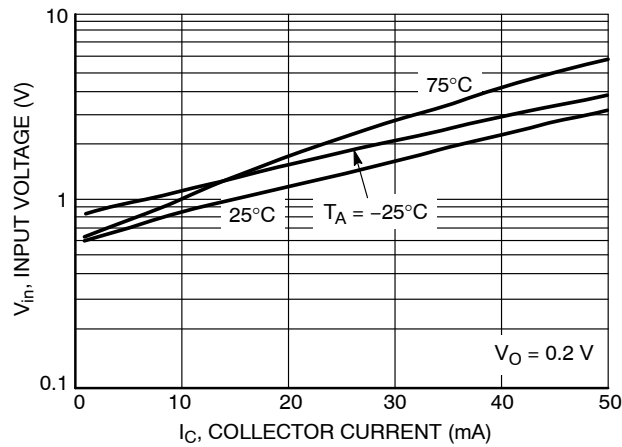
**Figure 3. DC Current Gain**



**Figure 4. Output Capacitance**



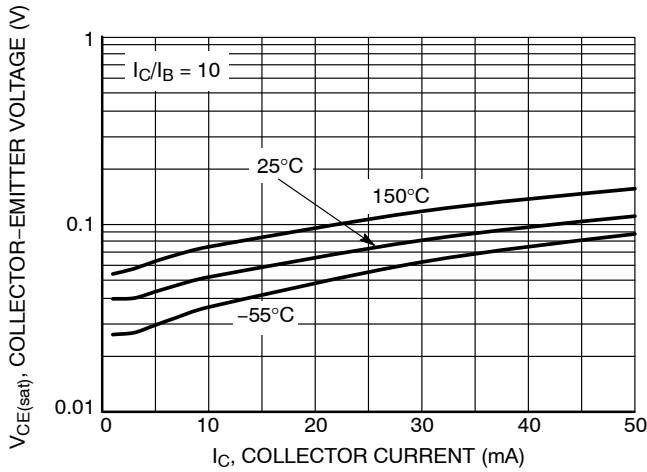
**Figure 5. Output Current vs. Input Voltage**



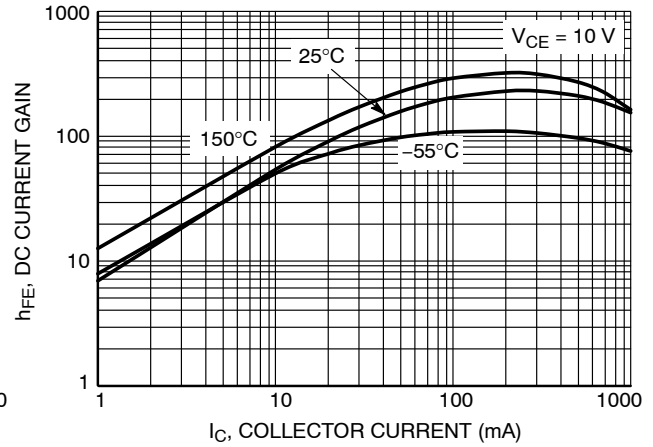
**Figure 6. Input Voltage vs. Output Current**

**MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6**

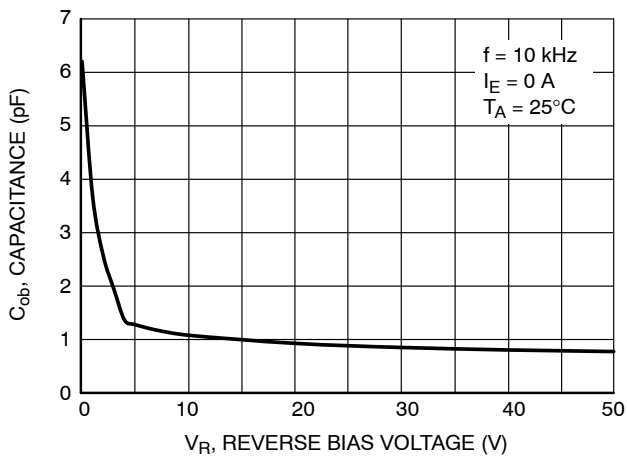
**TYPICAL CHARACTERISTICS – PNP TRANSISTOR  
MUN5335DW1, NSBC123JPDXV6**



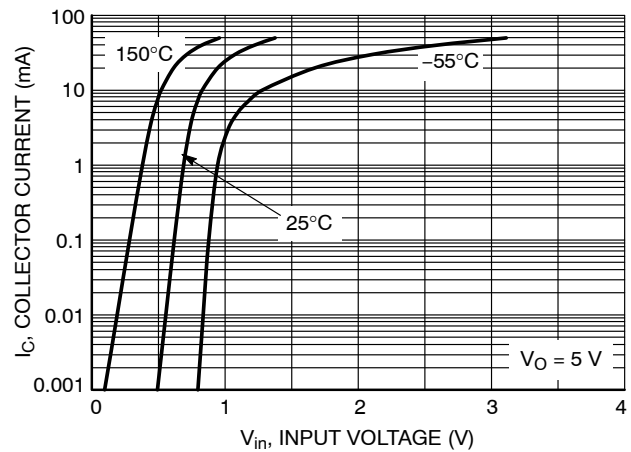
**Figure 7.  $V_{CE(sat)}$  vs.  $I_C$**



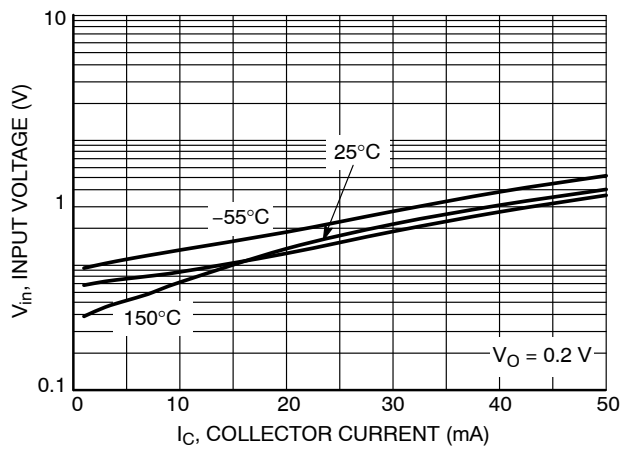
**Figure 8. DC Current Gain**



**Figure 9. Output Capacitance**



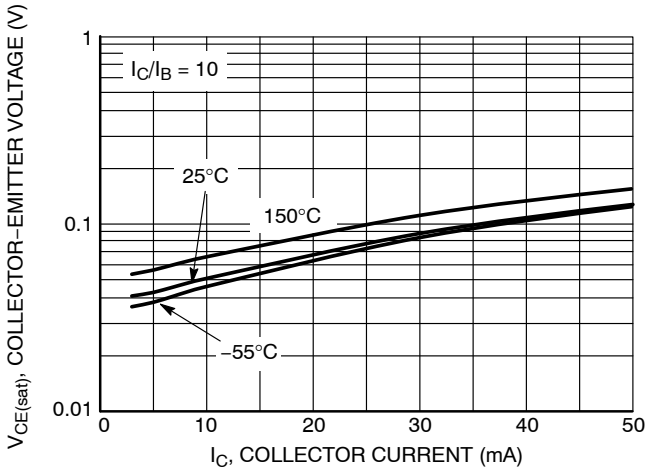
**Figure 10. Output Current vs. Input Voltage**



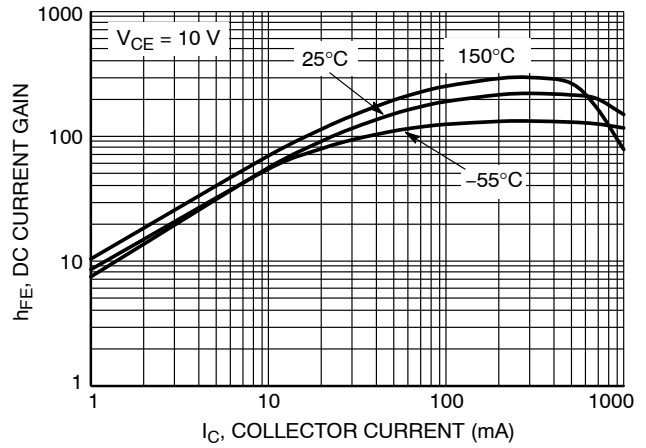
**Figure 11. Input Voltage vs. Output Current**

**MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6**

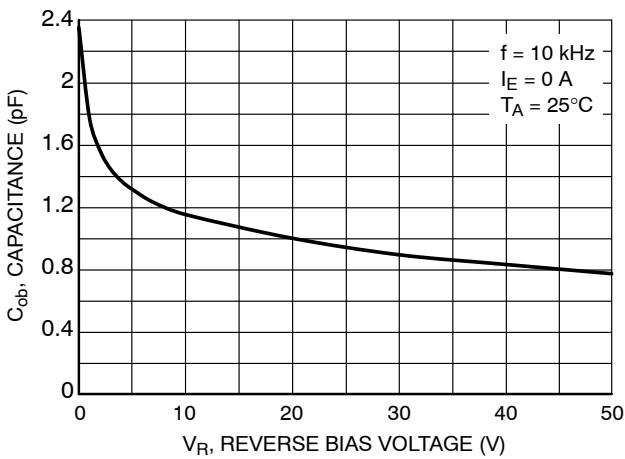
**TYPICAL CHARACTERISTICS – NPN TRANSISTOR  
 NSBC123JPDP6**



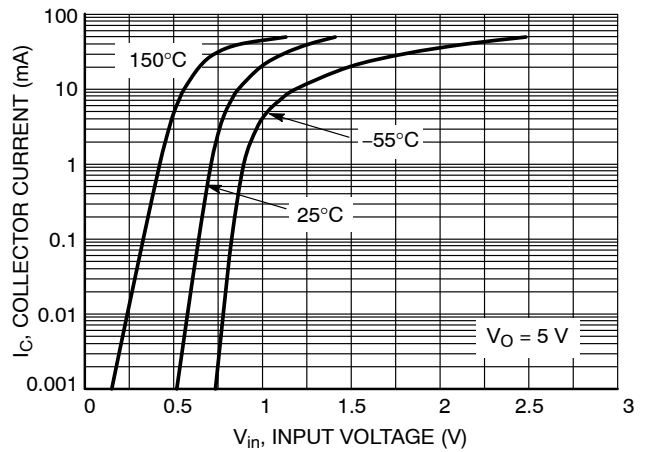
**Figure 12.  $V_{CE(sat)}$  vs.  $I_C$**



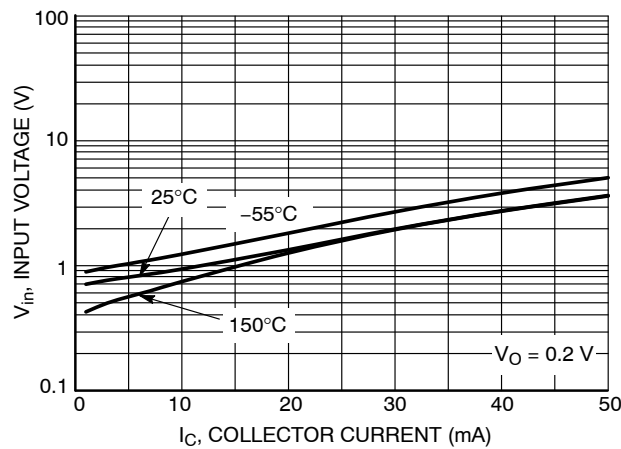
**Figure 13. DC Current Gain**



**Figure 14. Output Capacitance**



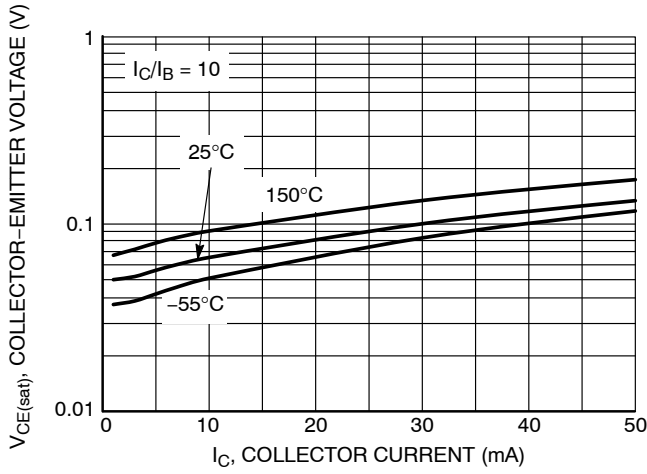
**Figure 15. Output Current vs. Input Voltage**



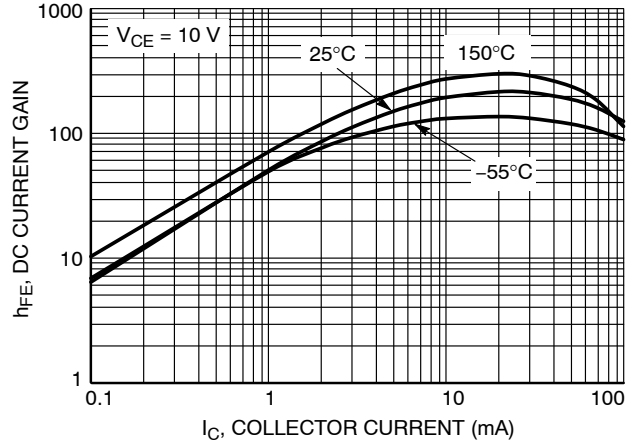
**Figure 16. Input Voltage vs. Output Current**

**MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6**

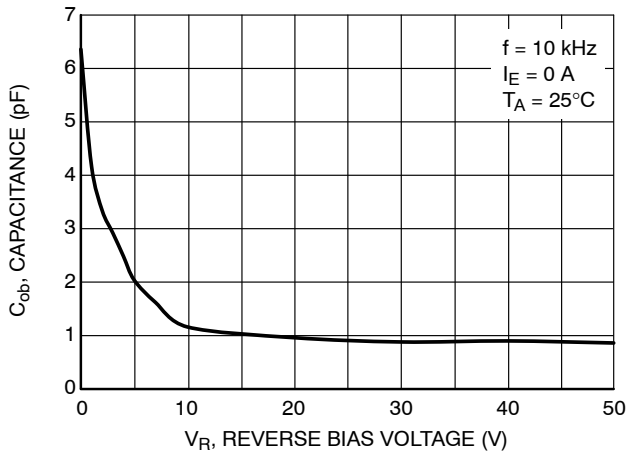
**TYPICAL CHARACTERISTICS – PNP TRANSISTOR  
 NSBC123JPDP6**



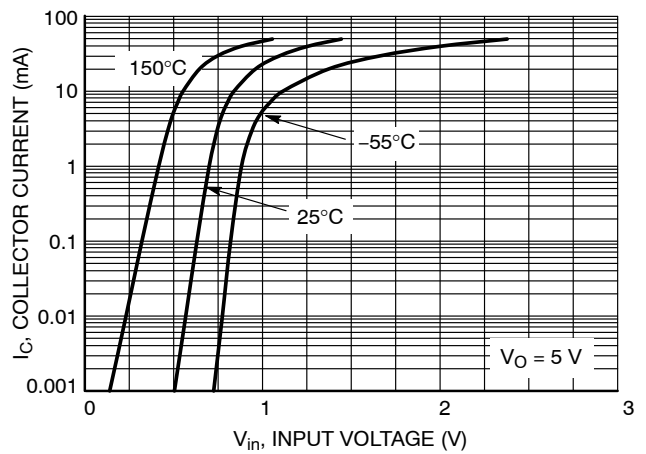
**Figure 17.  $V_{CE(sat)}$  vs.  $I_C$**



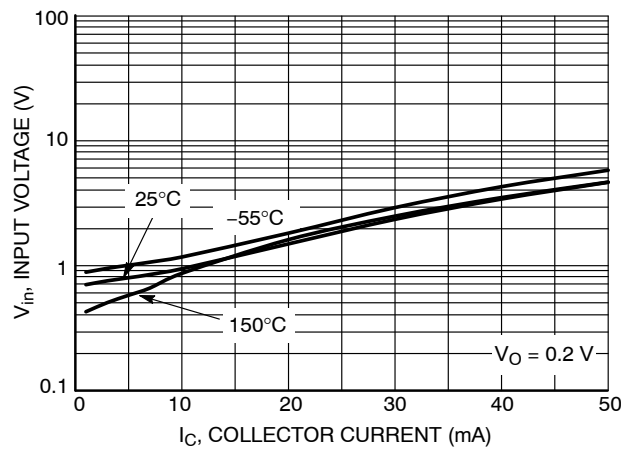
**Figure 18. DC Current Gain**



**Figure 19. Output Capacitance**



**Figure 20. Output Current vs. Input Voltage**



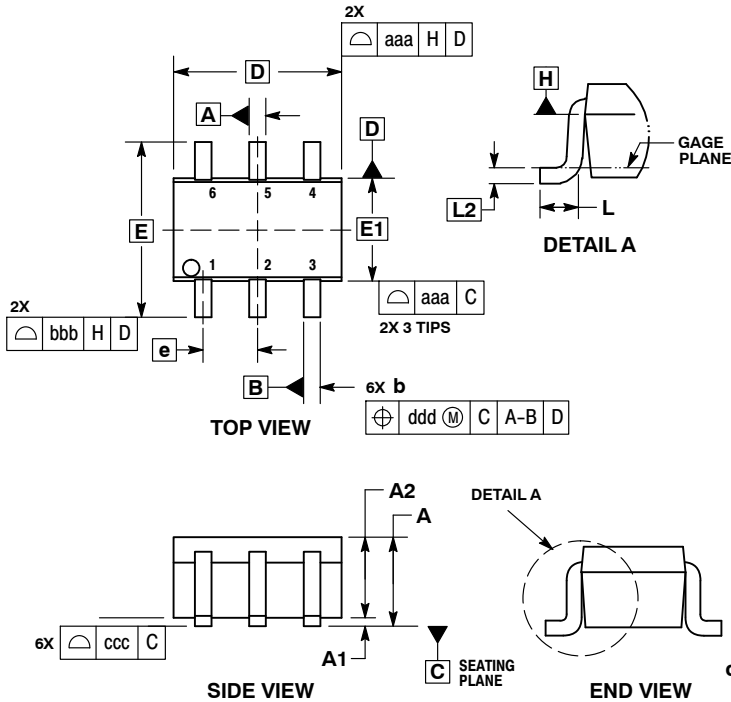
**Figure 21. Input Voltage vs. Output Current**



**MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6**

**PACKAGE DIMENSIONS**

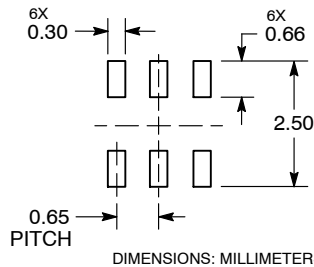
**SC-88/SC70-6/SOT-363**  
CASE 419B-02  
ISSUE Y



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
  4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
  5. DATUMS A AND B ARE DETERMINED AT DATUM H.
  6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
  7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

**RECOMMENDED SOLDERING FOOTPRINT\***

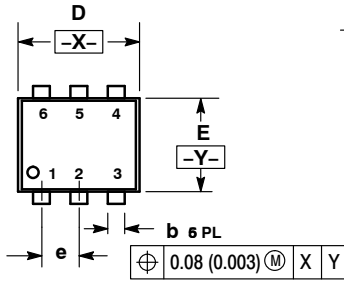


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**MUN5335DW1, NSBC123JPDXV6, NSBC123JPDP6**

**PACKAGE DIMENSIONS**

**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE G

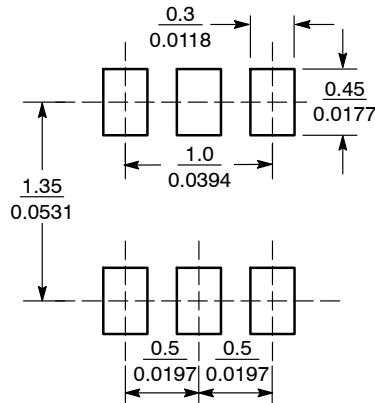


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.021	0.023
b	0.17	0.22	0.27	0.007	0.009	0.011
C	0.08	0.12	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.062	0.066
E	1.10	1.20	1.30	0.043	0.047	0.051
e	0.5 BSC			0.02 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
H <sub>E</sub>	1.50	1.60	1.70	0.059	0.062	0.066

**SOLDERING FOOTPRINT\***



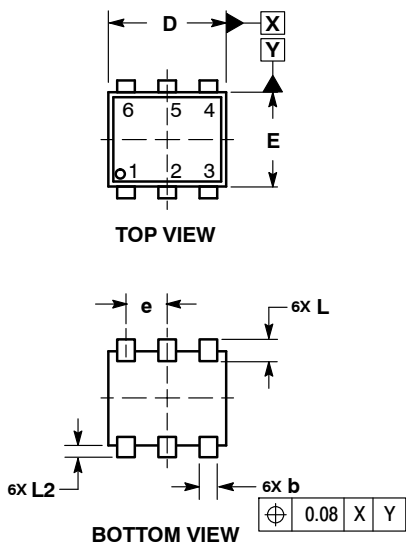
SCALE 20:1 (mm/inches)

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

## MUN5335DW1, NSBC123JPDXV6, NSBC123JPD6

### PACKAGE DIMENSIONS

SOT-963  
CASE 527AD  
ISSUE E

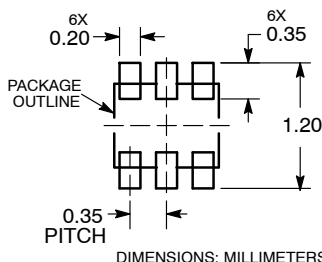


NOTES:


1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.34	0.37	0.40
b	0.10	0.15	0.20
C	0.07	0.12	0.17
D	0.95	1.00	1.05
E	0.75	0.80	0.85
e	0.35 BSC		
H <sub>E</sub>	0.95	1.00	1.05
L	0.19 REF		
L2	0.05	0.10	0.15

### 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.

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