

MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

Complementary Bias Resistor Transistors

R1 = 22 kΩ, R2 = 22 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_A = 25°C both polarities Q₁ (PNP) & Q₂ (NPN), unless otherwise noted)

Rating	Symbol	Max	Unit
Collector-Base Voltage	V _{CBO}	50	Vdc
Collector-Emitter Voltage	V _{CEO}	50	Vdc
Collector Current – Continuous	I _C	100	mAdc
Input Forward Voltage	V _{IN(fwd)}	40	Vdc
Input Reverse Voltage	V _{IN(rev)}	10	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†
MUN5312DW1T1G, SMUN5312DW1T1G*	SOT-363	3,000 / Tape & Reel
NSVMUN5312DW1T3G*	SOT-363	10,000 / Tape & Reel
MUN5312DW1T2G, NSVMUN5312DW1T2G*	SOT-363	3,000 / Tape & Reel
NSBC124EPDXV6T1G	SOT-563	4,000 / Tape & Reel
NSBC124EPDXV6T5G	SOT-563	8,000 / Tape & Reel
NSBC124EPDP6T5G	SOT-963	8,000 / Tape & Reel

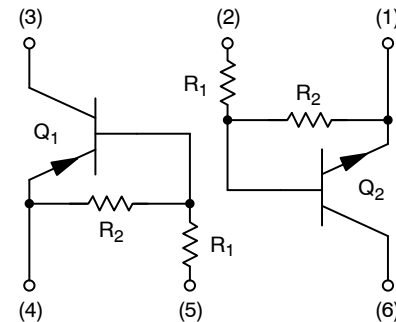
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



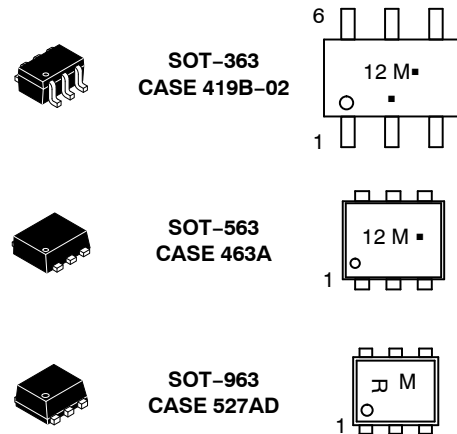
ON Semiconductor®

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PIN CONNECTIONS



MARKING DIAGRAMS



12/R = 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.

MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
MUN5312DW1 (SOT-363) ONE JUNCTION HEATED			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 43) (Note 44) Derate above 25°C (Note 43) (Note 44)	P_D	187 256 1.5 2.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 43) (Note 44)	$R_{\theta JA}$	670 490	$^\circ\text{C}/\text{W}$
MUN5312DW1 (SOT-363) BOTH JUNCTION HEATED (Note 45)			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 43) (Note 44) Derate above 25°C (Note 43) (Note 44)	P_D	250 385 2.0 3.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 43) (Note 44)	$R_{\theta JA}$	493 325	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Lead (Note 43) (Note 44)	$R_{\theta JL}$	188 208	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
NSBC124EPDXV6 (SOT-563) ONE JUNCTION HEATED			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 43) Derate above 25°C (Note 43)	P_D	357 2.9	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 43)	$R_{\theta JA}$	350	$^\circ\text{C}/\text{W}$
NSBC124EPDXV6 (SOT-563) BOTH JUNCTION HEATED (Note 45)			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 43) Derate above 25°C (Note 43)	P_D	500 4.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 43)	$R_{\theta JA}$	250	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
NSBC124EPDP6 (SOT-963) ONE JUNCTION HEATED			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 46) (Note 47) Derate above 25°C (Note 46) (Note 47)	P_D	231 269 1.9 2.2	MW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 46) (Note 47)	$R_{\theta JA}$	540 464	$^\circ\text{C}/\text{W}$
NSBC124EPDP6 (SOT-963) BOTH JUNCTION HEATED (Note 45)			
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 46) (Note 47) Derate above 25°C (Note 46) (Note 47)	P_D	339 408 2.7 3.3	MW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 46) (Note 47)	$R_{\theta JA}$	369 306	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

43. FR-4 @ Minimum Pad.

44. FR-4 @ 1.0 x 1.0 Inch Pad.

45. Both junction heated values assume total power is sum of two equally powered channels.

46. FR-4 @ 100 mm², 1 oz. copper traces, still air.

47. FR-4 @ 500 mm², 1 oz. copper traces, still air.

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

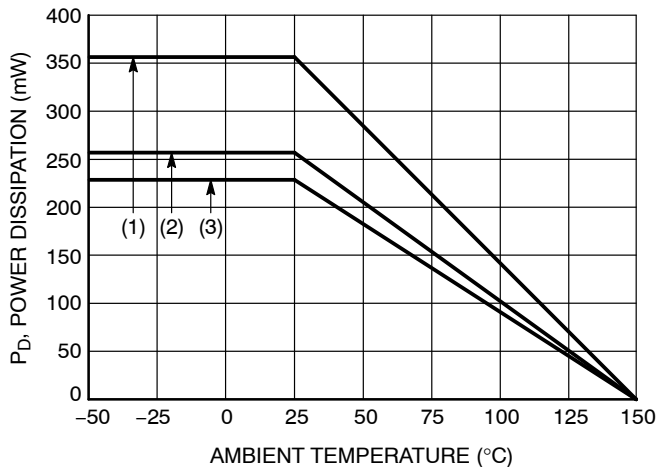
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Cutoff Current ($V_{CB} = 50\text{ V}$, $I_E = 0$)	I_{CBO}	-	-	100	nAdc
Collector-Emitter Cutoff Current ($V_{CE} = 50\text{ V}$, $I_B = 0$)	I_{CEO}	-	-	500	nAdc
Emitter-Base Cutoff Current ($V_{EB} = 6.0\text{ V}$, $I_C = 0$)	I_{EBO}	-	-	0.2	mAdc
Collector-Base Breakdown Voltage ($I_C = 10\ \mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	50	-	-	Vdc
Collector-Emitter Breakdown Voltage (Note 48) ($I_C = 2.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	50	-	-	Vdc

ON CHARACTERISTICS

DC Current Gain (Note 48) ($I_C = 5.0\text{ mA}$, $V_{CE} = 10\text{ V}$)	h_{FE}	60	100	-	
Collector-Emitter Saturation Voltage (Note 48) ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$)	$V_{CE(sat)}$	-	-	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)	$V_{i(off)}$	-	1.2	-	Vdc
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)	$V_{i(on)}$	-	1.9	-	Vdc
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	Vdc
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	-	-	Vdc
Input Resistor	R1	15.4	22	28.6	k Ω
Resistor Ratio	R_1/R_2	0.8	1.0	1.2	

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.

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



- (1) SOT-363; 1.0 × 1.0 Inch Pad
- (2) SOT-563; Minimum Pad
- (3) SOT-963; 100 mm², 1 oz. Copper Trace

Figure 109. Derating Curve

TYPICAL CHARACTERISTICS – NPN TRANSISTOR
MUN5312DW1, NSBC124EPDXV6

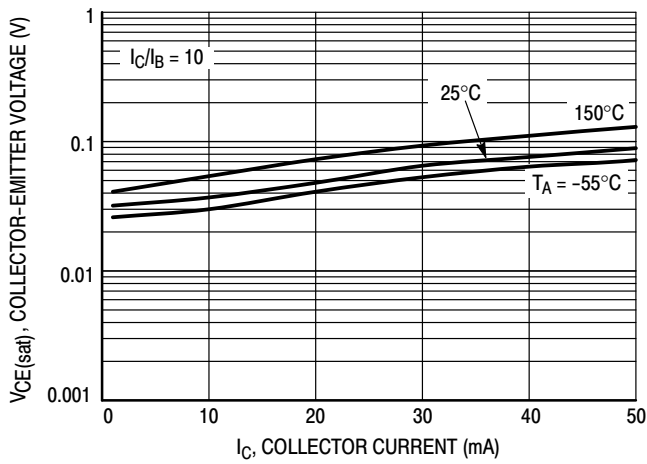


Figure 110. $V_{CE(sat)}$ vs. I_C

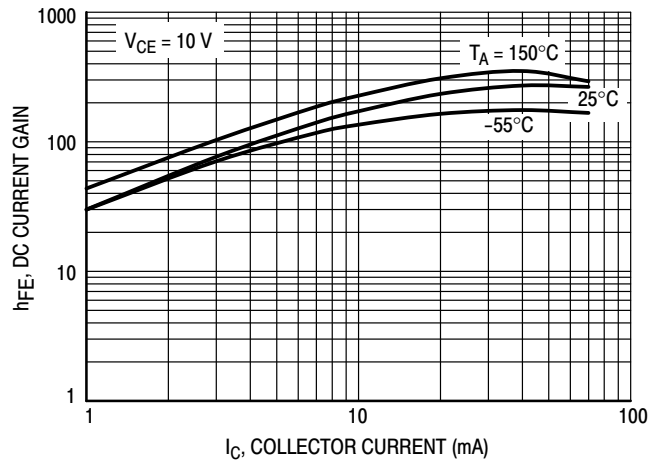


Figure 111. DC Current Gain

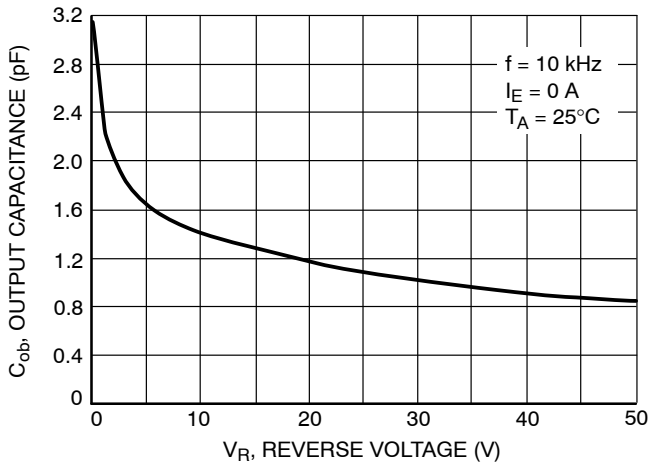


Figure 112. Output Capacitance

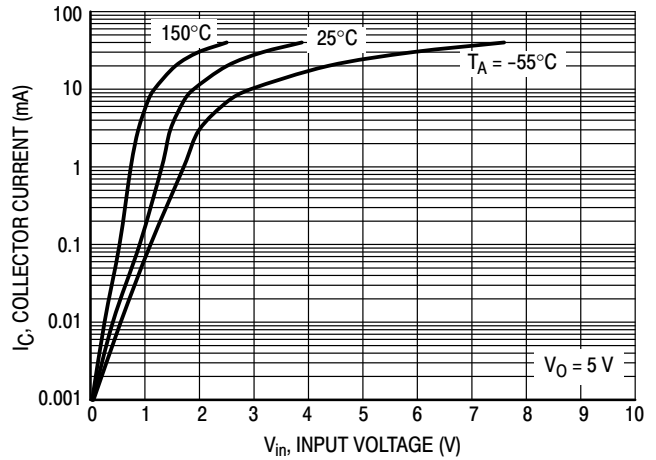


Figure 113. Output Current vs. Input Voltage

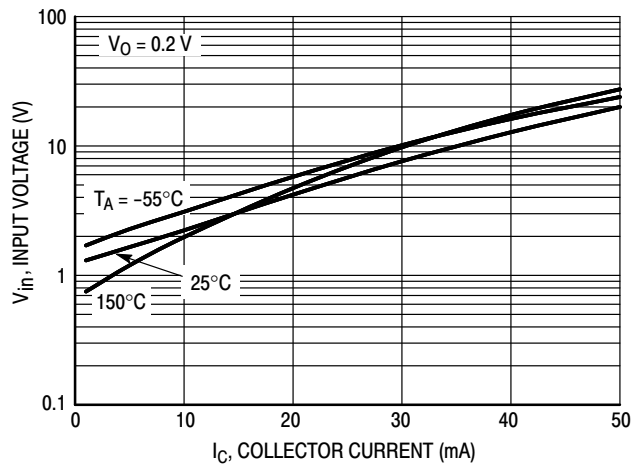


Figure 114. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – PNP TRANSISTOR
MUN5312DW1, NSBC124EPDXV6

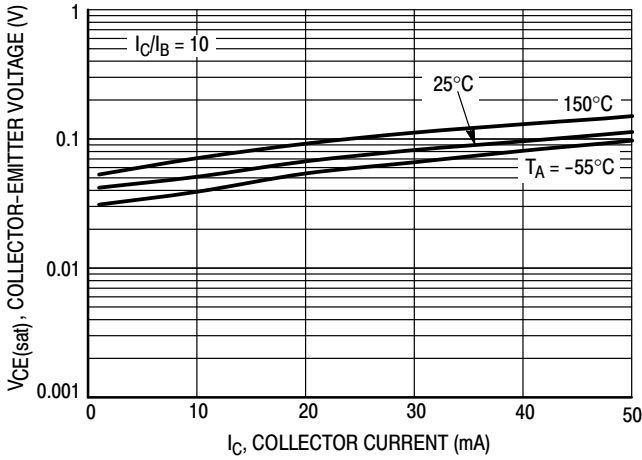


Figure 115. $V_{CE(sat)}$ vs. I_C

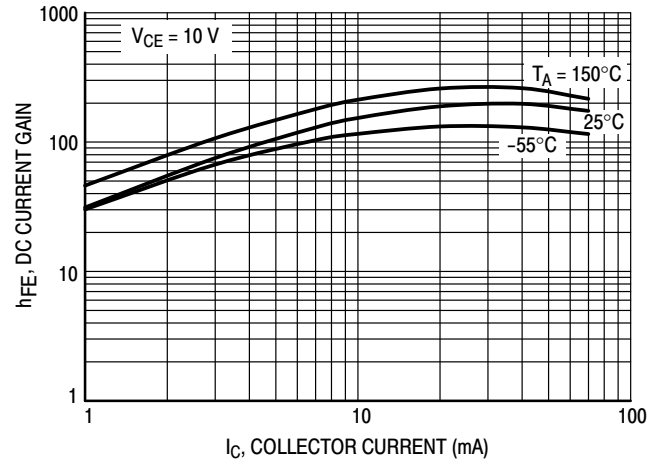


Figure 116. DC Current Gain

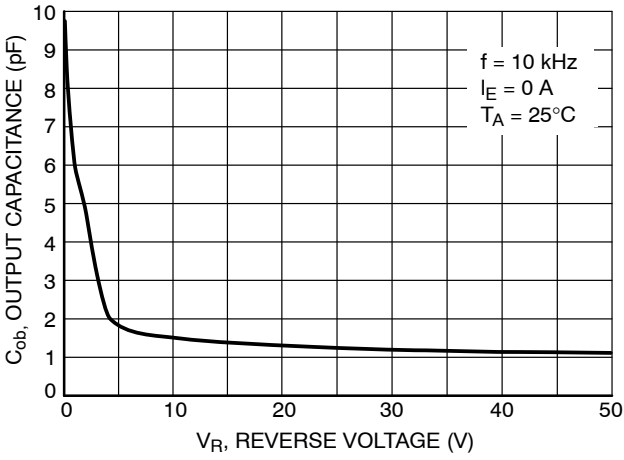


Figure 117. Output Capacitance

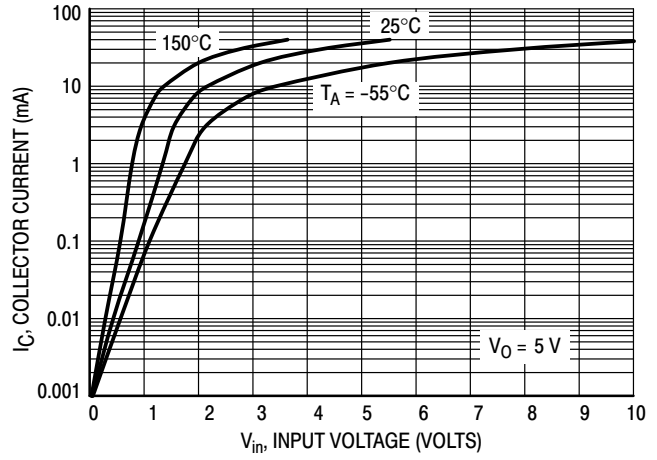


Figure 118. Output Current vs. Input Voltage

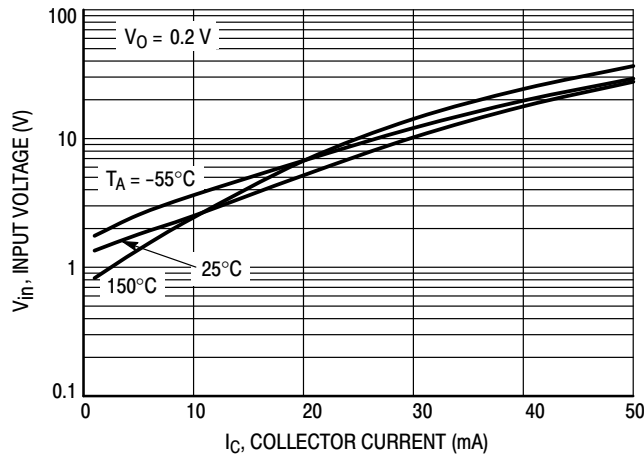


Figure 119. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – NPN TRANSISTOR
NSBC124EPDP6

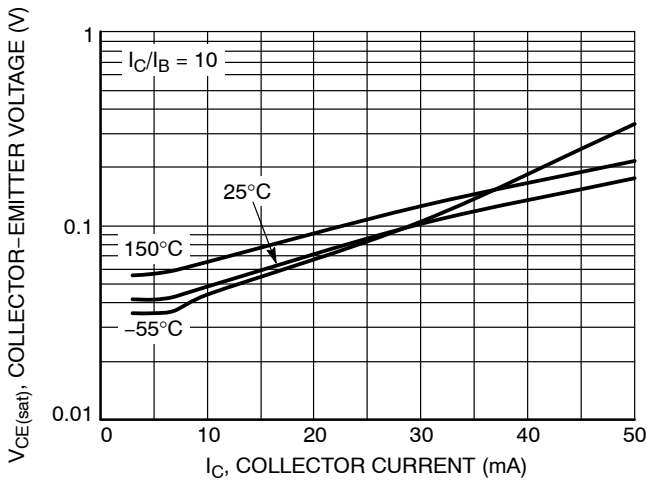


Figure 120. $V_{CE(sat)}$ vs. I_C

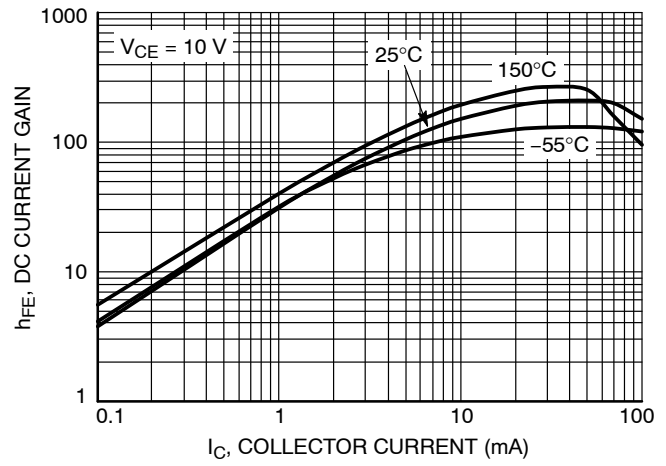


Figure 121. DC Current Gain

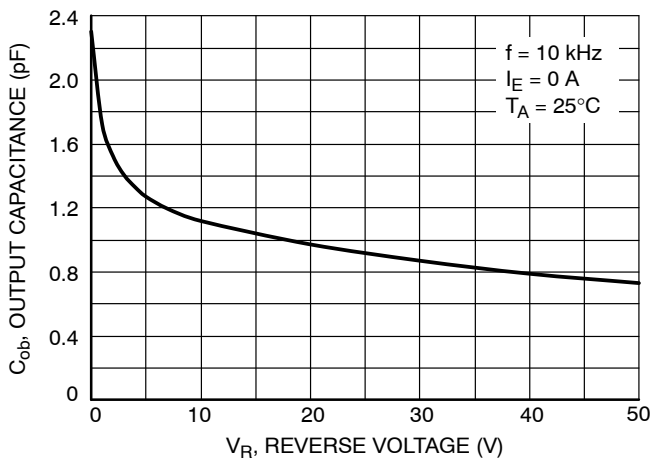


Figure 122. Output Capacitance

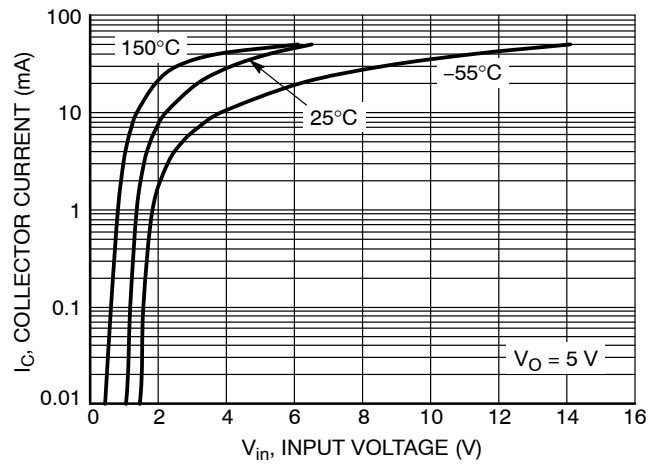


Figure 123. Output Current vs. Input Voltage

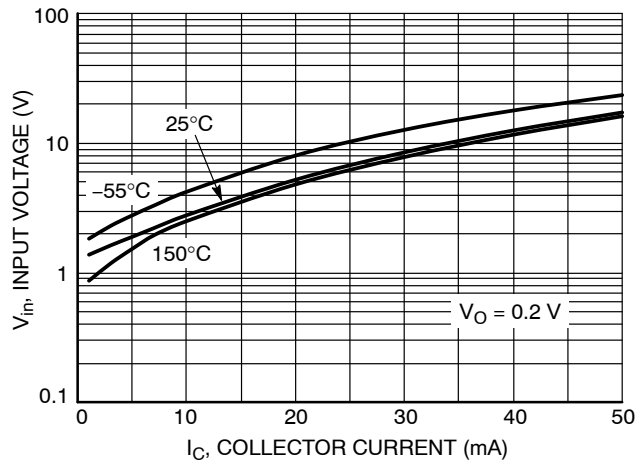


Figure 124. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – PNP TRANSISTOR
NSBC124EPDP6

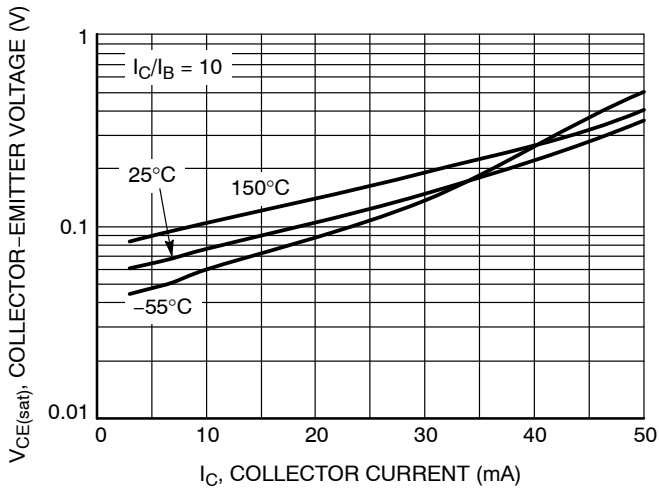


Figure 125. $V_{CE(sat)}$ vs. I_C

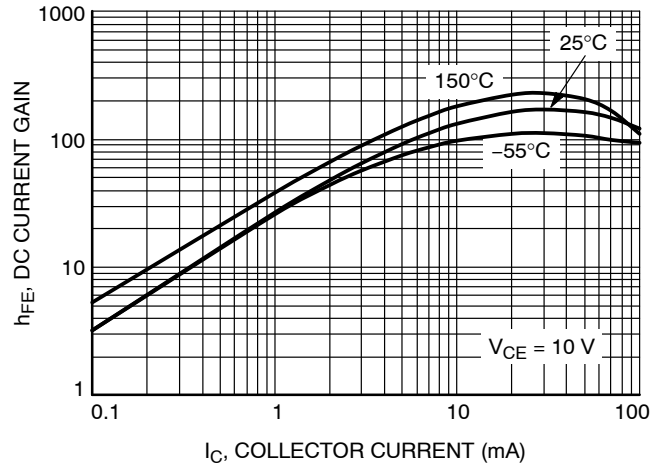


Figure 126. DC Current Gain

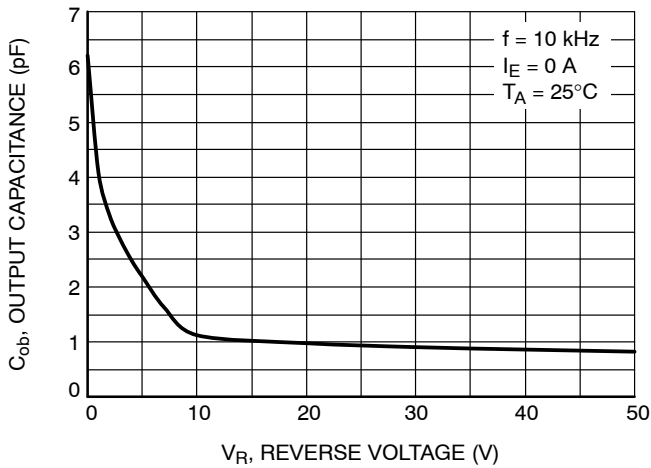


Figure 127. Output Capacitance

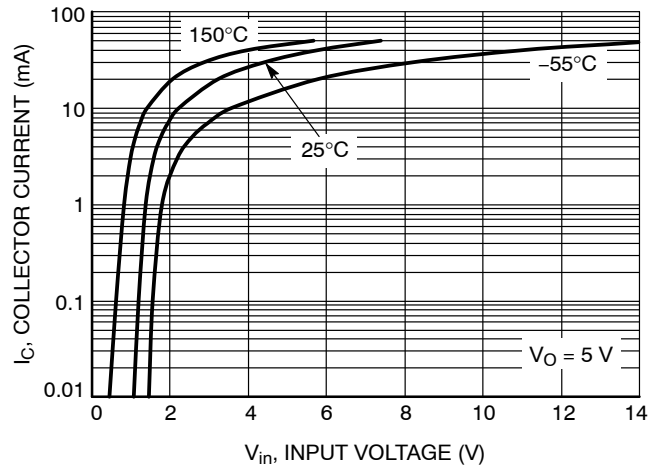


Figure 128. Output Current vs. Input Voltage

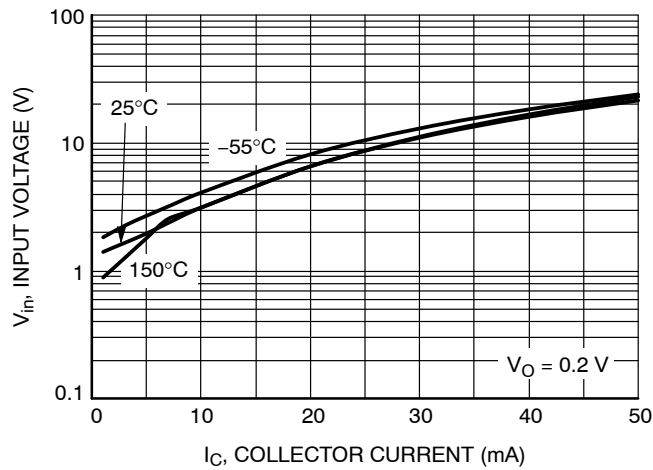
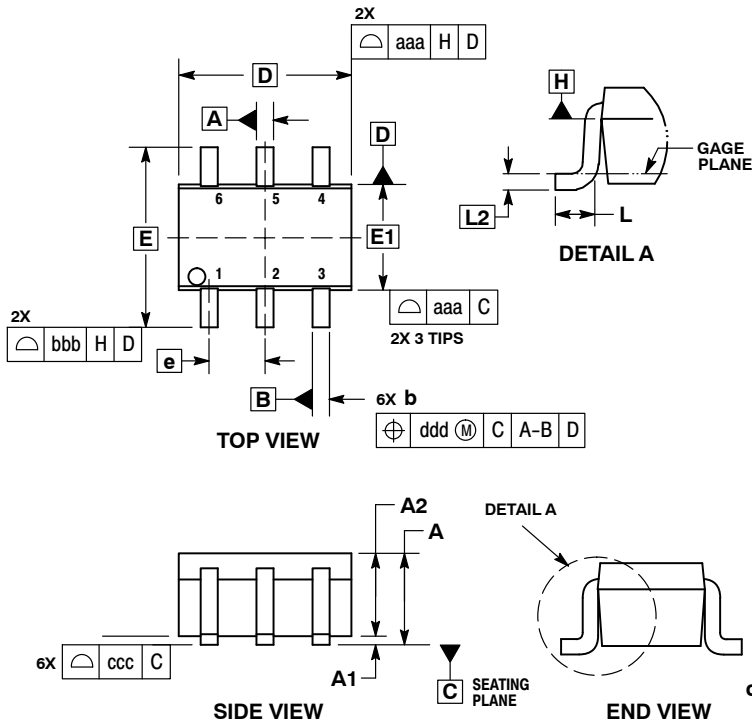


Figure 129. Input Voltage vs. Output Current

PACKAGE DIMENSIONS

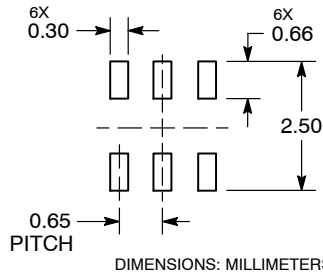
SC-88/SC70-6/SOT-363
CASE 419B-02
ISSUE Y



- 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*

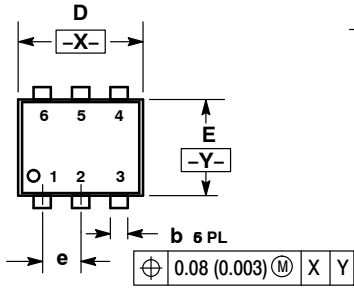


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

PACKAGE DIMENSIONS

SOT-563, 6 LEAD CASE 463A ISSUE G

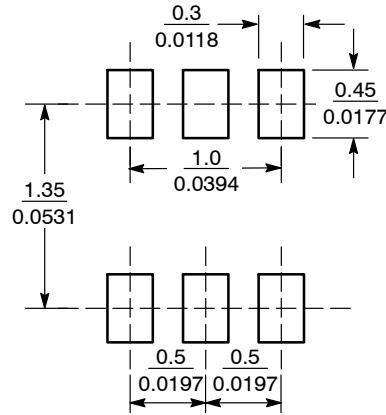


NOTES:

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 _E	1.50	1.60	1.70	0.059	0.062	0.066

SOLDERING FOOTPRINT*



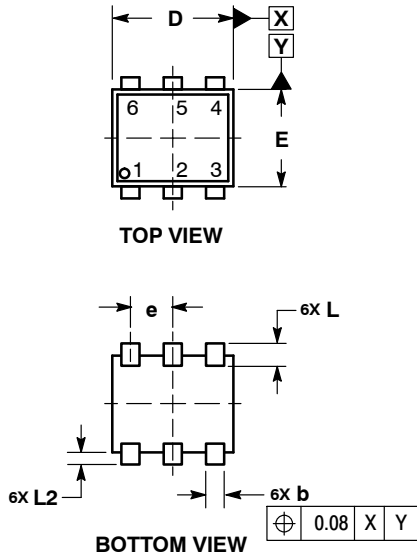
SCALE 20:1 ($\frac{\text{mm}}{\text{inches}}$)

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

MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

PACKAGE DIMENSIONS

SOT-963
CASE 527AD
ISSUE E

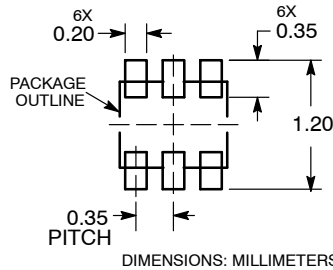


NOTES:

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.

DIM	MILLIMETERS		
	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		
He	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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