

NSBC114EF3T5G Series

Preferred Devices

Digital Transistors (BRT)

NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

This new series of digital transistors is designed to replace a single device and its external resistor bias network. The digital transistor contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The digital transistor eliminates these individual components by integrating them into a single device. The use of a digital transistor can reduce both system cost and board space. The device is housed in the SOT-1123 package which is designed for low power surface mount applications.

Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SOT-1123 Package can be Soldered using Wave or Reflow.
- Available in 4 mm, 8000 Unit Tape & Reel
- These are Pb-Free Devices
- These are Halide-Free Devices

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

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

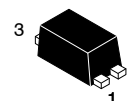
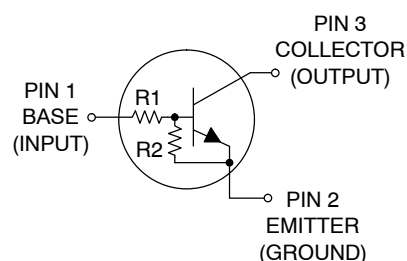
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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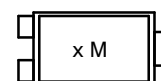
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NPN SILICON DIGITAL TRANSISTORS



SOT-1123
CASE 524AA
STYLE 1

MARKING DIAGRAM



- x = Device Code
- M = Date Code
- G or ■ = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NSBC114EF3T5G	SOT-1123 (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.

DEVICE MARKING INFORMATION

See specific marking information in the device marking table on page 2 of this data sheet.

NSBC114EF3T5G Series

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 1) Derate above 25°C	P_D	254 2.0	mW mW/ $^\circ\text{C}$
Thermal Resistance (Note 1) Junction-to-Ambient	$R_{\theta JA}$	493	$^\circ\text{C}/\text{W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ (Note 2) Derate above 25°C	P_D	297 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance Junction-to-Ambient (Note 2)	$R_{\theta JA}$	421	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction-to-Lead 3 (Note 1)	$R_{\theta JL}$	193	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

1. FR-4 @ 100 mm², 1 oz. copper traces, still air.
2. FR-4 @ 500 mm², 1 oz. copper traces, still air.

DEVICE MARKING AND RESISTOR VALUES

Device	Marking*	R1 (k)	R2 (k)	Package	Shipping [†]
NSBC114EF3T5G	A (0°)	10	10	SOT-1123 (Pb-Free)	8000/Tape & Reel
NSBC124EF3T5G	L (0°)	22	22		
NSBC144EF3T5G	D (0°)	47	47		
NSBC114YF3T5G	J (0°)	10	47		
NSBC123TF3T5G	T (0°)	2.2	∞		
NSBC143EF3T5G	P (0°)	4.7	4.7		
NSBC143ZF3T5G	R (0°)	4.7	47		
NSBC123JF3T5G	V (0°)	2.2	47		
NSBC144WF3T5G	Q (0°)	47	22		
NSBC114TF3T5G	K (90°)	10	∞		
NSBC115TF3T5G	P (90°)	100	∞		

[†]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.

*(XX°) = Degree rotation in the clockwise direction.

NSBC114EF3T5G Series

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ 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}	–	–	0.5	mAdc
	NSBC114EF3T5G	–	–	0.2	
	NSBC124EF3T5G	–	–	0.1	
	NSBC144EF3T5G	–	–	0.2	
	NSBC114YF3T5G	–	–	0.9	
	NSBC114TF3T5G	–	–	4.0	
	NSBC123TF3T5G	–	–	0.1	
	NSBC115TF3T5G	–	–	1.5	
	NSBC143EF3T5G	–	–	0.18	
	NSBC143ZF3T5G	–	–	0.2	
	NSBC123JF3T5G	–	–	0.13	
	NSBC144WF3T5G	–	–	0.13	
Collector–Base Breakdown Voltage ($I_C = 10\ \mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	50	–	–	Vdc
Collector–Emitter Breakdown Voltage (Note 3) ($I_C = 2.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	50	–	–	Vdc
ON CHARACTERISTICS (Note 3)					
DC Current Gain ($V_{CE} = 10\text{ V}$, $I_C = 5.0\text{ mA}$)	h_{FE}	35	60	–	
	NSBC114EF3T5G	60	100	–	
	NSBC124EF3T5G	80	140	–	
	NSBC144EF3T5G	80	140	–	
	NSBC114YF3T5G	160	350	–	
	NSBC114TF3T5G/NSBC115TF3T5G	15	30	–	
	NSBC123TF3T5G	80	200	–	
	NSBC143EF3T5G	80	140	–	
	NSBC143ZF3T5G	80	140	–	
	NSBC123JF3T5G	80	140	–	
	NSBC144WF3T5G	80	140	–	
Collector–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$) NSBC114EF3T5G/NSBC124EF3T5G/NSBC144EF3T5G NSBC114YF3T5G/NSBC144WF3T5G/NSBC123JF3T5G ($I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$) NSBC143EF3T5G/NSBC143ZF3T5G/NSBC123TF3T5G/ NSBC114TF3T5G ($I_C = 10\text{ mA}$, $I_B = 5\text{ mA}$) NSBC115TF3T5G	$V_{CE(sat)}$	–	–	0.25	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
	NSBC114TF3T5G	–	–	0.2	
	NSBC114EF3T5G	–	–	0.2	
	NSBC124EF3T5G	–	–	0.2	
	NSBC114YF3T5G	–	–	0.2	
	NSBC123TF3T5G	–	–	0.2	
	NSBC143EF3T5G	–	–	0.2	
	NSBC143ZF3T5G	–	–	0.2	
	NSBC123JF3T5G	–	–	0.2	
	NSBC144EF3T5G	–	–	0.2	
($V_{CC} = 5.0\text{ V}$, $V_B = 3.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$)	NSBC144WF3T5G	–	–	0.2	
($V_{CC} = 5.0\text{ V}$, $V_B = 4.0\text{ V}$, $R_L = 1.0\text{ k}\Omega$)	NSBC144WF3T5G	–	–	0.2	
($V_{CC} = 5.0\text{ V}$, $V_B = 5.0\text{ V}$, $R_L = 1.0\text{ k}\Omega$)	NSBC115TF3T5G	–	–	0.2	

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

NSBC114EF3T5G Series

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 4)					
Output Voltage (off) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) NSBC114EF3T5G/NSBC124EF3T5G/NSBC144EF3T5G NSBC144YF3T5G/NSBC143EF3T5G/NSBC123JF3T5G NSBC144WF3T5G ($V_{CC} = 5.0\text{ V}$, $V_B = 0.25\text{ V}$, $R_L = 1.0\text{ k}\Omega$) NSBC123TF3T5G/NSBC143ZF3T5G/NSBC114TF3T5G/ NSBC115TF3T5G	V_{OH}	4.9	–	–	Vdc
Input Resistor NSBC114TF3T5G NSBC114EF3T5G NSBC124EF3T5G NSBC144EF3T5G NSBC114YF3T5G NSBC123TF3T5G NSBC143EF3T5G NSBC143ZF3T5G NSBC123JF3T5G NSBC144WF3T5G NSBC115TF3T5G	R1	7.0 7.0 15.4 32.9 7.0 1.5 3.3 3.3 1.54 32.9 70	10 10 22 47 10 2.2 4.7 4.7 2.2 47 100	13 13 28.6 61.1 13 2.9 6.1 6.1 2.86 61.1 130	k Ω
Resistor Ratio NSBC114EF3T5G/NSBC124EF3T5G/ NSBC144EF3T5G/NSBC123EF3T5G NSBC114YF3T5G NSBC114TF3T5G/NSBC115TF3T5G/NSBC123TF3T5G NSBC143ZF3T5G NSBC123JF3T5G NSBC144WF3T5G	R_1/R_2	0.8 0.17 – 0.055 0.038 1.7	1.0 0.21 – 0.1 0.047 2.1	1.2 0.25 – 0.185 0.056 2.6	

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

NSBC114EF3T5G Series

TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114EF3T5G

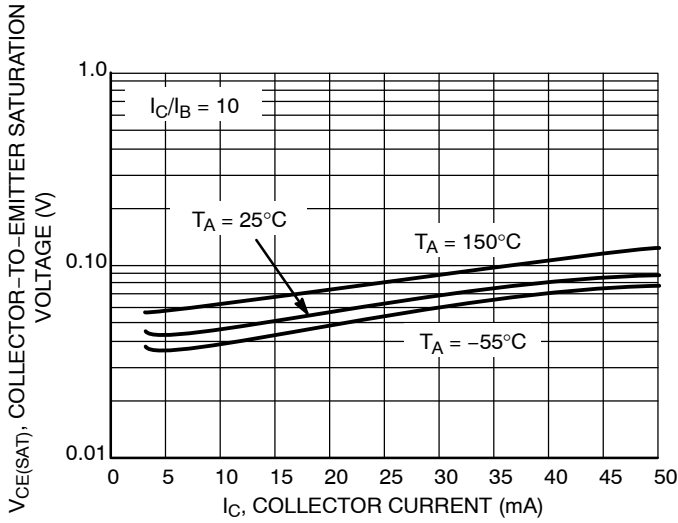


Figure 1. $V_{CE(sat)}$ vs. I_C

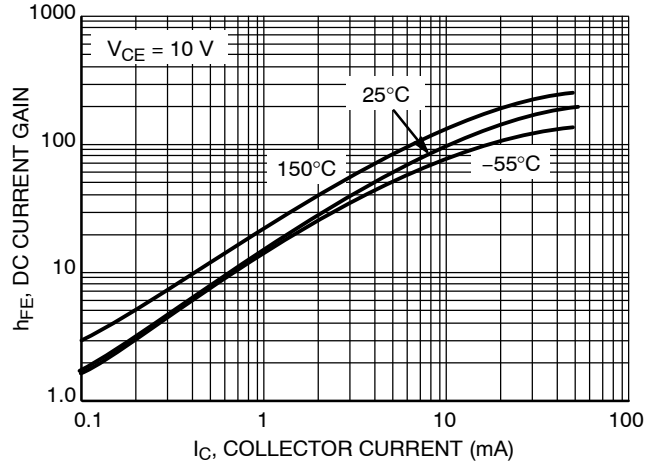


Figure 2. DC Current Gain

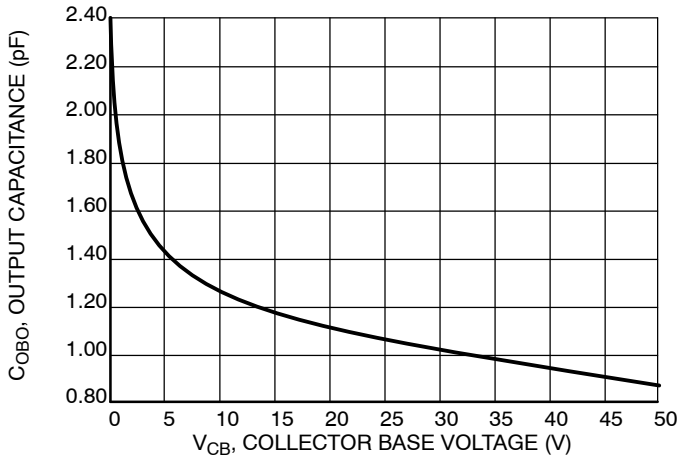


Figure 3. Output Capacitance

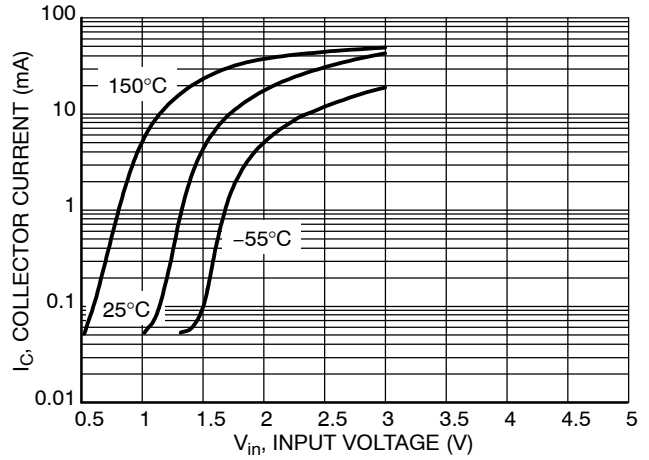


Figure 4. Output Current vs. Input Voltage

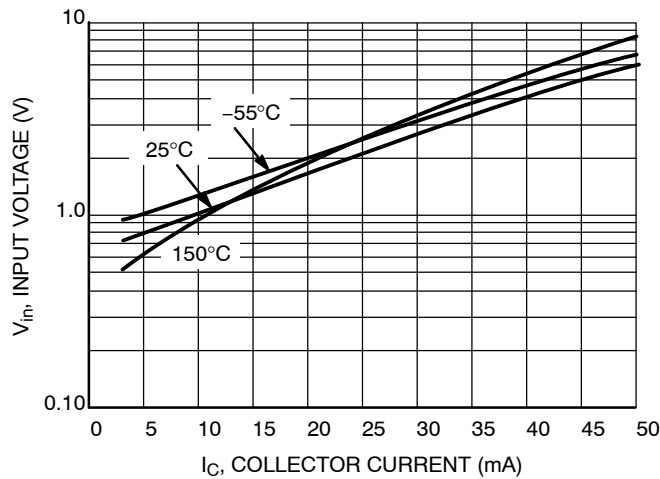


Figure 5. Input Voltage vs. Output Current

NSBC114EF3T5G Series

TYPICAL APPLICATIONS FOR NPN BRTs

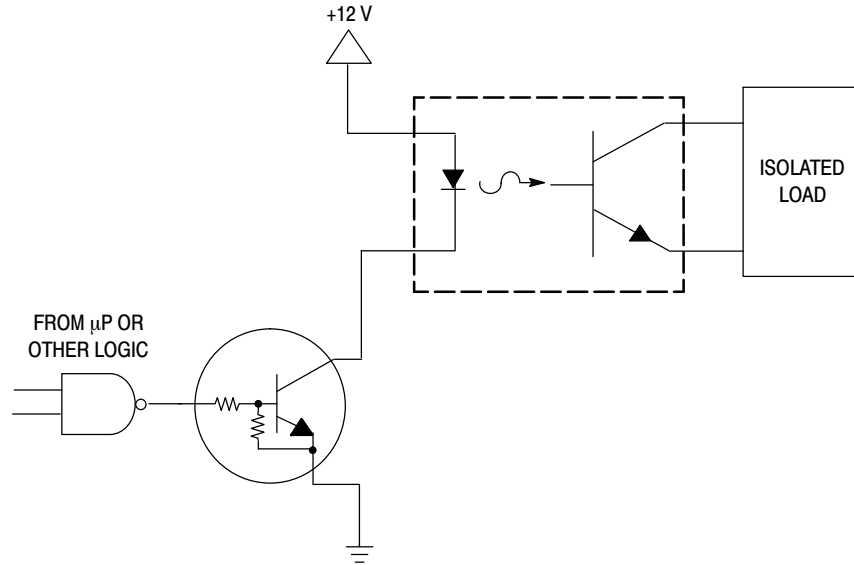


Figure 6. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

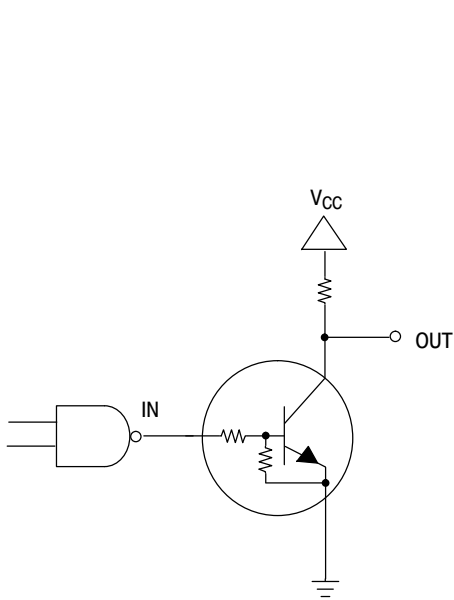


Figure 7. Open Collector Inverter: Inverts the Input Signal

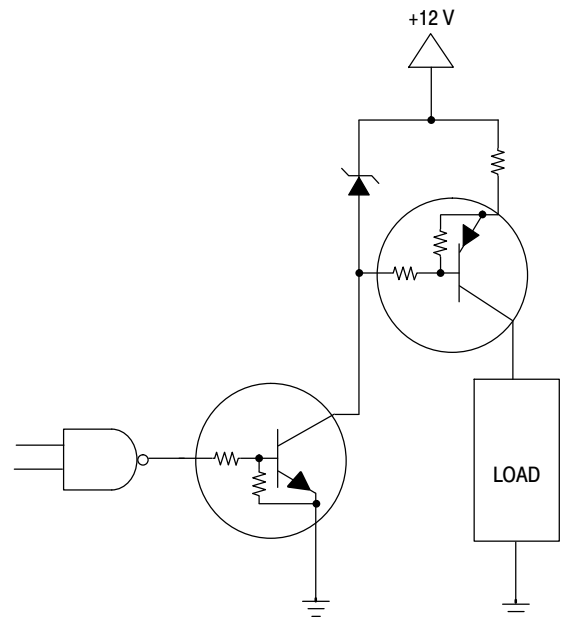
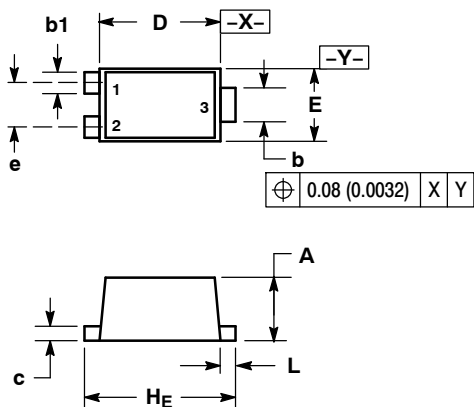


Figure 8. Inexpensive, Unregulated Current Source

NSBC114EF3T5G Series

PACKAGE DIMENSIONS

SOT-1123
CASE 524AA-01
ISSUE B

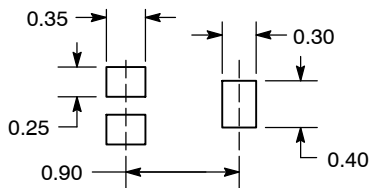


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.34	0.37	0.40	0.013	0.015	0.016
b	0.15	0.22	0.28	0.006	0.009	0.011
b1	0.10	0.15	0.20	0.004	0.006	0.008
c	0.07	0.12	0.17	0.003	0.005	0.007
D	0.75	0.80	0.85	0.030	0.031	0.033
E	0.55	0.60	0.65	0.022	0.024	0.026
e	0.35	---	0.40	0.014	---	0.016
HE	0.95	1.00	1.05	0.037	0.039	0.041
L	0.05	0.10	0.15	0.002	0.004	0.006

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*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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