# **Digital Transistors (BRT)** R1 = 22 k $\Omega$ , R2 = 22 k $\Omega$

## NPN 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> = $25^{\circ}$ C)

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	Ι <sub>C</sub>	100	mAdc
Input Forward Voltage	V <sub>IN(fwd)</sub>	40	Vdc
Input Reverse Voltage	V <sub>IN(rev)</sub>	10	Vdc

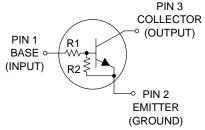
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

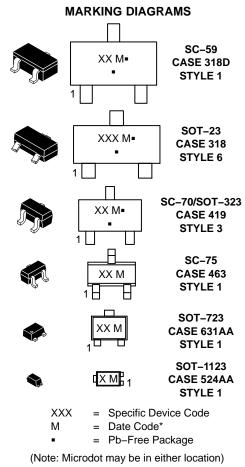


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\*Date Code orientation may vary depending upon manufacturing location.

#### **ORDERING INFORMATION**

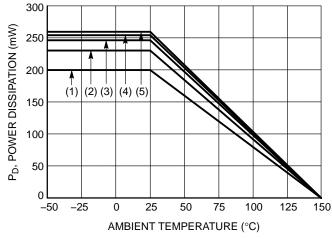
See detailed ordering, marking, and shipping information in the package dimensions section on page 2 of this data sheet.

#### Table 1. ORDERING INFORMATION

Device	Part Marking	Package	Shipping <sup>†</sup>
MUN2212T1G, NSVMUN2212T1G*	8B	SC–59 (P–Free)	3000 / Tape & Reel
MMUN2212LT1G, NSVMMUN2212LT1G*	A8B	SOT-23 (P-Free)	3000 / Tape & Reel
MUN5212T1G, SMUN5212T1G*	8B	SC-70/SOT-323 (P-Free)	3000 / Tape & Reel
DTC124EET1G, SDTC124EET1G*	8B	SC–75 (P–Free)	3000 / Tape & Reel
DTC124EM3T5G	8B	SOT-723 (P-Free)	8000 / Tape & Reel
NSBC124EF3T5G	L	SOT-1123 (P-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.

\*S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q101 Qualified and PPAP Capable.



SC-75 and SC-70/SOT323; Minimum Pad
 SC-59; Minimum Pad
 SOT-23; Minimum Pad
 SOT-1123; 100 mm<sup>2</sup>, 1 oz. copper trace
 SOT-723; Minimum Pad

Figure 1. Derating Curve

#### **Table 2. THERMAL CHARACTERISTICS**

THERMAL CHARACTERISTICS (SC-59) (MUN2212)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{\circ}C (Note 1) (Note 2)	PD	230 338 1.8 2.7	mW mW/°C
Thermal Resistance, (Note 1) Junction to Ambient (Note 2)	R <sub>θJA</sub>	540 370	°C/W
Thermal Resistance, (Note 1) Junction to Lead (Note 2)	R <sub>θJL</sub>	264 287	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
THERMAL CHARACTERISTICS (SOT-23) (MMUN2212L)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{\circ}C (Note 1) (Note 2)	PD	246 400 2.0 3.2	mW mW/°C
Thermal Resistance,(Note 1)Junction to Ambient(Note 2)	R <sub>θJA</sub>	508 311	°C/W
Thermal Resistance, (Note 1) Junction to Lead (Note 2)	R <sub>θJL</sub>	174 208	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
THERMAL CHARACTERISTICS (SC-70/SOT-323) (MUN5212)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{\circ}C (Note 1) (Note 2)	PD	202 310 1.6 2.5	mW mW/°C
Thermal Resistance,(Note 1)Junction to Ambient(Note 2)	R <sub>θJA</sub>	618 403	°C/W
Thermal Resistance, (Note 1) Junction to Lead (Note 2)	R <sub>θJL</sub>	280 332	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
THERMAL CHARACTERISTICS (SC-75) (DTC124EE)		_	
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{\circ}C (Note 1) (Note 2)	PD	200 300 1.6 2.4	mW mW/°C
Thermal Resistance,(Note 1)Junction to Ambient(Note 2)	R <sub>θJA</sub>	600 400	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
THERMAL CHARACTERISTICS (SOT-723) (DTC124EM3)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{\circ}C (Note 1) (Note 2)	PD	260 600 2.0 4.8	mW mW/°C
Thermal Resistance,(Note 1)Junction to Ambient(Note 2)	R <sub>θJA</sub>	480 205	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

FR-4 @ 1.0 x 1.0 Inch Pad.
 FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces, still air.
 FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces, still air.

#### **Table 2. THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
THERMAL CHARACTERISTICS (SOT-1123) (NSBC124EF3)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 3) (Note 4) Derate above 25^{\circ}C (Note 3) (Note 4)	PD	254 297 2.0 2.4	mW mW/°C
Thermal Resistance,(Note 3)Junction to Ambient(Note 4)	R <sub>θJA</sub>	493 421	°C/W
Thermal Resistance, Junction to Lead (Note 3)	R <sub>θJL</sub>	193	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

1. FR-4 @ Minimum Pad.

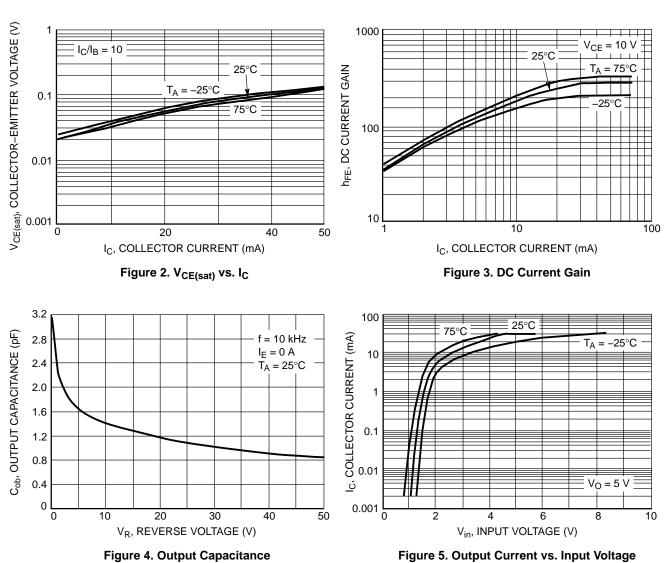
FR-4 @ 1.0 x 1.0 Inch Pad.
 FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces, still air.
 FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces, still air.

#### Table 3. ELECTRICAL CHARACTERISTICS ( $T_A = 25^{\circ}C$ , unless otherwise noted)

Characteristic	Symbol	Min	Тур	Max	Unit
OFF CHARACTERISTICS					
Collector–Base Cutoff Current ( $V_{CB} = 50 \text{ V}, I_E = 0$ )	I <sub>CBO</sub>	_	_	100	nAdc
Collector–Emitter Cutoff Current ( $V_{CE} = 50 V$ , $I_B = 0$ )	I <sub>CEO</sub>	-	_	500	nAdc
Emitter–Base Cutoff Current ( $V_{EB} = 6.0 \text{ V}, I_C = 0$ )	I <sub>EBO</sub>	-	_	0.2	mAdc
Collector–Base Breakdown Voltage $(I_C = 10 \ \mu A, I_E = 0)$	V <sub>(BR)CBO</sub>	50	-	_	Vdc
Collector–Emitter Breakdown Voltage (Note 5) $(I_C = 2.0 \text{ mA}, I_B = 0)$	V <sub>(BR)CEO</sub>	50	_	_	Vdc
ON CHARACTERISTICS		-			
DC Current Gain (Note 5) ( $I_C = 5.0 \text{ mA}, V_{CE} = 10 \text{ V}$ )	h <sub>FE</sub>	60	100	_	
Collector–Emitter Saturation Voltage (Note 5) $(I_C = 10 \text{ mA}, I_B = 0.3 \text{ mA})$	V <sub>CE(sat)</sub>	_	_	0.25	Vdc
Input Voltage (off) $(V_{CE} = 5.0 \text{ V}, I_C = 100 \mu\text{A})$	V <sub>i(off)</sub>	-	1.2	0.8	Vdc
Input Voltage (on) ( $V_{CE} = 0.3 \text{ V}, I_C = 5.0 \text{ mA}$ )	V <sub>i(on)</sub>	2.5	1.6	_	Vdc
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 k $\Omega$ )	V <sub>OL</sub>	-	_	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 <sub>OH</sub>	4.9	_	_	Vdc
Input Resistor	R1	15.4	22	28.6	kΩ
Resistor Ratio	R <sub>1</sub> /R <sub>2</sub>	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. 5. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle  $\leq 2\%$ .



TYPICAL CHARACTERISTICS MUN2212, MMUN2212L, NSVMMUN2212LT1G, MUN5212, DTC124EE, DTC124EM3

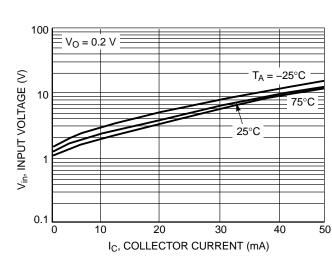
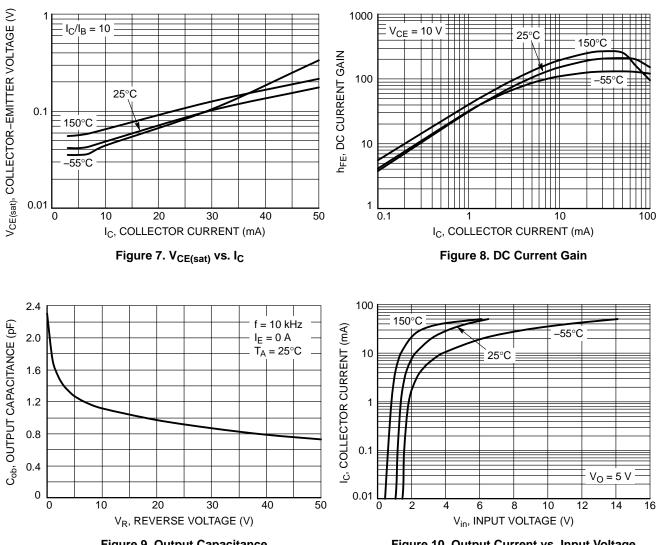


Figure 6. Input Voltage vs. Output Current



#### **TYPICAL CHARACTERISTICS – NSBC124EF3**

Figure 9. Output Capacitance

Figure 10. Output Current vs. Input Voltage

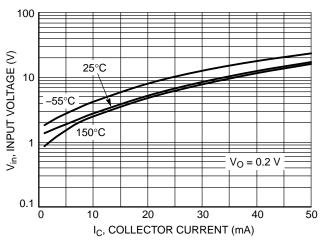


Figure 11. Input Voltage vs. Output Current





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SCALE 2:1



#### **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.

SC-59 CASE 318D-04 ISSUE H

DATE 28 JUN 2012

NOTES:

DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		MILLIMETERS INCHES			
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	1.00	1.15	1.30	0.039	0.045	0.051
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.35	0.43	0.50	0.014	0.017	0.020
С	0.09	0.14	0.18	0.003	0.005	0.007
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
е	1.70	1.90	2.10	0.067	0.075	0.083
L	0.20	0.40	0.60	0.008	0.016	0.024
HE	2.50	2.80	3.00	0.099	0.110	0.118

#### GENERIC **MARKING DIAGRAM**



= Specific Device Code XXX Μ = Date Code

= Pb-Free Package\*

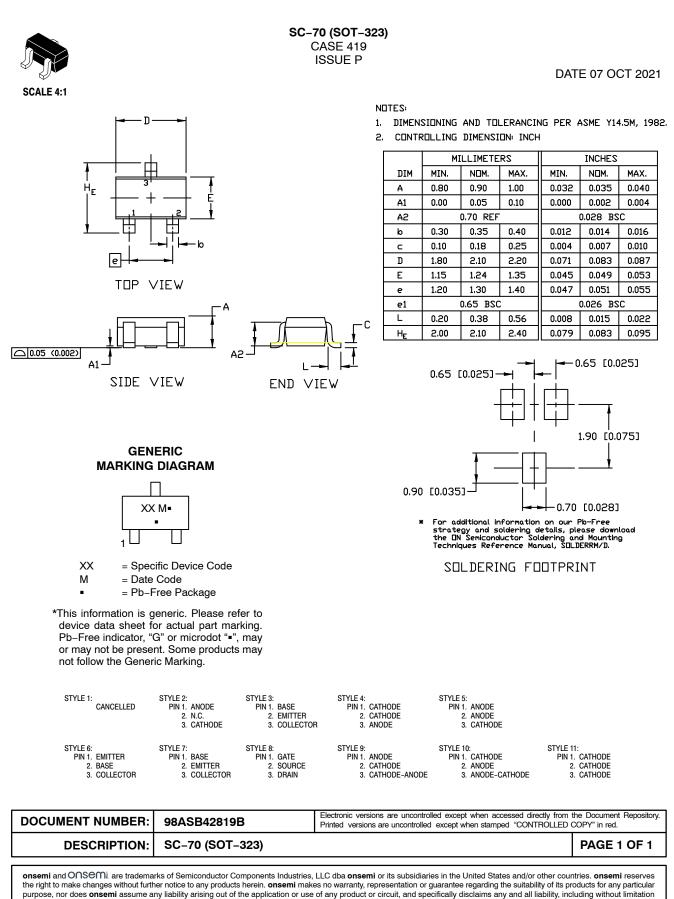
(\*Note: Microdot may be in either location)

\*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.

STYLE 1:	STYLE 2:	STYLE 3:
PIN 1. BASE	PIN 1. ANODE	PIN 1. ANODE
2. EMITTER	2. N.C.	2. ANODE
3. COLLECTOR	3. CATHODE	3. CATHODE
Style 4:	Style 5:	STYLE 6:
Pin 1. Cathode	Pin 1. Cathode	PIN 1. ANODE
2. N.C.	2. Cathode	2. CATHODE
3. Anode	3. Anode	3. ANODE/CATHODE

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1.000

0.039

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mm

inches

0.508

0.020

 
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SOT-1123 CASE 524AA **ISSUE C** 





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2. EMITTER	2. N/C	2. ANODE	2. CATHODE	2. SOURCE
3. COLLECTOR	3. CATHODE	3. CATHODE	3. ANODE	3. DRAIN

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DATE 29 NOV 2011

- NOTES:
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- MINIMUM THICKNESS OF BASE MATERIAL. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. 4.

	MILLIMETERS			
DIM	MIN	MAX		
Α	0.34	0.40		
b	0.15	0.28		
b1	0.10	0.20		
С	0.07	0.17		
D	0.75	0.85		
Е	0.55	0.65		
е	0.35	0.40		
HE	0.95	1.05		
L	0.185 REF			
L2	0.05	0.15		

GENERIC **MARKING DIAGRAM\*** 

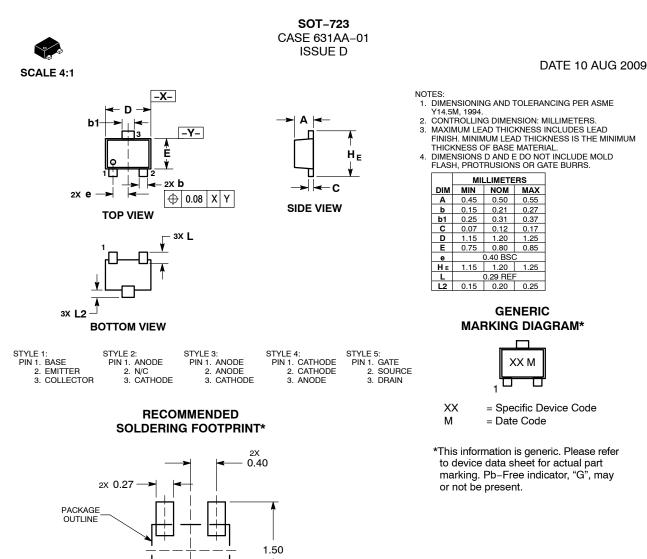
= Specific Device Code Х Μ = Date Code

\*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.

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3X 0.52 - - 0.36 DIMENSIONS: MILLIMETERS

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