# Onsemi

Q

(6)

# **Dual NPN Bias Resistor** Transistors

R1 = 2.2 kΩ, R2 = 47 kΩ

**NPN Transistors with Monolithic Bias Resistor Network** 

## MUN5235DW1, NSBC123JDXV6, NSBC123JDP6

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, common for Q<sub>1</sub> and Q<sub>2</sub>, 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	Ι <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>
MUN5235DW1T1G, SMUN5235DW1T1G	SOT-363	3,000 / Tape & Reel
SMUN5235DW1T3G	SOT-363	10,000 / Tape & Reel
NSBC123JDXV6T1G	SOT-563	4,000 / Tape & Reel
NSBC123JDXV6T5G NSVBC123JDXV6T5G*	SOT-563	8,000 / Tape & Reel
NSBC123JDP6T5G	SOT-963	8,000 / Tape & Reel
NSVBC123JDXV6T1G	SOT-563	4,000 / Tape & Reel

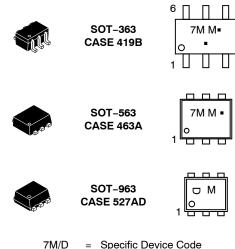
+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

**PIN CONNECTIONS** (3) (2)(1)٩ ج  $R_1$ R<sub>2</sub> Q1  $Q_2$  $R_2$ Ş R<sub>1</sub>

#### **MARKING DIAGRAMS**

(5)

(4)



Μ = Date Code\* = Pb-Free Package

(Note: Microdot may be in either location)

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

#### THERMAL CHARACTERISTICS

	Characteristic	Symbol	Max	Unit
MUN5235DW1 (SOT-363) ON	E JUNCTION HEATED			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{C} (Note 2)	(Note 1)	PD	187 256 1.5 2.0	mW mW/°C
Thermal Resistance, Junction to Ambient	(Note 1) (Note 2)	$R_{ extsf{ heta}JA}$	670 490	°C/W
MUN5235DW1 (SOT-363) BO	TH JUNCTION HEATED (Note 3)		• • • • •	
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 1) (Note 2) Derate above 25^{C} (Note 2)	(Note 1)	PD	250 385 2.0 3.0	mW mW/°C
Thermal Resistance, Junction to Ambient (Note 2)	(Note 1)	R <sub>θJA</sub>	493 325	°C/W
Thermal Resistance, Junction to Lead (Note 1) (Note 2)		R <sub>θJL</sub>	188 208	°C/W
Junction and Storage Temperation	ature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
NSBC123JDXV6 (SOT-563) C	ONE JUNCTION HEATED		· · · ·	
$\begin{array}{l} \mbox{Total Device Dissipation} \\ T_A = 25^\circ C \qquad (Note 1) \\ \mbox{Derate above } 25^\circ C \end{array}$	(Note 1)	P <sub>D</sub>	357 2.9	mW mW/°C
Thermal Resistance, Junction to Ambient	(Note 1)	R <sub>θJA</sub>	350	°C/W
NSBC123JDXV6 (SOT-563) E	SOTH JUNCTION HEATED (Note 3)			
$\begin{array}{l} \mbox{Total Device Dissipation} \\ T_A = 25^\circ C \qquad (Note 1) \\ \mbox{Derate above } 25^\circ C \end{array}$	(Note 1)	P <sub>D</sub>	500 4.0	mW mW/°C
Thermal Resistance, Junction to Ambient	(Note 1)	$R_{ extsf{ heta}JA}$	250	°C/W
Junction and Storage Tempera	ature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
NSBC123JDP6 (SOT-963) Of	E JUNCTION HEATED			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 4) (Note 5) Derate above 25^{\circ}C (Note 5)	(Note 4)	PD	231 269 1.9 2.2	MW mW/°C
Thermal Resistance, Junction to Ambient (Note 5)	(Note 4)	R <sub>θJA</sub>	540 464	°C/W
NSBC123JDP6 (SOT-963) BC	OTH JUNCTION HEATED (Note 3)			
Total Device Dissipation $T_A = 25^{\circ}C$ (Note 4) (Note 5) Derate above 25^{C} (Note 5)	(Note 4)	PD	339 408 2.7 3.3	MW mW/°C
Thermal Resistance, Junction to Ambient (Note 5)	(Note 4)	R <sub>θJA</sub>	369 306	°C/W
Junction and Storage Temperation	atura Danga	TJ, T <sub>stg</sub>	-55 to +150	°C

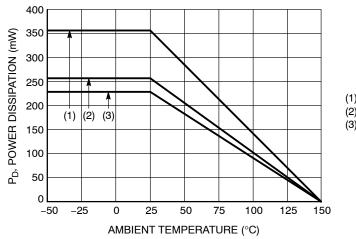
FR-4 @ 1.0 × 1.0 Inch Pad.
FR-4 @ 1.0 × 1.0 Inch Pad.
Both junction heated values assume total power is sum of two equally powered channels.
FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces, still air.
FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces, still air.

ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C, comr	mon for Q <sub>1</sub> and Q <sub>2</sub> , unless otherwise noted)
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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 $(V_{CE} = 50 \text{ V}, I_B = 0)$	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 6) $(I_{C} = 2.0 \text{ mA}, I_{B} = 0)$	V <sub>(BR)CEO</sub>	50	-	_	Vdc
ON CHARACTERISTICS					
DC Current Gain (Note 6) (I <sub>C</sub> = 5.0 mA, V <sub>CE</sub> = 10 V)	h <sub>FE</sub>	80	140	-	
Collector-Emitter Saturation Voltage (Note 6) $(I_{C} = 10 \text{ mA}, I_{B} = 1.0 \text{ mA})$	V <sub>CE(sat)</sub>	-	-	0.25	V
Input Voltage (Off) (V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA)	V <sub>i(off)</sub>	-	0.6	_	Vdc
Input Voltage (On) $(V_{CE} = 0.2 \text{ V}, I_C = 5.0 \text{ mA})$	V <sub>i(on)</sub>	-	0.8	_	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	1.5	2.2	2.9	kΩ
Resistor Ratio	R <sub>1</sub> /R <sub>2</sub>	0.038	0.047	0.056	

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.

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



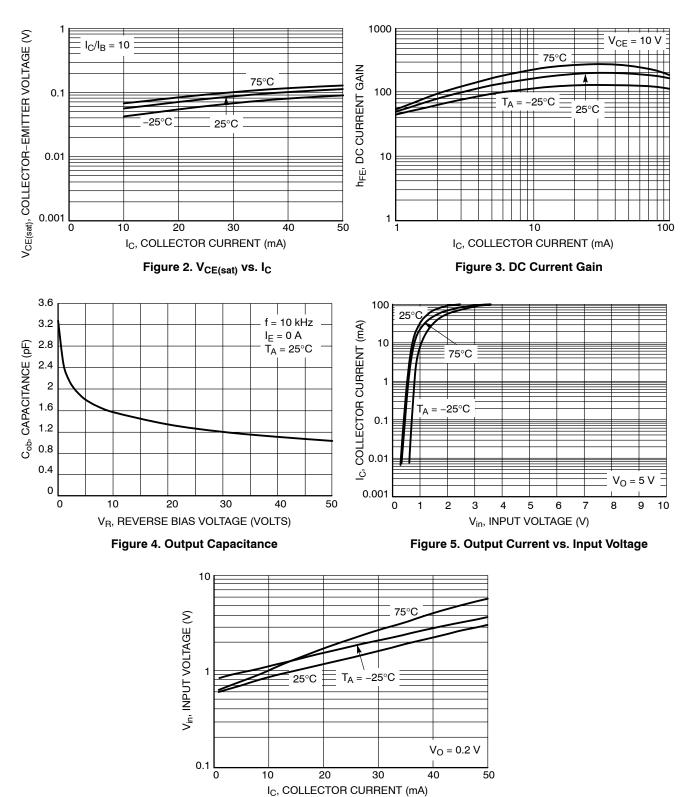
(1) SOT–363;  $1.0 \times 1.0$  Inch Pad

(2) SOT-563; Minimum Pad

(3) SOT-963; 100 mm<sup>2</sup>, 1 oz. Copper Trace

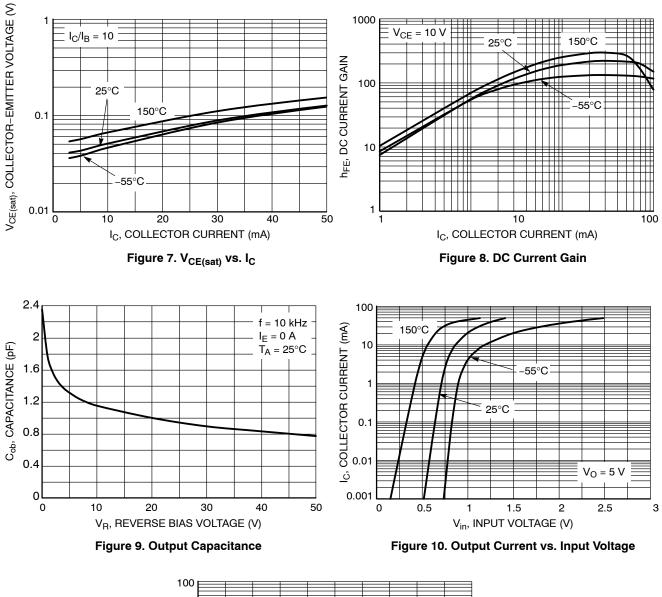
Figure 1. Derating Curve

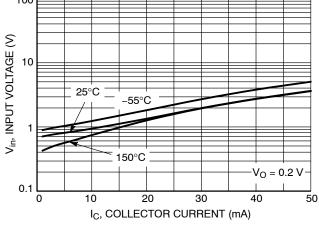
#### TYPICAL CHARACTERISTICS MUN5235DW1, NSBC123JDXV6









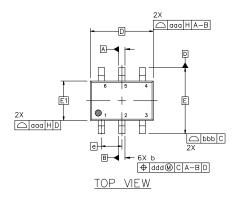




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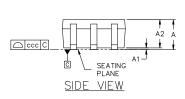
#### SC-88 2.00x1.25x0.90, 0.65P CASE 419B-02 **ISSUE Z**

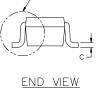
DATE 18 APR 2024



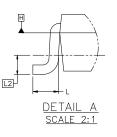


- DIMENSIONING AND TOLERANCING CONFORM TO ASME 1. Y14.5-2018.
- 2.
- ALL DIMENSION ARE IN MILLIMETERS. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 3. PER END.
- 4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF
- DATUMS A AND B ARE DETERMINED AT DATUM H. 5.
- DIMENSIONS & AND C APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP. 6.
- DIMENSION & DOES NOT INCLUDE DAMBAR PROTRUSION. 7 ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION & AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.





DETAIL A



	MILLIMETERS			
DIM	MIN.	NOM.	MAX.	
A			1.10	
A1	0.00		0.10	
A2	0.70	0.90	1.00	
b	0.15	0.20	0.25	
С	0.08	0.15	0.22	
D	2.00 BSC			
E	2.10 BSC			
E1	1.25 BSC			
е		0.65 BSC	)	
L	0.26	0.36	0.46	
L2	0.15 BSC			
aaa	0.15			
bbb	0.30			
ccc	0.10			
ddd	0.10			

6X 0.66 6X 0.30-2.50 0.65 PITCH

RECOMMENDED MOUNTING FOOTPRINT\*

FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

XXX = Specific Device Code = Date Code\* Μ

GENERIC **MARKING DIAGRAM\*** 

XXXM-

. 0

6

= Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing 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. Some products may not follow the Generic Marking.

#### **STYLES ON PAGE 2**

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DESCRIPTION:	SC-88 2.00x1.25x0.90, 0.65P		PAGE 1 OF 2	
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#### SC-88 2.00x1.25x0.90, 0.65P CASE 419B-02 ISSUE Z

#### DATE 18 APR 2024

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13:	STYLE 14:	STYLE 15:	STYLE 16:	STYLE 17:	STYLE 18:
PIN 1. ANODE	PIN 1. VREF	PIN 1. ANODE 1	PIN 1. BASE 1	PIN 1. BASE 1	PIN 1. VIN1
2. N/C	2. GND	2. ANODE 2	2. EMITTER 2	2. EMITTER 1	2. VCC
3. COLLECTOR	3. GND	3. ANODE 3	3. COLLECTOR 2	3. COLLECTOR 2	3. VOUT2
4. EMITTER	4. IOUT	4. CATHODE 3	4. BASE 2	4. BASE 2	4. VIN2
5. BASE	5. VEN	5. CATHODE 2	5. EMITTER 1	5. EMITTER 2	5. GND
6. CATHODE	6. VCC	6. CATHODE 1	6. COLLECTOR 1	6. COLLECTOR 1	6. VOUT1
STYLE 19:	STYLE 20:	STYLE 21:	STYLE 22:	STYLE 23:	STYLE 24:
PIN 1. I OUT	PIN 1. COLLECTOR	PIN 1. ANODE 1	PIN 1. D1 (i)	PIN 1. Vn	PIN 1. CATHODE
2. GND	2. COLLECTOR	2. N/C	2. GND	2. CH1	2. ANODE
3. GND	3. BASE	3. ANODE 2	3. D2 (i)	3. Vp	3. CATHODE
4. V CC	4. EMITTER	4. CATHODE 2	4. D2 (c)	4. N/C	4. CATHODE
5. V EN	5. COLLECTOR	5. N/C	5. VBUS	5. CH2	5. CATHODE
6. V REF	6. COLLECTOR	6. CATHODE 1	6. D1 (c)	6. N/C	6. CATHODE
STYLE 25:	STYLE 26:	STYLE 27:	STYLE 28:	STYLE 29:	STYLE 30:
PIN 1. BASE 1	PIN 1. SOURCE 1	PIN 1. BASE 2	PIN 1. DRAIN	PIN 1. ANODE	PIN 1. SOURCE 1
2. CATHODE	2. GATE 1	2. BASE 1	2. DRAIN	2. ANODE	2. DRAIN 2
3. COLLECTOR 2	3. DRAIN 2	3. COLLECTOR 1	3. GATE	3. COLLECTOR	3. DRAIN 2
4. BASE 2	4. SOURCE 2	4. EMITTER 1	4. SOURCE	4. EMITTER	4. SOURCE 2
5. EMITTER	5. GATE 2	5. EMITTER 2	5. DRAIN	5. BASE/ANODE	5. GATE 1
6. COLLECTOR 1	6. DRAIN 1	6. COLLECTOR 2	6. DRAIN	6. CATHODE	6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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#### 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. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM 3 THICKNESS OF BASE MATERIAL. -A D MILLIMETERS А 6X L DIM В MIN NDM. MAX. m 0.50 0.55 А 0.60 ł 6 4 PIN b 0.17 0.22 0.27 F Н REFERENCE C 0.08 0.13 0.18 2 ັບ 1 3 D 1.50 1.60 1.70 E 1.20 1.30 1.10 -⊨ 6X b C ⊕ 0.08∭ A B е 0.50 BSC е Н 1.50 1.60 1.70 TOP VIEW SIDE VIEW L 0.10 0.20 0.30 1.30 6X 0.45 0.30 1.80 STYLE 1: STYLE 2 STYLE 3 PIN 1. EMITTER 1 2. BASE 1 PIN 1. EMITTER 1 PIN 1. CATHODE 1 2. CATHODE 1 2. EMITTER 2 3. COLLECTOR 2 3. BASE 2 3. ANDDE/ANDDE 2 4. EMITTER 2 4. COLLECTOR 2 4. CATHODE 2 0.50 5. BASE 2 5. BASE 1 5. CATHODE 2 6. COLLECTOR 1 PITCH 6. COLLECTOR 1 6. ANDDE/ANDDE 1 RECOMMENDED MOUNTING FOOTPRINT\* STYLE 6: PIN 1. CATHODE 2. ANODE FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE STYLE 5 STYLE 4: 1. CATHODE 2. CATHODE PIN 1. COLLECTOR PIN 2. COLLECTOR 3. BASE 3. ANDDE 3. CATHODE 4. ANDDE 5. CATHODE 4. CATHODE 5. CATHODE 4. EMITTER MANUAL, SOLDERRM/D. 5, COLLECTOR 6. COLLECTOR 6. CATHODE 6. CATHODE GENERIC **MARKING DIAGRAM\*** STYLE 7: STYLE 8 STYLE 9 PIN 1. CATHODE PIN 1. DRAIN PIN 1. SOURCE 1 2. ANDDE 2. DRAIN 2. GATE 1 XXM. 3. CATHODE 4. CATHODE 3. GATE 4. SDURCE 5. DRAIN 3. DRAIN 2 4. SDURCE 2 5. GATE 2 1 5. ANDDE 6. CATHODE 6. DRAIN 6. DRAIN 1 XX = Specific Device Code M = Month Code = Pb-Free Package STYLE 10: STYLE 11: \*This information is generic. Please refer to PIN 1. CATHODE 1 PIN 1. EMITTER 2 device data sheet for actual part marking. 2. N/C 3. CATHODE 2 2. BASE 2 3. COLLECTOR 1 Pb-Free indicator, "G" or microdot "•", may 4. ANDDE 2 EMITTER 1 4. or may not be present. Some products may BASE 5. N/C 5. not follow the Generic Marking. 6. ANDDE 1 COLLECTOR 2 6. Electronic versions are uncontrolled except when accessed directly from the Document Repository. **DOCUMENT NUMBER:** 98AON11126D Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. **DESCRIPTION:** SOT-563-6 1.60x1.20x0.55, 0.50P PAGE 1 OF 1

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#### SOT-963 1.00x1.00x0.37, 0.35P CASE 527AD ISSUE F DATE 20 FEB 2024 NDTES: MILLIMETERS DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018. 1. CONTROLLING DIMENSION: MILLIMETERS. 2. DIM MIN. NDM. MAX. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH З. 0.37 0.40 Α 0.34 THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL. 0.10 0.15 0.20 h DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, 4. PROTRUSIONS, OR GATE BURRS. С 0.07 0.12 0.17 A D D 0.95 1.00 1.05 А В Ε 0.75 0.80 0.85 4 6 0.35 BSC e Н Н 0.95 1.00 1.05 0.19 REF L2 0.05 0.10 0.15 ΤΠΡ VIEW С 6X 0.20 -6X 0.35 SIDE VIEW e 6X L 1.20 PACKAGE DUTLINE 0.35 PITCH L2 6X b RECOMMENDED MOUNTING $\oplus$ 0.08 A B FOOTPRINT BOTTOM VIEW \*For additional information on our Pb-Free strategy and soldering details, please download the DN Semiconductor STYLE 1: PIN 1. EMITTER 1 STYLE 3: STYLE 2: PIN 1. EMITTER 1 PIN 1. CATHODE 1 Soldering and Mounting Techniques Reference manual, SOLDERRM/D. 2. BASE 1 2. EMITTER2 2. CATHODE 1 3. COLLECTOR 2 4. EMITTER 2 3. ANODE/ANODE 2 4. CATHODE 2 3. BASE 2 4. COLLECTOR 2 5. BASE 2 5. BASE 1 5. CATHODE 2 6. COLLECTOR 1 6. COLLECTOR 1 6. ANODE/ANODE 1 STYLE 4: STYLE 5: STYLE 6: PIN 1. CATHODE 2. CATHODE 3. ANODE 4. ANODE PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE PIN 1. COLLECTOR 2. COLLECTOR GENERIC 3. BASE 4. EMITTER **MARKING DIAGRAM\*** 5 COLLECTOR 5. CATHODE 6. CATHODE 5 CATHODE 6. COLLECTOR 6. CATHODE STYLE 9: PIN 1. SOURCE 1 2. GATE 1 STYLE 7: PIN 1. CATHODE 2. ANODE STYLE 8: XXM PIN 1. DRAIN 2. DRAIN 1 3. CATHODE 4. CATHODE 3. GATE 4. SOURCE 3. DRAIN 2 4. SOURCE 2 XX = Specific Device Code 5. ANODE 6. CATHODE 5. DRAIN 5. GATE 2 6. DRAIN = Month Code 6. DRAIN 1 М STYLE 10: PIN 1. CATHODE 1 \*This information is generic. Please refer to device data sheet for actual part marking. 2. N/C 3. CATHODE 2 Pb-Free indicator, "G" or microdot "=", may 4. ANODE 2 5. N/C or may not be present. Some products may not follow the Generic Marking. ANODE 1 Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. **DOCUMENT NUMBER:** 98AON26456D **DESCRIPTION:** SOT-963 1.00x1.00x0.37, 0.35P PAGE 1 OF 1

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