

# General Purpose Transistor

## Medium Power, NPN

### 80 V, 1 A

## BCP56M

The BCP56MTW is designed for general purpose amplifier applications. It is housed in DFN2020–3 offering superior thermal performance. The transistor is ideal for medium–power surface mount applications where board space and reliability are at a premium.

### Specification Features

- Wettable Flank Package for Optimal Automated Optical Inspection (AOI)
- 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 ( $T_A = 25^\circ\text{C}$ )

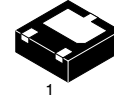
Rating	Symbol	Max	Unit
Collector–Emitter Voltage	$V_{CEO}$	80	Vdc
Collector–Base Voltage	$V_{CBO}$	100	Vdc
Emitter–Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current – Continuous (Note 1)	$I_C$	1.0	A
Collector Current – Peak (Note 1)	$I_{CM}$	2.0	A

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.

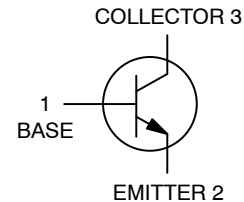
### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Power Dissipation (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5	W
Thermal Resistance, Junction–to–Ambient (Note 2)	$R_{\theta JA}$	78	$^\circ\text{C/W}$
Total Power Dissipation (Note 3) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	875	mW
Thermal Resistance, Junction–to–Ambient (Note 3)	$R_{\theta JA}$	138	$^\circ\text{C/W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	–65 to +150	$^\circ\text{C}$

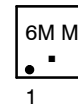
1. Reference SOA Curve
2. Surface–mounted on FR4 board using a 600 mm<sup>2</sup> pad area and 2 oz. Cu
3. Surface–mounted on FR4 board using a 100 mm<sup>2</sup> pad area and 2 oz. Cu



WDFNW3  
CASE 515AA



### MARKING DIAGRAM



6M = Specific Device Code  
M = Date Code

### ORDERING INFORMATION

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

# BCP56M

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

Characteristics	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ , $I_B = 0\text{ A}$ )	$V_{(BR)CEO}$	80	–	–	V
Collector-Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{A}$ , $I_E = 0\text{ A}$ )	$V_{(BR)CBO}$	100	–	–	V
Emitter-Base Breakdown Voltage ( $I_E = 10\text{ }\mu\text{A}$ , $I_C = 0$ )	$V_{(BR)EBO}$	5	–	–	V
Collector-Base Cutoff Current ( $V_{CB} = 30\text{ V}$ , $I_E = 0$ )	$I_{CBO}$	–	–	100	nA
Emitter-Base Cutoff Current ( $V_{EB} = 5\text{ V}$ , $I_C = 0$ )	$I_{EBO}$	–	–	100	nA

## ON CHARACTERISTICS (Note 4)

DC Current Gain ( $I_C = 5\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ ) ( $I_C = 150\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ )  ( $I_C = 500\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ )	All Part Types BCP56M BCP5610M BCP5616M All Part Types	$h_{FE}$	63 63 63 100 40	– – – – –	– 250 160 250 –	
Collector-Emitter Saturation Voltage ( $I_C = 500\text{ mA}$ , $I_B = 50\text{ mA}$ )		$V_{CE(sat)}$	–	–	0.50	V
Base-Emitter Saturation Voltage ( $I_C = 500\text{ mA}$ , $I_B = 50\text{ mA}$ )		$V_{BE(sat)}$	–	–	2.0	V
Base-Emitter Turn-on Voltage ( $I_C = 500\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ )		$V_{BE(on)}$	–	–	1.0	V

## SMALL SIGNAL CHARACTERISTICS

Transition Frequency ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ , $f = 100\text{ MHz}$ )	$f_T$	–	140	–		MHz
Output Capacitance ( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	–	65	–		pF
Input Capacitance ( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	–	130	–		pF
Input Impedance ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{ie}$	–	4	–		k
Voltage Feedback Ratio ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{re}$	–	0.4	–		$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	–	135	–		–
Output Admittance ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$H_{oe}$	–	4	–		$\mu\text{mhos}$
Noise Figure ( $I_C = 0.2\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 2.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ , $BW = 200\text{ Hz}$ )	NF	–	1	–		dB

## SWITCHING CHARACTERISTICS

Delay Time ( $V_{CC} = 30\text{ Vdc}$ , $I_C = 150\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_d$	–	20	–		ns
Rise Time ( $V_{CC} = 30\text{ Vdc}$ , $I_C = 150\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_r$	–	20	–		ns
Storage Time ( $V_{CC} = 30\text{ Vdc}$ , $I_C = 150\text{ mA}$ , $I_{B1} = 15\text{ mA}$ , $I_{B2} = 15\text{ mA}$ )	$t_s$	–	900	–		ns
Fall Time ( $V_{CC} = 30\text{ Vdc}$ , $I_C = 150\text{ mA}$ , $I_{B1} = 15\text{ mA}$ , $I_{B2} = 15\text{ mA}$ )	$t_f$	–	110	–		ns

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.

4. Pulse Condition: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
BCP56MTWG	6M	WDFNW3 (Pb-Free)	3000 / Tape & Reel
BCP5610MTWG	6N		
BCP5616MTWG	6P		
NSVBCP56MTWG*	6M		
NSVBCP5610MTWG*	6N		
NSVBCP5616MTWG*	6P		

<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.

\*NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

## TYPICAL CHARACTERISTICS

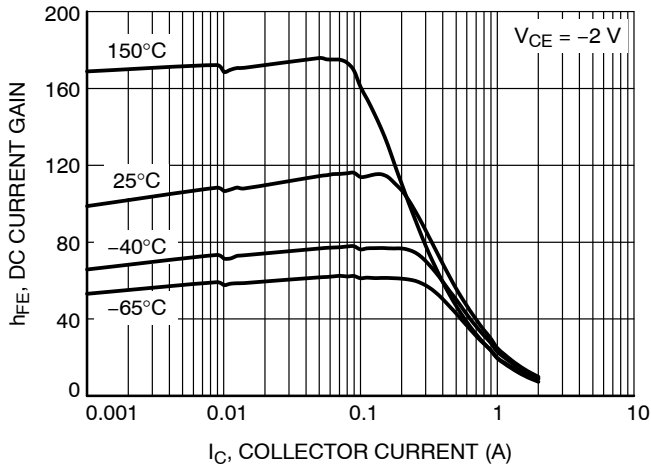


Figure 1. DC Current Gain

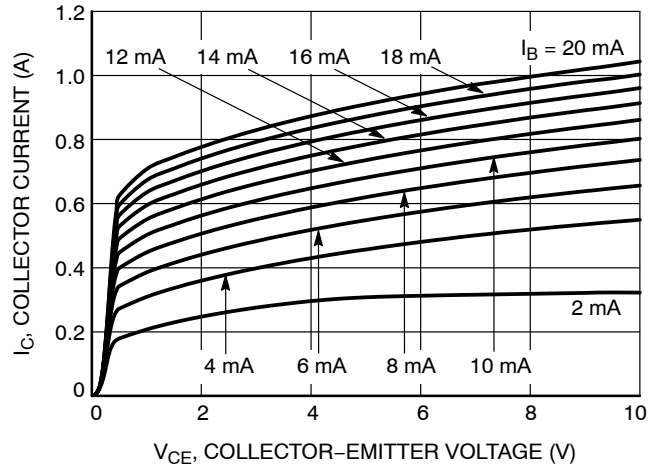


Figure 2. Collector Current vs. Collector Emitter Voltage

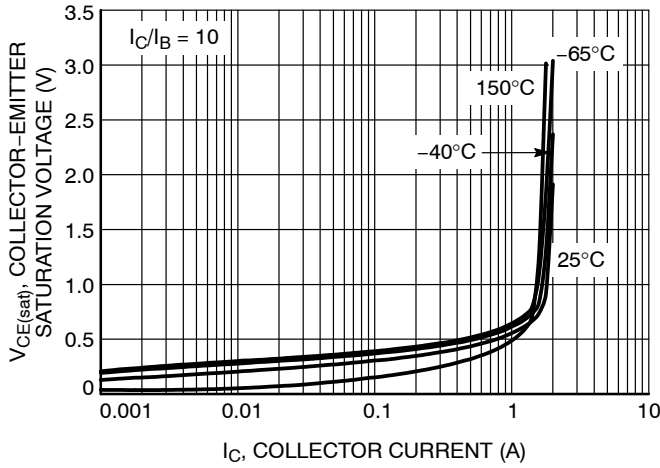


Figure 3. Collector Emitter Saturation Voltage vs. Collector Current

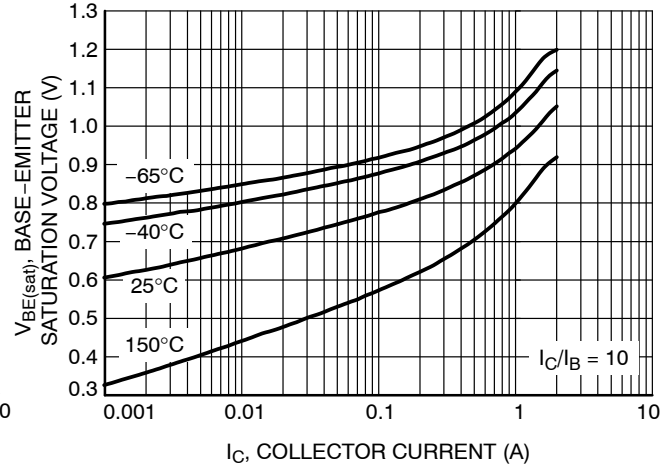


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

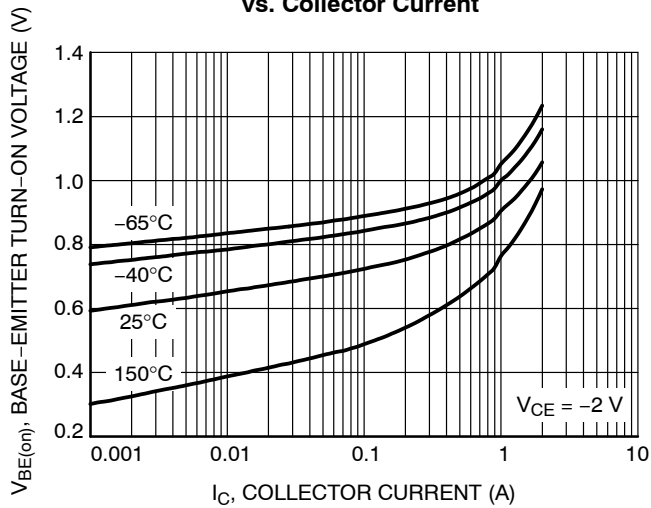
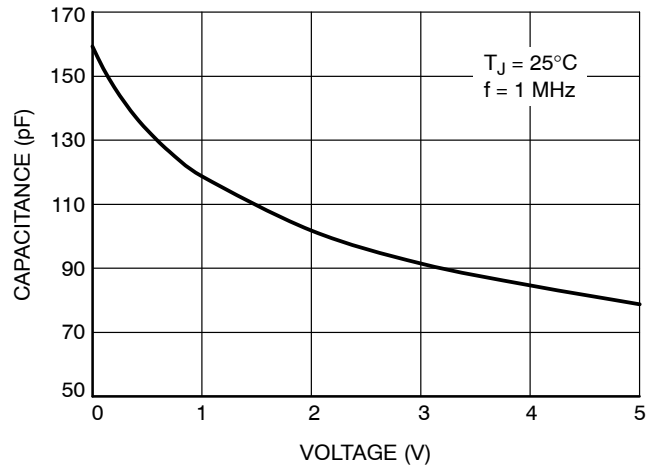
Figure 5. BCP53M, Base Emitter Turn-On Voltage vs. Collector Current  $V_{BE(on)}$ 

Figure 6. Input Capacitance

# BCP56M

## TYPICAL CHARACTERISTICS

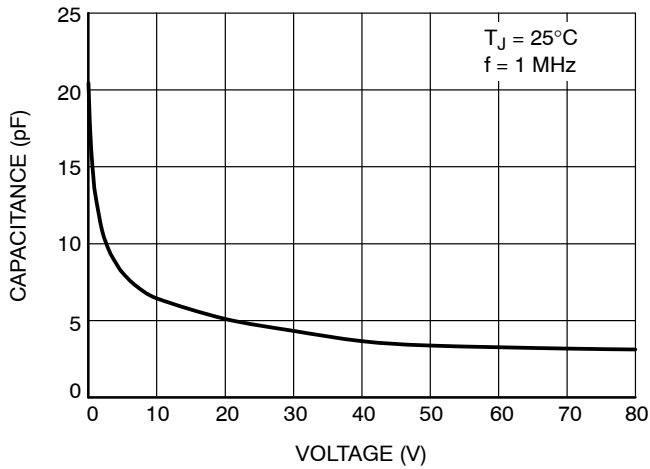


Figure 7. Output Capacitance

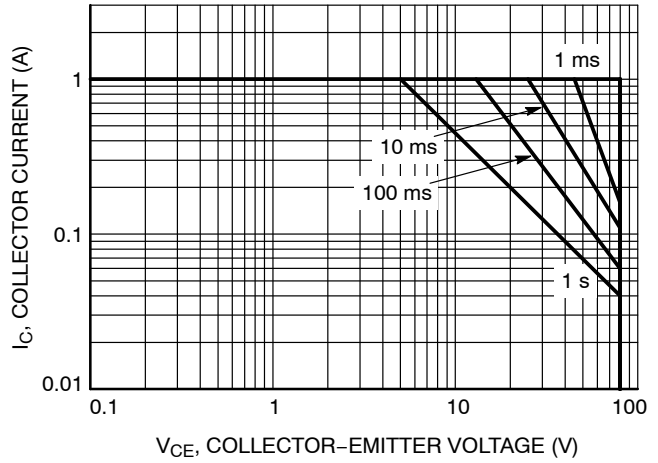


Figure 8. Safe Operating Area

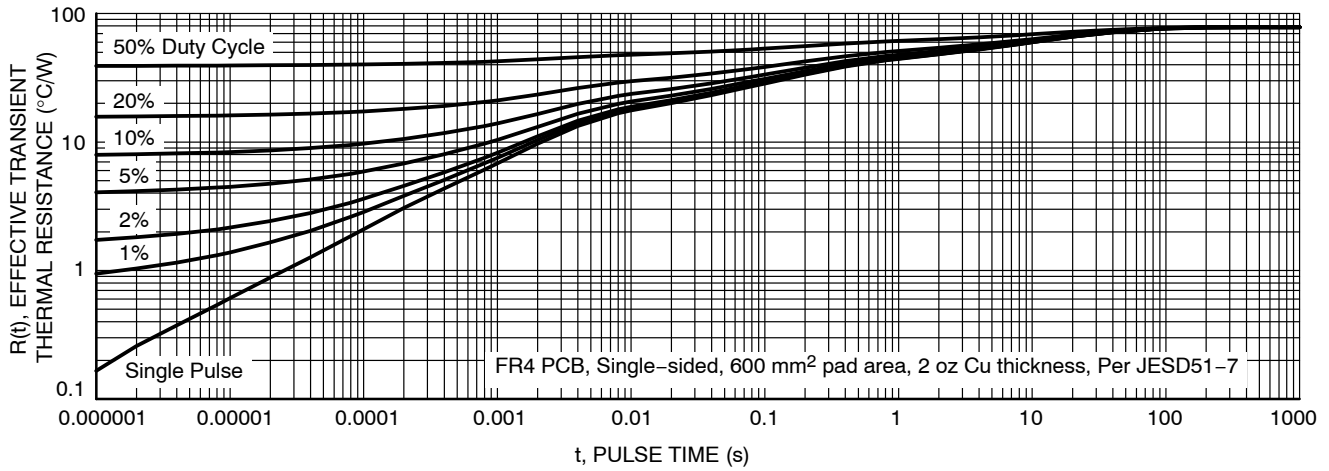


Figure 9. Transient Thermal Impedance from Junction-to-Ambient as a Function of Pulse Duration

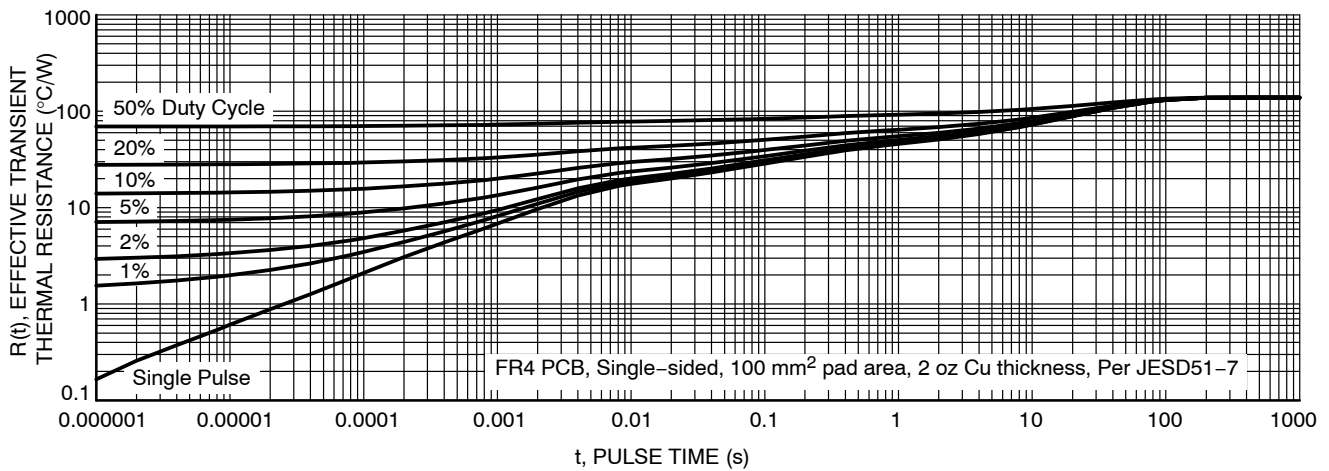
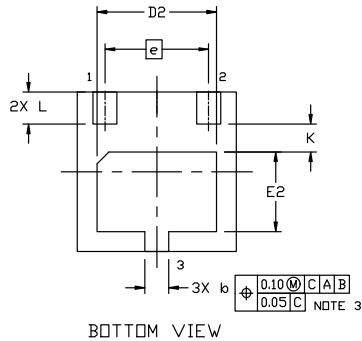
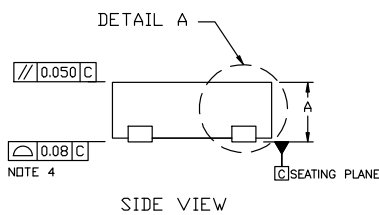
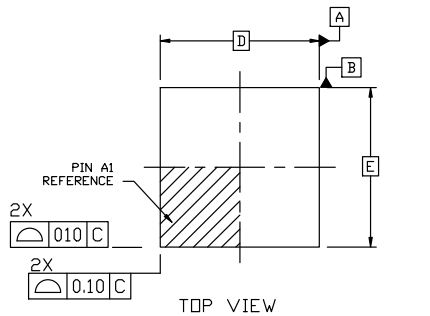
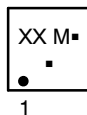


Figure 10. Transient Thermal Impedance from Junction-to-Ambient as a Function of Pulse Duration


**WDFNW3 2x2, 1.3P**  
**CASE 515AA**  
**ISSUE A**

DATE 26 JUL 2022


**GENERIC**  
**MARKING DIAGRAM\***


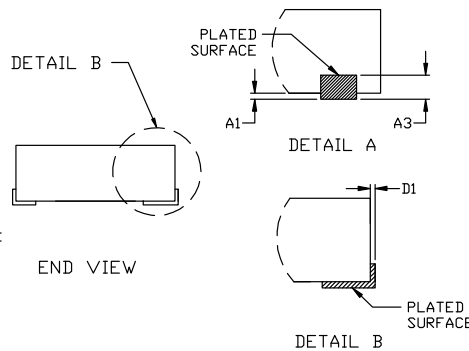
XX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

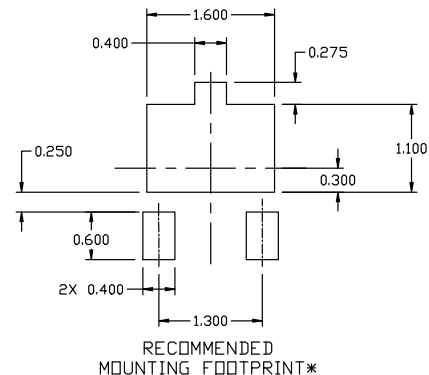
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	---	0.05
A3	0.20 REF		
b	0.25	0.30	0.35
D	2.00 BSC		
D1	0.00	---	0.04
D2	1.40	1.50	1.60
E	2.00 BSC		
E2	0.90	1.00	1.10
e	1.30 BSC		
K	0.35 REF		
L	0.35	0.40	0.45



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

**DOCUMENT NUMBER:** 98AON33309H

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**DESCRIPTION:** WDFNW3 2x2, 1.3P

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