MDNCV2200

Comparator, 0.85 V to 6 V, 10 μA, 1 μs, Rail-to-Rail, Open Drain and Push-Pull Outputs

The MDNCV2200 is an industry first sub−one volt, low power comparator. This device consumes only 10 μA of supply current. It is guaranteed to operate at a low voltage of 0.85 V which allows it to be used in systems that require less than 1.0 V and is fully operational up to 6.0 V. Additional features include no output phase inversion with overdriven inputs, internal hysteresis, which allows for clean output switching, and rail−to−rail input and output performance. The MDNCV2200 is available in complementary push−pull and open drain outputs. The MDNCV2200 is available in a UDFN 1.2x1.0 package.

Features

- Operating Voltage of 0.85 V to 6.0 V
- Rail−to−Rail Input/Output Performance
- Low Supply Current of 10 μA
- No Phase Inversion with Overdriven Input Signals
- Glitchless Transitioning in or out of Tri−State Mode
- Complementary or Open Drain Output Configuration
- Internal Hysteresis
- Propagation Delay of 1.0 μs for NCS2200
- AEC−Q100 Qualified
- This Device is Pb−Free and are RoHS Compliant

Typical Applications

- Medical Devices

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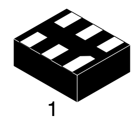
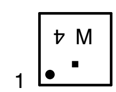


UDFN 1.2x1.0
MU SUFFIX
CASE 517AA

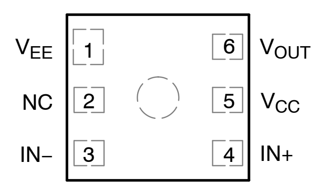
MARKING DIAGRAM



(Top View)

4 = Specific Device Code (4 with 180° Rotation)
M = Date Code
▪ = Pb−Free Package

PIN CONNECTION



Top View

UDFN 1.2x1.0

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

May, 2019 − Rev. 0

Publication Order Number:
MDNCV2200/D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage Range (V_{CC} to V_{EE})	V_S	6.0	V
Non−inverting/Inverting Input to V_{EE}	V_{CM}	−0.2 to (V_{CC} + 0.2)	V
Operating Junction Temperature	T_J	150	°C
Operating Ambient Temperature Range	T_A	−40 to +125	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C
Output Short Circuit Duration Time (Note 1)	t_S	Indefinite	s
ESD Tolerance (Note 2) Human Body Model Machine Model	ESD HBM MM	 1900 200	V
Thermal Resistance, Junction−to−Ambient UDFN	$R_{\theta JA}$	 350	°C/W

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.

1. The maximum package power dissipation limit must not be exceeded.

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

2. ESD data available upon request.
3. For more information, refer to application note, AND8080/D.

ELECTRICAL CHARACTERISTICS (For all values V_{CC} = 0.85 V to 6.0 V, V_{EE} = 0 V, T_A = 25°C, unless otherwise noted.) (Note 4)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{HYS}	Input Hysteresis	T_A = 25°C	2.0	4.5	20	mV
V_{IO}	Input Offset Voltage	V_{CC} = 0.85 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 −10 −12	 0.5 –	 +10 +12	mV
		V_{CC} = 3.0 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 −6.0 −8.0	 0.5 –	 +6.0 +8.0	
		V_{CC} = 6.0 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 −5.0 −7.0	 0.5 –	 +5.0 +7.0	
V_{CM}	Common Mode Voltage Range		–	V_{EE} to V_{CC}	–	V
I_{SC}	Output Short−Circuit Sourcing or Sinking	V_{out} = GND	–	60	–	mA
CMRR	Common Mode Rejection Ratio	V_{CM} = V_{CC}	53	70	–	dB
I_{IB}	Input Bias Current		–	1.0	–	pA
PSRR	Power Supply Rejection Ratio	ΔV_S = 2.575 V	45	80	–	dB
I_{CC}	Supply Current	V_{CC} = 0.85 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 7.5 –	 15 17	μA
		V_{CC} = 3.0 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 8.0 –	 15 17	
		V_{CC} = 6.0 V T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 9.0 –	 15 17	
V_{OH}	Output Voltage High	V_{CC} = 0.85 V, I_{source} = 0.5 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 V_{CC} − 0.25 V_{CC} − 0.275	 V_{CC} − 0.10 –	–	V
		V_{CC} = 3.0 V, I_{source} = 3.0 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 V_{CC} − 0.3 V_{CC} − 0.35	 V_{CC} − 0.12 –	–	
		V_{CC} = 6.0 V, I_{source} = 5.0 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	 V_{CC} − 0.3 V_{CC} − 0.35	 V_{CC} − 0.12 –	–	
V_{OL}	Output Voltage Low	V_{CC} = 0.85 V, I_{sink} = 0.5 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 V_{EE} + 0.10 –	 V_{EE} + 0.25 V_{EE} + 0.275	V
		V_{CC} = 3.0 V, I_{sink} = 3.0 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 V_{EE} + 0.12 –	 V_{EE} + 0.3 V_{EE} + 0.35	
		V_{CC} = 6.0 V, I_{sink} = 5.0 mA T_A = 25°C T_A = T_{LOW} to T_{HIGH}	–	 V_{EE} + 0.12 –	 V_{EE} + 0.3 V_{EE} + 0.35	
t_{PHL}	Propagation Delay, High−to−Low	20 mV Overdrive, C_L = 15 pF, V_{CC} = 2.85 V	–	625	–	ns
t_{PLH}	Propagation Delay, Low−to−High		–	750	–	ns
t_{FALL}	Output Fall Time	V_{CC} = 6.0 V, C_L = 50 pF (Note 5)	–	22	–	ns
t_{RISE}	Output Rise Time	V_{CC} = 6.0 V, C_L = 50 pF (Note 5)	–	20	–	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. The limits over the extended temperature range are guaranteed by design only.
5. Input signal: 1 kHz, squarewave signal with 10 ns edge rate.
6. T_{LOW} = −40°C, T_{HIGH} = +125°C.

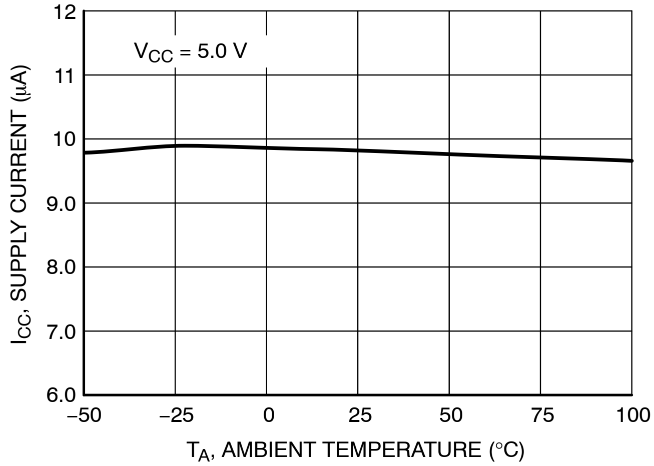


Figure 1. Supply Current vs. Temperature

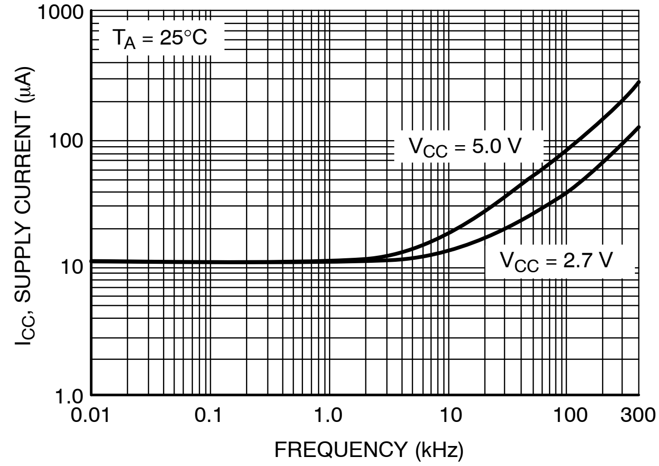


Figure 2. Supply Current vs. Output Transition Frequency

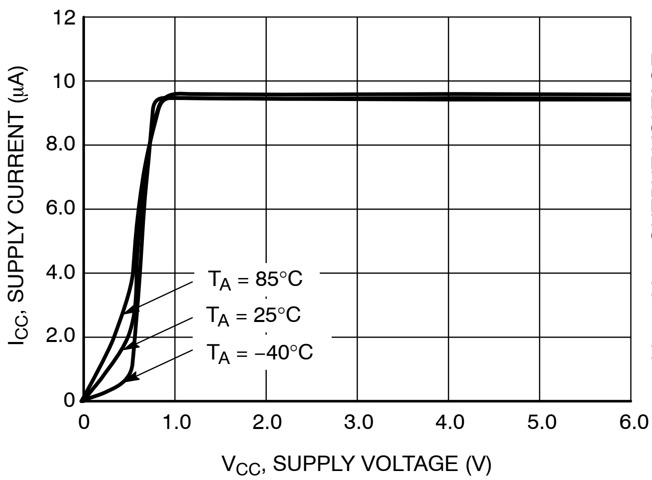


Figure 3. Supply Current vs. Supply Voltage

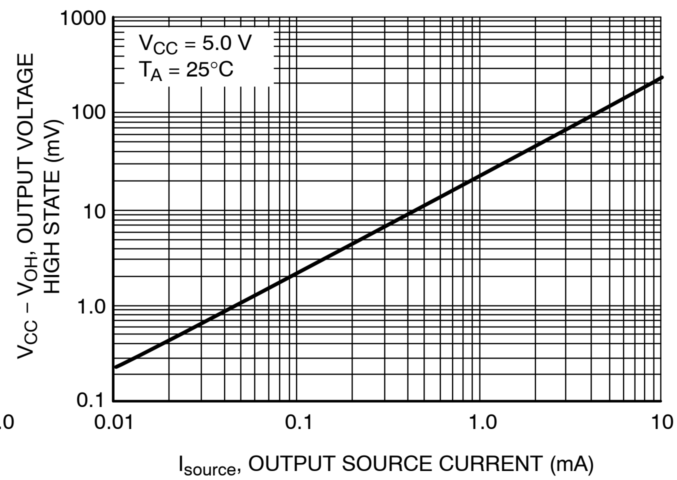


Figure 4. Output Voltage High State vs. Output Source Current

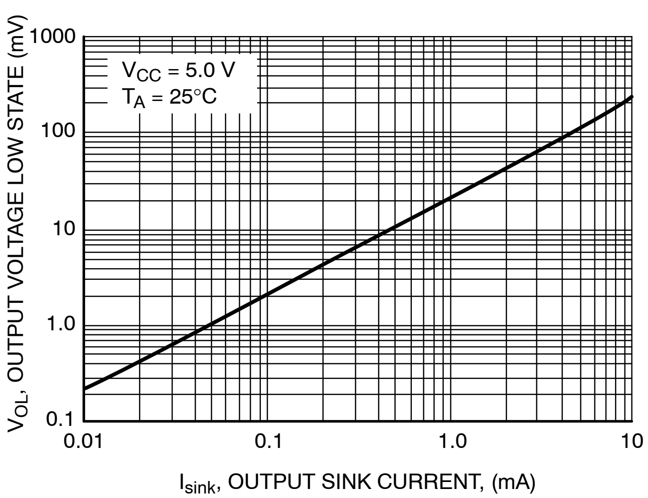


Figure 5. Output Voltage Low State vs. Output Sink Current

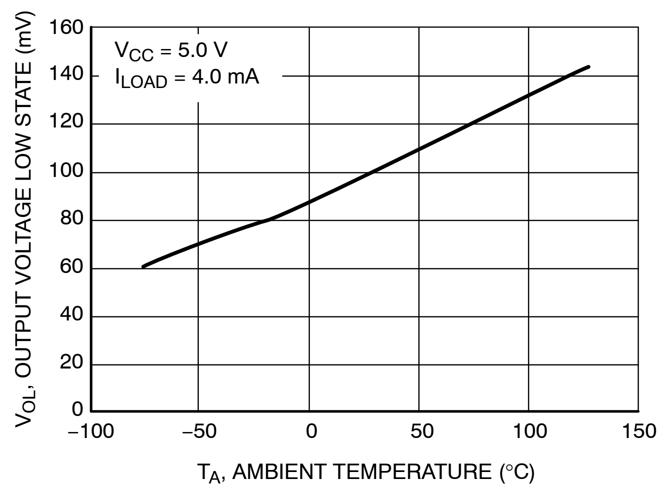


Figure 6. Output Voltage Low State vs. Temperature

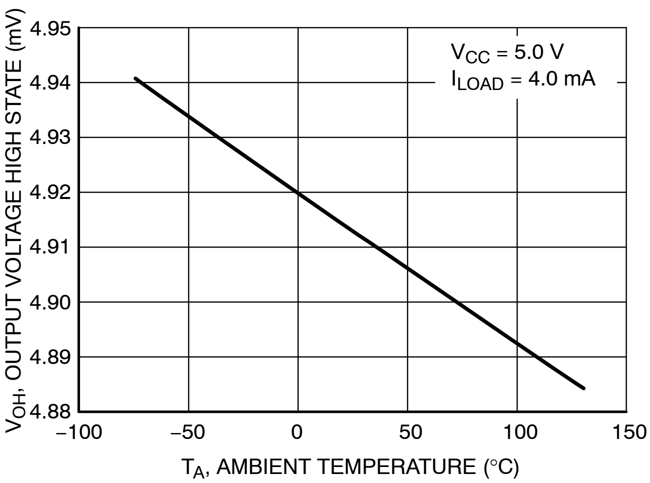


Figure 7. Output Voltage High State vs. Temperature

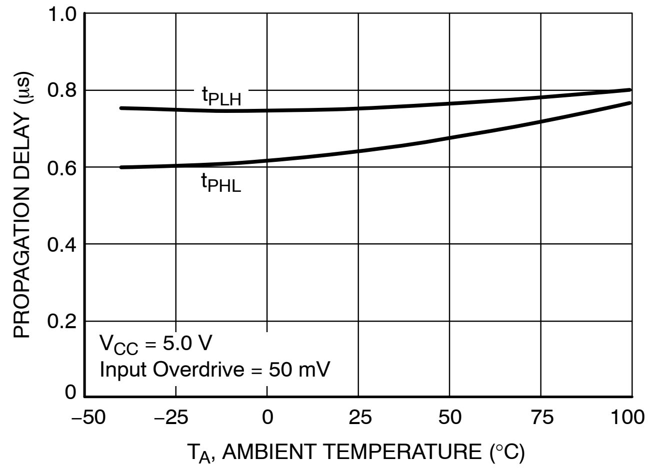


Figure 8. Propagation Delay vs. Temperature

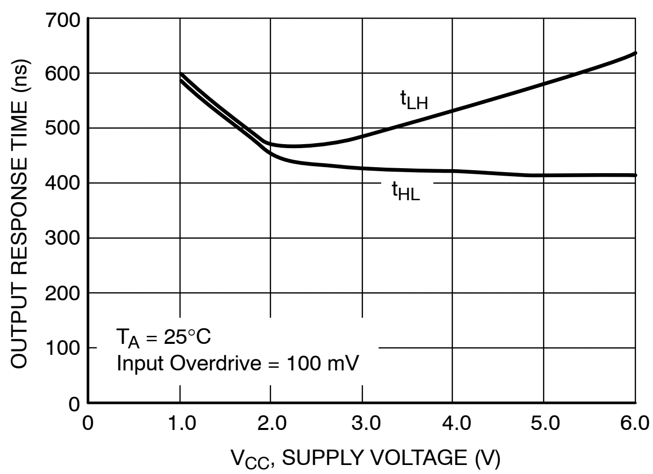


Figure 9. Output Response Time vs. Supply Voltage

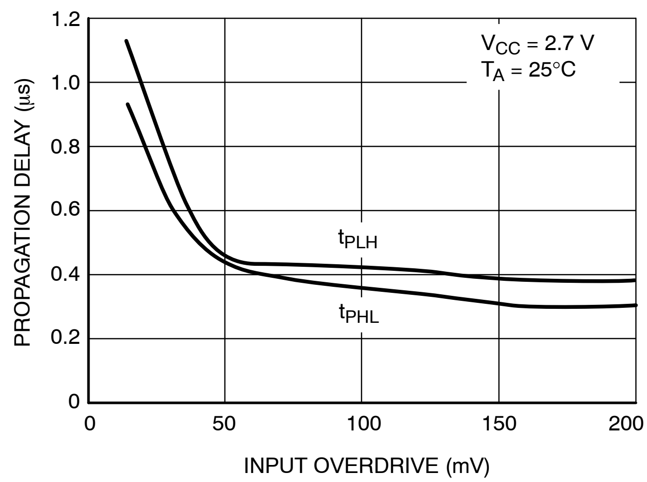


Figure 10. Propagation Delay vs. Input Overdrive

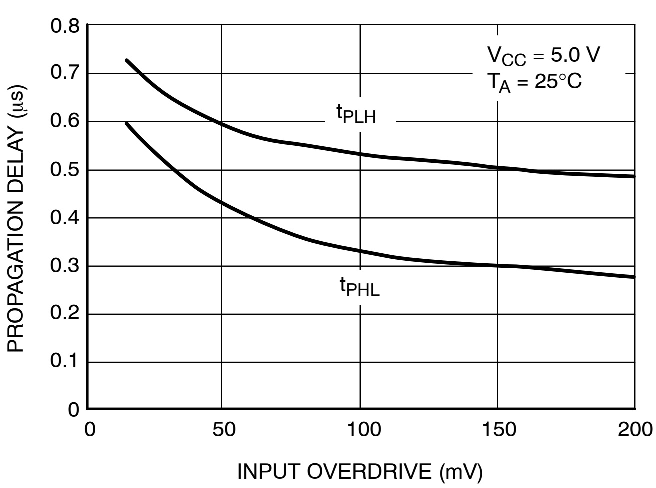


Figure 11. Propagation Delay vs. Input Overdrive

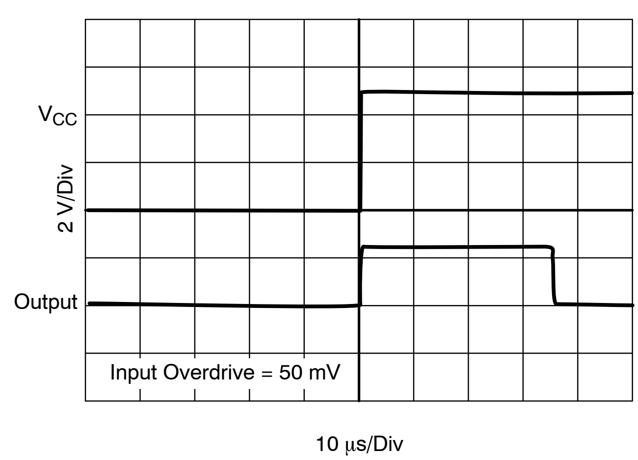


Figure 12. Powerup Delay

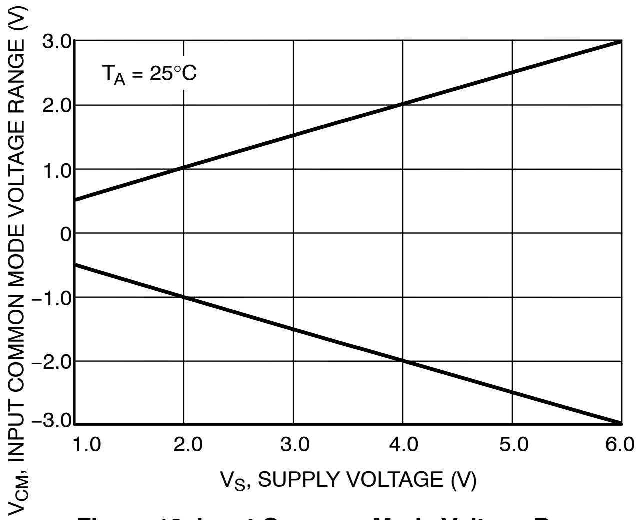


Figure 13. Input Common Mode Voltage Range vs. Supply Voltage

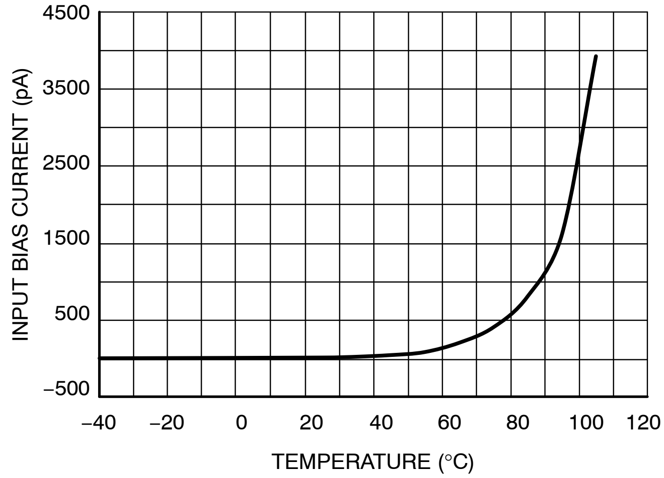


Figure 14. Input Bias Current vs. Temperature

OPERATING DESCRIPTION

The MDNCV2200 is an industry first sub−one volt, low power comparator. The device is designed for rail−to−rail input and output performance. This device consumes only 10 μA of supply current while achieving a typical propagation delay of 1.1 μs at a 20 mV input overdrive. Figures 10 and 11 show propagation delay with various input overdrives. This comparator is guaranteed to operate at a low voltage of 0.85 V up to 6.0 V. This is accomplished by the use of a modified analog CMOS process that implements depletion MOSFET devices. The common−mode input voltage range extends 0.1 V beyond the upper and lower rail without phase inversion or other adverse effects.

Output Stage

The MDNCV2200 has a complementary P and N Channel output stage that has capability of driving a rail−to−rail output swing with a load ranging up to 5.0 mA. It is designed such that shoot−through current is minimized while switching. This feature eliminates the need for bypass capacitors under most circumstances.

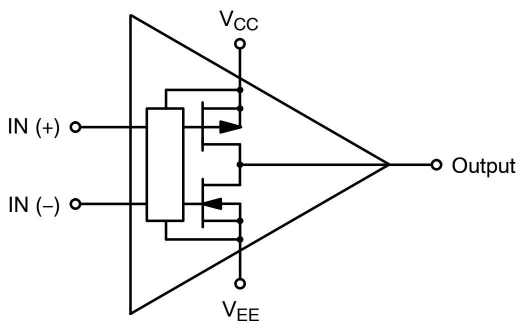
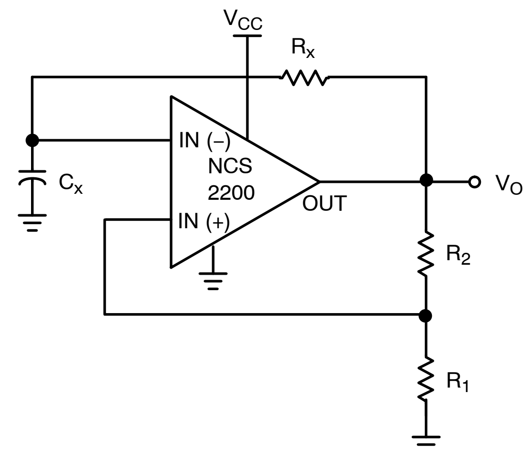


Figure 15. Complementary Push−Pull Output Configuration



The oscillation frequency can be programmed as follows:

$$f = \frac{1}{T} = \frac{1}{2.2\ R_X C_X}$$

Figure 16. Schmitt Trigger Oscillator

ORDERING INFORMATION

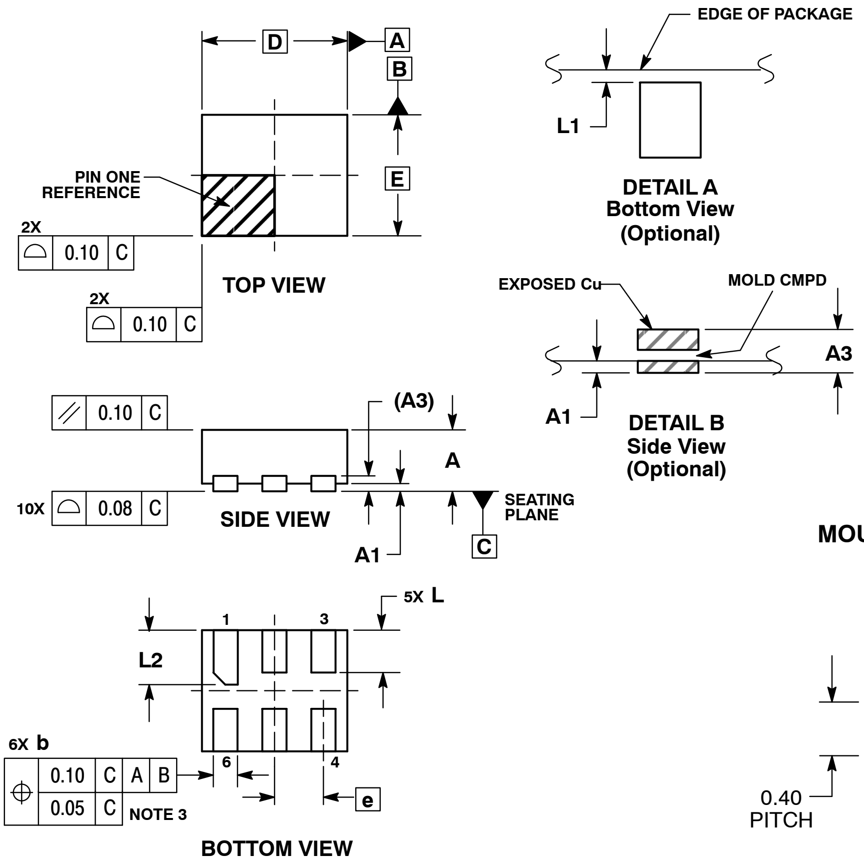
Device	Pinout Style	Output Type	Package	Shipping†
MDNCV2200AMUTBG	N/A	Complementary Push−Pull	UDFN (Pb−Free)	3000 / Tape & Reel

This device contains 93 active transistors.

†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.

PACKAGE DIMENSIONS

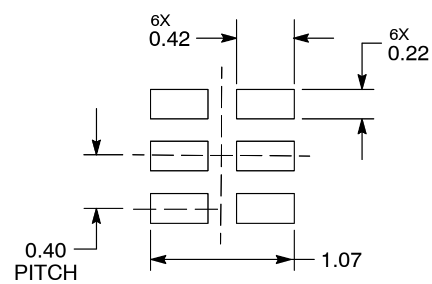
UDFN6, 1.2x1.0, 0.4P
CASE 517AA
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	**MIN**	**MAX**
A	0.45	0.55
A1	0.00	0.05
A3	0.127 REF	
b	0.15	0.25
D	1.20 BSC	
E	1.00 BSC	
e	0.40 BSC	
L	0.30	0.40
L1	0.00	0.15
L2	0.40	0.50

MOUNTING 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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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