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MC74VHCT132A

Quad 2-Input NAND Schmitt Trigger

The MC74VHCT132A is an advanced high speed CMOS Schmitt NAND trigger fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

Pin configuration and function are the same as the MC74VHC00, but the inputs have hysteresis and, with its Schmitt trigger function, the VHCT132A can be used as a line receiver which will receive slow input signals.

The VHCT inputs are compatible with TTL levels. This device can be used as a level converter for interfacing 3.3 V to 5.0 V, because it has full 5.0 V CMOS level output swings.

The VHCT132A input structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. The output structures also provide protection when $V_{CC} = 0$ V. These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

Features

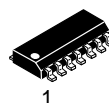
- High Speed: $t_{PD} = 4.9$ ns (Typ) at $V_{CC} = 5.0$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max) at $T_A = 25^\circ\text{C}$
- TTL-Compatible Inputs: $V_{IL} = 0.8$ V; $V_{IH} = 2.0$ V
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2.0 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 0.8$ V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance:
 - Human Body Model > 2000 V;
 - Machine Model > 200 V
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant



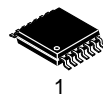
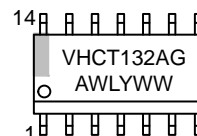
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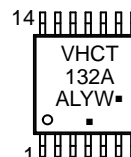
MARKING DIAGRAMS



SOIC-14
D SUFFIX
CASE 751A



TSSOP-14
DT SUFFIX
CASE 948G



A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
WW, W = Work Week
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

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

MC74VHCT132A

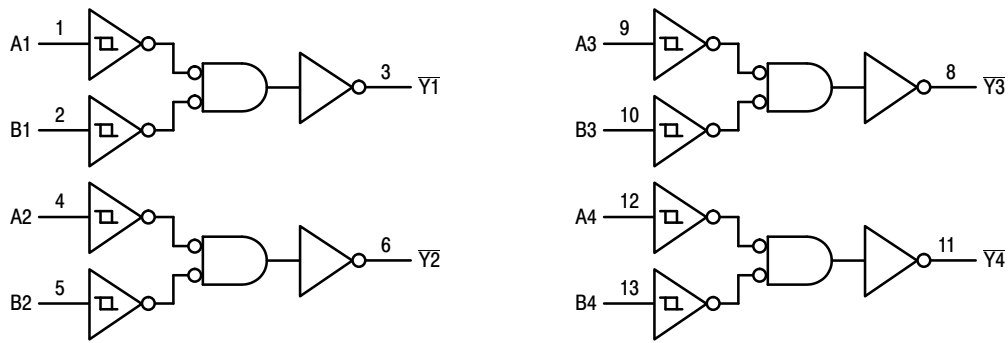
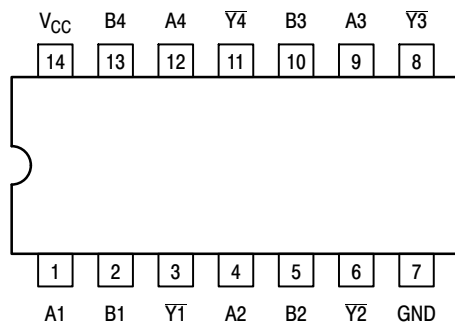


Figure 1. Logic Diagram



FUNCTION TABLE

| Inputs | | Output |
|--------|---|--------|
| A | B | Y |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

Figure 2. Pinout: 14-Lead Packages (Top View)

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------------|-----------------------|--------------------|
| MC74VHCT132ADR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| MC74VHCT132ADTRG | TSSOP-14 (Pb-Free) | 2500 / 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.

MC74VHCT132A

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------|---|-------------------------|------|
| V_{CC} | DC Supply Voltage | - 0.5 to + 7.0 | V |
| V_{in} | DC Input Voltage | - 0.5 to + 7.0 | V |
| V_{out} | DC Output Voltage | - 0.5 to $V_{CC} + 0.5$ | V |
| I_{IK} | Input Diode Current | - 20 | mA |
| I_{OK} | Output Diode Current | ± 20 | mA |
| I_{out} | DC Output Current, per Pin | ± 25 | mA |
| I_{CC} | DC Supply Current, V_{CC} and GND Pins | ± 50 | mA |
| P_D | Power Dissipation in Still Air, SOIC Package† TSSOP Package† | 500 450 | mW |
| T_{stg} | Storage Temperature | - 65 to + 150 | °C |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

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.

†Derating - SOIC Package: - 7 mW/°C from 65° to 125°C

TSSOP Package: - 6.1 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|-----------|--|------|----------|------|
| V_{CC} | DC Supply Voltage | 4.5 | 5.5 | V |
| V_{in} | DC Input Voltage | 0 | 5.5 | V |
| V_{out} | DC Output Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature, All Package Types | - 40 | + 85 | °C |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | V_{CC} V | $T_A = 25^\circ\text{C}$ | | | $T_A \leq 85^\circ\text{C}$ | | $T_A \leq 125^\circ\text{C}$ | | Unit |
|-----------|--|---|-------------------|--------------------------|-----|----------------------|-----------------------------|----------------------|------------------------------|----------------------|---------------|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| V_{T+} | Positive Threshold Voltage | | 3.0 4.5 5.5 | | | 1.7 2.0 2.0 | | 1.6 2.0 2.0 | | 1.6 2.0 2.0 | V |
| V_{T-} | Negative Threshold Voltage | | 3.0 4.5 6.0 | 0.35 0.5 0.6 | | | 0.35 0.5 0.6 | | 0.35 0.5 0.6 | | V |
| V_H | Hysteresis Voltage | | 3.0 4.5 5.5 | 0.30 0.40 0.50 | | 1.20 1.40 1.60 | 0.30 0.40 0.50 | 1.20 1.40 1.60 | 0.30 0.40 0.50 | 1.20 1.40 1.60 | V |
| V_{OH} | Minimum High-Level Output Voltage $I_{OH} = -50\mu\text{A}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -50\mu\text{A}$ | 2.0 | 1.9 | 2.0 | | 1.9 | | 1.9 | | V |
| | | | 3.0 | 2.9 | 3.0 | | 2.9 | | 2.9 | | |
| | | | 4.5 | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | $I_{OH} = -4\text{mA}$ $I_{OH} = -8\text{mA}$ | 4.5 5.5 | 2.58 3.94 | | | 2.48 3.80 | | 2.34 3.66 | | |
| V_{OL} | Maximum Low-Level Output Voltage | $V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 50\mu\text{A}$ | 2.0 | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | | 3.0 | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | | 4.5 | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | $I_{OL} = 4\text{mA}$ $I_{OL} = 8\text{mA}$ | 4.5 5.5 | | | 0.36 0.36 | | 0.44 0.44 | | 0.52 0.52 | |
| I_{IN} | Maximum Input Leakage Current | $V_{IN} = 5.5\text{V}$ or GND | 0 to 5.5 | | | ± 0.1 | | ± 1.0 | | ± 1.0 | μA |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND | 5.5 | | | 2.0 | | 20 | | 40 | μA |
| I_{CCT} | Quiescent Supply Current | Input: $V_{IN} = 3.4\text{V}$ | 5.5 | | | 1.35 | | 1.50 | | 1.65 | mA |
| I_{OPD} | Output Leakage Current | $V_{OUT} = 5.5\text{V}$ | 0.0 | | | 0.5 | | 5.0 | | 10 | μA |

MC74VHCT132A

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$)

| Symbol | Parameter | Test Conditions | T _A = 25°C | | | T _A = – 40 to 85°C | | T _A ≤ 125°C | | Unit |
|--|---|---|-----------------------|-------------|--------------|-------------------------------|--------------|------------------------|--------------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, A or B to Y | V _{CC} = 3.3 ± 0.3 V C _L = 15pF C _L = 50pF | | 7.6 10.1 | 11.9 15.4 | 1.0 1.0 | 14.0 17.5 | | 16.5 20.0 | ns |
| | | V _{CC} = 5.0 ± 0.5 V C _L = 15pF C _L = 50pF | | 4.9 6.4 | 7.7 9.7 | 1.0 1.0 | 9.0 11.0 | | 11.0 13.0 | |
| C _{in} | Maximum Input Capacitance | | | 4 | 10 | | 10 | | 10 | pF |
| C _{PD} | Power Dissipation Capacitance (Note 1) | Typical @ 25°C, V _{CC} = 5.0 V | | | | | | | | pF |
| | | 16 | | | | | | | | |

1. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPER)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/4$ (per gate). C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$, $C_L = 50\text{pF}$, $V_{CC} = 5.0\text{ V}$)

| Symbol | Characteristic | $T_A = 25^\circ\text{C}$ | | Unit |
|-----------|--|--------------------------|------|------|
| | | Typ | Max | |
| V_{OLP} | Quiet Output Maximum Dynamic V_{OL} | 0.3 | 0.8 | V |
| V_{OLV} | Quiet Output Minimum Dynamic V_{OL} | -0.3 | -0.8 | V |
| V_{IHD} | Minimum High Level Dynamic Input Voltage | | 3.5 | V |
| V_{ILD} | Maximum Low Level Dynamic Input Voltage | | 1.5 | V |

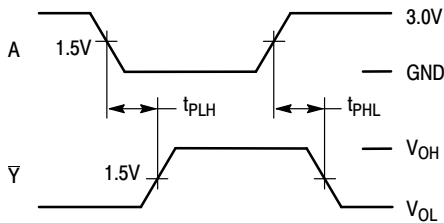
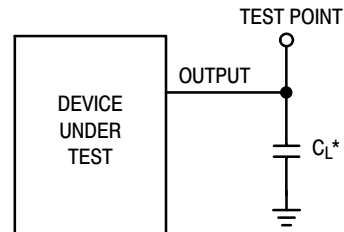


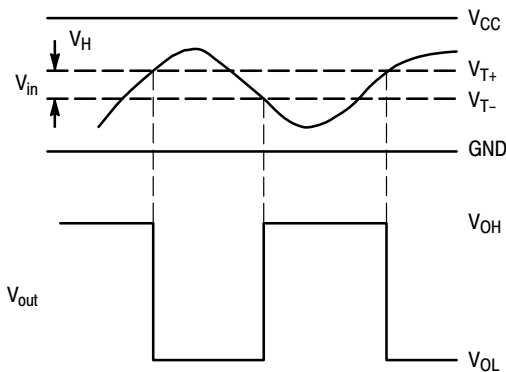
Figure 3. Switching Waveforms



*Includes all probe and jig capacitance

Figure 4. Test Circuit

(a) A Schmitt-Trigger Squares Up Inputs With Slow Rise and Fall Times



(b) A Schmitt-Trigger Offers Maximum Noise Immunity

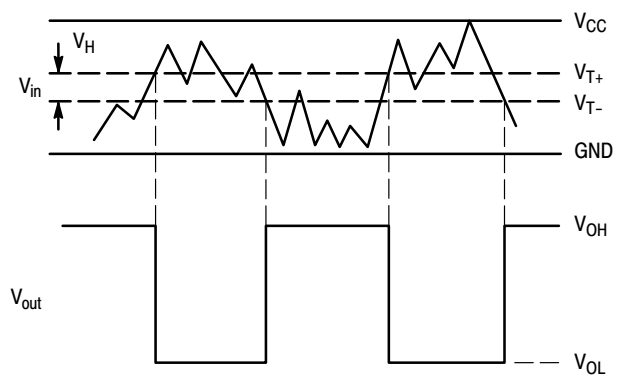
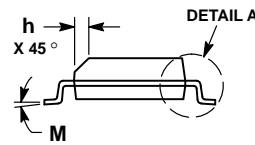
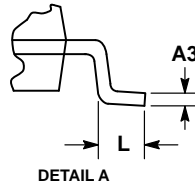
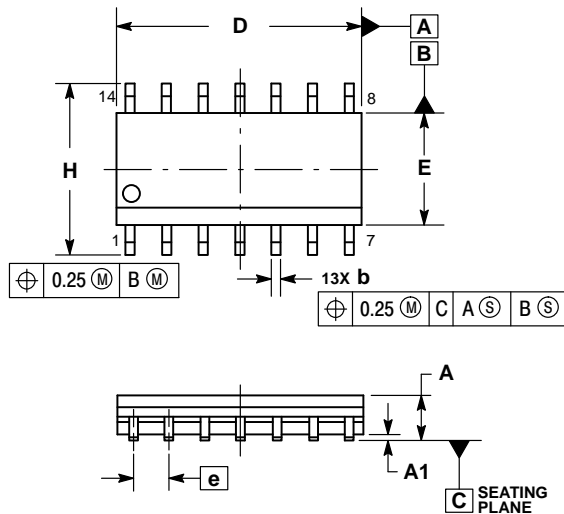


Figure 5. Typical Schmitt-Trigger Applications

MC74VHCT132A

PACKAGE DIMENSIONS

SOIC-14
CASE 751A-03
ISSUE K

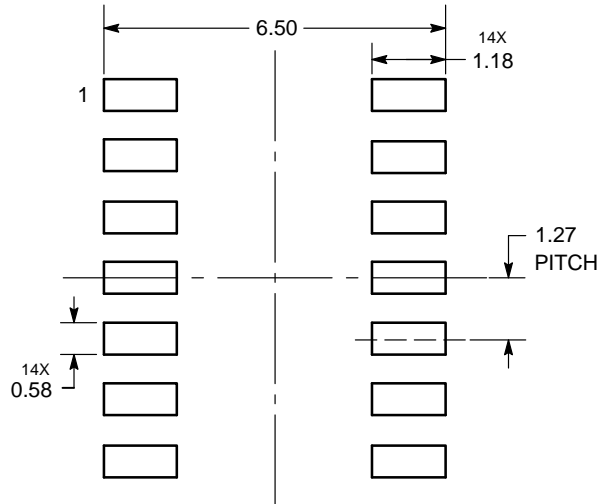


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0° | 7° | 0° | 7° |

SOLDERING FOOTPRINT*



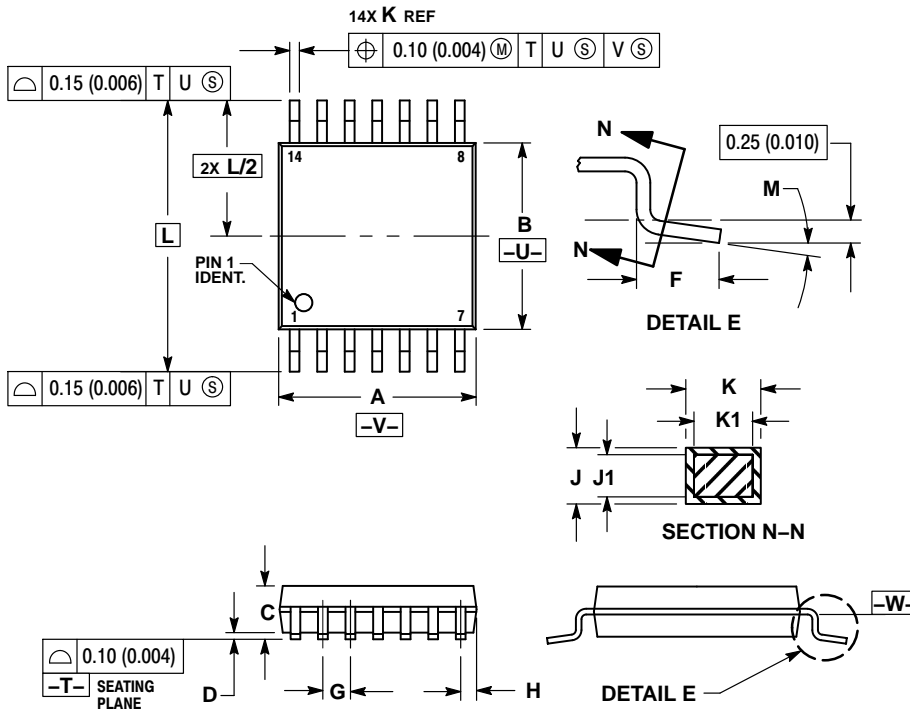
DIMENSIONS: MILLIMETERS

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

MC74VHCT132A

PACKAGE DIMENSIONS

TSSOP-14
CASE 948G
ISSUE B

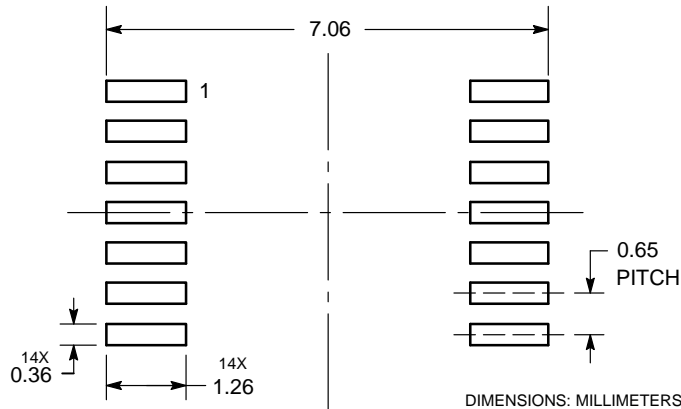



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.10 | 0.193 | 0.200 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | — | 1.20 | — | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 | BSC | 0.026 | BSC |
| H | 0.50 | 0.60 | 0.020 | 0.024 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 | BSC | 0.252 | BSC |
| M | 0° | 8° | 0° | 8° |

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