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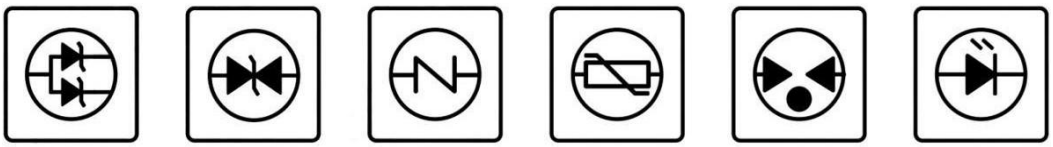
SEMICONDUCTOR




# MSLMV331SE-7

**Product specification**

## GENERAL DESCRIPTION

The MSLMV331SE-7 is the single comparator version, are open-drain output comparators for maximum flexibility. It can operate from 1.8V to 5.5V, and have low power consuming 50μA (TYP) per channel at output low.

The MSLMV331SE-7 are the most cost-effective solutions for applications where low voltage operation, low power and space saving are the primary specifications in circuit design for portable consumer products.

The MSLMV331SE-7 are available in SC70-5 packages. It operates over an ambient temperature range of -25°C to +125°C.

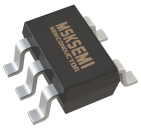
## FEATURES

- Supply Range: +1.8V to +5.5V
- Low Supply Current
- 50μA (TYP) per channel at $V_S$ = 5V and output low
- Input Common-Mode Voltage Range Includes Ground
- Low Output Saturation Voltage 100mV Typical
- Open-Drain Output for Maximum Flexibility
- SPECIFIED UP TO +125°C
- Micro SIZE PACKAGES: SC70-5

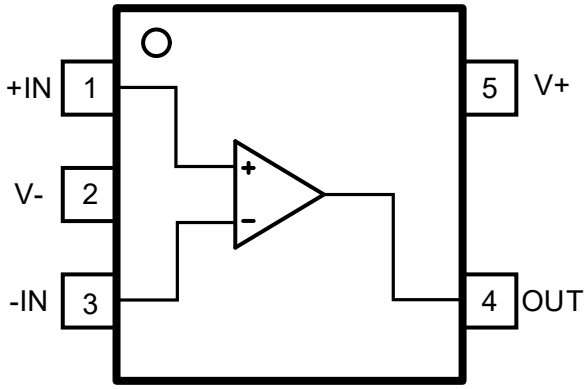
## APPLICATIONS

- Hysteresis Comparators
- Oscillators
- Window Comparators
- Industrial Equipment
- Test and Measurement

## Reference News

| Type No | SC70-5 | MARKING |
|---|---|---|
| MSLMV331SE-7 |  | V331 |

## Pin Configuration and Functions (Top View)




## Pin Description

| Pin Name | Pin Number SC70-5 | I/O | Description |
|---|---|---|---|
| +IN | 1 | I | Noninverting input |
| V- | 2 | - | Negative(lowest) power supply |
| -IN | 3 | I | Inverting input |
| OUT | 4 | O | Output |
| V+ | 5 | - | Positive (highest) power supply |

## SIMPLIFIED SCHEMATIC

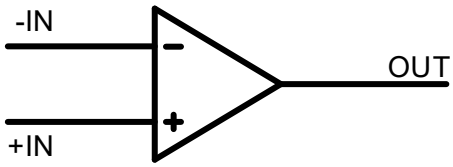



Figure 1. Simplified Schematic

## Absolute Maximum Ratings(1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Voltage | Supply, $V_s$=(V+) - (V-) | | 7 | V |
| | Input pin (IN+, IN-) (2) | (V-) - 0.3 | (V+) + 0.3 | V |
| | Signal output pin (3) | (V-) - 0.3 | (V+) + 0.3 | V |
| Current | Signal Input pin (IN+, IN-) (2) | -10 | 10 | mA |
| | Signal output pin (3) | -55 | 55 | mA |
| Temperature | Operating Range | -25 | 85 | °C |
| | Storage | -65 | 150 | °C |
| | Junction | | 150 | °C |

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±55mA or less.

(3) Short-circuit from output to $V_{CC}$ can cause excessive heating and eventual destruction.

## ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins (1) | ±2000 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins (2) | ±1000 | V |

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

## Recommended Operating Conditions

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Supply voltage，Vs= (V+) - (V-） | Single-supply | 1.8 | 5.5 | V |
| | Dual-supply | ±0.9 | ±2.75 | V |

## ELECTRICAL CHARACTERISTICS($V_S$ = 5.0V)

At $T_A$ = 25°C, $V_{CM}$ = $V_S$/2, unless otherwise noted.

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| **POWER SUPPLY** | | | | | |
| Operating Voltage Range | | 1.8 | | 5.5 | V |
| Quiescent Current/per channel (Output High) | | | 29 | | μA |
| Quiescent Current/per channel (Output Low) | | | 50 | | μA |
| Power Supply Rejection Ratio | $V_S$ = 1.8V to 5.5V, $V_{CM}$ = $V_S$/2 | | 70 | | dB |
| **INPUT** | | | | | |
| Input offset voltage | | -4 | ±0.8 | 4 | mV |
| Input Offset Voltage Drift | | | 0.8 | | μV/°C |
| Common-Mode Voltage Range | | (V-)-0.1 | | 4.5 | V |
| Common-mode Rejection Ratio | $V_{CM}$ = -0.1V to 4.5V | | 70 | | dB |
| Input Bias Current | | | 2 | | pA |
| Input Offset Current | | | 1 | | pA |
| **OUTPUT** | | | | | |
| Saturation Voltage | $I_O$≤4mA | | 100 | | mV |
| Output Pull-up Voltage Range | | | | 5.6 | V |
| Output Current(sinking) | $V_O$≤1.5V | | 50 | | mA |
| **SWITCHING** | | | | | |
| Propagation Delay H To L | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 460 | | ns |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 400 | | |
| Propagation Delay L To H | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 950 | | |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 850 | | |
| Fall Time | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 36 | | ns |

## ELECTRICAL CHARACTERISTICS($V_S$ = 2.7V)

At $T_A$ = 25°C, $V_{CM}$ = $V_S$/2, unless otherwise noted.

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| **POWER SUPPLY** | | | | | |
| Operating Voltage Range | | 1.8 | | 5.5 | V |
| Quiescent Current/per channel (Output High) | | | 17 | | μA |
| Quiescent Current/per channel (Output Low) | | | 30 | | μA |
| Power Supply Rejection Ratio | $V_S$ = 1.8V to 5.5V, $V_{CM}$ = $V_S$/2 | | 70 | | dB |
| **INPUT** | | | | | |
| Input offset voltage | | -4 | ±0.8 | 4 | mV |
| Input Offset Voltage Drift | | | 0.8 | | μV/°C |
| Common-Mode Voltage Range | | (V-)-0.1 | | 2.2 | V |
| Common-mode Rejection Ratio | $V_{CM}$ = -0.1V to 2.2V | | 70 | | dB |
| Input Bias Current | | | 2 | | pA |
| Input Offset Current | | | 1 | | pA |
| **OUTPUT** | | | | | |
| Saturation Voltage | $I_O$≤4mA | | 82 | | mV |
| Output Pull-up Voltage Range | | | | 5.6 | V |
| Output Current(sinking) | $V_O$≤1.5V | | 20 | | mA |
| **SWITCHING** | | | | | |
| Propagation Delay H To L | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 420 | | ns |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 380 | | |
| Propagation Delay L To H | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 900 | | |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 880 | | |
| Fall Time | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 36 | | ns |

## ELECTRICAL CHARACTERISTICS($V_S$ = 1.8V)

At $T_A$ = 25°C, $V_{CM}$ = $V_S$/2, unless otherwise noted.

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| **POWER SUPPLY** | | | | | |
| Operating Voltage Range | | 1.8 | | 5.5 | V |
| Quiescent Current/per channel (Output High) | | | 15 | | μA |
| Quiescent Current/per channel (Output Low) | | | 26 | | μA |
| Power Supply Rejection Ratio | $V_S$ = 1.8V to 5.5V, $V_{CM}$ = $V_S$/2 | | 70 | | dB |
| **INPUT** | | | | | |
| Input offset voltage | | -4 | ±0.8 | 4 | mV |
| Input Offset Voltage Drift | | | 0.8 | | μV/°C |
| Common-Mode Voltage Range | | (V-)-0.1 | | 1.3 | V |
| Common-mode Rejection Ratio | $V_{CM}$ = -0.1V to 1.3V | | 70 | | dB |
| Input Bias Current | | | 2 | | pA |
| Input Offset Current | | | 1 | | pA |
| **OUTPUT** | | | | | |
| Saturation Voltage | $I_O$≤4mA | | 96 | | mV |
| Output Pull-up Voltage Range | | | | 5.6 | V |
| Output Current(sinking) | $V_O$≤1.5V | | 7 | | mA |
| **SWITCHING** | | | | | |
| Propagation Delay H To L | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 480 | | ns |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 430 | | |
| Propagation Delay L To H | $R_{PU}$=5.1KΩ, Overdrive =10mV | | 820 | | |
| | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 800 | | |
| Fall Time | $R_{PU}$=5.1KΩ, Overdrive =100mV | | 38 | | ns |

## TYPICAL CHARACTERISTICS

At $T_A$ = 25°C, $V_S$ = +5V, $V_{CM}$ = $V_S$/2, unless otherwise noted.

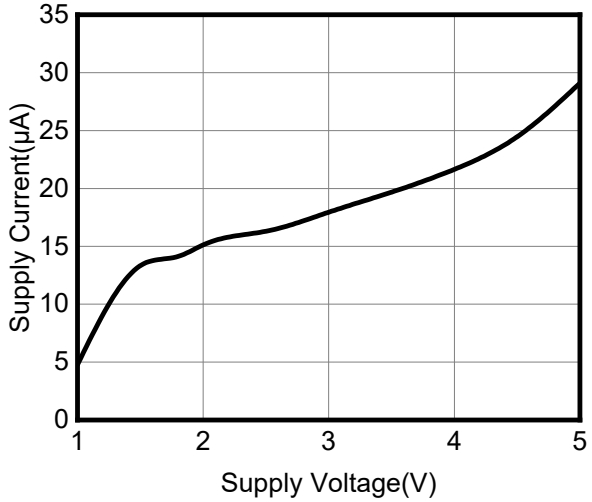



Figure 2. Supply Current vs Supply Voltage Output High

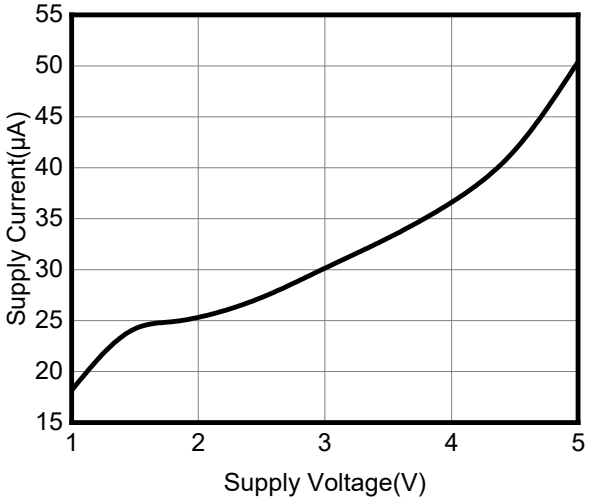



Figure 3. Supply Current vs Supply Voltage Output Low

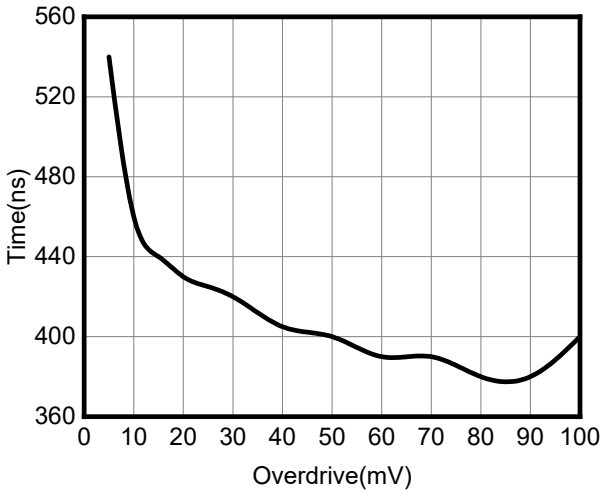



Figure 4. Response Time vs Input Overdrives Negative Transition($V_{CC}$=5V)

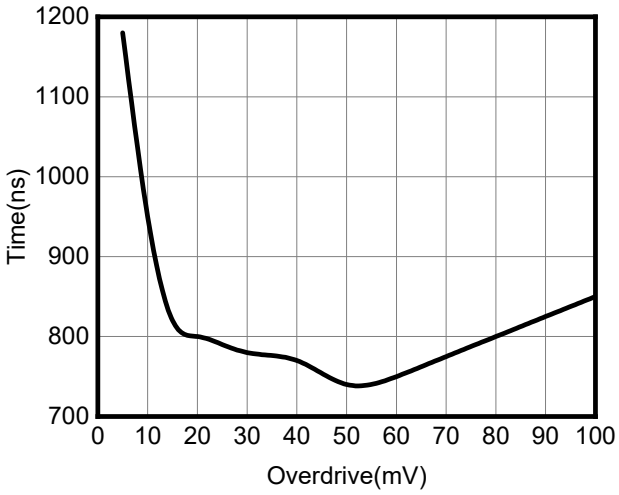



Figure 5. Response Time vs Input Overdrives Positive Transition($V_{CC}$=5V)

## DETAILED DESCRIPTION

### Overview

The MSLMV331SE-7 of comparators can operate up to 5.5V on the supply pin.This standard device has proven ubiquity and versatility across a wide range of applications. This is due to its low power and high speed. The open-drain output allows the user to configure the output's logic low voltage ($V_{OL}$) and can be utilized to enable the comparator to be used in AND functionality.

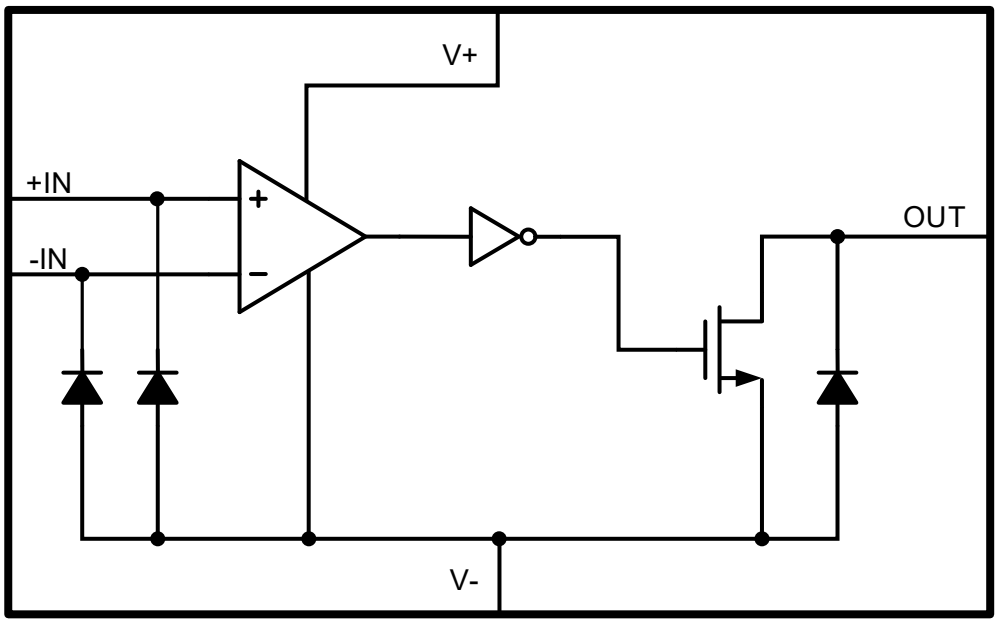



Figure 9. Functional Block Diagram

## APPLICATION and IMPLEMENTATION

### Application Information

MSLMV331SE-7 will typically be used to compare a single signal to a reference or two signals against each other. Many users take advantage of the open drain output (logic high with pull-up) to drive the comparison logic output to a logic voltage level to an MCU or logic device.

### Typical Application

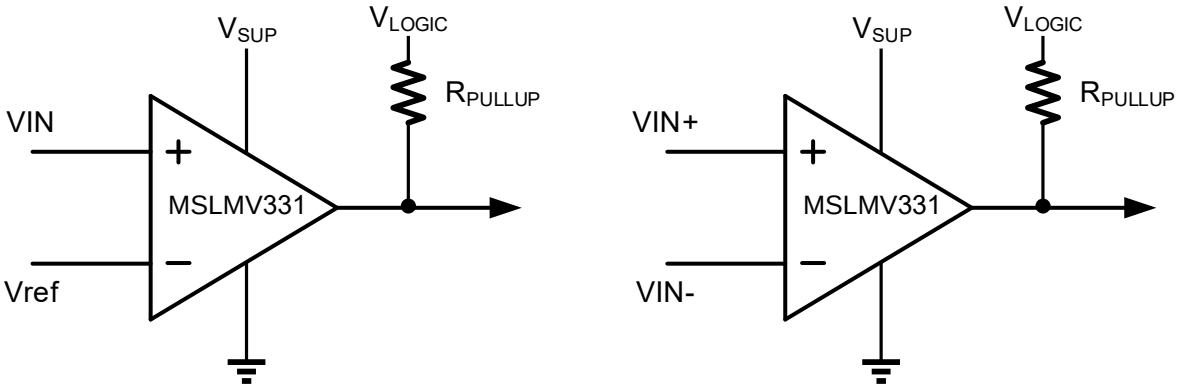



Figure 10. Typical Application Schematic

### Power Supply Recommendations

For fast response and comparison applications with noisy or AC inputs, it is recommended to use a bypass capacitor on the supply pin to reject any variation on the supply voltage. This variation causes temporary fluctuations in the comparator's input common mode range and create an inaccurate comparison.

## Layout

### Layout Guidelines

For accurate comparator applications without hysteresis it is important maintain a stable power supply with minimized noise and glitches, which can affect the high-level input common mode voltage range. In order to achieve this, it is best to add a bypass capacitor between the supply voltage and ground. This should be implemented on the positive power supply and negative supply (if available). If a negative supply is not being used, do not put a capacitor between the IC's GND pin and system ground.

### Layout Example

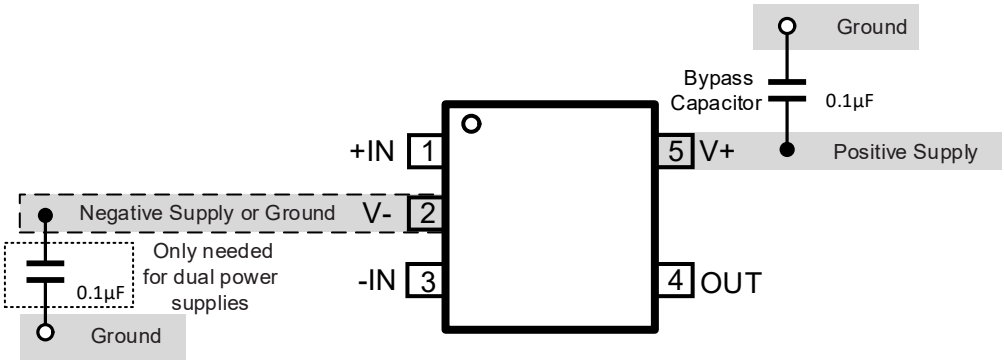
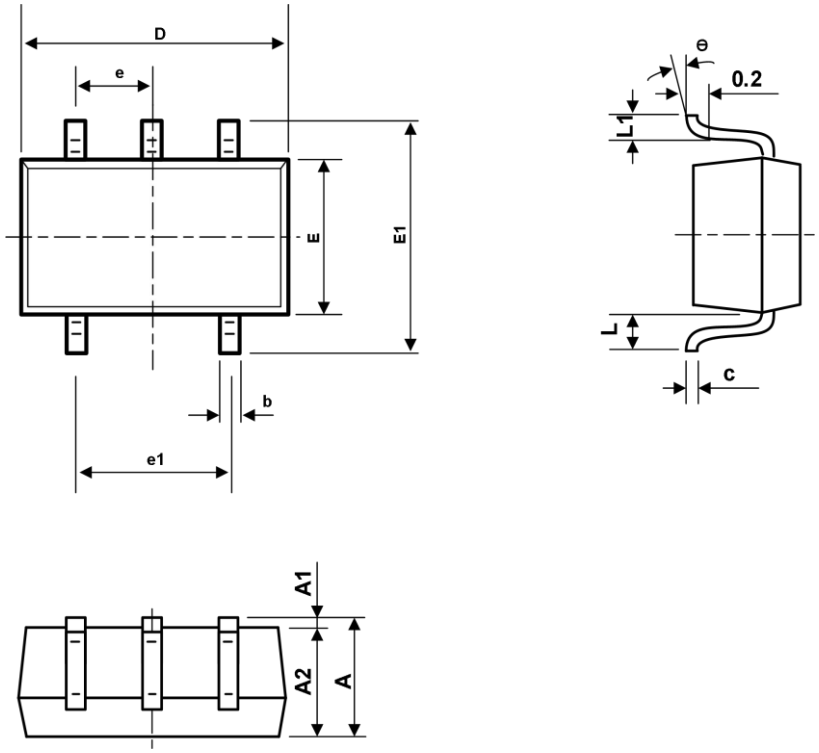



Figure 11. MSLMV331SE-7 Layout Example

## Package Outline

**SC70-5**




| symbol | Dimension In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.110 | 0.175 | 0.004 | 0.007 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 1.150 | 1.350 | 0.045 | 0.053 |
| E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| e | 0.650TYP | | 0.026TYP | |
| e1 | 1.200 | 1.400 | 0.047 | 0.055 |
| L | 0.525REF | | 0.021REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

## ORDER INFORMATION

| P/N | PKG | QTY |
|---|---|---|
| MSLMV331SE-7 | SC70-5 | 3000 |

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