

MAS9162

80 mA LDO Voltage Regulator IC

This is preliminary information on a new product under development. Micro Analog Systems Oy reserves the right to make any changes without notice.

Preliminary

- **Low Noise, 30 μ Vrms, without External Bypass Capacitor**
- **Very Short Start-up Time: 10 μ s**
- **Stable Low-ESR Output Capacitors**
- **Low Minimum Output Capacitance Requirement: 0.22 μ F**
- **Regulator Enable/Disable Control**

DESCRIPTION

MAS9162 is a low dropout voltage regulator with an enable/disable pin, which allows device to be turned off or on by pulling control to low or high.

No external bypass capacitor is needed for achieving the low noise level of 30 μ Vrms. In addition to the noise levels, MAS9162 excels in dropout voltage (95 mV typical at 50 mA) and in start-up time (typically 10 μ s from start-up to within $\pm 1\%$ of $V_{OUT(NOM)}$).

The Equivalent Series Resistance (ESR) range of output capacitors that can be used with MAS9162 is very wide. This ESR range from a few m Ω up to a couple of Ohms combined with no minimum output

current requirement makes the usage of MAS9162 easier and low in cost. Also the minimum output capacitance requirement is very low. This combined with very short start-up time makes it possible to switch the regulator off and on even in timing critical and/or noise sensitive applications.

An internal thermal protection circuit prevents the device from overheating. Also the maximum output current is internally limited. In order to save power the device goes into sleep mode when the regulator is disabled.

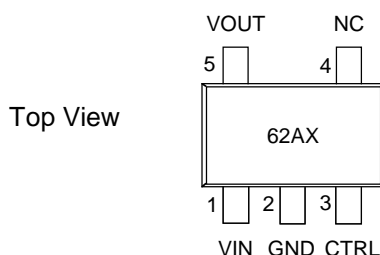
FEATURES

- No External Bypass Capacitor Needed
- Optimized for Fast Start-up
- Internal Thermal Shutdown
- Short Circuit Protection
- SOT23-5 Package
- Pin Compatible with MC33761
- Several Output Voltage Options Available, See Ordering Information p. 8

APPLICATION

- RF-Oscillators
- Cellular Phones
- Cordless Phones
- Pagers
- Battery Powered Systems
- Portable Systems
- Radio Control Systems

PIN CONFIGURATION



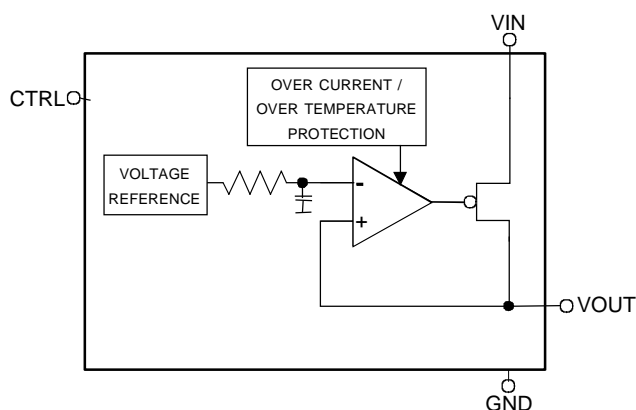
For Top Marking Information see Ordering Information p. 8

PIN DESCRIPTION

| Pin Name | Pin | Type | Function |
|----------|-----|------|----------------------------------|
| VIN | 1 | P | Power Supply Voltage |
| GND | 2 | G | Ground |
| CTRL | 3 | I | Enable/Disable Pin for Regulator |
| N/C | 4 | - | Not Connected |
| VOUT | 5 | O | Output |

G = Ground, I = Input, O = Output, P = Power

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

All voltages with respect to ground.

| Parameter | Symbol | Conditions | Min | Max | Unit |
|----------------------------|------------|------------|------|-------------------|------|
| Supply Voltage | V_{IN} | | -0.3 | 6 | V |
| Voltage Range for All Pins | | | -0.3 | $V_{IN} + 0.3$ | V |
| ESD Rating | | HBM | | 2 | kV |
| Junction Temperature | T_{Jmax} | | | +175 (limited) | °C |
| Storage Temperature | T_S | | -55 | +150 | °C |

Stresses beyond those listed may cause permanent damage to the device. The device may not operate under these conditions, but it will not be destroyed.

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Conditions | Min | Max | Unit |
|--------------------------------|----------|------------|----------------------|------|------|
| Operating Junction Temperature | T_J | | -40 | +125 | °C |
| Operating Ambient Temperature | T_A | | -40 | +85 | °C |
| Operating Supply Voltage | V_{IN} | | $V_{OUT(NOM)} + 0.3$ | 5.3 | V |

ELECTRICAL CHARACTERISTICS

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, typical values at $T_A = +27^{\circ}\text{C}$, $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$, $I_{OUT} = 1\text{ mA}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 1.0\text{ }\mu\text{F}$, $V_{CTRL} = 2\text{ V}$, unless otherwise specified.

◆ Thermal Protection

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------|--------|------------|-----|-----|-----|--------------------|
| Threshold High | T_H | | 145 | 160 | 175 | $^{\circ}\text{C}$ |
| Threshold Low | T_L | | 135 | 150 | 165 | $^{\circ}\text{C}$ |

The hysteresis of 10°C prevents the device from turning on too soon after thermal shut-down.

◆ Control Terminal Specifications

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|------------|--|-----|--------|------|---------------|
| Control Voltage OFF State ON State | V_{CTRL} | | 1.6 | | 0.55 | V |
| Control Current | I_{CTRL} | $V_{CTRL} = V_{IN}$ $V_{CTRL} = 0\text{ V}$ | | 5 0 | 15 | μA |

◆ Voltage Parameters

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--------------------------|------------|---|----------------|----------------|----------------|------------------|
| Output Voltage Tolerance | V_{OUT} | $I_{OUT} = 0\text{ mA}$ $I_{OUT} = 50\text{ mA}$ | - 1.7 - 3.5 | | + 1.7 + 1.7 | $\%V_{OUT(NOM)}$ |
| Dropout Voltage | V_{DROP} | $I_{OUT} = 1\text{ mA}$ $I_{OUT} = 10\text{ mA}$ $I_{OUT} = 50\text{ mA}$ | | 46 51 95 | | mV |

◆ Current Parameters

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------|---|----------------------------|-------------------|-----|---------------|
| Continuous Output Current | I_{OUT} | | 0 | | 80 | mA |
| Short Circuit Current | I_{MAX} | $R_L = 0\text{ }\Omega$ | | 230 | | mA |
| Peak Output Current | I_{PK} | $V_{OUT} > 95\% * V_{OUT(NOM)}$ | | 180 | | mA |
| Ground Pin Current | I_{GND} | $I_{OUT} = 0\text{ mA}$ $I_{OUT} = 10\text{ mA}$ $I_{OUT} = 50\text{ mA}$ | | 170 210 250 | | μA |
| Ground Pin Current, Sleep Mode | I_{GND} | $V_{CTRL} < 0.3\text{ V}$ | $T_A = 25^{\circ}\text{C}$ | 0.02 | 0.5 | μA |
| | | | $T_A = 85^{\circ}\text{C}$ | 0.2 | 2 | |

◆ Power Dissipation

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|----------|--------------------------------------|---|-------|-----|------|
| Thermal Resistance (Junction-to-Air) | R_{JA} | typical PC board mounting, still air | | 255.9 | | °C/W |
| Maximum Power Dissipation | P_d | any ambient temperature | $P_{dMAX} = \frac{T_{J(MAX)} - T_A}{R_{JA}}$ Note 1 | | | W |

Note 1: $T_{J(MAX)}$ denotes maximum operating junction temperature (+125°C), T_A ambient temperature, and R_{JA} junction-to-air thermal resistance (+255.9°C/W).

◆ Line and Load Regulation

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------------|--------|---|-----|------|-----|------|
| Line Regulation | | $V_{OUT(NOM)} + 1\text{ V} < V_{IN} < 5.3\text{ V}$ $I_{OUT} = 50\text{ mA}$ | | 0.75 | 2 | mV |
| Load Regulation | | $I_{OUT} = 1.0\text{ to }50\text{ mA}$ | | 13.5 | 25 | mV |

◆ Noise and Ripple Rejection

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------------|-----------|--|-----|----------------|-----|-------------------------------------|
| Output Noise Voltage | V_{RMS} | 100 Hz < f < 100 kHz | | 30 | | μVrms |
| Noise Density | V_N | $I_{OUT} = 50\text{ mA}$, f = 10 kHz | | 140 | | $\frac{\text{nV}}{\text{sqrt(Hz)}}$ |
| PSRR | | f = 1 kHz f = 10 kHz f = 100 kHz | | 50 38 37 | | dB |

◆ Dynamic Parameters

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|--------|---|-----|-----|-----|------|
| Start-up Delay (from start-up to 80% of $V_{OUT(NOM)}$) | | $V_{CTRL} = 0\text{ to }2.4\text{ V}$, $I_{OUT} = 50\text{ mA}$, $C_L \leq 1.0\text{ }\mu\text{F}$ | | 6.5 | | μs |
| Overshoot | | $V_{CTRL} = 0\text{ to }2.4\text{ V}$ | | 2.0 | 8.0 | % |
| Start-up Time (settling time of voltage transient from start-up to within ±1% of $V_{OUT(NOM)}$) | | $V_{CTRL} = 0\text{ to }2.4\text{ V}$, $I_{OUT} = 50\text{ mA}$, $C_L \leq 1.0\text{ }\mu\text{F}$ | | 10 | | μs |

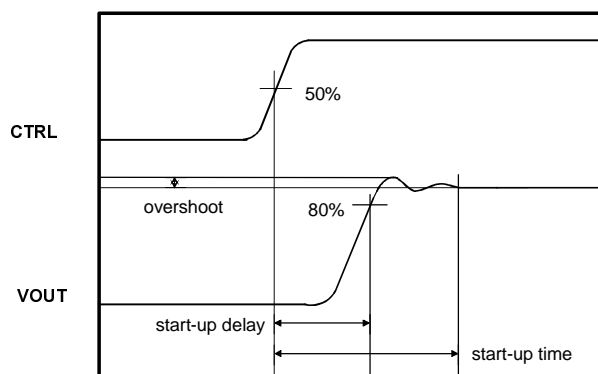
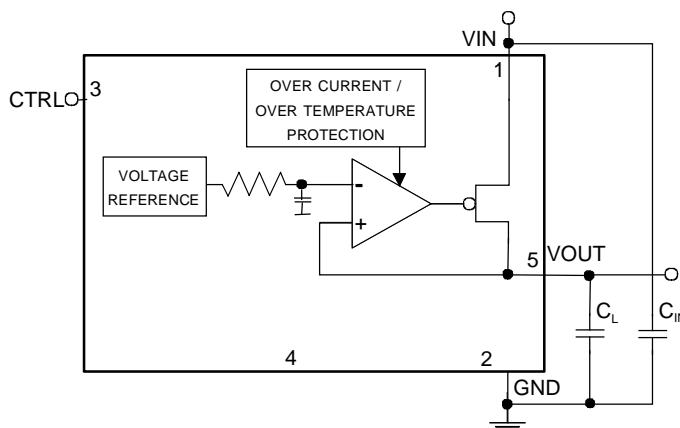


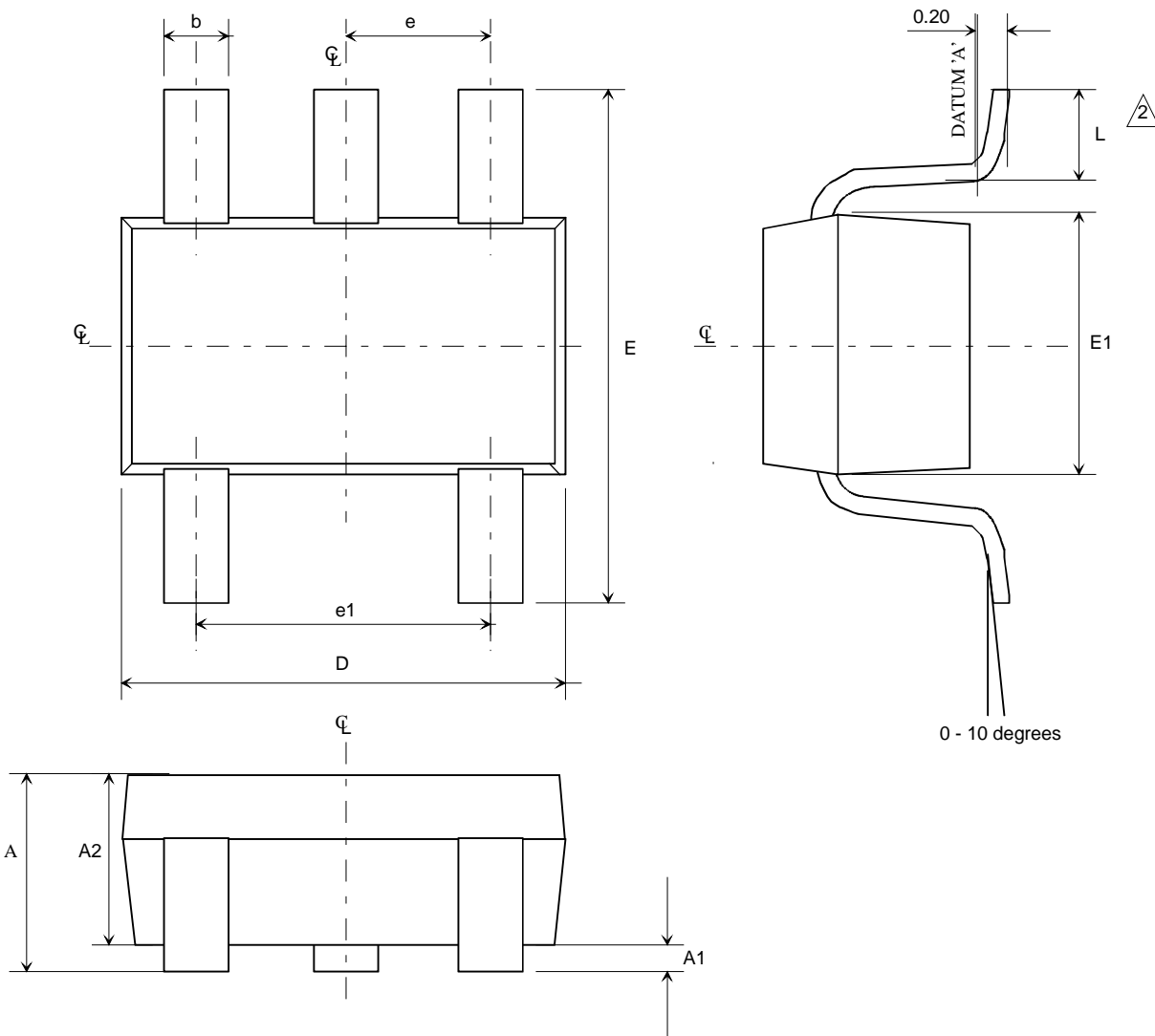
Figure1. Definitions of start-up delay, overshoot and start-up time.

APPLICATION INFORMATION


| Parameter | Symbol | Min | Typ | Max | Unit | Note |
|-----------------------------|----------|------|-----|-----|---------------|--|
| Output Capacitance | C_L | 0.22 | 1.0 | | μF | <ol style="list-style-type: none"> 1. Ceramic and film capacitors can be used. 2. The value of C_L should be smaller than or equal to the value of C_{IN}. |
| Effective Series Resistance | ESR | 0.01 | | 2 | Ohm | <ol style="list-style-type: none"> 1. When within this range stable with all $I_{OUT} = 0 \text{ mA} \dots 80 \text{ mA}$ values. |
| Input Capacitance | C_{IN} | 0.5 | | | μF | <ol style="list-style-type: none"> 1. A big enough input capacitance is needed to prevent possible impedance interactions between the supply and MAS9162. 2. Ceramic, tantalum, and film capacitors can be used. If a tantalum capacitor is used, it should be checked that the surge current rating is sufficient for the application. 3. In the case that the inductance between a battery and MAS9162 is very small ($< 0.1 \mu\text{H}$) $0.47 \mu\text{F}$ input capacitor is sufficient. 4. The value of C_{IN} should not be smaller than the value of C_L. |

Values given on the table are minimum requirements unless otherwise specified. When selecting capacitors, tolerance and temperature coefficient must be considered to **make sure that the requirement is met in all potential operating conditions.**

PACKAGE (SOT23_5) OUTLINE



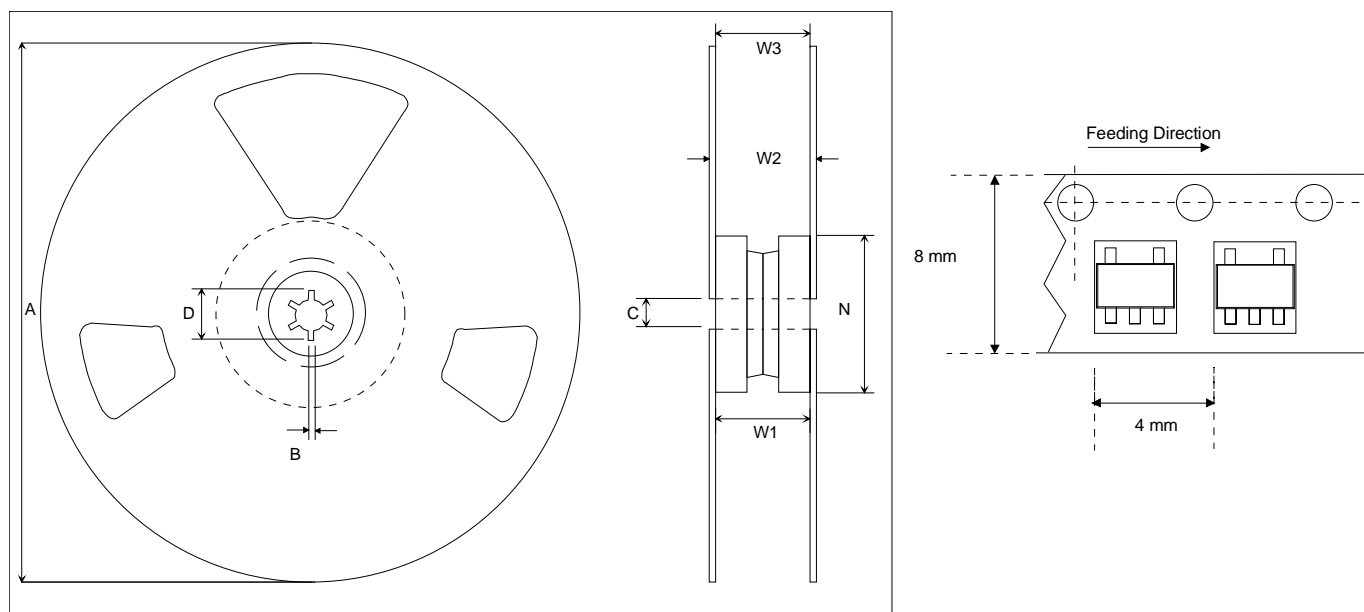
- NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS
 2. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM A & LEAD SURFACE.
 3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR
 4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
 5. COMPLY TO EIAJ SC74

| Symbol | Min | Max | Unit |
|--------|---------|------|------|
| A | 0.90 | 1.45 | mm |
| A1 | 0.00 | 0.15 | mm |
| A2 | 0.90 | 1.30 | mm |
| b | 0.25 | 0.50 | mm |
| C | 0.09 | 0.20 | mm |
| D | 2.80 | 3.10 | mm |
| E | 2.60 | 3.00 | mm |
| E1 | 1.50 | 1.75 | mm |
| L | 0.35 | 0.55 | mm |
| e | 0.95ref | | mm |
| e1 | 1.90ref | | mm |

SOLDERING INFORMATION

| | |
|---------------------------------|---|
| Resistance to Soldering Heat | According to RSH test IEC 68-2-58/20 2*220°C |
| Maximum Reflow Temperature | 235°C |
| Maximum Number of Reflow Cycles | 2 |
| Seating Plane Co-planarity | max 0.08 mm |
| Lead Finish | Solder plate 7.62 - 25.4 μm, material Sn 85% Pb 15% |

TAPE & REEL SPECIFICATIONS



Other Dimensions according to EIA-481 Standard

3000 Components on Each Reel

| Dimension | Min | Max | Unit |
|----------------------------------|--|-------|------|
| A | | 178 | mm |
| B | 1.5 | | mm |
| C | 12.80 | 13.50 | mm |
| D | 20.2 | | mm |
| N | 50 | | mm |
| W ₁ (measured at hub) | 8.4 | 9.9 | mm |
| W ₂ (measured at hub) | | 14.4 | mm |
| Trailer | 160 | | mm |
| Leader | 390, of which minimum 160 mm of empty carrier tape sealed with cover tape | | mm |

ORDERING INFORMATION

| Product Code | Product | Top Marking | Package | Comments |
|---------------|-----------------------------|-------------|---------|---------------|
| MAS9162AST1-T | 3.30 V Voltage Regulator IC | 62A1 | SOT23-5 | Tape and Reel |
| MAS9162AST2-T | 2.80 V Voltage Regulator IC | 62A2 | SOT23-5 | Tape and Reel |
| MAS9162AST3-T | 2.50 V Voltage Regulator IC | 62A3 | SOT23-5 | Tape and Reel |
| MAS9162AST6-T | 3.00 V Voltage Regulator IC | 62A6 | SOT23-5 | Tape and Reel |
| MAS9162AST7-T | 2.90 V Voltage Regulator IC | 62A7 | SOT23-5 | Tape and Reel |
| MAS9162AST8-T | 2.86 V Voltage Regulator IC | 62A8 | SOT23-5 | Tape and Reel |
| MAS9162AST9-T | 2.70 V Voltage Regulator IC | 62A9 | SOT23-5 | Tape and Reel |

For more voltage options contact Micro Analog Systems Oy.

LOCAL DISTRIBUTOR

MICRO ANALOG SYSTEMS OY CONTACTS

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