

MAS9124

150 mA LDO Voltage Regulator IC

- **Low Noise: 20 μ Vrms**
- **Low Minimum Output Capacitance Requirement: 0.22 μ F**
- **Excellent Ripple Rejection: 65 dB**
- **Very Low Dropout: 70 mV**
- **Regulator Enable/Disable Control**
- **Stable with Low-ESR Output Capacitors**

DESCRIPTION

MAS9124 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.

Due to the low noise level of only 20 μ Vrms, MAS9124 is suitable for sensitive circuits, e.g., in portable applications. In addition to the noise levels, MAS9124 excels in dropout voltage (70 mV typical at 50 mA) and rise time (16 μ s typical without bypass capacitor). Also its ripple rejection ability of 65 dB at 10 kHz exceeds that of competition.

The Equivalent Series Resistance (ESR) range of output capacitors that can be used with MAS9124 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 MAS9124 easier and low in cost.

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

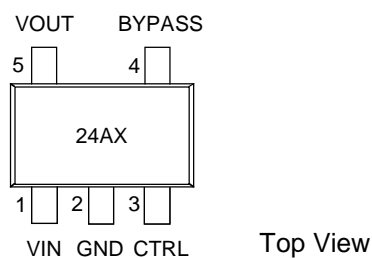
FEATURES

- Low Noise
- Functionally and Pin Compatible with LP2985
- Can be used w/o C_{BYPASS}, see p. 5
- Internal Thermal Shutdown
- Short Circuit Protection
- SOT23-5 Package
- Several Output Voltage Options Available, see Ordering Information p. 8

APPLICATION

- Cellular Phones
- Cordless Phones
- Accessories
- Pagers
- Battery Powered Systems
- Portable Systems
- Radio Control Systems
- Low Voltage Systems

PIN CONFIGURATION AND DESCRIPTION

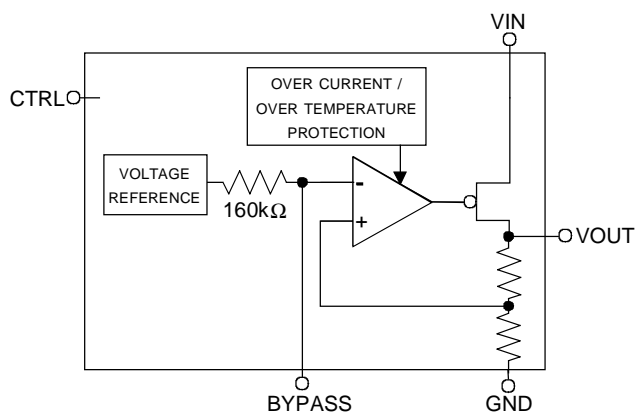


Pin Name	Pin	Type	Function
VIN	1	P	Power Supply Voltage
GND	2	G	Ground
CTRL	3	I	Enable/Disable Pin for Regulator
BYPASS	4	I	Pin for Bypass Capacitor
VOUT	5	O	Output

For Top Marking Information see
Ordering Information p. 8

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}		2.5	5.3	V

ELECTRICAL CHARACTERISTICS

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, typical values at $T_A = +27^{\circ}\text{C}$, $V_{IN} = V_{OUT(NOM)} + 1.0\text{ V}$ (or min 3.8 V), $I_{OUT} = 1.0\text{ mA}$, $C_{IN} = 1.0\text{ }\mu\text{F}$, $C_L = 1.0\text{ }\mu\text{F}$, $C_{BYPASS} = 10\text{ nF}$, $V_{CTRL} = V_{IN}$, 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}		-0.3 1.6		0.55 $V_{IN} + 0.3$	V
Control Current	I_{CTRL}	$V_{CTRL} = V_{IN}$ $V_{CTRL} = 0\text{ V}$		5 0	10	μA

If CTRL-pin is not connected, MAS9124 is in OFF state (900 k Ω pull-down resistor to ground).

◆ Voltage Parameters

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage Tolerance	V_{OUT}	$I_{OUT} = 0\text{ mA}$ $I_{OUT} = 150\text{ mA}$	$V_{OUT(NOM)} - 0.05$ $V_{OUT(NOM)} - 0.10$		$V_{OUT(NOM)} + 0.05$ $V_{OUT(NOM)} + 0.05$	V
Dropout Voltage	V_{DROP}	$I_{OUT} = 1\text{ mA}$ $I_{OUT} = 50\text{ mA}$ $I_{OUT} = 150\text{ mA}$ MAS9124A4 (150 mA) MAS9124A5 (150 mA)		1.7 70 200	320 800 1100	mV

◆ Current Parameters

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Continuous Output Current	I_{OUT}			150		mA
Short Circuit Current	I_{MAX}	$R_L = 0\text{ }\Omega$		450	675	mA
Peak Output Current	I_{PK}	$V_{OUT} > 95\% * V_{OUT(NOM)}$		410		mA
Ground Pin Current	I_{GND}	$I_{OUT} = 0\text{ mA}$ $I_{OUT} = 10\text{ mA}$ $I_{OUT} = 50\text{ mA}$ $I_{OUT} = 150\text{ mA}$		120 130 160 220	200 400	μA
Ground Pin Current, Sleep Mode	I_{GND}	$V_{CTRL} < 0.3\text{ V}$		0.01	5	μA

◆ Power Dissipation

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Junction to Case Thermal Resistance	R_{JC}			81.0		°C/W
Junction to Ambient Thermal Resistance	R_{JA}			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		$V_{OUT(NOM)} + 1V < V_{IN} < 5.3V$, $I_{OUT} = 60mA$		0.7		mV
Load Regulation		$I_{OUT} = 1.0$ to $50mA$ $I_{OUT} = 1.0$ to $150mA$		5 10		mV

◆ Noise and Ripple Rejection

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Noise Voltage	V_{RMS}	$300Hz < f < 50kHz$ $C_{BYPASS} = 10nF$ w/o C_{BYPASS}		20 110		μV_{rms}
Noise Density	V_N	$I_{OUT} = 50mA$, $f = 1.0kHz$		100		$\frac{nV}{\sqrt{Hz}}$
PSRR		$f = 1kHz$ $f = 10kHz$ $f = 100kHz$		67 65 48		dB

◆ Dynamic Parameters

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rise Time (10%...90%)		$V_{CTRL} = 0$ to $2.4V$, $I_{OUT} = 30mA$ $C_{BYPASS} = 10nF$ w/o C_{BYPASS}		4 16		ms μs
Overshoot		$V_{CTRL} = 0$ to $2.4V$, w/o C_{BYPASS}		3	10	%
Start-up Delay		V_{CTRL} to V_{OUT} , w/o C_{BYPASS} (see figure 1 below)		17		μs

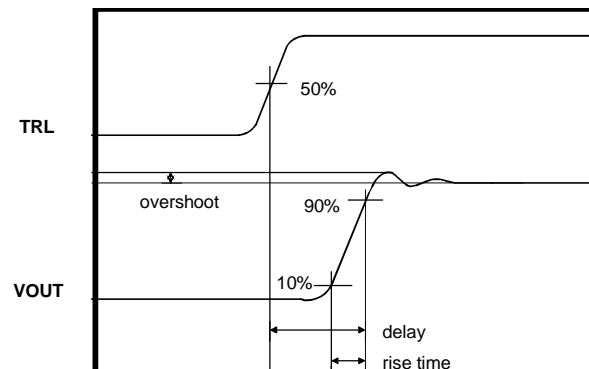
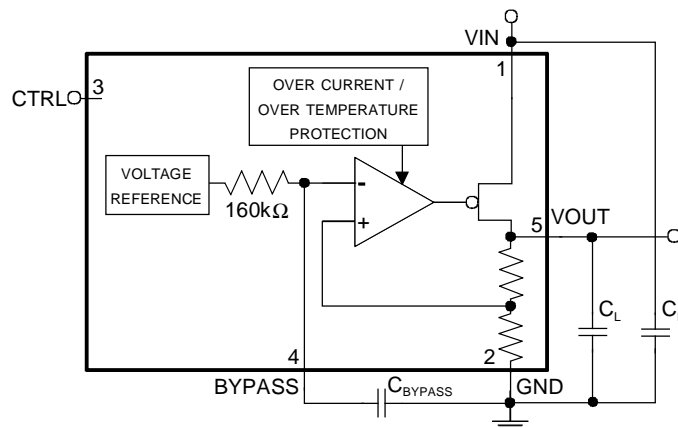


Figure1. Definitions of rise time, overshoot and start-up delay

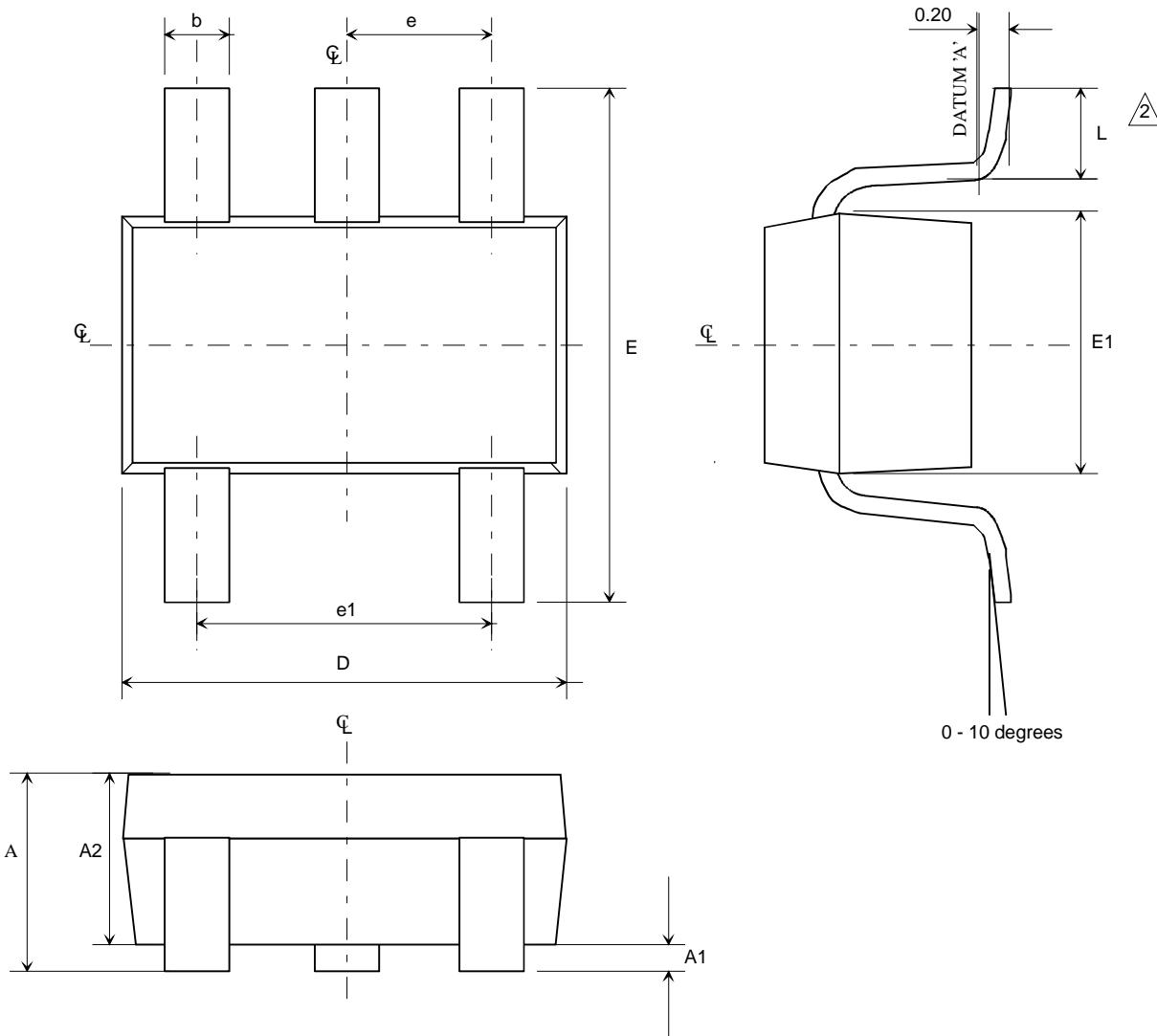
APPLICATION INFORMATION



Parameter	Symbol	Min	Max	Unit	Note
Output Capacitance	C_L	0.22		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	3	Ohm	<ol style="list-style-type: none"> 1. When within this range, stable with all $I_{OUT} = 0 \text{ mA} \dots 150 \text{ mA}$ values.
Bypass Capacitance (Optional: if C_{BYPASS} is not used, noise performance and PSRR decline, but rise time is improved.)	C_{BYPASS}	Typically 0.01		μF	<ol style="list-style-type: none"> 1. Ceramic and film capacitors are best suited. For maximum output voltage accuracy DC leakage current through capacitor should be kept as low as possible. In any case DC leakage current must be below 100 nA.
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 MAS9124. 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 MAS9124 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



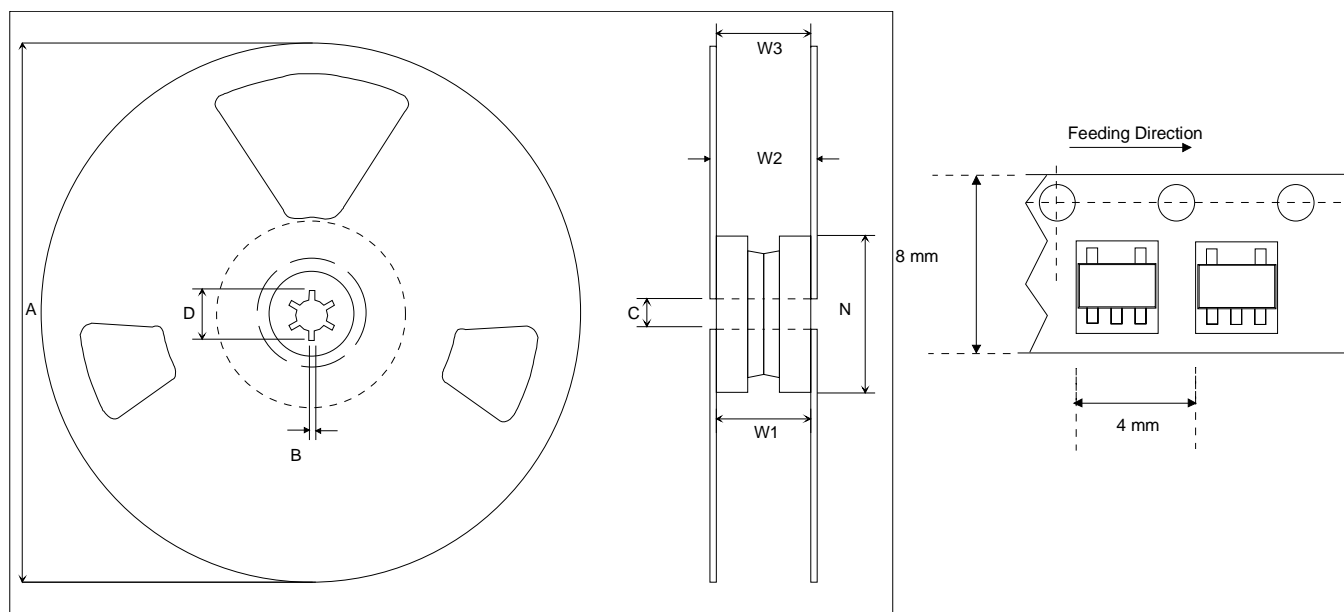
- NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS
 2. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM A & LEAD SURFACE.
 3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR
 4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
 5. COMPLY TO EIAJ SC74

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
MAS9124AST5-T	1.50 V Voltage Regulator IC	24A5	SOT23-5	Tape and Reel
MAS9124AST4-T	1.80 V Voltage Regulator IC	24A4	SOT23-5	Tape and Reel
MAS9124ASTA-T	2.30 V Voltage Regulator IC	24AA	SOT23-5	Tape and Reel
MAS9124ASTB-T	2.40 V Voltage Regulator IC	24AB	SOT23-5	Tape and Reel
MAS9124AST3-T	2.50 V Voltage Regulator IC	24A3	SOT23-5	Tape and Reel
MAS9124ASTC-T	2.60 V Voltage Regulator IC	24AC	SOT23-5	Tape and Reel
MAS9124AST9-T	2.70 V Voltage Regulator IC	24A9	SOT23-5	Tape and Reel
MAS9124AST2-T	2.80 V Voltage Regulator IC	24A2	SOT23-5	Tape and Reel
MAS9124AST8-T	2.86 V Voltage Regulator IC	24A8	SOT23-5	Tape and Reel
MAS9124AST7-T	2.90 V Voltage Regulator IC	24A7	SOT23-5	Tape and Reel
MAS9124AST6-T	3.00 V Voltage Regulator IC	24A6	SOT23-5	Tape and Reel
MAS9124ASTD-T	3.10 V Voltage Regulator IC	24AD	SOT23-5	Tape and Reel
MAS9124AST1-T	3.30 V Voltage Regulator IC	24A1	SOT23-5	Tape and Reel

For more voltage options contact Micro Analog Systems Oy.

LOCAL DISTRIBUTOR

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