

**MAS9125****5 Outputs LDO Voltage Regulator IC**

- **Five Low Dropout Voltage Regulators**
- **Enable/Disable Control Pin for Each Regulator**
- **Common Control Pin to Shutdown The Whole Circuit**
- **All Outputs Ultra Low Noise**
- **Excellent Ripple Rejection**
- **Very Low Quiescent Current**
- **Thermal and Current Limiting Protection**

**DESCRIPTION**

The MAS9125 is a voltage regulator IC with five 2.8 V ultra low noise LDO regulators. Each regulator has its own independent enable/disable control pin. Additionally, all the outputs can be turned off by using a common control pin, which overrides regulator specific control pins. The highest output current is 150 mA (for the output 4). MAS9125 features a very low quiescent current: max 5  $\mu$ A in Off State and 90  $\mu$ A in On State. The dropout voltage is typically 0.11 V for outputs 1, 2, 3, and 5 and 0.17 V for output 4. The regulators 1, 2, and 3 have a common power supply pin marked as VCC\_1. VCC\_2 functions as a power supply pin for the regulators 4 and 5.

MAS9125 excels especially in noise performance and ripple rejection. Since all the outputs exhibit ultra low noise, noise sensitive circuitry can be driven by any of them. With high ripple rejection, MAS9125 effectively shields downstream electronics against power line disturbances.

An internal thermal protection circuit prevents the device from overheating. The maximum output current is limited internally, too.

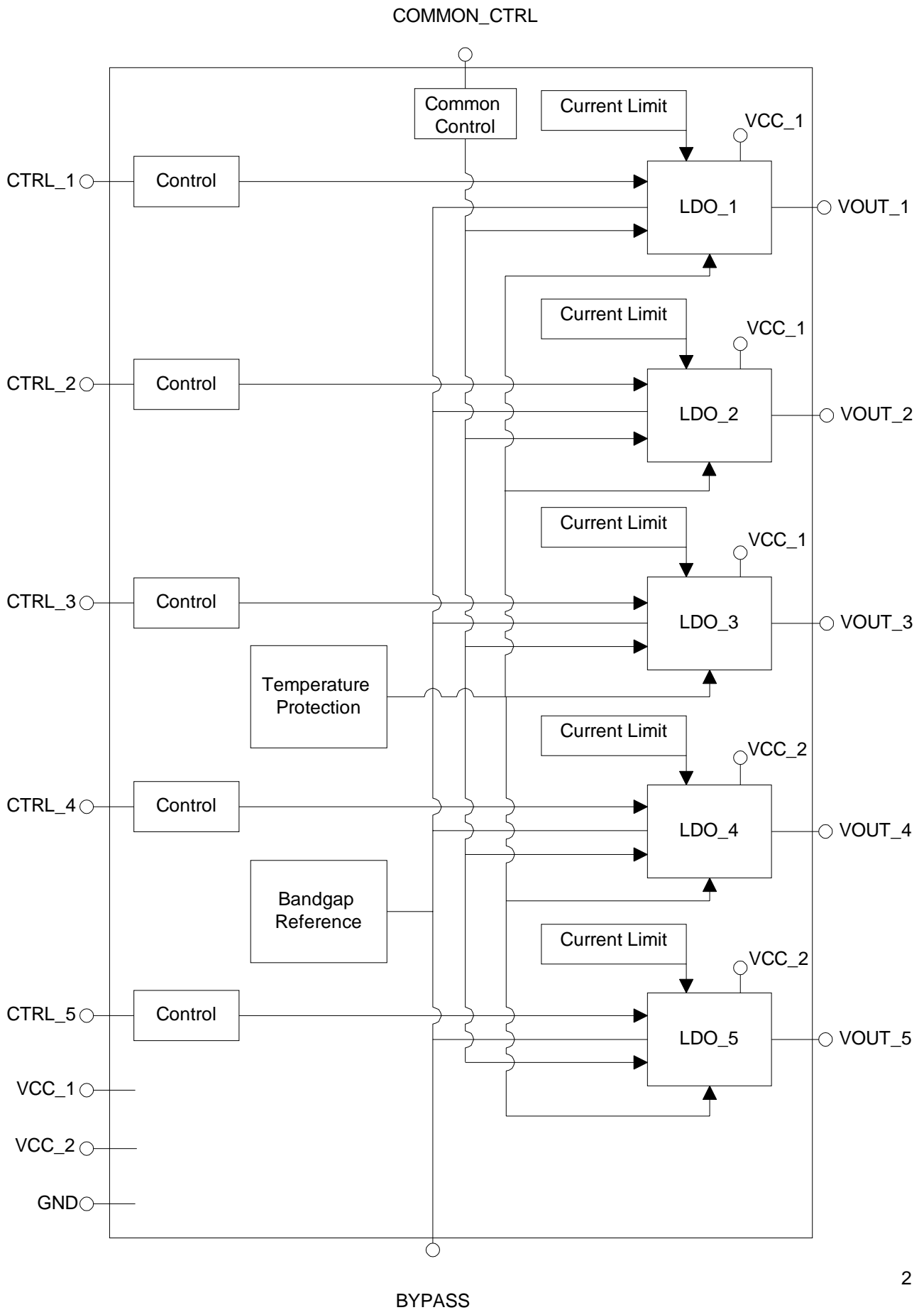
**FEATURES**

- 2.8 V Regulators at 30 mA, 40 mA, 50 mA, 150 mA, and 60 mA
- Excellent Ripple Rejection: 72 dB Typical at 1 kHz, and 52 dB Typical at 10 kHz
- Ultra Low Noise: 21  $\mu$ Vrms Typical and 30  $\mu$ Vrms Maximum for All Regulators over Frequency Range 100 Hz...100 kHz
- Fast Dynamic Response
- Output Voltage Accuracy  $<\pm 1.7\%$  at 27 °C
- 100 nF for Output Capacitors 1, 2, 4, and 5 and 1  $\mu$ F for Output Capacitor 3
- Separate Enable/Disable Control for Each Output
- Common Control Pin to Shutdown the Whole IC
- Very Low Quiescent Current: Maximum 5  $\mu$ A in Off State (Independent & Common Controls Off), Typical 90  $\mu$ A in On State (Common Control On, Independent Controls Off)
- TSSOP16 Package
- Functionally and Pin Compatible with MC33765

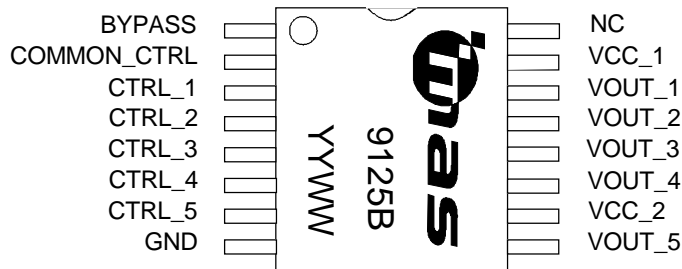
**APPLICATIONS**

- Mobile Phones
- Cordless Phones
- Portable Systems
- Battery Powered Systems
- Systems Needing Stabilized Power in Separate Blocks

**BLOCK DIAGRAM**



## PIN CONFIGURATION & TOP MARKING



Top Marking Definitions:  
YYWW = Year Week

## PIN DESCRIPTION

Pin Name	Pin	Type	Function
BYPASS	1	I	Noise Bypass
COMMON_CTRL	2	I	Control Pin to Shutdown the Whole IC (Logic 0 = Shutdown, Logic 1 = Enable Regulator Specific Control Pins)
CTRL_1	3	I	Enable/Disable Control for Regulator 1
CTRL_2	4	I	Enable/Disable Control for Regulator 2
CTRL_3	5	I	Enable/Disable Control for Regulator 3
CTRL_4	6	I	Enable/Disable Control for Regulator 4
CTRL_5	7	I	Enable/Disable Control for Regulator 5
GND	8	P	Ground
VOUT_5	9	O	2.8 V/60 mA Regulator Output
VCC_2	10	P	Power Supply Voltage
VOUT_4	11	O	2.8 V/150 mA Regulator Output
VOUT_3	12	O	2.8 V/50 mA Regulator Output
VOUT_2	13	O	2.8 V/40 mA Regulator Output
VOUT_1	14	O	2.8 V/30 mA Regulator Output
VCC_1	15	P	Power Supply Voltage
NC	16		Not Connected

I = Input, O = Output, P = Power

## ABSOLUTE MAXIMUM RATINGS

All Voltages with Respect to Ground

Parameter	Symbol	Conditions	Min	Max	Unit
Power Supply Voltage	$V_{CC}$			6	V
Thermal Resistance (Junction-to-Air)	$R_{\theta JA}$			144	$^{\circ}C/W$
Operating Junction Temperature				125	$^{\circ}C$
Junction Temperature	$T_J$			175	$^{\circ}C$
Operating Ambient Temperature	$T_A$		-40	+85	$^{\circ}C$
Storage Temperature	$T_S$		-55	+150	$^{\circ}C$

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

## ELECTRICAL CHARACTERISTICS

 For typical values  $T_A = 27^{\circ}C$ , for min/max values  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted

### ◆ Thermal Protection

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Threshold High	$T_H$		150	160	170	$^{\circ}C$
Threshold Low	$T_L$		140	150	160	$^{\circ}C$

A hysteresis of  $10^{\circ}C$  prevents oscillation in case of thermal shutdown. After the regulator temperature has dropped by this value, it will turn on again automatically.

### ◆ Common Control Pin Parameters

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage ON-state OFF-state	$V_{C-CTRL}$		0 2.0		$V_{CC}$ 0.3	V

### ◆ Single Regulator Control Pin Parameters

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage ON-state OFF-state	$V_{CTRL1..5}$		0 2.0		$V_{CC}$ 0.3	V

**◆ Current Parameters**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Regulator 1 Output Current	$I_{OUT1}$	Listed maximum output currents are peak values. Maximum power dissipation should be used to determine the maximum total DC current.	0.5		30	mA
Regulator 2 Output Current	$I_{OUT2}$		0.5		40	mA
Regulator 3 Output Current	$I_{OUT3}$		0		50	mA
Regulator 4 Output Current	$I_{OUT4}$		0.5		150	mA
Regulator 5 Output Current	$I_{OUT5}$		0.5		60	mA
Current Limit	$I_{MAX1..5}$	$I_{OUT}$ refers to each regulators' maximum output current $I_{OUT1..5}$		$3 \times I_{OUT}$		mA
Quiescent Current	$I_{QOFF}$	$I_{OUT} = 0 \text{ A}$ , $V_{C-CTRL} < 0.3 \text{ V}$ , $V_{CTRL1..5} < 0.3 \text{ V}$			5	$\mu\text{A}$
Quiescent Current	$I_{QON}$	$I_{OUT} = 0 \text{ A}$ , $V_{C-CTRL} > 2.0 \text{ V}$ , $V_{CTRL1..5} > 2.0 \text{ V}$		500		$\mu\text{A}$
Quiescent Current	$I_{QC-ON}$	$I_{OUT} = 0 \text{ A}$ , $V_{C-CTRL} > 2.0 \text{ V}$ , $V_{CTRL1..5} < 0.3 \text{ V}$		90		$\mu\text{A}$
Total RMS Output Current	$I_{RMS}$	$T_A = 85^\circ\text{C}$ , $V_{CC} = 5.3 \text{ V}$			110	mA
Total RMS Output Current	$I_{RMS}$	$T_A = 25^\circ\text{C}$ , $V_{CC} = 5.3 \text{ V}$			250	mA

**◆ Power Dissipation**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Dissipation	$P_d$	$V_{CC} = 5.3 \text{ V}$ , $T_A = 85^\circ\text{C}$			285	mW
Power Dissipation	$P_d$	$V_{CC} = 5.3 \text{ V}$ , $T_A = 25^\circ\text{C}$			700	mW

**◆ Voltage Parameters**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC1..2}$		3.0	3.6	5.3	V
Output Voltage	$V_{OUT1..5}$		2.7	2.8	2.85	V
Regulator 1 Dropout Voltage	$V_{DROP1}$	$I_{OUT1} = 25 \text{ mA}$ for Typical $V_{DROP1}$ $I_{OUT1} = \text{Max}$ for Max $V_{DROP1}$		0.11	0.17	V
Regulator 2 Dropout Voltage	$V_{DROP2}$	$I_{OUT2} = 35 \text{ mA}$ for Typical $V_{DROP2}$ $I_{OUT2} = \text{Max}$ for Max $V_{DROP2}$		0.11	0.17	V
Regulator 3 Dropout Voltage	$V_{DROP3}$	$I_{OUT3} = 40 \text{ mA}$ for Typical $V_{DROP3}$ $I_{OUT3} = \text{Max}$ for Max $V_{DROP3}$		0.11	0.17	V
Regulator 4 Dropout Voltage	$V_{DROP4}$	$I_{OUT4} = 140 \text{ mA}$ for Typical $V_{DROP4}$ $I_{OUT4} = \text{Max}$ for Max $V_{DROP4}$		0.17	0.30	V
Regulator 5 Dropout Voltage	$V_{DROP5}$	$I_{OUT5} = 40 \text{ mA}$ for Typical $V_{DROP5}$ $I_{OUT5} = \text{Max}$ for Max $V_{DROP5}$		0.11	0.17	V

**◆ External Capacitors**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Capacitors for Regulators 1, 2, 4, 5 Regulator 3	$C_{OUT1..5}$ $C_{OUT3}$		0.10 1		1	$\mu\text{F}$
Effective Series Resistance	ESR		0.05	1	3	$\Omega$
Bypass Capacitor	$C_{BYPASS}$			100		nF

**◆ Load Regulation**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Load Regulation		$V_{CC} = 3.6\text{ V}$ , $I_{OUT}$ from 0.5 mA to Max			0.5	$\frac{\text{mV}}{\text{mA}}$

**◆ Line Regulation**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Line Regulation		$I_{OUT} = \text{Max}$ , $V_{CC}$ from 5.3 V to 3.6 V		0.15	1.2	mV

**◆ Ripple Rejection**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Ripple Rejection		$V_{CC} = V_{OUT} + 0.8\text{ V}$ , $I_{OUT1..5} = \text{Max}$ $C_{OUT1,2,4,5} = 100\text{ nF}$ , $C_{OUT3} = 1\text{ }\mu\text{F}$ $C_{BYPASS} = 100\text{ nF}$				dB
Regulators 1, 2, 3, 5		$f = 1\text{ kHz}$	60	74		
Regulator 4		$f = 1\text{ kHz}$	58	72		
Regulators 1, 2, 3, 5		$f = 10\text{ kHz}$	42	54		
Regulator 4		$f = 10\text{ kHz}$	40	52		
Regulator 3		$f = 100\text{ kHz}$	26	38		
Regulators 1, 2, 4, 5		$f = 100\text{ kHz}$	22	34		

**◆ Noise and Crosstalk**

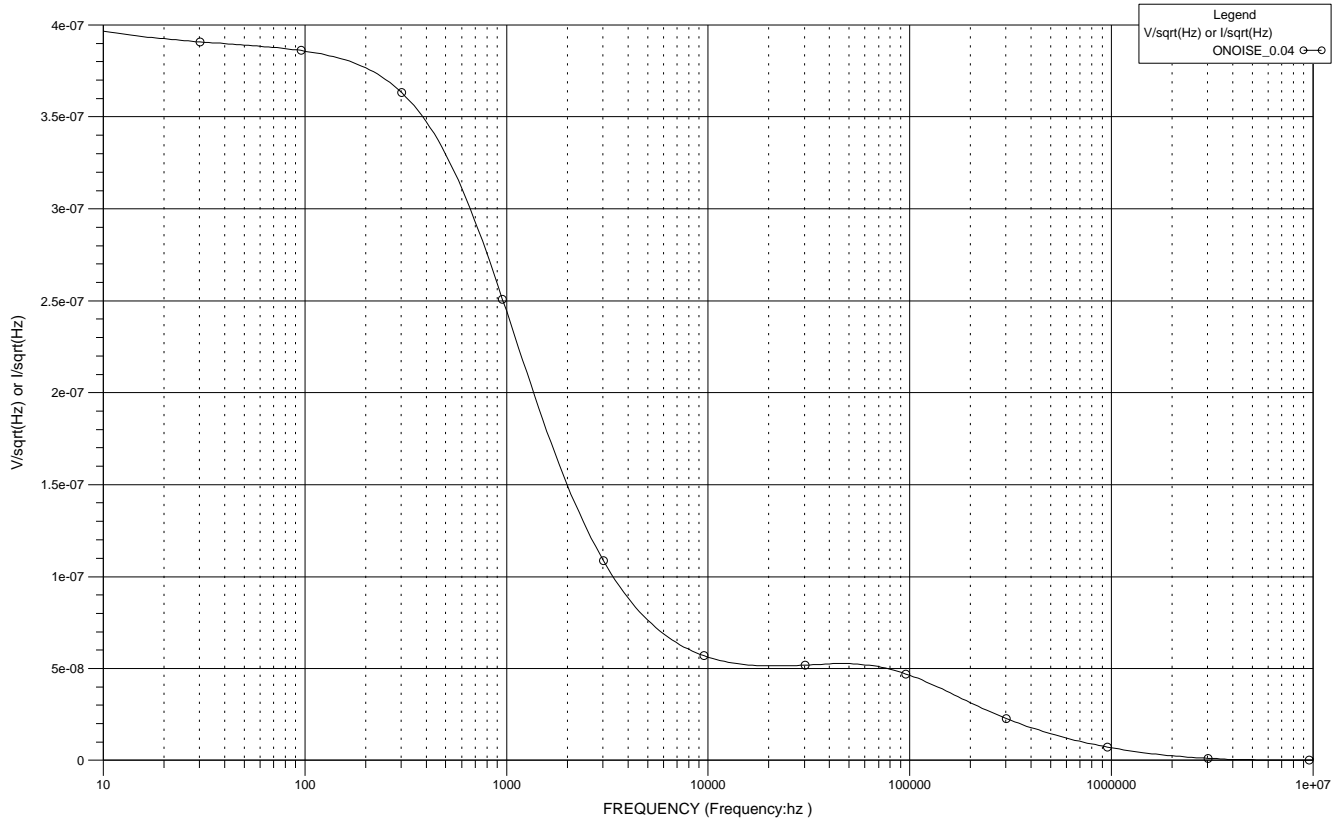
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Noise Voltage	$V_{NO}$	$100\text{ Hz} < f < 100\text{ kHz}$ , $C_{BYPASS} = 100\text{ nF}$				$\mu\text{Vrms}$
All Regulators		$C_{OUT1,2,4,5} = 100\text{ nF}$ , $C_{OUT3} = 1\text{ }\mu\text{F}$		21	30	
Dynamic Crosstalk Attenuation		$f = 10\text{ kHz}$ (Note 1)	40			dB

Note 1: Dynamic Crosstalk is the ratio between a forced output signal to signal transferred to other outputs.

**◆ Dynamic Parameters**

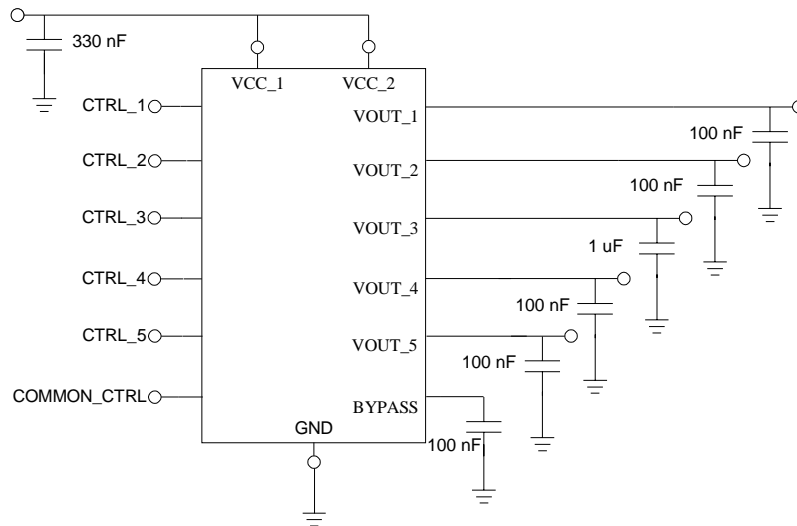
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rise Time (From Enable to $V_{OUT}$ 90%, Common Control at ON state) Regulators 1,2,4,5 Regulator 3		$V_{C-CTRL} > 2.0\text{ V}$ , $V_{CTRL1..5}$ separately from $< 0.3\text{ V}$ to $> 2.0\text{ V}$  $C_{OUT1,2,4,5} = 100\text{ nF}$ $C_{OUT3} = 1\text{ }\mu\text{F}$			30 70	$\mu\text{s}$
Overshoot		$V_{C-CTRL} > 2.0\text{ V}$ , $V_{CTRL1..5}$ separately from $< 0.3\text{ V}$ to $> 2.0\text{ V}$ $C_{OUT1,2,4,5} = 100\text{ nF}$ , $C_{OUT3} = 1\text{ }\mu\text{F}$		1	8	%
Settling Time (from $V_{OUT}$ 90% to max $\pm 0.1\%$ fluctuation)		$V_{C-CTRL} > 2.0\text{ V}$ , $V_{CTRL1..5}$ separately from $< 0.3\text{ V}$ to $> 2.0\text{ V}$ $C_{1,2,4,5} = 100\text{ nF}$ , $C_3 = 1\text{ }\mu\text{F}$			70	$\mu\text{s}$

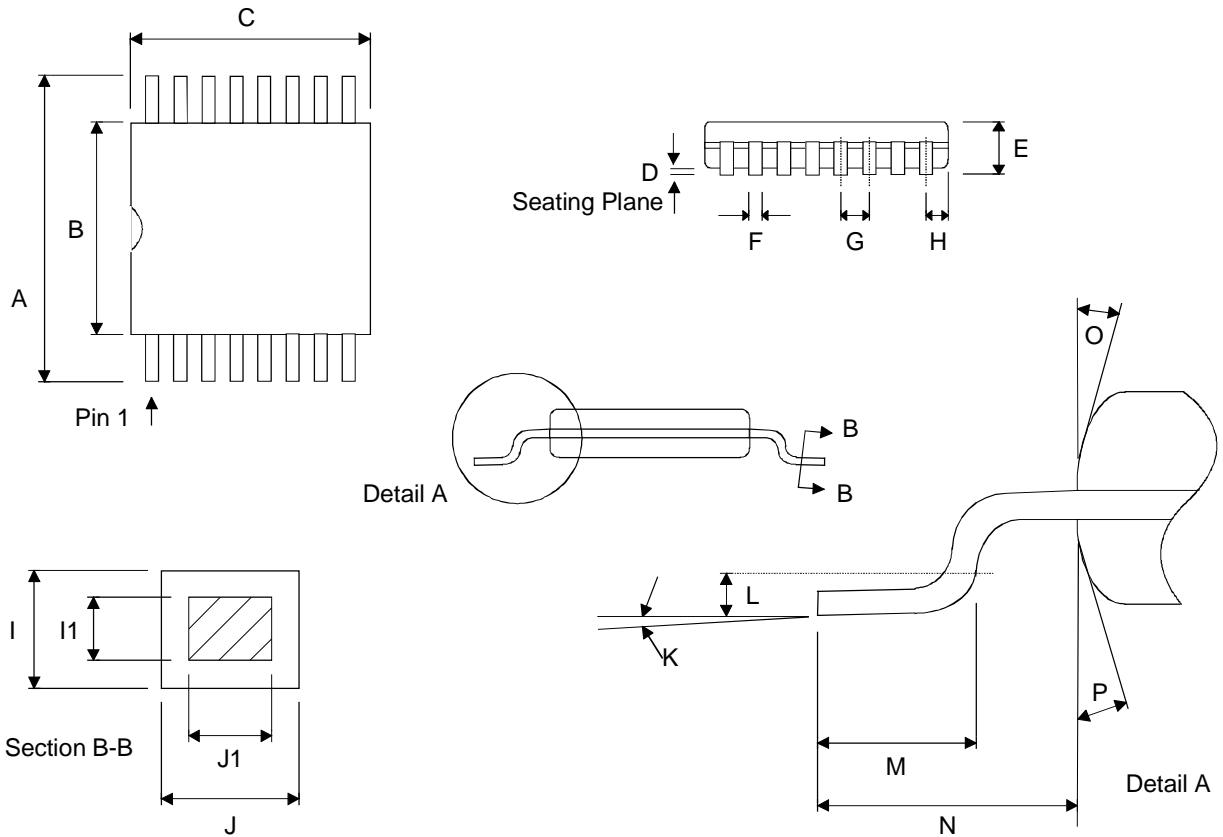
## OUTPUT NOISE PERFORMANCE FOR REGULATOR 3



$V_{IN} = 3.6 \text{ V}$ ,  $I_{OUT} = 40 \text{ mA}$ ,  $C_{BYPASS} = 10 \text{ nF}$ ,  $T_J = 27 \text{ }^\circ\text{C}$

## APPLICATION INFORMATION



**PACKAGE (TSSOP16) OUTLINES**


Dimension	Min	Max	Unit
A	6.40 BSC		mm
B	4.30	4.50	mm
C	5.00 BSC		mm
D	0.05	0.15	mm
E		1.10	mm
F	0.19	0.30	mm
G	0.65 BSC		mm
H	0.18	0.28	mm
I	0.09	0.20	mm
I1	0.09	0.16	mm
J	0.19	0.30	mm
J1	0.19	0.25	mm
K	0°	8°	
L	0.24	0.26	mm
M	0.50	0.75	mm
(The length of a terminal for soldering to a substrate)			
N	1.00 REF		mm
O	12°		
P	12°		

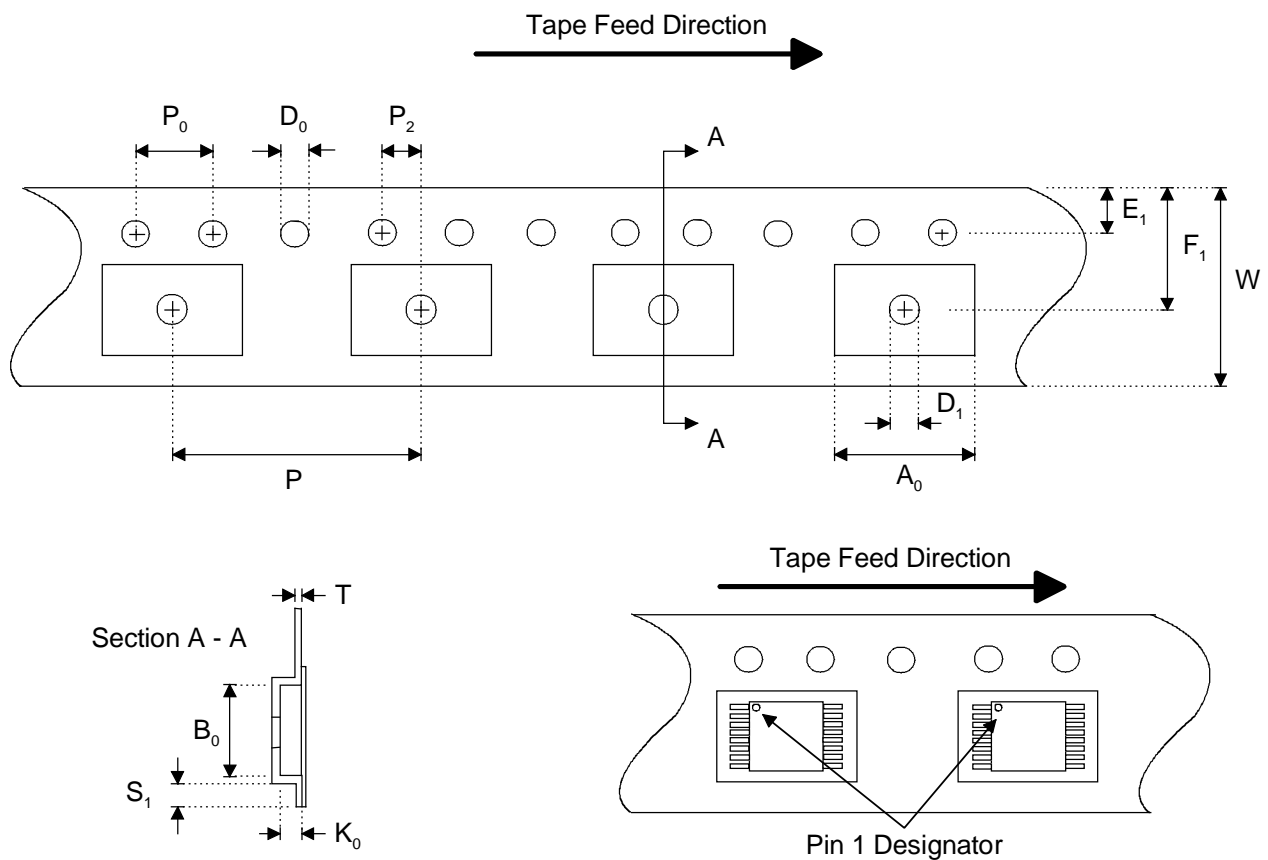
Dimensions do not include mold flash, protrusions, or gate burrs.  
 All dimensions are in accordance with JEDEC standard MO-153.



## SOLDERING INFORMATION

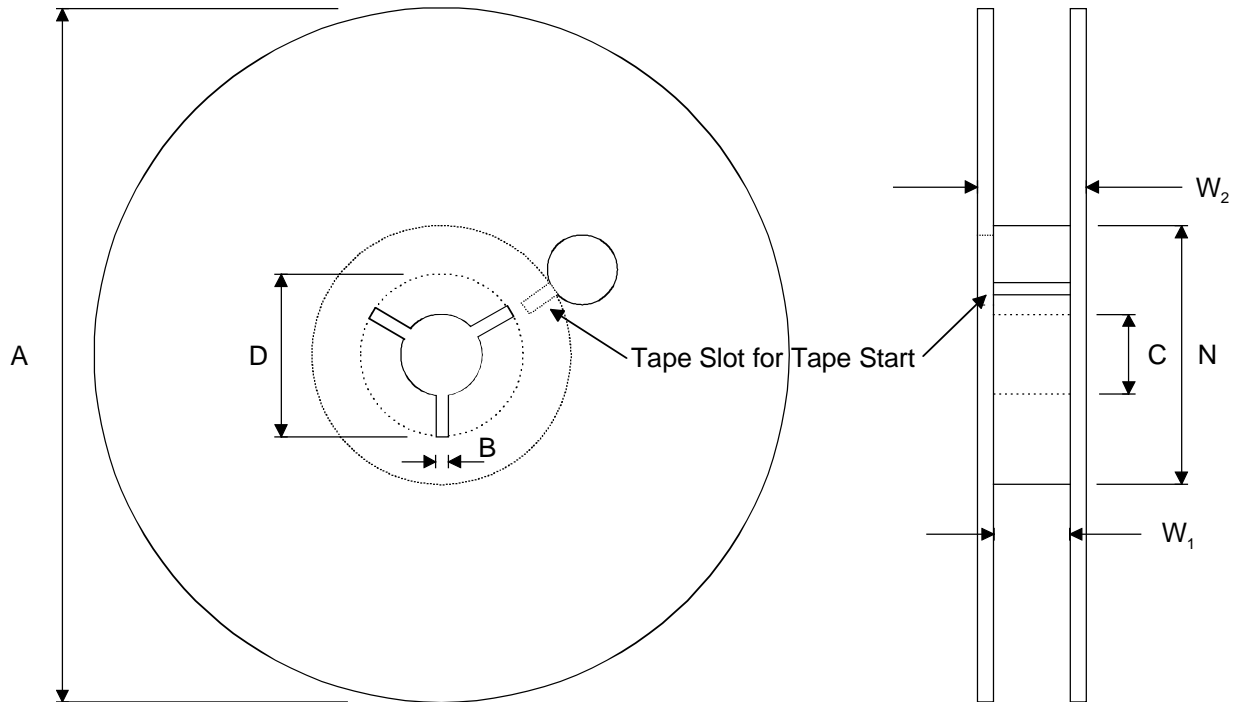
Resistance to Soldering Heat	According to RSH test IEC 68-2-58/20 2*220°C
Maximum Reflow Temperature	235°C
Maximum Number of Reflow Cycles	2
Seating Plane Co-planarity	max 0.08 mm
Lead Finish	Solder plate 7.62 - 25.4 μm, material Sn 85% Pb 15%

## EMBOSSED TAPE SPECIFICATIONS



Dimension	Min	Max	Unit
$A_0$	6.50	6.70	mm
$B_0$	5.20	5.40	mm
$D_0$	1.50 +0.10 / -0.00		mm
$D_1$	1.50		mm
$E_1$	1.65	1.85	mm
$F_1$	7.20	7.30	mm
$K_0$	1.20	1.40	mm
$P$	11.90	12.10	mm
$P_0$	4.0		mm
$P_2$	1.95	2.05	mm
$S_1$	0.6		mm
$T$	0.25	0.35	mm
$W$	11.70	12.30	mm

## REEL SPECIFICATIONS

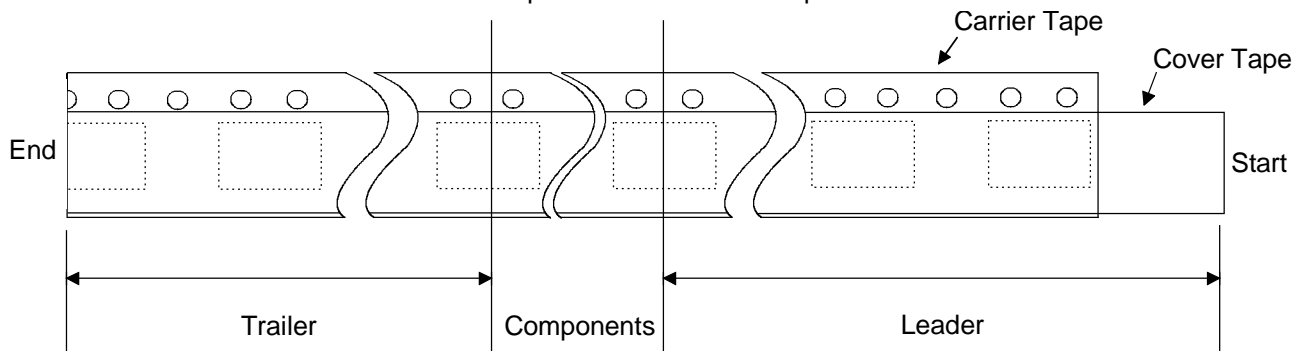


2000 Components on Each Reel

Reel Material: Conductive, Plastic Antistatic or Static Dissipative

Carrier Tape Material: Conductive

Cover Tape Material: Static Dissipative



Dimension	Min	Max	Unit
A		330	mm
B	1.5		mm
C	12.80	13.50	mm
D	20.2		mm
N	50		mm
$W_1$ (measured at hub)	12.4	14.4	mm
$W_2$ (measured at hub)		18.4	mm
Trailer	160		mm
Leader	390, of which minimum 160mm of empty carrier tape sealed with cover tape		mm
Weight		1500	g

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**ORDERING INFORMATION**

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Product Code	Product	Package	Comments
MAS9125BUAC-T	LDO Voltage Regulator IC	TSSOP16	2k Units on Tape and Reel in Moisture Barrier Bag

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**LOCAL DISTRIBUTOR**

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**MICRO ANALOG SYSTEMS OY CONTACTS**

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