MAS9160

2-Output LDO Voltage Regulator IC

- **Dual Regulator: 2 × 150 mA**
- **Very Low Crosstalk**
- **Low Dropout: 70 mV**
- **High Ripple Rejection: 62 dB**
- **Low Noise: 30 µVrms**
- **Stable with Low-ESR Output Capacitors**
- **Separate Enable/Disable Control for Both Regulators**

DESCRIPTION

MAS9160 is a voltage regulator IC with two low dropout voltage regulators, which both have their own enable/disable pin allowing the regulators to be turned off or on separately by pulling the particular control to low or high.
Due to the low noise level of only 30 µVrms, MAS9160 is suitable for sensitive circuits, e.g., in portable applications. In addition to the low noise level, MAS9160 excels in dropout voltage (70 mV typical at 50 mA) and in very good crosstalk rejection. Also its ripple rejection ability of 62 dB at 1 kHz exceeds that of competition.

A wide range of values of Equivalent Series Resistance (ESR) of output capacitors can be used with MAS9160. This ESR range from a few mΩ up to a couple of Ohms combined with no minimum output current requirement makes the usage of MAS9160 easier and low in cost.
In order to save power the device goes into sleep mode when both regulators are disabled. An internal thermal protection circuit prevents the device from overheating. Also the maximum output current is internally limited.

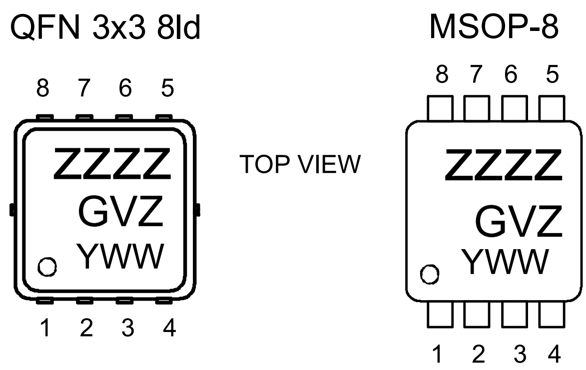
FEATURES

- Low Noise
- Functionally and Pin Compatible with LP2967and LP3986
- Can Be Used w/o C_{BYPASS}, see p. 9
- Auto-discharge Function
- Internal Thermal Shutdown
- Short Circuit Protection
- Small QFN 3x3 or MSOP-8 Package
- Several Output Voltage Options Available, see Ordering Information p. 18

APPLICATIONS

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

PIN CONFIGURATION



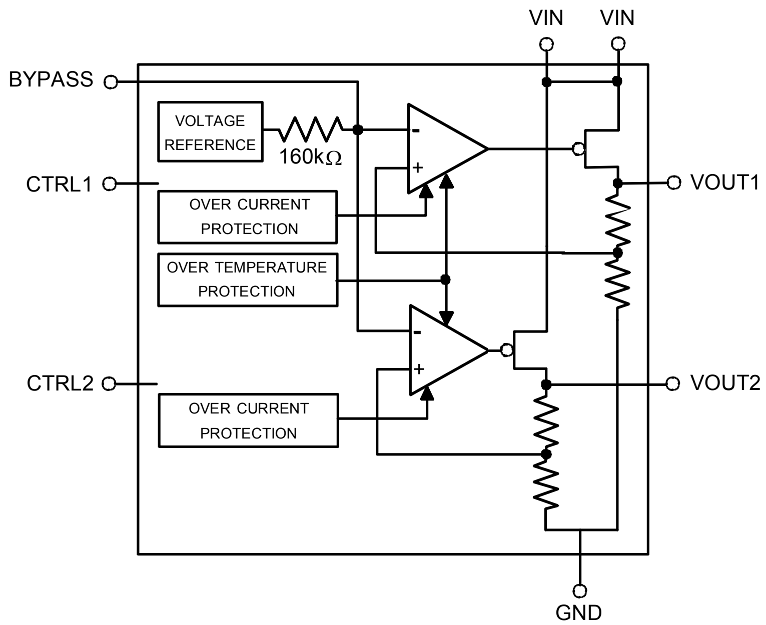
Top Marking Information:
zzzz = 9160
G = Green (Pb Free, RoHS Compliant) Package
vz = Product Specific Code, see p. 18, Ordering Information
YWW = Year Week

PIN DESCRIPTION

Pin Name	Pin Number in MSOP-8 and QFN	Type	Function
VIN	1, 8	P	Power Supply Voltage for Both Regulators
GND	4	G	Ground
CTRL1	3	I	Enable/Disable Pin for the First Regulator
CTRL2	6	I	Enable/Disable Pin for the Second Regulator
BYPASS	5	I	Pin for Bypass Capacitor
VOUT1	2	O	Output Voltage of the First Regulator
VOUT2	7	O	Output Voltage of the Second Regulator
Exposed Pad (in QFN package)			Connect exposed pad to GND for better thermal conductivity

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

All voltages with respect to ground.

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}	$V_{OUT(NOM)} < 2.2$ V	2.5	5.3	V
		$V_{OUT(NOM)} \geq 2.2$ V	$V_{OUT(NOM)}$ + 0.3		

ELECTRICAL CHARACTERISTICS

◆ Thermal Protection

T_A = -40°C to +85°C, typical values at T_A = +27°C, V_{IN} = $V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Threshold High	T_H		140	160	175	°C
Threshold Low	T_L		130	150	165	°C

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

◆ Control Terminal Specifications

T_A = -40°C to +85°C, typical values at T_A = +27°C, V_{IN} = $V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Control Voltage	V_{CTRL}					V
OFF State			–0.3		0.55	
ON State			1.6		V_{IN} + 0.3	
Control Current, one control input	I_{CTRL}					µA
		$V_{CTRL} = V_{IN}$		5	10	
		V_{CTRL} = 0 V		0		

If CTRL-pin is not connected, the particular regulator is in OFF state (900 kΩ pull-down resistor to ground).

◆ Voltage Parameters

T_A = -40°C to +85°C, typical values at T_A = +27°C, V_{IN} = $V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage Tolerance	V_{OUT}					V
		I_{OUT} = 0 mA	$V_{OUT(NOM)}$ – 0.05		$V_{OUT(NOM)}$ + 0.05	
		I_{OUT} = 150 mA	$V_{OUT(NOM)}$ – 0.10		$V_{OUT(NOM)}$ + 0.05	
Dropout Voltage	V_{DROP}					mV
		I_{OUT} = 1 mA		2		
		I_{OUT} = 50 mA		70		
		I_{OUT} = 150 mA		200		

◆ Current Parameters

T_A = -40°C to +85°C, typical values at T_A = +27°C, V_{IN} = $V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Continuous Output Current	I_{OUT}		0		150	mA
Short Circuit Current	I_{MAX}	R_L = 0 Ω	200	450	675	mA
Peak Output Current	I_{PK}	V_{OUT} > 95% * $V_{OUT(NOM)}$		410		mA
Ground Pin Current	I_{GND}	one regulator on				µA
		I_{OUT} = 0 mA		140		
		I_{OUT} = 10 mA		145		
		I_{OUT} = 50 mA		170		
		I_{OUT} = 150 mA		235		
Ground Pin Current	I_{GND}	both regulators on				µA
		I_{OUT} = 0 mA		215		
		I_{OUT} = 10 mA		230		
		I_{OUT} = 50 mA		280		
		I_{OUT} = 150 mA		410		
Ground Pin Current, Sleep Mode	I_{GND}	$V_{CTRL1,2}$ = 0 V, T_A = 27°C		0.03	1.0	µA
		$V_{CTRL1,2}$ = 0 V, T_A = 85°C		0.5	5.0	

◆ Power Dissipation

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Junction to Ambient Thermal Resistance	R_{JA}	thermal test board according to JESD51 (4 layers), MSOP-8 package		216		°C/W
		thermal test board according to JESD51 (4 layers), QFN 3x3 8ld package		64		
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-ambient thermal resistance.

◆ Line and Load Regulation

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Line Regulation		$V_{OUT(NOM)}$ + 1 V < V_{IN} < 5.3 V, I_{OUT} = 60 mA		0.7		mV
Load Regulation						mV
		I_{OUT} = 1.0 to 50 mA		9	20	
		I_{OUT} = 1.0 to 150 mA		24	45	

◆ Noise and Ripple Rejection

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Noise Voltage	V_{RMS}	300 Hz < f < 50 kHz				µVrms
		C_{BYPASS} = 10 nF		30		
		w/o C_{BYPASS}		154		
Output Noise Voltage vs. C_{BYPASS} Value	V_{RMS}	I_{OUT} = 50 mA 10 Hz < f < 100 kHz				µVrms
		C_{BYPASS} = 10 nF		44		
		C_{BYPASS} = 3.3 nF		46		
		C_{BYPASS} = 1 nF		51		
Noise Density	V_N	I_{OUT} = 50 mA, f = 1.0 kHz		150		$nV/\sqrt{Hz}$
PSRR		I_{OUT} = 50 mA				dB
		f = 1 kHz		62		
		f = 10 kHz		55		
		f = 100 kHz		35		

◆ Dynamic Parameters

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rise Time (10%…90%)		V_{CTRL} = 0 to 2.4 V, I_{OUT} = 30 mA C_{BYPASS} = 10 nF w/o C_{BYPASS}		 4 16		 ms µs
Rise Time (10%…90%) vs. C_{BYPASS} Value		V_{CTRL} = 0 to 2.4 V, I_{OUT} = 50 mA C_{BYPASS} = 10 nF C_{BYPASS} = 3.3 nF C_{BYPASS} = 1 nF		 4 1.3 0.4		ms
Overshoot		V_{CTRL} = 0 to 2.4 V, w/o C_{BYPASS}		3	5	%
Start-up Delay (from start-up to 90% * $V_{OUT(NOM)}$)		one regulator on, w/o C_{BYPASS}		26		µs

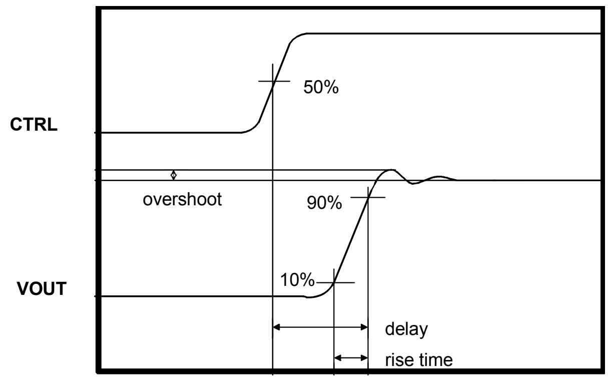


Figure1. Definitions of rise time, overshoot and start-up delay.

TYPICAL PERFORMANCE CHARACTERISTICS

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

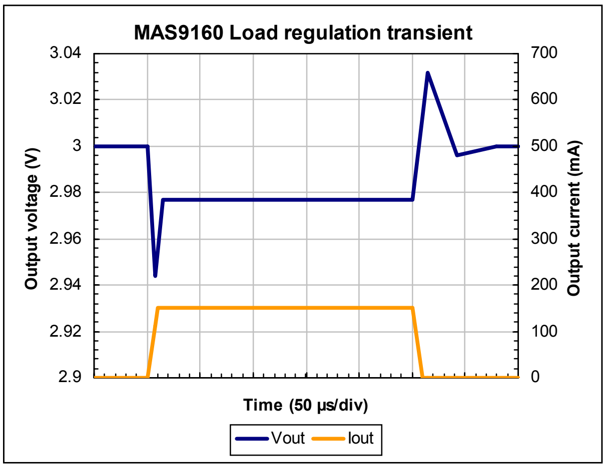


Figure 2. Typical load regulation transient. I_{OUT} = 0…150 mA in 10 µs.

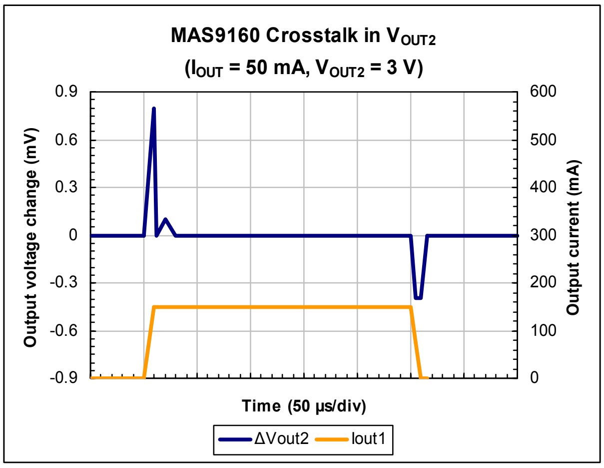


Figure 3. Typical cross-coupling at load regulation transient. I_{OUT1} = 0…150 mA in 10 µs (Figure 2).

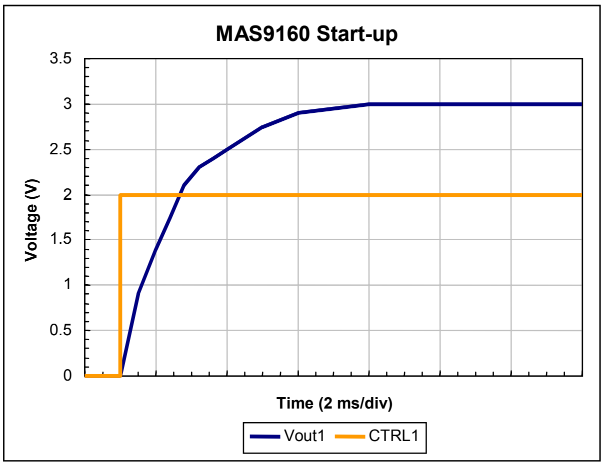


Figure 4. Start-up. C_{BYPASS} = 10 nF, CTRL2 = 0 V (i.e. regulator 2 in power off).

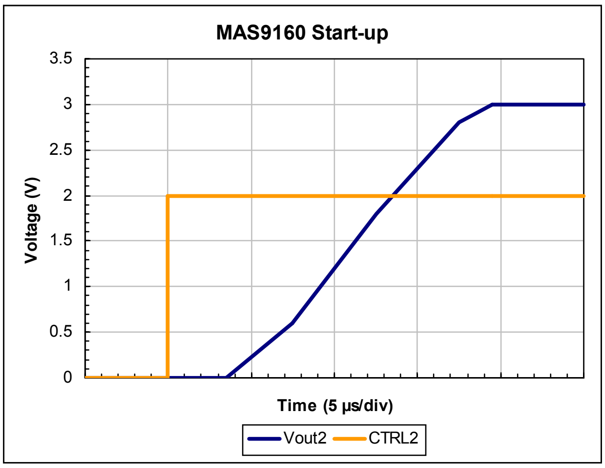


Figure 5. Start-up. C_{BYPASS} = 10 nF, CTRL1 = 2 V (i.e. regulator 1 in power on).

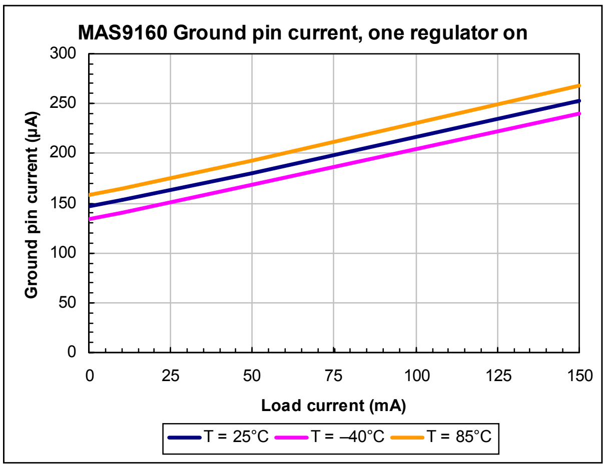


Figure 6. Current consumption vs. load current and temperature. One regulator is on.

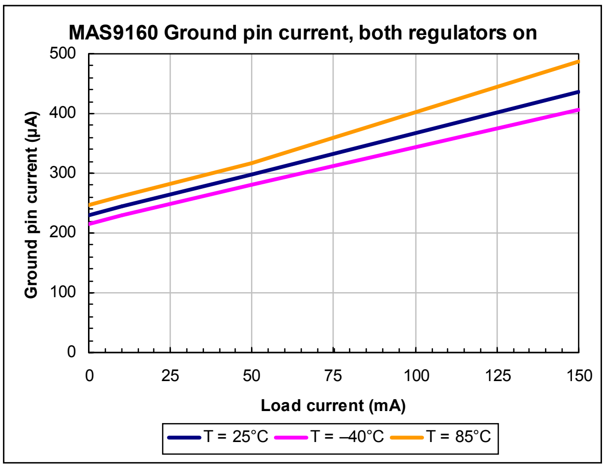


Figure 7. Current consumption vs. load current and temperature. Both regulators are on.

TYPICAL PERFORMANCE CHARACTERISTICS

T_A = -40°C to +85°C, typical values at T_A = +27°C, $V_{IN} = V_{OUT(NOM)}$ + 1.0 V, I_{OUT} = 1.0 mA, C_{IN} = 1.0 µF, C_L = 1.0 µF, C_{BYPASS} = 10 nF, V_{CTRL} = 3.8 V, unless otherwise specified

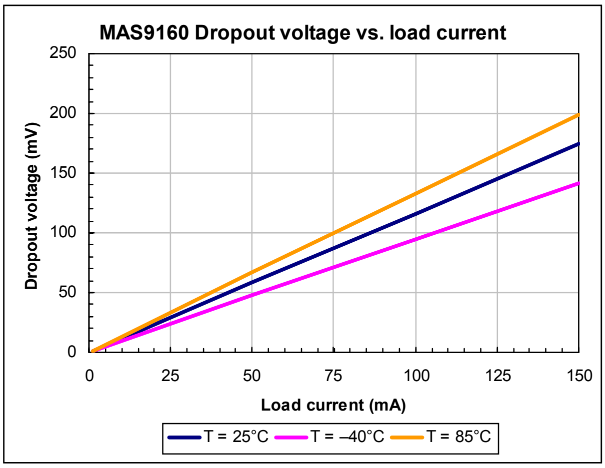


Figure 8. Dropout voltage vs. load current and temperature.

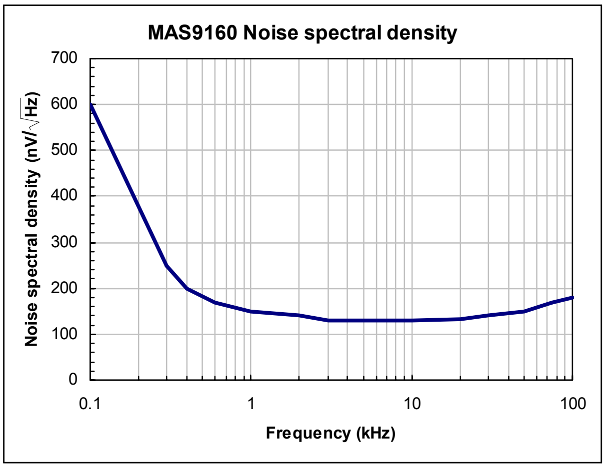


Figure 9. Output noise spectral density. C_{BYPASS} = 10 nF, C_L = 1 µF, I_{OUT} = 50 mA.

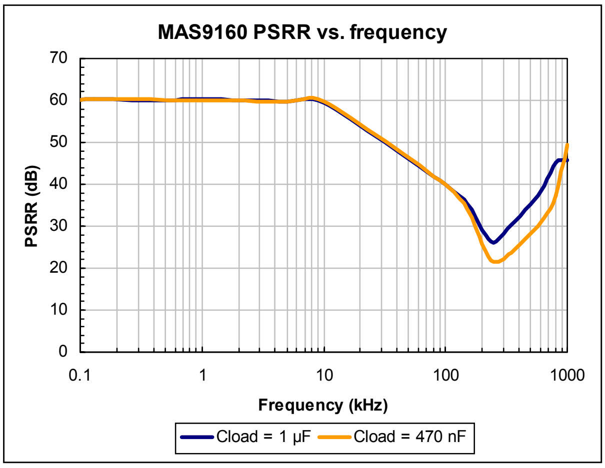
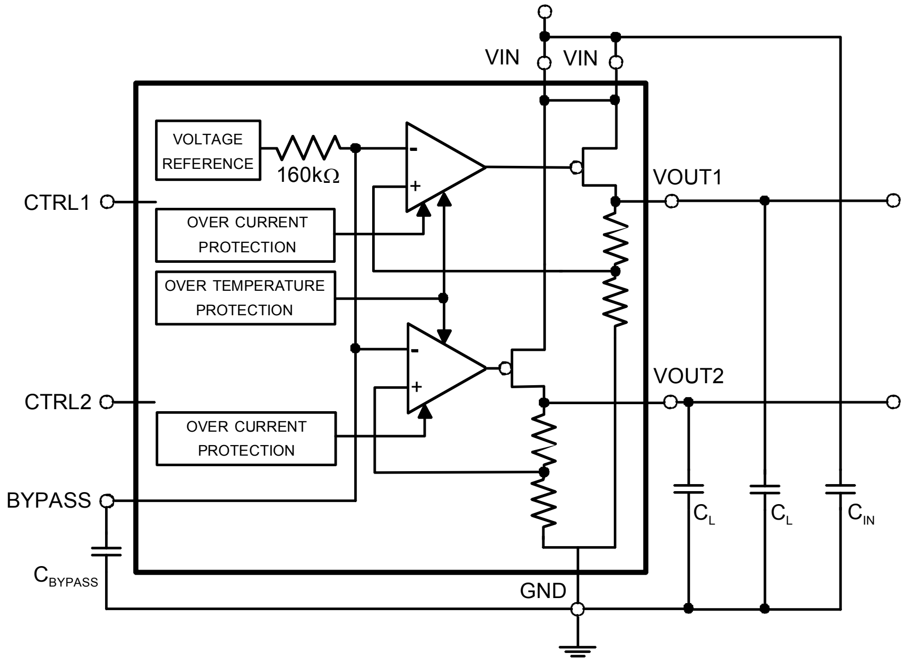


Figure 10. PSRR vs. frequency. C_{BYPASS} = 10 nF, I_{OUT} = 50 mA.

APPLICATION INFORMATION



Parameter	Symbol	Min	Max	Unit	Note
Output Capacitance	C_L	0.22		µF	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	1. When within this range, stable with all I_{OUT} = 0 mA…150 mA values.
Bypass Capacitance (Optional: if C_{BYPASS} is not used, noise performance declines, but rise time is improved. If one of the regulators is already on, C_{BYPASS} does not have effect on rise time.)	C_{BYPASS}	Typically 0.01		µF	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	1. A big enough input capacitance is needed to prevent possible impedance interactions between the supply and MAS9160. 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 MAS9160 is very small (< 0.1 µH) 0.47 µF 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.**

APPLICATION INFORMATION

◆ Auto-Discharge Function

MAS9160 includes auto-discharge function, which means that a shutdown transistor turns on and discharges the output capacitor, when the particular output of MAS9160 is turned off.

◆ Calculating Maximum Power Dissipation

Maximum power dissipation of the package may limit output current or input voltage, which can be used, especially with the combination of low output voltage and high input voltage.

The power dissipation can be calculated by using the formula:

$$P_d = (V_{IN} - V_{OUT}) * I_{OUT} + V_{IN} * I_{GND}$$

It shall not exceed the maximum power dissipation, allowed by the package:

$$P_{dMAX} = \frac{T_{JMAX} - T_A}{R_{JA}}$$

where T_{JMAX} is maximum junction temperature (T_{JMAX} = 125°C), T_A is ambient temperature and R_{JA} is junction-to-ambient thermal resistance of the package.

When assumed that:

T_A = +65°C, V_{OUT} = 1.8 V, V_{IN} = 5.3 V and used package is QFN x3 8ld the equation yields:

$$P_{dMAX} = \frac{125°C - 65°C}{64°C/W} = 0.94\ W$$

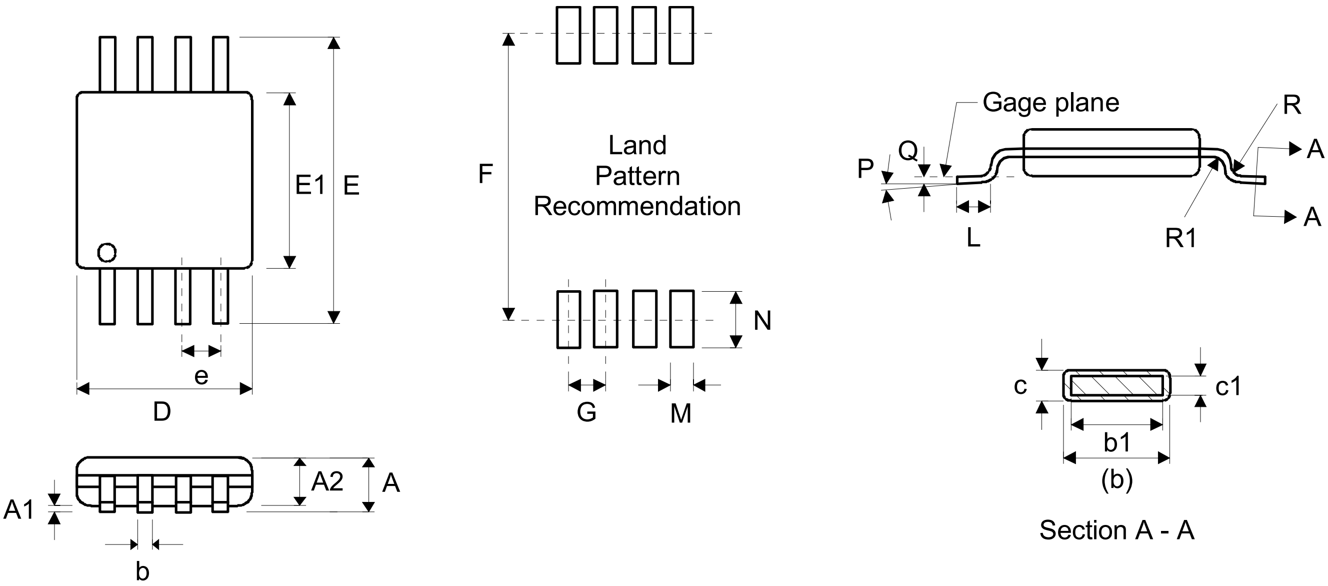
from which can be calculated:

$$I_{OUTMAX} = \frac{P_{dMAX}}{V_{IN} - V_{OUT}} = 268\ mA$$

V_{IN} * I_{GND} is negligible and can be omitted.

Consequently, it can be seen that under these conditions the average output current should not exceed 268 mA.

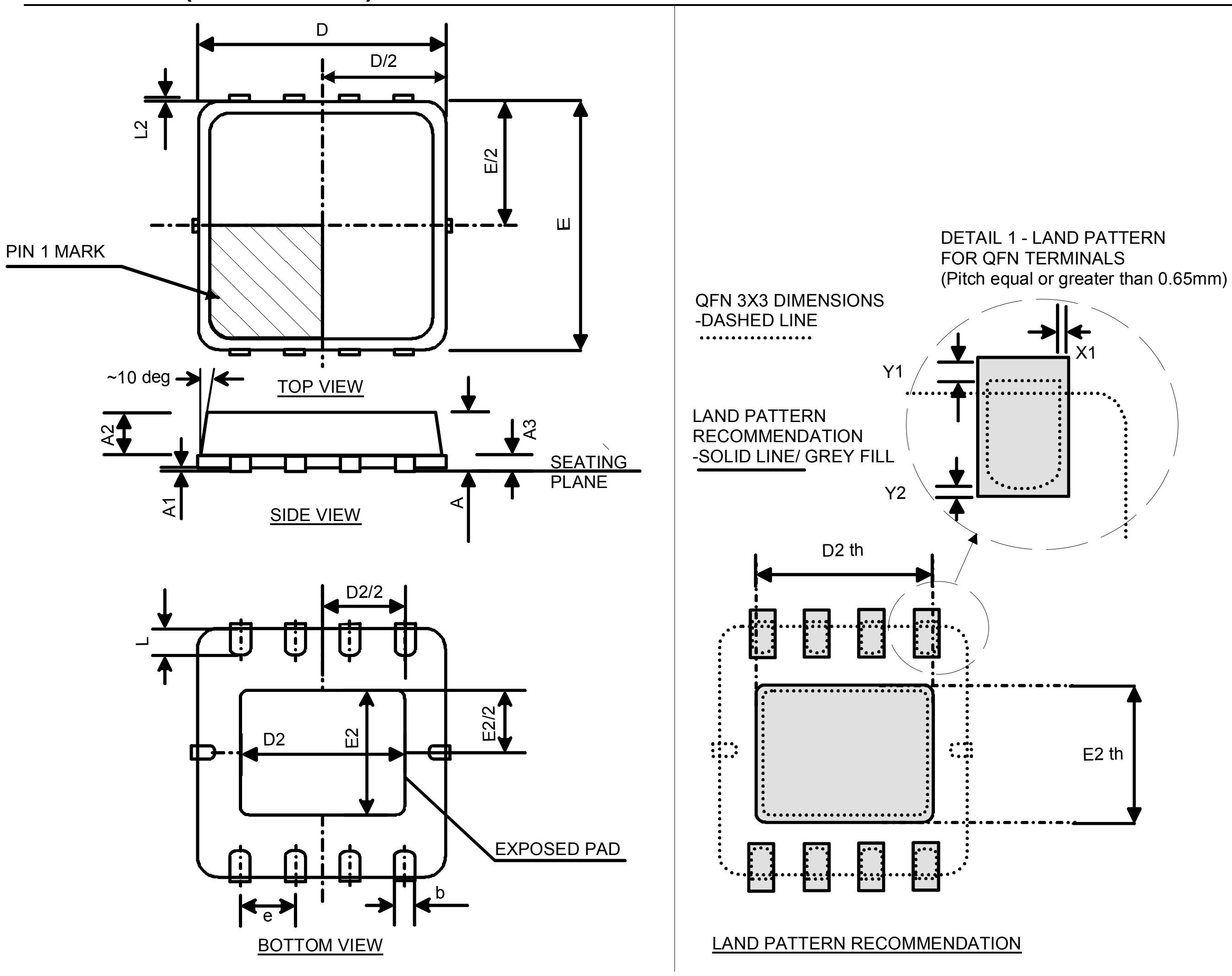
PACKAGE OUTLINE (MSOP-8)



Symbol	Min	Nom	Max	Unit
A			1.10	mm
A1	0		0.15	mm
A2	0.75	0.85	0.95	mm
b	0.22		0.38	mm
b1	0.22	0.30	0.33	mm
c	0.08		0.23	mm
c1	0.08		0.18	mm
D		3.00 BSC		mm
E		4.90 BSC		mm
E1		3.00 BSC		mm
e		0.65 BSC		mm
F		4.8		mm
G		0.65		mm
L (Terminal length for soldering)	0.40	0.60	0.80	mm
M		0.41		mm
N		1.02		mm
P	0°		8°	
Q		0.25 BSC		mm
R	0.07			mm
R1	0.07			mm

Dimensions do not include mold or interlead flash, protrusions or gate burrs.
All measurement according to JEDEC standard MO-187.

PACKAGE (QFN 3X3 8ld) OUTLINE / LAND PATTERN RECOMMENDATION



Note: The exposed pad should be connected to GND layer for better thermal conductivity.

Symbol	Min	Nom	Max	Unit
		PACKAGE DIMENSIONS		
A	0.8	0.9	1.0	mm
A1	0	0.025	0.05	mm
A2	0.65	0.70	0.75	mm
A3	0.15	0.20	0.25	mm
b	0.285	0.305	0.385	mm
D		3.00 BSC		mm
D2 (exposed pad)	1.92	2.02	2.12	mm
E		3.00 BSC		mm
E2 (exposed pad)	1.11	1.21	1.31	mm
e		0.65 BSC		mm
L	0.2	0.29	0.45	mm
L2	-	-	0.125	mm
		LAND PATTERN RECOMMENDATION DIMENSIONS		
X1 (per side)	0.025	-	-	mm
Y1	-	0.2	-	mm
Y2	-	0.05	-	mm
D2th (exposed pad)	>D2	2.2	2.4	mm
E2th (exposed pad)	>E2	1.5	1.6	mm

SOLDERING INFORMATION

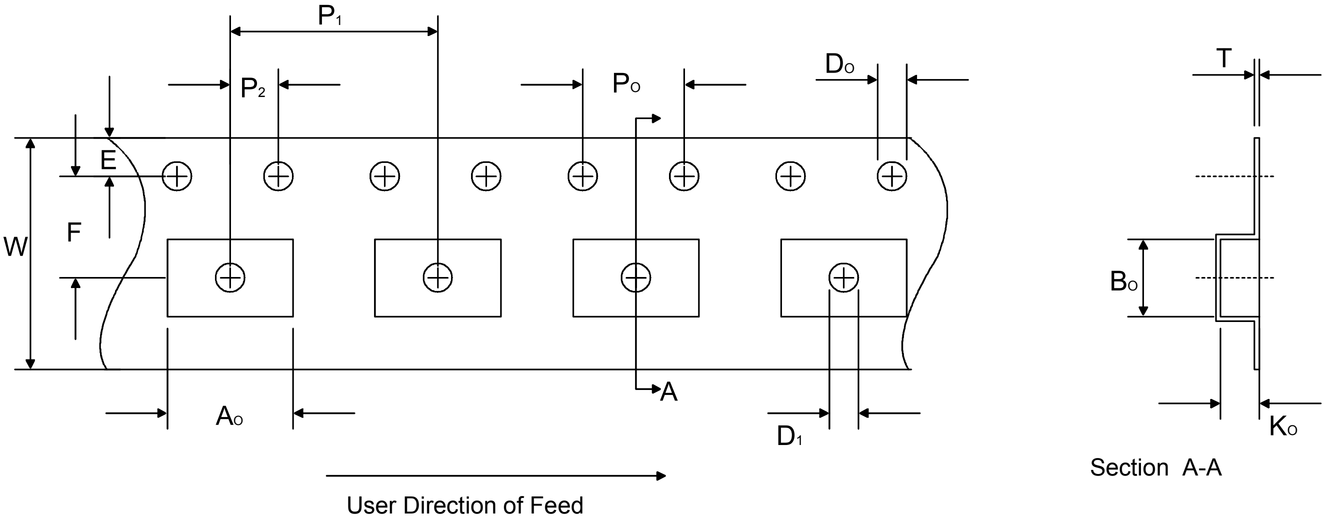
◆ For Eutectic Sn/Pb MSOP-8

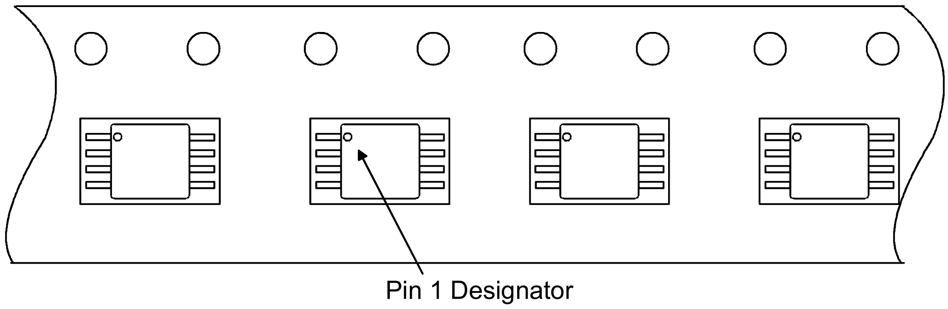
Resistance to Soldering Heat	According to RSH test IEC 68-2-58/20 2*220°C
Maximum Temperature	240°C
Maximum Number of Reflow Cycles	3
Reflow profile	Thermal profile parameters stated in JESD22-A113 should not be exceeded. http://www.jedec.org
Seating Plane Co-planarity	max 0.08 mm
Lead Finish	Solder plate 7.62 - 25.4 µm, material Sn 85% Pb 15%

◆ For Pb Free, RoHS Compliant MSOP-8 and QFN 3 mm x 3 mm 8ld

Resistance to Soldering Heat	According to RSH test IEC 68-2-58/20
Maximum Temperature	260°C
Maximum Number of Reflow Cycles	3
Reflow profile	Thermal profile parameters stated in IPC/JEDEC J-STD-020 should not be exceeded. http://www.jedec.org
Lead Finish	Solder plate 7.62 - 25.4 µm, material Matte Tin

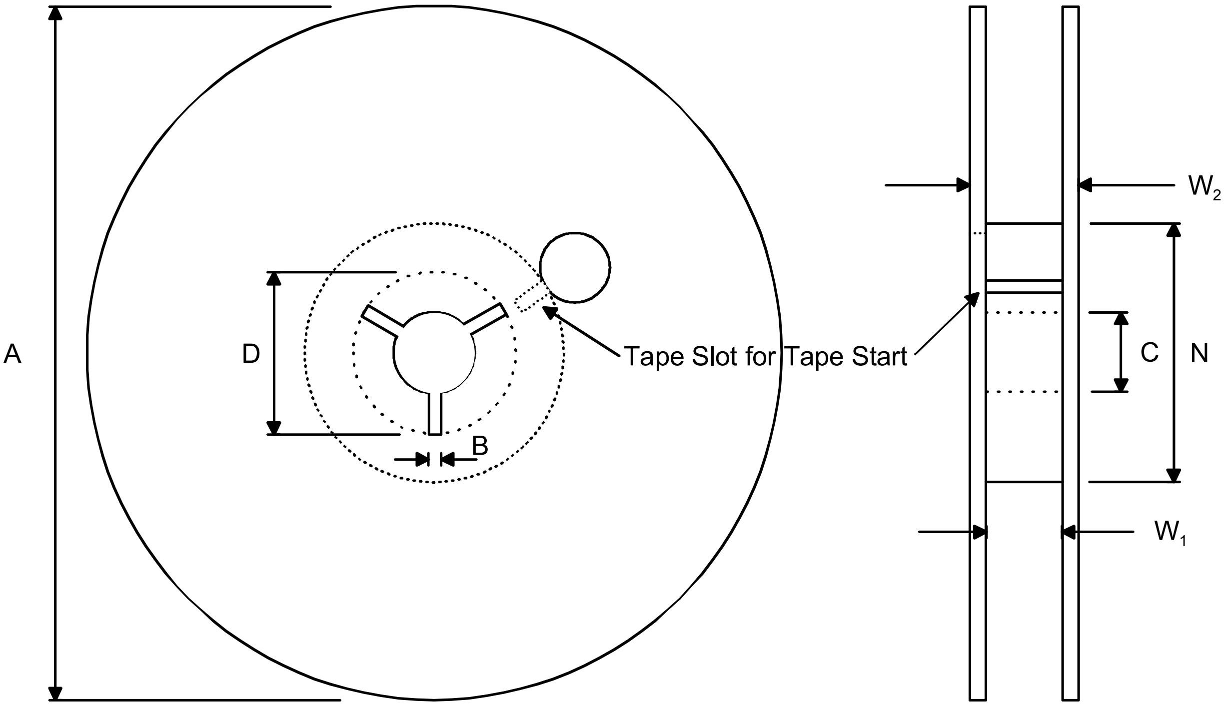
EMBOSSED TAPE SPECIFICATIONS (MSOP-8)





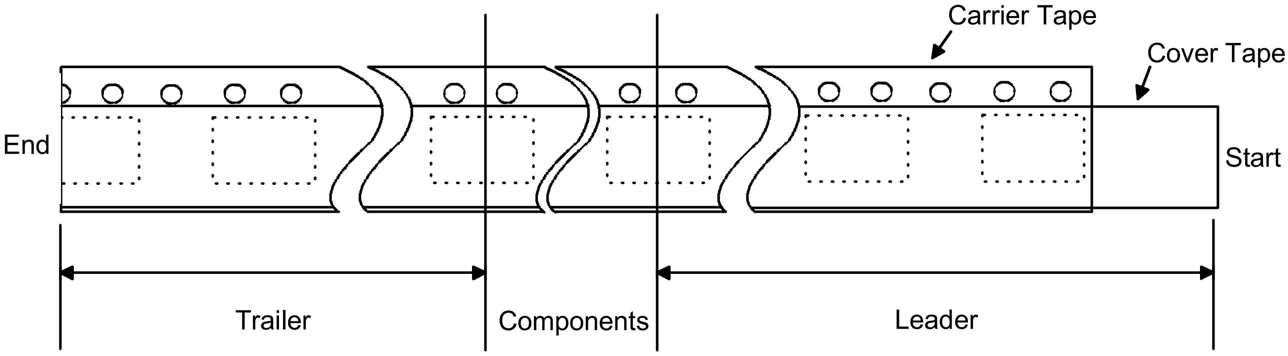
Dimension	Min/Max	Unit
Ao	5.00 ±0.10	mm
Bo	3.20 ±0.10	mm
Do	1.50 +0.1/-0.0	mm
D1	1.50 min	mm
E	1.75	mm
F	5.50 ±0.05	mm
Ko	1.45 ±0.10	mm
Po	4.0	mm
P1	8.0 ±0.10	mm
P2	2.0 ±0.05	mm
T	0.3 ±0.05	mm
W	12.00 +0.30/-0.10	mm

REEL SPECIFICATIONS (MSOP-8)



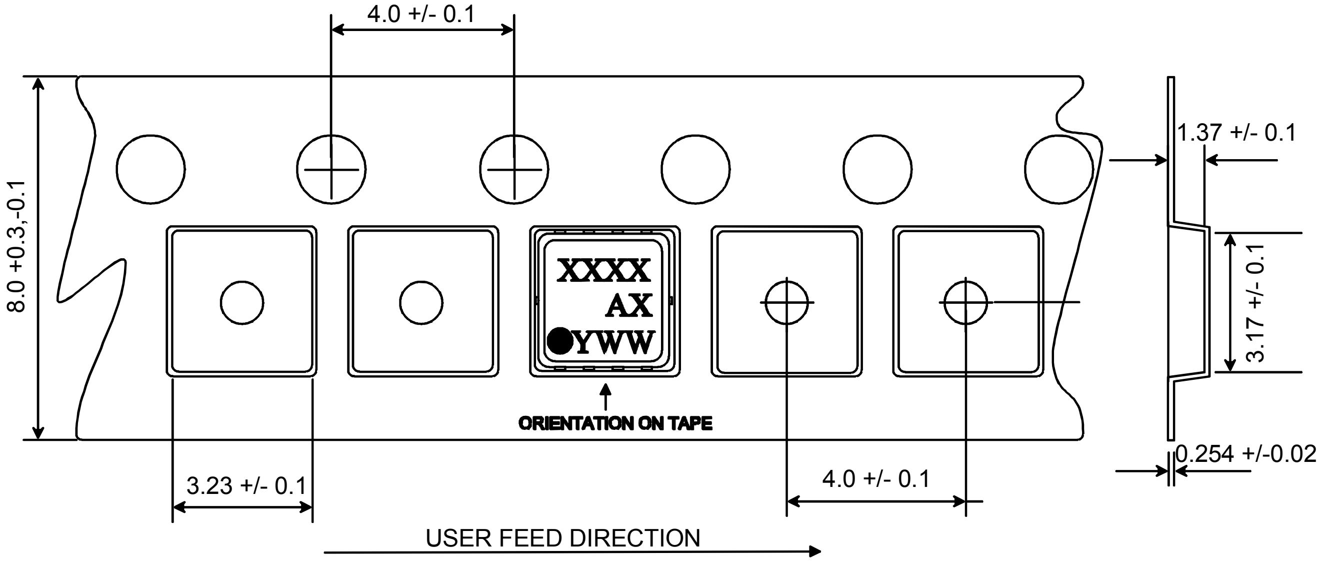
4000 Components on Each Reel

Reel Material: Conductive, Plastic Antistatic or Static Dissipative
Carrier Tape Material: Conductive
Cover Tape Material: Static Dissipative

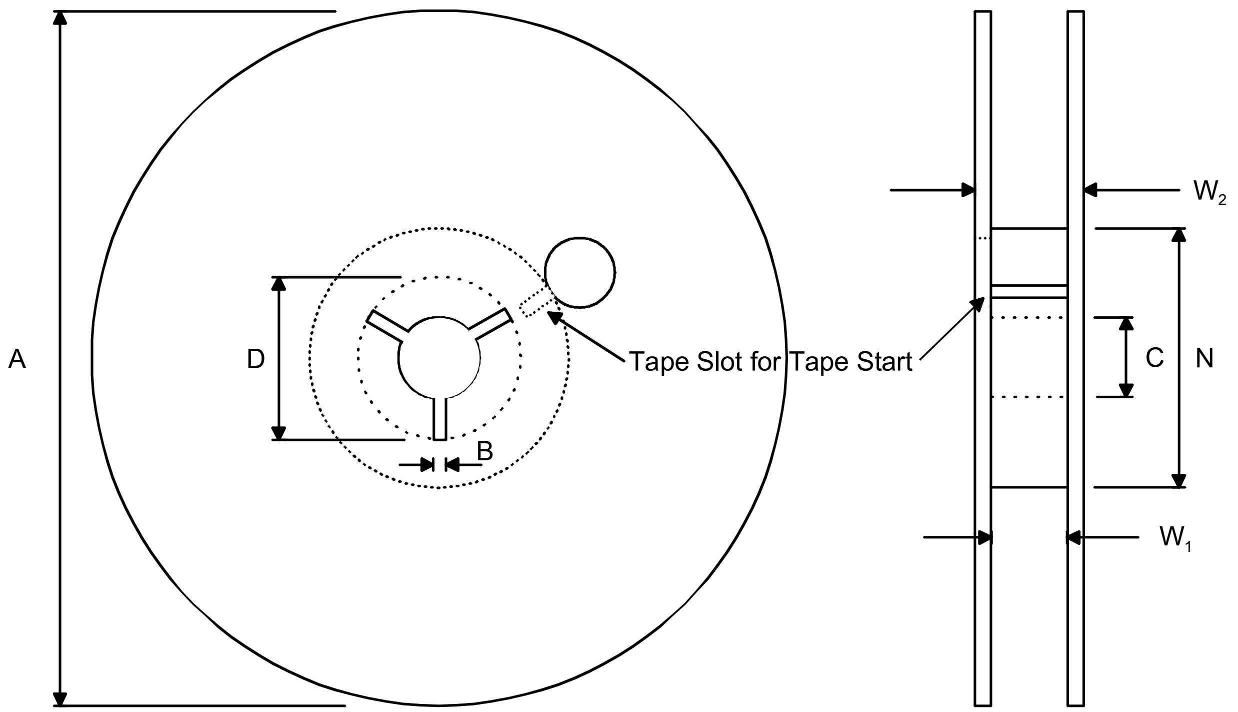


Dimension	Min	Max	Unit
A		330	mm
B	1.5		mm
C	12.80	13.50	mm
D	20.2		mm
N	50		mm
W_1 (measured at hub)	12.4	14.4	mm
W_2 (measured at hub)		18.4	mm
Trailer	160		mm
Leader	390, of which minimum 160 mm of empty carrier tape sealed with cover tape		mm
Weight		1500	g

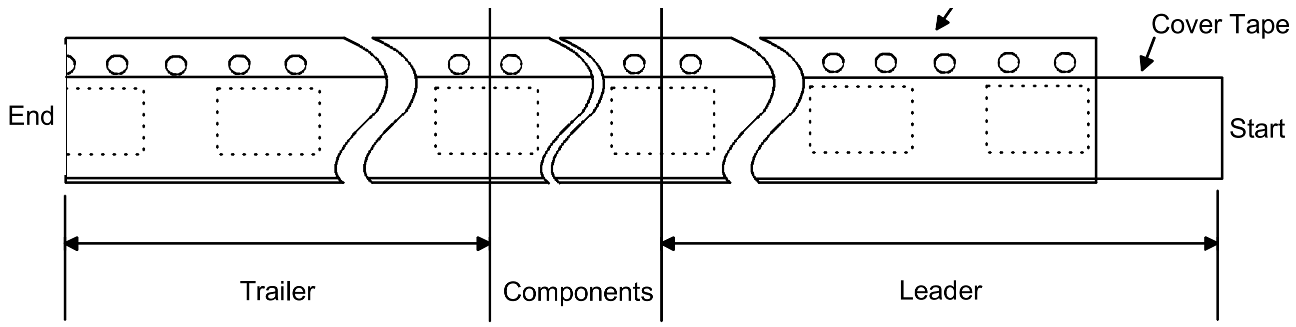
EMBOSSED TAPE SPECIFICATIONS (QFN 3x3)



REEL SPECIFICATIONS (QFN 3x3)



Reel Material: Conductive, Plastic Antistatic or Static Dissipative
Carrier Tape Material: Conductive
Cover Tape Material: Static Dissipative



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	$V_{OUT1(NOM)}$	$V_{OUT2(NOM)}$	Top Marking	Package	Comments
MAS9160ANHH06	1.5V	2.5V	9160 GAN	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASMN-T	1.5V	2.5V	9160 AN	MSOP-8	Tape and Reel 4k/reel
MAS9160ANSN06	1.5V	2.5V	9160 GAN	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160AMHH06	1.5V	2.8V	9160 GAM	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASMM-T	1.5V	2.8V	9160 AM	MSOP-8	Tape and Reel 4k/reel
MAS9160AMSN06	1.5V	2.8V	9160 GAM	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160A4HH06	1.8V	1.8V	9160 GA4	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASM4-T	1.8V	1.8V	9160 A4	MSOP-8	Tape and Reel 4k/reel
MAS9160A4SN06	1.8V	1.8V	9160 GA4	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160AHHH06	1.8V	2.8V	9160 GAH	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASMH-T	1.8V	2.8V	9160 AH	MSOP-8	Tape and Reel 4k/reel
MAS9160AHSN06	1.8V	2.8V	9160 GAH	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160A3HH06	2.5V	2.5V	9160 GA3	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASM3-T	2.5V	2.5V	9160 A3	MSOP-8	Tape and Reel 4k/reel
MAS9160A3SN06	2.5V	2.5V	9160 GA3	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160AJHH06	2.5V	2.8V	9160 GAJ	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASMJ-T	2.5V	2.8V	9160 AJ	MSOP-8	Tape and Reel 4k/reel
MAS9160AJSN06	2.5V	2.8V	9160 GAJ	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160A2HH06	2.8V	2.8V	9160 GA2	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASM2-T	2.8V	2.8V	9160 A2	MSOP-8	Tape and Reel 4k/reel
MAS9160A2SN06	2.8V	2.8V	9160 GA2	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel

MAS9160A6HH06	3.0V	3.0V	9160 GA6	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASM6-T	3.0V	3.0V	9160 A6	MSOP-8	Tape and Reel 4k/reel
MAS9160A6SN06	3.0V	3.0V	9160 GA6	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel
MAS9160A1HH06	3.3V	3.3V	9160 GA1	QFN8 Pb Free, RoHS Compliant	Tape and Reel 3k/reel
MAS9160ASM1-T	3.3V	3.3V	9160 A1	MSOP-8	Tape and Reel 4k/reel
MAS9160A1SN06	3.3V	3.3V	9160 GA1	MSOP-8 Pb Free, RoHS Compliant	Tape and Reel 4k/reel

For more voltage options contact Micro Analog Systems Oy.

LOCAL DISTRIBUTOR

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