LM4120 Precision Micropower Low Dropout Voltage Reference

Check for Samples: LM4120

FEATURES

- **Small SOT23-5 Package**
- **Low Dropout Voltage: 120 mV Typ @ 1 mA**
- **High Output Voltage Accuracy: 0.2%**
- **Source and Sink Current Output: ±5 mA**
- **Supply Current: 160 µA Typ.**
- **Low Temperature Coefficient: 50 ppm/°C**
- **Enable Pin**
- **Fixed Output Voltages: 1.8, 2.048, 2.5, 3.0, 3.3, 4.096 and 5.0V**
- **Industrial Temperature Range: −40°C to +85°C**
- **(For Extended Temperature Range, −40°C to 125°C, Contact Texas Instruments)**

APPLICATIONS

- **Portable, Battery Powered Equipment**
- **Instrumentation and Process Control**
- **Automotive & Industrial**
- **Test Equipment**
- **Data Acquisition Systems**
- **Precision Regulators**
- **Battery Chargers**
- **Base Stations**
- **Communications**
- **Medical Equipment**

DESCRIPTION

The LM4120 is a precision low power low dropout bandgap voltage reference with up to 5 mA output current source and sink capability.

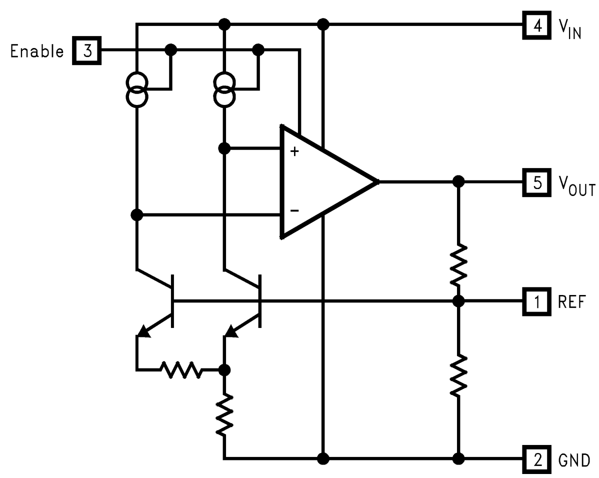
This series reference operates with input voltages as low as 2V and up to 12V consuming 160 µA (Typ.) supply current. In power down mode, device current drops to less than 2 µA.

The LM4120 comes in two grades (A and Standard) and seven voltage options for greater flexibility. The best grade devices (A) have an initial accuracy of 0.2%, while the standard have an initial accuracy of 0.5%, both with a tempco of 50ppm/°C ensured from −40°C to +125°C.

The very low dropout voltage, low supply current and power-down capability of the LM4120 makes this product an ideal choice for battery powered and portable applications.

The device performance is ensured over the industrial temperature range (−40°C to +85°C), while certain specs are ensured over the extended temperature range (−40°C to +125°C). Please contact Texas Instruments for full specifications over the extended temperature range. The LM4120 is available in a standard 5-pin SOT-23 package.

Functional Block Diagram



Connection Diagram

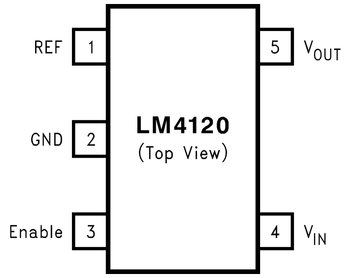


Figure 1. SOT23-5 Surface Mount Package

Table 1. SOT-23 Package Marking Information(1)

Field Information
First Field:
R = Reference
Second and third Field:
21 = 1.800V Voltage Option
14 = 2.048V Voltage Option
08 = 2.500V Voltage Option
15 = 3.000V Voltage Option
16 = 3.300V Voltage Option
17 = 4.096V Voltage Option
18 = 5.000V Voltage Option
Fourth Field:
A-B = Initial Reference Voltage Tolerance
A = ±0.2%
B = ±0.5%

(1) Only four fields of marking are possible on the SOT-23's small surface. This table gives the meaning of the four fields.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings [1][2]

Maximum Voltage on input or enable pins	−0.3V to 14V
Output Short-Circuit Duration	Indefinite
Power Dissipation (T_A = 25°C) [3]:	
DBV005B package − θ_{JA}	280°C/W
Power Dissipation	350 mW
ESD Susceptibility [4] Human Body Model Machine Model	 2 kV 200V
Lead Temperature:	
Soldering, (10 sec.)	+260°C
Vapor Phase (60 sec.)	+215°C
Infrared (15 sec.)	+220°C

(1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(3) Without PCB copper enhancements. The maximum power dissipation must be de-rated at elevated temperatures and is limited by T_{JMAX} (maximum junction temperature), θ_{J-A} (junction to ambient thermal resistance) and T_A (ambient temperature). The maximum power dissipation at any temperature is: $PDiss_{MAX} = (T_{JMAX} - T_A)/\theta_{J-A}$ up to the value listed in the Absolute Maximum Ratings.
(4) The human body model is a 100 pF capacitor discharged through a 1.5 kΩ resistor into each pin. The machine model is a 200 pF capacitor discharged directly into each pin.

Operating Range [1]

Storage Temperature Range	−65°C to +150°C
Ambient Temperature Range	−40°C to +85°C
Junction Temperature Range	−40°C to +125°C

(1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Electrical Characteristics
LM4120-1.8V, 2.048V and 2.5V

Unless otherwise specified V_{IN} = 3.3V, I_{LOAD} = 0, C_{OUT} = 0.01µF, $T_A = T_j$ = 25°C. Limits with standard typeface are for T_j = 25°C, and limits in **boldface type** apply over the −40°C ≤ T_A ≤ +85°C temperature range.

Symbol	Parameter	Conditions	Min [1]	Typ [2]	Max [1]	Units
V_{OUT}	Output Voltage Initial Accuracy LM4120A-1.800 LM4120A-2.048 LM4120A-2.500				±0.2	%
	LM4120-1.800 LM4120-2.048 LM4120-2.500				±0.5	%
TCV_{OUT}/°C	Temperature Coefficient	−40°C ≤ T_A ≤ +125°C		14	50	ppm/°c
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	3.3V ≤ V_{IN} ≤ 12V		0.0007	0.008 **0.01**	%/V

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate TI's Averaging Outgoing Quality Level (AOQL).
(2) Typical numbers are at 25°C and represent the most likely parametric norm.

Electrical Characteristics
LM4120-1.8V, 2.048V and 2.5V (continued)

Unless otherwise specified V_{IN} = 3.3V, I_{LOAD} = 0, C_{OUT} = 0.01µF, T_A = T_j = 25°C. Limits with standard typeface are for T_j = 25°C, and limits in **boldface type** apply over the −40°C ≤ T_A ≤ +85°C temperature range.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
$\Delta V_{OUT}/\Delta I_{LOAD}$	Load Regulation	0 mA ≤ I_{LOAD} ≤ 1 mA		0.03	0.08 **0.17**	%/mA
		1 mA ≤ I_{LOAD} ≤ 5 mA		0.01	0.04 **0.1**	
		−1 mA ≤ I_{LOAD} ≤ 0 mA		0.04	0.12	
		−5 mA ≤ I_{LOAD} ≤ −1 mA		0.01		
$V_{IN}–V_{OUT}$	Dropout Voltage (3)	I_{LOAD} = 0 mA		45	65 **80**	mV
		I_{LOAD} = +1 mA		120	150 **180**	
		I_{LOAD} = +5 mA		180	210 **250**	
V_N	Output Noise Voltage (4)	0.1 Hz to 10 Hz		20		μV_{PP}
		10 Hz to 10 kHz		36		μV_{PP}
I_S	Supply Current			160	250 **275**	µA
I_{SS}	Power-down Supply Current	Enable = 0.4V −40°C ≤ T_J ≤ +85°C Enable = 0.2V			1 **2**	µA
V_H	Logic High Input Voltage		**2.4**	2.4		V
V_L	Logic Low Input Voltage			0.4	**0.2**	V
I_H	Logic High Input Current			7	**15**	µA
I_L	Logic Low Input Current			0.1		µA
I_{SC}	Short Circuit Current	V_{IN} = 3.3V, V_{OUT} = 0		15		mA
			6		**30**	
		V_{IN} = 12V, V_{OUT} = 0		17		
			6		**30**	
Hyst	Thermal Hysteresis (5)	−40°C ≤ T_A ≤ 125°C		0.5		mV/V
ΔV_{OUT}	Long Term Stability (6)	1000 hrs. @ 25°C		100		ppm

(3) Dropout voltage is the differential voltage between V_{OUT} and V_{IN} at which V_{OUT} changes ≤ 1% from V_{OUT} at V_{IN} = 3.3V for 1.8V, 2.0V, 2.5V and V_{OUT} + 1V for others.For 1.8V option, dropout voltage is not ensured over temperature. A parasitic diode exists between input and output pins; it will conduct if V_{OUT} is pulled to a higher voltage than V_{IN}.
(4) Output noise voltage is proportional to V_{OUT}. V_N for other voltage option is calculated using ($V_{N(1.8V)}$/1.8) * V_{OUT}. V_N (2.5V) = (36µV_{PP}/1.8) * 2.5 = 46µV_{PP}.
(5) Thermal hysteresis is defined as the change in +25°C output voltage before and after exposing the device to temperature extremes.
(6) Long term stability is change in V_{REF} at 25°C measured continuously during 1000 hrs.

Electrical Characteristics
LM4120-3.0V, 3.3V, 4.096V and 5.0V

Unless otherwise specified V_{IN} = V_{OUT} + 1V, I_{LOAD} = 0, C_{OUT} = 0.01µF, T_A = T_j = 25°C. Limits with standard typeface are for T_j = 25°C, and limits in **boldface type** apply over the −40°C ≤ T_A ≤ +85°C temperature range.

Electrical Characteristics
LM4120-3.0V, 3.3V, 4.096V and 5.0V (continued)

Unless otherwise specified $V_{IN} = V_{OUT}$ + 1V, I_{LOAD} = 0, C_{OUT} = 0.01µF, $T_A = T_j$ = 25°C. Limits with standard typeface are for T_j = 25°C, and limits in **boldface type** apply over the −40°C ≤ T_A ≤ +85°C temperature range.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
V_{OUT}	Output Voltage Initial Accuracy LM4120A-3.000 LM4120A-3.300 LM4120A-4.096 LM4120A-5.000				±0.2	%
	LM4120-3.000 LM4120-3.300 LM4120-4.096 LM4120-5.000				±0.5	%
TCV_{OUT}/°C	Temperature Coefficient	−40°C ≤ T_A ≤ +125°C		14	50	ppm/°c
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	(V_{OUT} + 1V) ≤ V_{IN} ≤ 12V		0.0007	0.008 **0.01**	%/V
$\Delta V_{OUT}/\Delta I_{LOAD}$	Load Regulation	0 mA ≤ I_{LOAD} ≤ 1 mA		0.03	0.08 **0.17**	%/mA
		1 mA ≤ I_{LOAD} ≤ 5 mA		0.01	0.04 **0.1**	
		−1 mA ≤ I_{LOAD} ≤ 0 mA		0.04	0.12	
		−5 mA ≤ I_{LOAD} ≤ −1 mA		0.01		
$V_{IN}-V_{OUT}$	Dropout Voltage (3)	I_{LOAD} = 0 mA		45	65 **80**	mV
		I_{LOAD} = +1 mA		120	150 **180**	
		I_{LOAD} = +5 mA		180	210 **250**	
V_N	Output Noise Voltage (4)	0.1 Hz to 10 Hz		20		μV_{PP}
		10 Hz to 10 kHz		36		μV_{PP}
I_S	Supply Current			160	250 **275**	µA
I_{SS}	Power-down Supply Current	Enable = 0.4V −40°C ≤ T_J ≤ +85°C Enable = 0.2V			1 **2**	µA
V_H	Logic High Input Voltage		**2.4**	2.4		V
V_L	Logic Low Input Voltage			0.4	**0.2**	V
I_H	Logic High Input Current			7	**15**	µA
I_L	Logic Low Input Current			0.1		µA
I_{SC}	Short Circuit Current	V_{OUT} = 0		15		mA
			6		**30**	
		V_{IN} = 12V, V_{OUT} = 0		17		
			6		**30**	

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlation using Statistical Quality Control (SQC) methods. The limits are used to calculate TI's Averaging Outgoing Quality Level (AOQL).
(2) Typical numbers are at 25°C and represent the most likely parametric norm.
(3) Dropout voltage is the differential voltage between V_{OUT} and V_{IN} at which V_{OUT} changes ≤ 1% from V_{OUT} at V_{IN} = 3.3V for 1.8V, 2.0V, 2.5V and V_{OUT} + 1V for others.For 1.8V option, dropout voltage is not ensured over temperature. A parasitic diode exists between input and output pins; it will conduct if V_{OUT} is pulled to a higher voltage than V_{IN}.
(4) Output noise voltage is proportional to V_{OUT}. V_N for other voltage option is calculated using ($V_{N(1.8V)}$/1.8) * V_{OUT}. V_N (2.5V) = (36μV_{PP}/1.8) * 2.5 = 46μV_{PP}.

Electrical Characteristics
LM4120-3.0V, 3.3V, 4.096V and 5.0V (continued)

Unless otherwise specified $V_{IN} = V_{OUT} + 1V$, $I_{LOAD} = 0$, $C_{OUT} = 0.01\mu F$, $T_A = T_j = 25°C$. Limits with standard typeface are for $T_j = 25°C$, and limits in **boldface type** apply over the $-40°C \le T_A \le +85°C$ temperature range.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
Hyst	Thermal Hysteresis (5)	$-40°C \le T_A \le 125°C$		0.5		mV/V
ΔV_{OUT}	Long Term Stability (6)	1000 hrs. @ 25°C		100		ppm

(5) Thermal hysteresis is defined as the change in +25°C output voltage before and after exposing the device to temperature extremes.
(6) Long term stability is change in V_{REF} at 25°C measured continuously during 1000 hrs.

LM4120 Typical Operating Characteristics

Unless otherwise specified, V_{IN} = 3.3V, V_{OUT} = 2.5V, I_{LOAD} = 0, C_{OUT} = 0.022µF, T_A = 25°C and V_{EN} = V_{IN}.

Long Term Drift

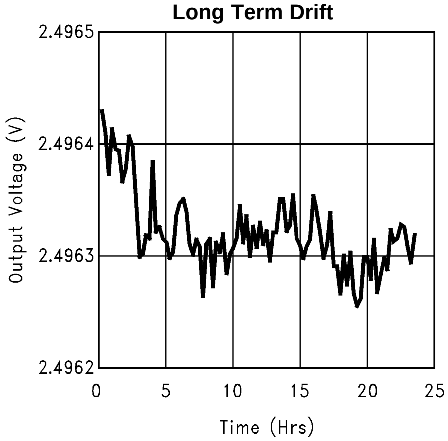


Figure 2.

Typical Temperature Drift

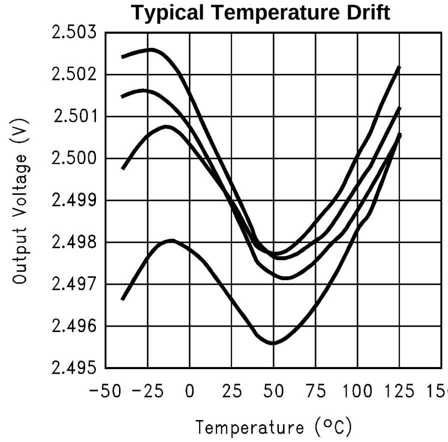


Figure 3.

Short Circuit Current vs Temperature

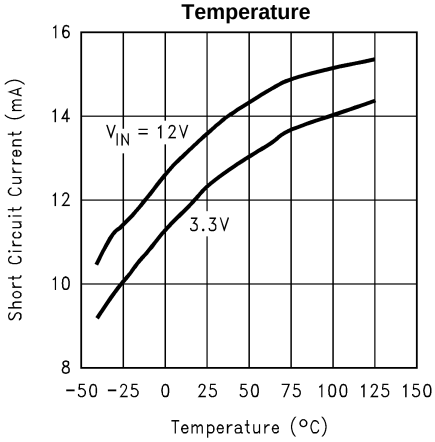


Figure 4.

Dropout Voltage vs Output Error

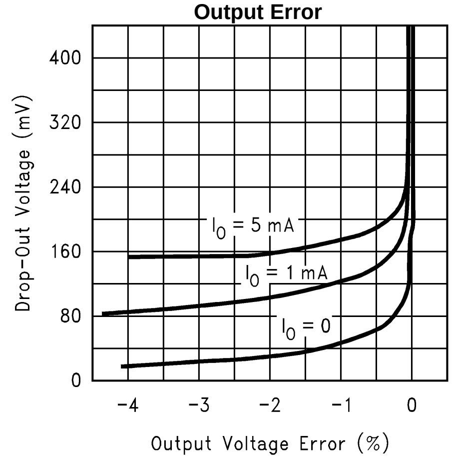


Figure 5.

Dropout Voltage vs Load Current

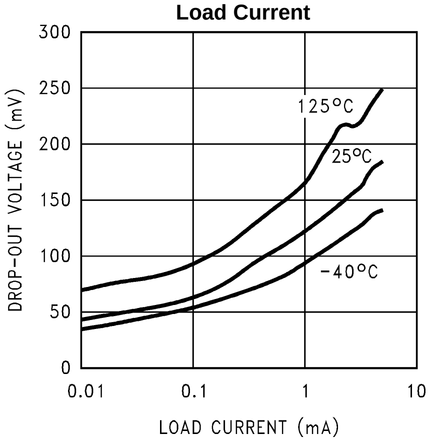


Figure 6.

Line Regulation

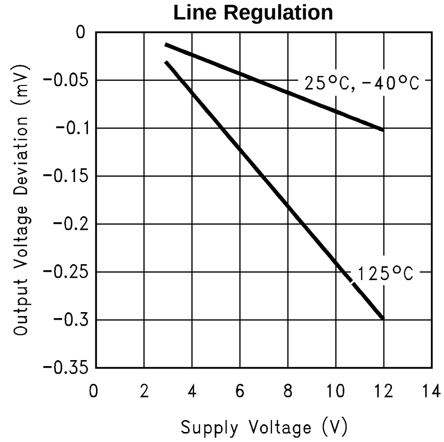


Figure 7.

LM4120 Typical Operating Characteristics (continued)

Unless otherwise specified, V_{IN} = 3.3V, V_{OUT} = 2.5V, I_{LOAD} = 0, C_{OUT} = 0.022µF, T_A = 25°C and V_{EN} = V_{IN}.

Load Regulation

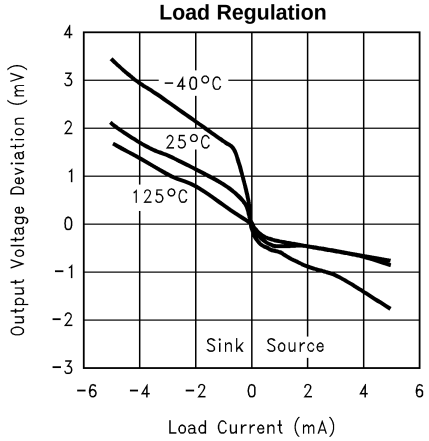


Figure 8.

GND Pin Current

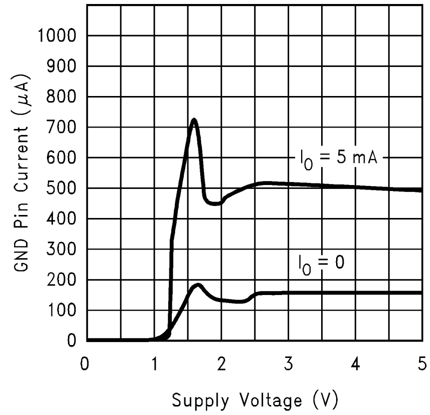


Figure 9.

GND Pin Current at No Load vs Temperature

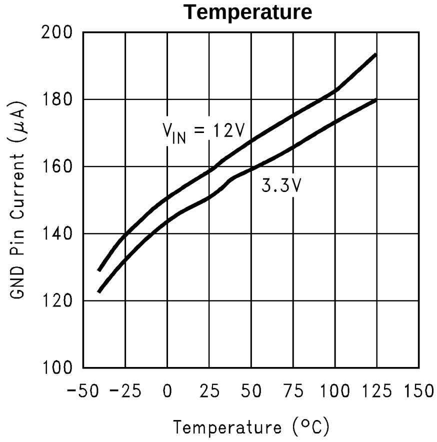


Figure 10.

GND Pin Current vs Load

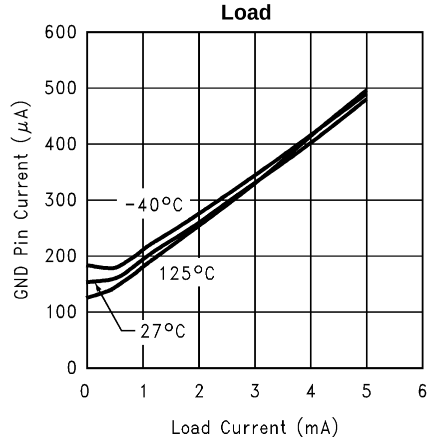


Figure 11.

0.1Hz to 10Hz output Noise

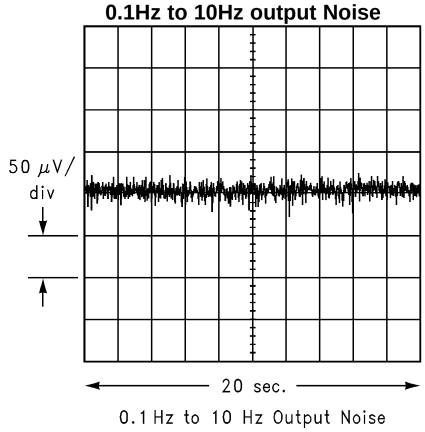


Figure 12.

Output Impedance vs Frequency

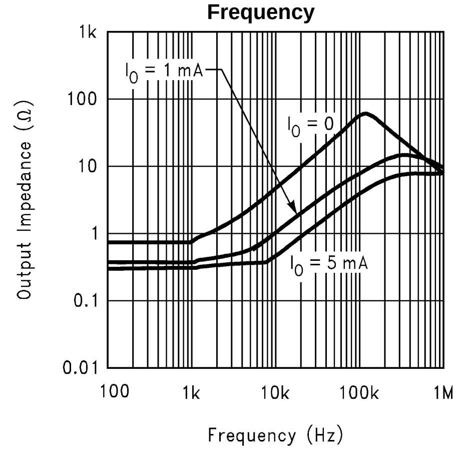


Figure 13.

LM4120 Typical Operating Characteristics (continued)

Unless otherwise specified, V_{IN} = 3.3V, V_{OUT} = 2.5V, I_{LOAD} = 0, C_{OUT} = 0.022µF, T_A = 25°C and V_{EN} = V_{IN}.

PSRR vs Frequency

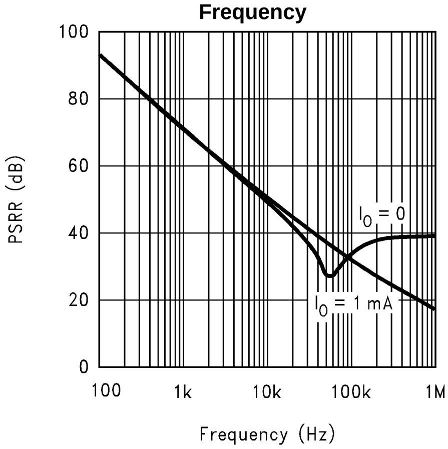


Figure 14.

Start-Up Response

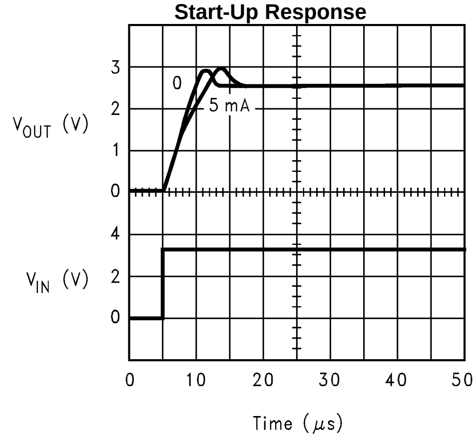


Figure 15.

Enable Response

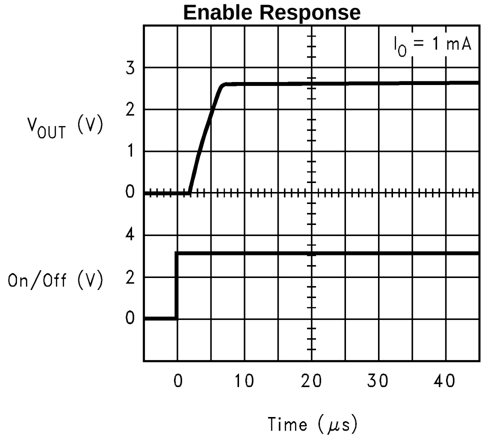


Figure 16.

Load Step Response

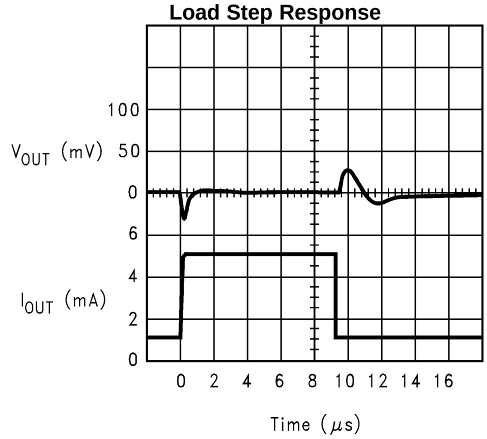


Figure 17.

Load Step Response

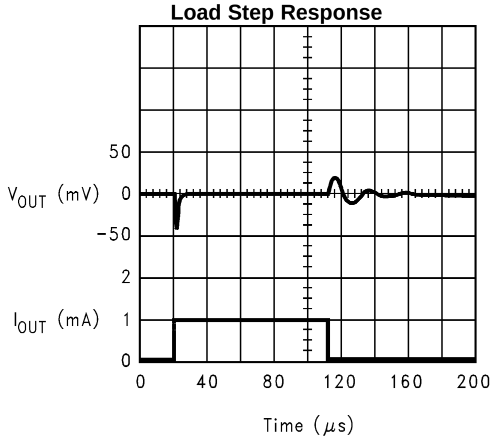


Figure 18.

Line Step Response

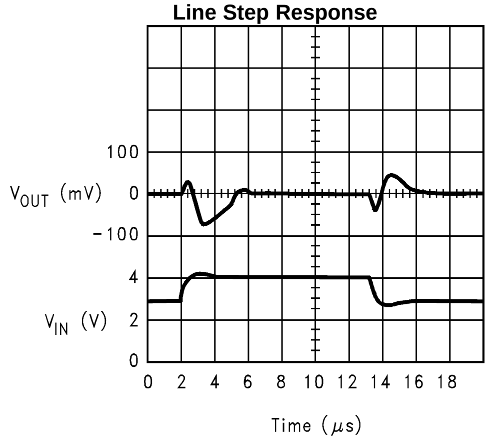


Figure 19.

LM4120 Typical Operating Characteristics (continued)

Unless otherwise specified, V_{IN} = 3.3V, V_{OUT} = 2.5V, I_{LOAD} = 0, C_{OUT} = 0.022µF, T_A = 25°C and V_{EN} = V_{IN}.

Thermal Hysteresis

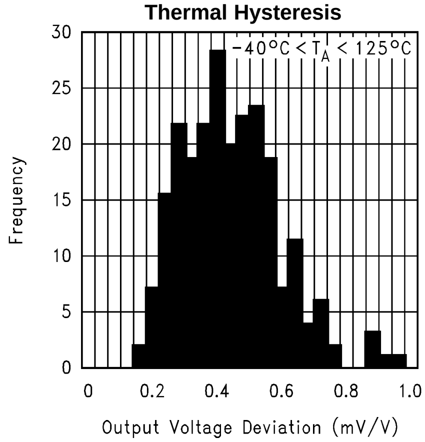


Figure 20.

Enable Pin Current

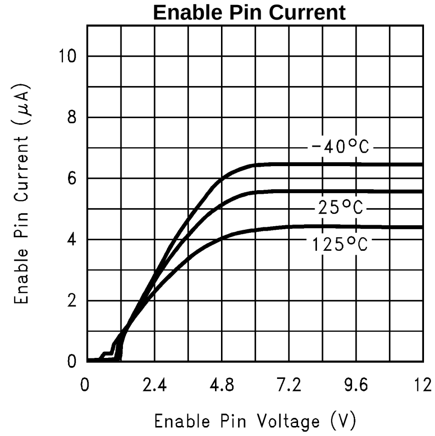


Figure 21.

PIN DESCRIPTIONS

Output (Pin 5)	Reference Output.
Input (Pin 4)	Positive Supply.
Ground (Pin 2)	Negative Supply or Ground Connection.
Enable (Pin 3)	Pulled to input for normal operation. Forcing this pin to ground will turn-off the output.
REF (Pin 1)	REF Pin. This pin should be left unconnected.

APPLICATION HINTS

The standard application circuit for the LM4120 is shown in Figure 22. It is designed to be stable with ceramic output capacitors in the range of 0.022µF to 0.047µF. Note that 0.022µF is the minimum required output capacitor. These capacitors typically have an ESR of about 0.1 to 0.5Ω. Smaller ESR can be tolerated, however larger ESR can not. The output capacitor can be increased to improve load transient response, up to about 1µF. However, values above 0.047µF must be tantalum. With tantalum capacitors, in the 1µF range, a small capacitor between the output and the reference pin is required. This capacitor will typically be in the 50pF range. Care must be taken when using output capacitors of 1µF or larger. These application must be thoroughly tested over temperature, line and load.

An input capacitor is typically not required. However, a 0.1µF ceramic can be used to help prevent line transients from entering the LM4120. Larger input capacitors should be tantalum or aluminium.

The reference pin is sensitive to noise, and capacitive loading. Therefore, the PCB layout should isolate this pin as much as possible.

The enable pin is an analog input with very little hysteresis. About 6µA into this pin is required to turn the part on, and it must be taken close to GND to turn the part off (see spec. table for thresholds). There is a *minimum* slew rate on this pin of about 0.003V/µS to prevent glitches on the output. All of these conditions can easily be met with ordinary CMOS or TTL logic. If the shutdown feature is not required, then this pin can safely be connected directly to the input supply. Floating this pin is not recommended.

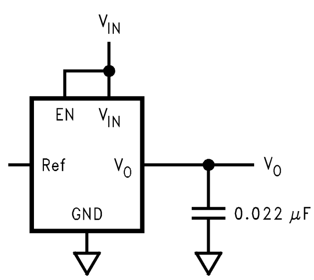


Figure 22.

INPUT CAPACITOR

Noise on the power-supply input can effect the output noise, but can be reduced by using an optional bypass capacitor between the input pin and the ground.

PRINTED CIRCUIT BOARD LAYOUT CONSIDERATION

The mechanical stress due to PC board mounting can cause the output voltage to shift from its initial value. References in SOT packages are generally less prone to assembly stress than devices in Small Outline (SOIC) package.

To reduce the stress-related output voltage shifts, mount the reference on the low flex areas of the PC board such as near to the edge or the corner of the PC board.

Typical Application Circuits

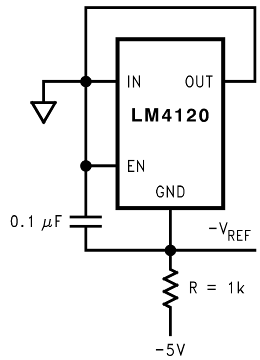


Figure 23. Voltage Reference with Negative Output

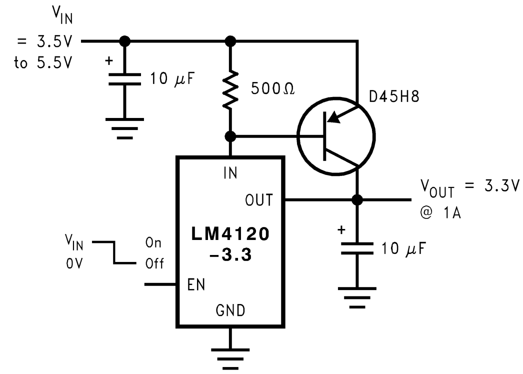


Figure 24. Precision High Current Low Dropout Regulator

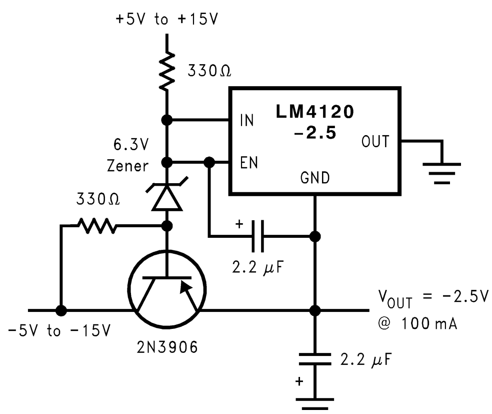


Figure 25. Precision High Current Negative Voltage Regulator

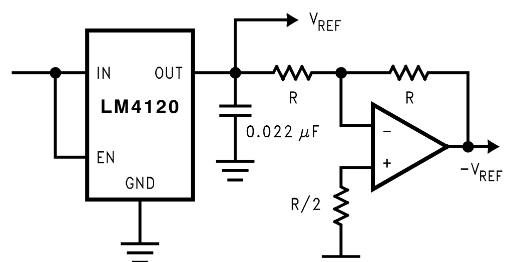


Figure 26. Voltage Reference with Complimentary Output

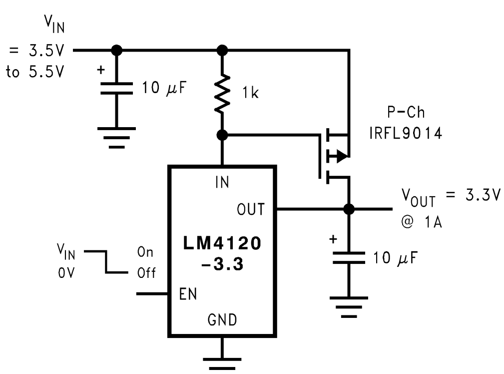


Figure 27. Precision High Current Low Droput Regulator

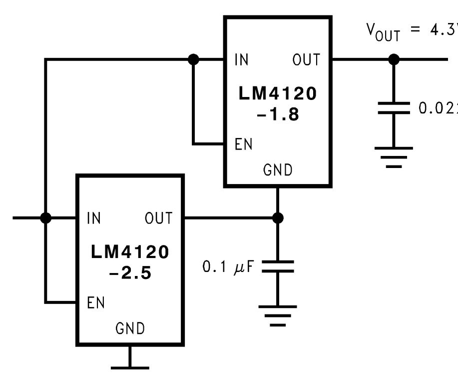


Figure 28. Stacking Voltage References

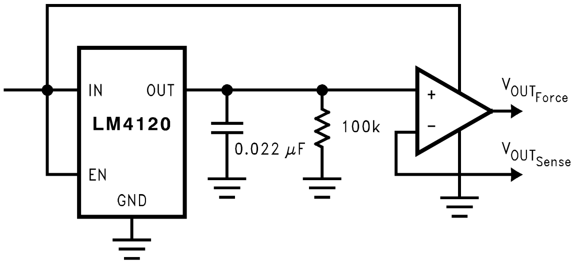


Figure 29. Precision Voltage Reference with Force and Sense Output

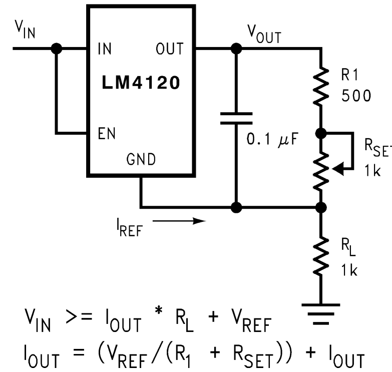


Figure 30. Programmable Current Source

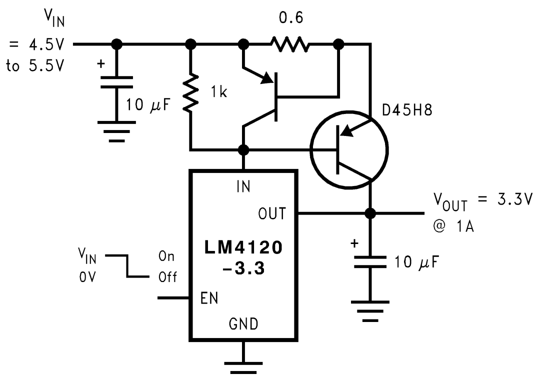


Figure 31. Precision Regulator with Current Limiting Circuit

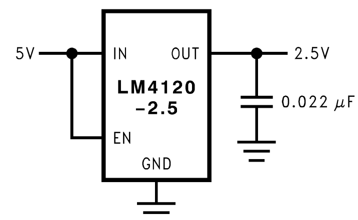


Figure 32. Power Supply Splitter

REVISION HISTORY

Changes from Revision B (April 2013) to Revision C	Page
• Changed layout of National Data Sheet to TI format	13

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4120AIM5-1.8	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R21A	Samples
LM4120AIM5-1.8/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R21A	Samples
LM4120AIM5-2.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R14A	Samples
LM4120AIM5-2.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R14A	Samples
LM4120AIM5-2.5	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R08A	Samples
LM4120AIM5-2.5/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R08A	Samples
LM4120AIM5-3.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R15A	Samples
LM4120AIM5-3.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R15A	Samples
LM4120AIM5-3.3	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R16A	Samples
LM4120AIM5-3.3/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R16A	Samples
LM4120AIM5-4.1	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R17A	Samples
LM4120AIM5-4.1/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R17A	Samples
LM4120AIM5-5.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R18A	Samples
LM4120AIM5-5.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R18A	Samples
LM4120AIM5X-1.8	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R21A	Samples
LM4120AIM5X-1.8/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R21A	Samples
LM4120AIM5X-2.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R14A	Samples
LM4120AIM5X-2.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R14A	Samples
LM4120AIM5X-2.5	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R08A	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4120AIM5X-2.5/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R08A	Samples
LM4120AIM5X-3.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R15A	Samples
LM4120AIM5X-3.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R15A	Samples
LM4120AIM5X-3.3	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R16A	Samples
LM4120AIM5X-3.3/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R16A	Samples
LM4120AIM5X-4.1	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R17A	Samples
LM4120AIM5X-4.1/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R17A	Samples
LM4120AIM5X-5.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R18A	Samples
LM4120AIM5X-5.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R18A	Samples
LM4120IM5-1.8	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R21B	Samples
LM4120IM5-1.8/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R21B	Samples
LM4120IM5-2.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R14B	Samples
LM4120IM5-2.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R14B	Samples
LM4120IM5-2.5	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R08B	Samples
LM4120IM5-2.5/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R08B	Samples
LM4120IM5-3.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R15B	Samples
LM4120IM5-3.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R15B	Samples
LM4120IM5-3.3	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R16B	Samples
LM4120IM5-3.3/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R16B	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM4120IM5-4.1	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R17B	Samples
LM4120IM5-4.1/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R17B	Samples
LM4120IM5-5.0	ACTIVE	SOT-23	DBV	5	1000	TBD	Call TI	Call TI	-40 to 85	R18B	Samples
LM4120IM5-5.0/NOPB	ACTIVE	SOT-23	DBV	5	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R18B	Samples
LM4120IM5X-1.8	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R21B	Samples
LM4120IM5X-1.8/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R21B	Samples
LM4120IM5X-2.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R14B	Samples
LM4120IM5X-2.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R14B	Samples
LM4120IM5X-2.5	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R08B	Samples
LM4120IM5X-2.5/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R08B	Samples
LM4120IM5X-3.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R15B	Samples
LM4120IM5X-3.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R15B	Samples
LM4120IM5X-3.3	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R16B	Samples
LM4120IM5X-3.3/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R16B	Samples
LM4120IM5X-4.1	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R17B	Samples
LM4120IM5X-4.1/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R17B	Samples
LM4120IM5X-5.0	ACTIVE	SOT-23	DBV	5	3000	TBD	Call TI	Call TI	-40 to 85	R18B	Samples
LM4120IM5X-5.0/NOPB	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	R18B	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

[4] Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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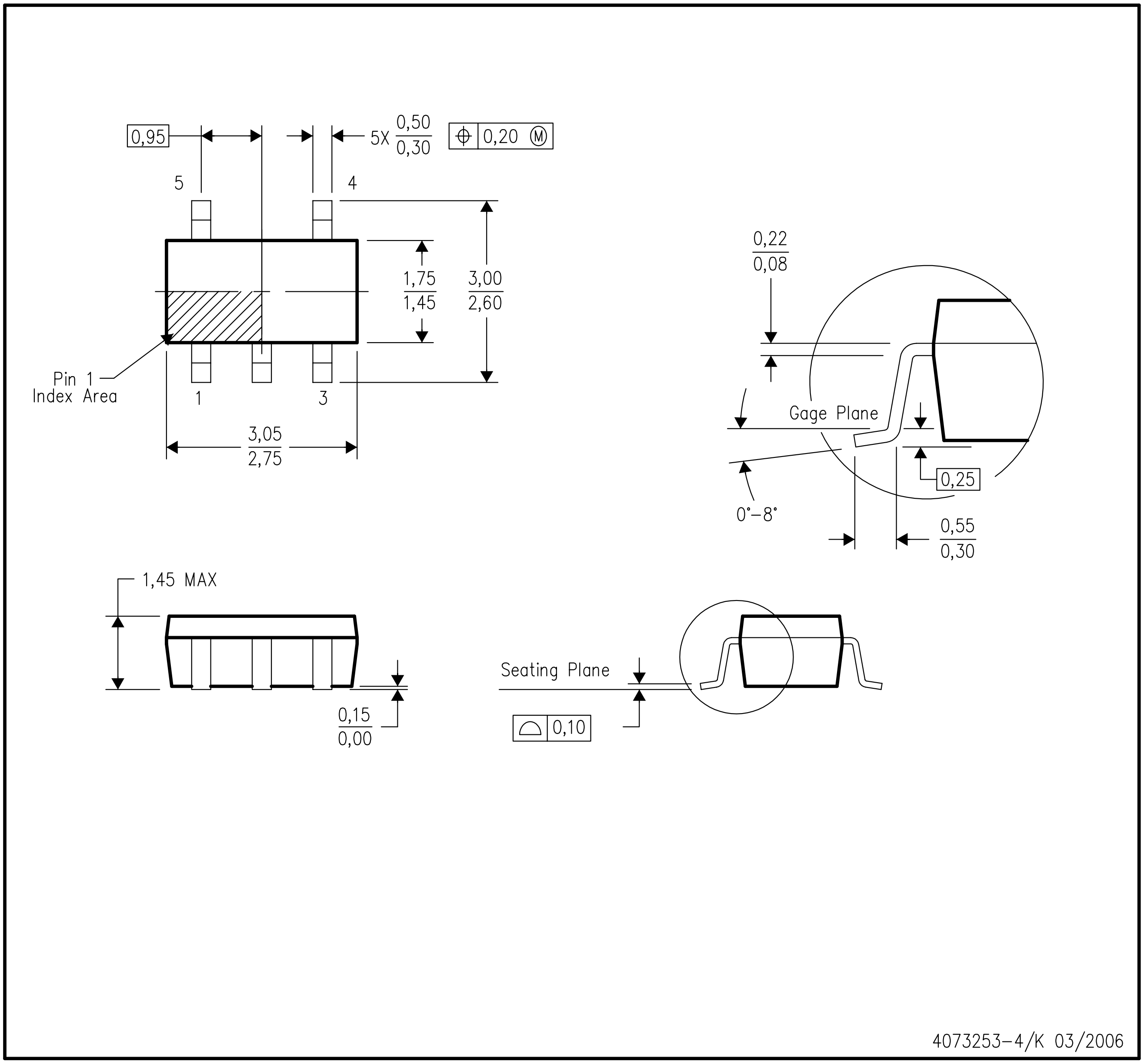
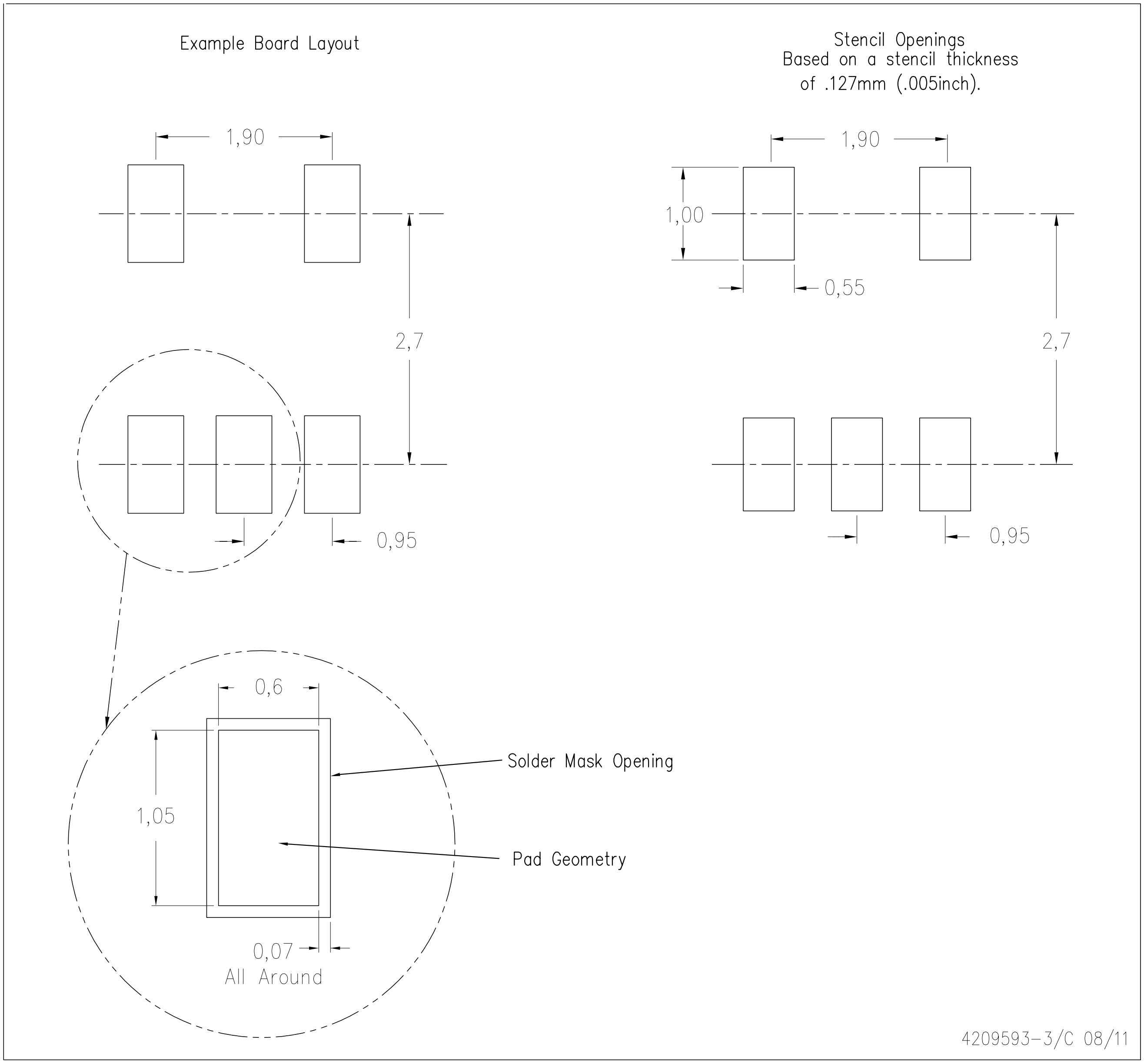
DBV (R-PDSO-G5) PLASTIC SMALL-OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO-178 Variation AA.

DBV (R-PDSO-G5) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC-7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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