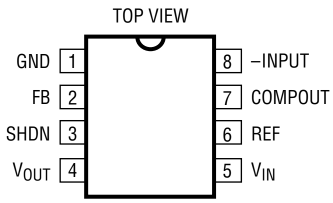
ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Voltage 36V
NPN Collector Voltage 36V
Output Short-Circuit Duration .... Indefinite
Power Dissipation .... Internally Limited
Operating Temperature Range
LT1120C .... 0°C to 100°C
LT1120I .... –40 to 100°C
Storage Temperature Range .... –65°C to 150°C

PACKAGE/ORDER INFORMATION

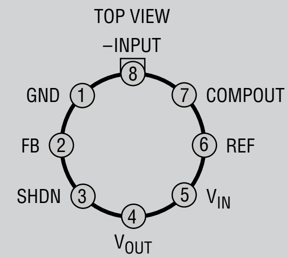


N8 PACKAGE 8-LEAD PDIP
S8 PACKAGE 8-LEAD PLASTIC SO
T_{JMAX} = 110°C, θ_{JA} = 130°C/W (N)
T_{JMAX} = 110°C, θ_{JA} = 150°C/W (S)

ORDER PART NUMBER
LT1120CN8 LT1120CS8 LT1120IN8 LT1120IS8
S8 PART MARKING
1120 1120I

J8 PACKAGE
8-LEAD CERDIP
T_{JMAX} = 150°C, θ_{JA} = 100°C/W (J)

ORDER PART NUMBER
LT1120CJ8



H PACKAGE
8-LEAD TO-5 METAL CAN
T_{JMAX} = 150°C, θ_{JA} = 150°C/W, θ_{JC} = 45°C/W

ORDER PART NUMBER
LT1120CH

OBSOLETE PACKAGES
Consider the N8 and S8 Packages for Alternate Source

Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. T_j = 25°C.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Reference					
Reference Voltage	4.5V ≤ V_{IN} ≤ 36V	2.46	2.50	2.54	V
Line Regulation	4.5V ≤ V_{IN} ≤ 36V		0.01	0.015	%/V
Load Regulation	–2mA ≤ I_{REF} ≤ 2mA, V_{IN} = 12V		0.3	0.6	%
Output Source Current	V_{IN} = 5V	2	4		mA
Output Sink Current	V_{IN} = 5V	2	4		mA
Temperature Stability			1		%
Regulator					
Supply Current	V_{IN} = 6V, I_{OUT} ≤ 100μA V_{IN} = 36V, I_{OUT} ≤ 100μA V_{IN} = 12V, I_{OUT} = 125mA		45 75 11	80 100 20	μA μA mA
Output Current	(V_{IN} – V_{OUT}) ≥ 1V, V_{IN} ≥ 6V	125			mA
Load Regulation	(V_{IN} – V_{OUT}) ≥ 1V, V_{IN} ≥ 6V		0.2	0.5	%
Line Regulation	6V ≤ V_{IN} ≤ 36V		0.01	0.015	%/V
Dropout Voltage	I_{OUT} = 100μA I_{OUT} = 125mA		0.02 0.4	0.05 0.65	V V

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25°C$. $T_j = 25°C$.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Feedback Sense Voltage	$V_{IN} = 12V$		2.44	2.5	2.56	V
Shutdown Pin Voltage		Normal			0.4	V
	$V_{OUT} \leq 0.5V$	Shutdown	2.2	1.4		V
Shutdown Pin Current	$V_{IN} = 1.4V$			25		µA
Feedback Bias Current				15	40	nA
Minimum Load Current	$V_{IN} = 36V$			1	5	µA
Short-Circuit Current	$V_{IN} = 36V$			300	400	mA
Comparator						
Offset Voltage	$V_{IN} = 36V$			3	7	mV
Bias Current	$V_{IN} = 36V$ (Note 2)			15	40	nA
Gain	$\Delta V_{OUT} = 29V$, $R_L = 20k$		2000	10000		V/V
Power Supply Rejection	$4.5V \leq V_S \leq 36V$		80	96		dB
Output Sink Current	$V_{IN} = 4.5V$		10	18		mA
Saturation Voltage	$I_{OUT} = 1mA$			0.4	0.6	V
Input Voltage Range			0		$V_{IN} - 1$	V
Response Time				5		µs
Leakage Current					2	µA

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25°C$.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Reference						
Reference Voltage	$4.5V \leq V_{IN} \leq 36V$	●	2.40	2.50	2.55	V
Line Regulation	$4.5V \leq V_{IN} \leq 36V$	●		0.01	0.02	%/V
Load Regulation	$-2mA \leq I_{REF} \leq 2mA$, $V_{IN} = 12V$	●		0.4	0.8	%
Output Source Current	$V_{IN} = 5V$	●	2			mA
Output Sink Current	$V_{IN} = 5V$	●	2			mA
Regulator						
Supply Current	$V_{IN} = 6V$, $I_{OUT} \leq 100µA$ $V_{IN} = 36V$, $I_{OUT} \leq 100µA$ $V_{IN} = 12V$, $I_{OUT} = 125mA$	● ● ●		65 85 11	95 100 20	µA µA mA
Output Current	$(V_{IN} - V_{OUT}) \geq 1V$, $V_{IN} \geq 6V$	●	125			mA
Load Regulation	$(V_{IN} - V_{OUT}) \geq 1V$, $V_{IN} \geq 6V$	●			1	%
Line Regulation	$6V \leq V_{IN} \leq 36V$	●			0.02	%/V
Dropout Voltage	$I_{OUT} = 100µA$ $I_{OUT} = 125mA$	● ●			0.06 0.85	V V
Feedback Sense Voltage	$V_{IN} = 12V$	●	2.38	2.5	2.57	V
Feedback Bias Current		●			50	nA
Minimum Load Current	$V_{IN} = 36V$	●			50	µA
Short-Circuit Current	$V_{IN} = 36V$	●		300	400	mA

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Comparator						
Offset Voltage		●			10	mV
Bias Current	V_{IN} = 36V (Note 2)	●		15	60	nA
Gain	ΔV_{OUT} = 29V, R_L = 20k	●	1000			V/V
Output Sink Current	V_{IN} = 4.5V (Note 3)	●	5	10		mA
Leakage Current	V_{IN} = 36V	●			8	µA

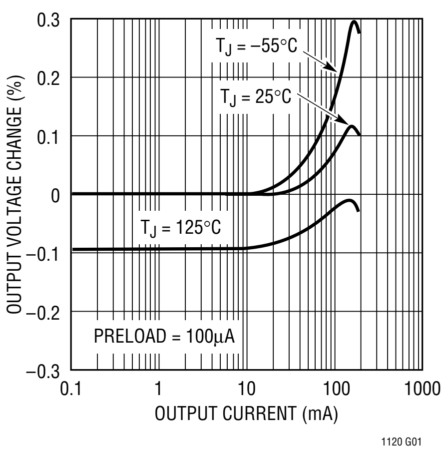
Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: T_A > 85°C, I bias maximum is 100nA.

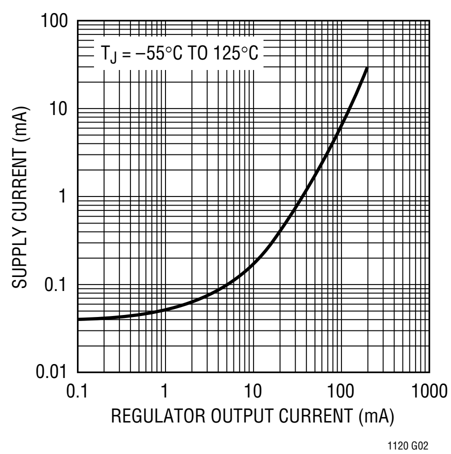
Note 3: For $T_A \leq -40$°C output current sink drops to 2.5mA.

TYPICAL PERFORMANCE CHARACTERISTICS

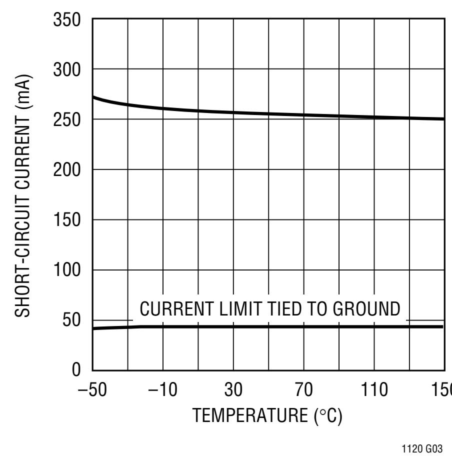
Regulator Load Regulation



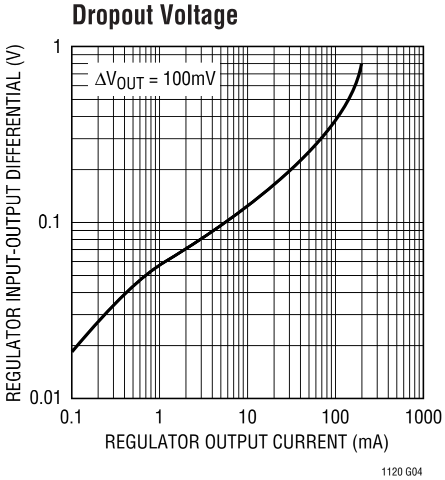
Supply Current



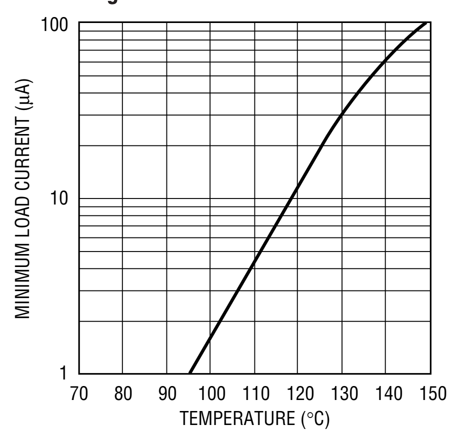
Regulator Short-Circuit Current



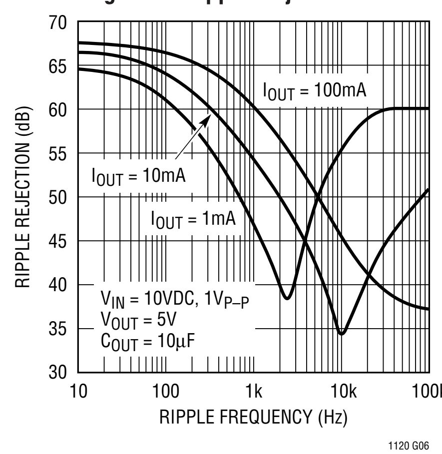
Dropout Voltage



Regulator Minimum Load Current

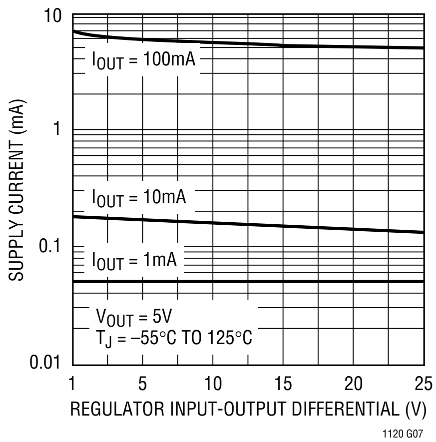


Regulator Ripple Rejection

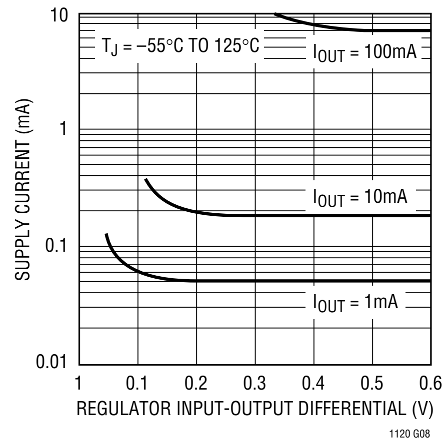


TYPICAL PERFORMANCE CHARACTERISTICS

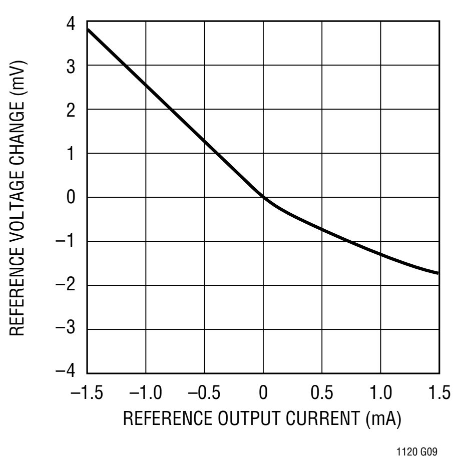
Supply Current



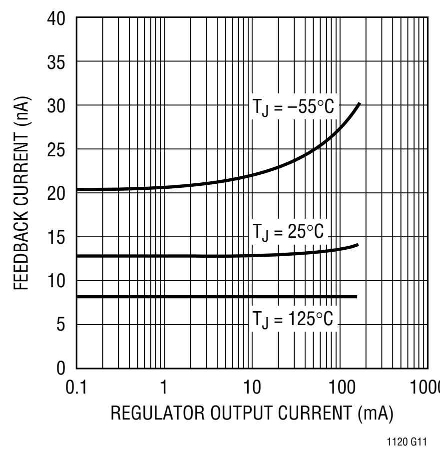
Supply Current at Dropout



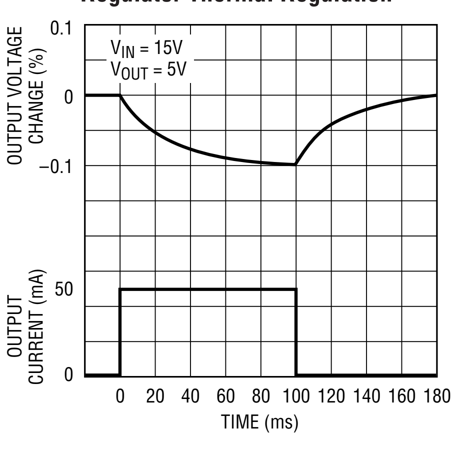
Reference Regulation



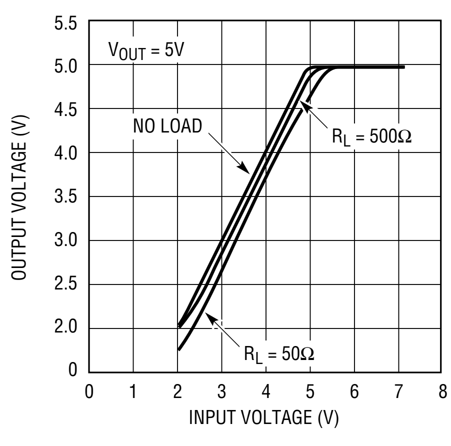
Feedback Pin Current



Regulator Thermal Regulation



LT1120 Turn-On Characteristic



PIN FUNCTIONS

GND (Pin 1): Ground.

FB (Pin 2): Feedback. This is the feedback point of the regulator. When operating, it is nominally at 2.5V. Optimum source resistance is 200k to 500k. The feedback pin should not be driven below ground or more positive than 5V.

SHDN (Pin 3): Shutdown. A logic 1 shuts off the main regulator. Caution: noise or leakage into the shutdown pin can affect output voltage.

V_{OUT} (Pin 4): Regulator Output. Main output, requires a 10µF output capacitor. Can be shorted to V_{IN} or ground without damaging the device.

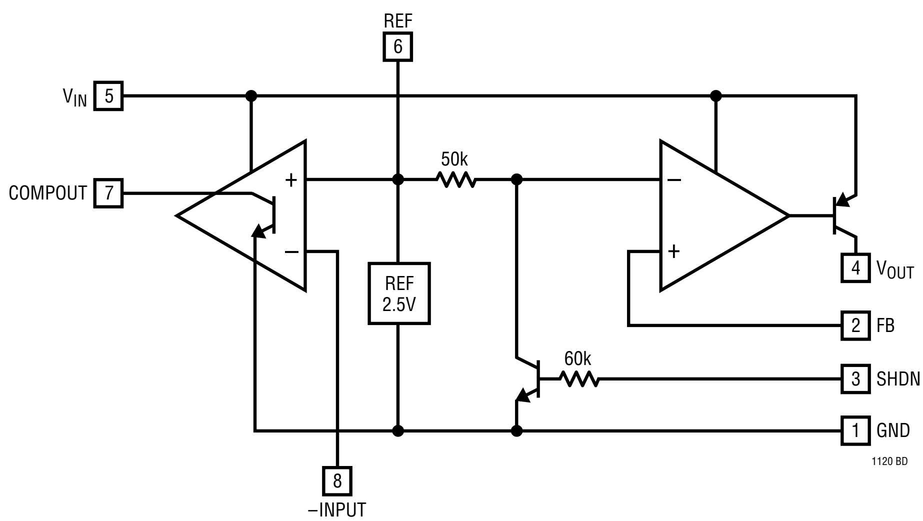
V_{IN} (Pin 5): Input Supply. Bypass with a 10µF capacitor. Must always be more positive than ground.

REF (Pin 6): Reference. 2.5V can source or sink current. May be shorted to ground or up to 5V. Voltages in excess of 5V can damage the device.

COMPOUT (Pin 7): Comparator Output. Open Collector NPN Output. May be connected to any voltage from ground to 36V more positive than ground (operates above V_{IN}). Short-circuit protected.

–INPUT (Pin 8): Comparator Input. Inverting comparator input.

BLOCK DIAGRAM



APPLICATIONS INFORMATION

The LT1120 is especially suited for micropower system applications. For example, the comparator section of the LT1120 may be used as a battery checker to provide an indication of low battery. Another type of system application for the LT1120 would be to generate the equivalent of split supplies off of a single power input. The regulator section provides regulated output voltage and the reference, which can both source and sink current, is then an artificial system ground providing a split supply for the system.

For many applications the comparator can be frequency compensated to operate as an amplifier. Compensation values for various gains are given in the data sheet. The comparator gain is purposely low to make it easier to frequency compensate as an amplifier. The NPN output is capable of sinking 10mA and can drive loads connected to voltages in excess of the positive power supply. This is useful for driving switches or linear regulators off of a higher input voltage.

APPLICATIONS INFORMATION

Reference

Internal to the LT1120 is a 2.5V trimmed class B output reference. The reference was designed to be able to source or sink current so it could be used in supply splitting applications as well as a general purpose reference for external circuitry. The design of the reference allows it to source typically 4mA or 5mA and sink 2mA. The available source and sink current decreases as temperature increases. It is sometimes desirable to decrease the AC output impedance by placing an output capacitor on them. The reference in the LT1120 becomes unstable with large capacitive loads placed directly on it. When using an output capacitor, about 20Ω should be used to isolate the capacitor from the reference pin. This 20Ω resistor can be placed directly in series with the capacitor or alternatively the reference line can have 20Ω placed in series with it and then a capacitor to ground. This is shown in Figure 1. Other than placing large capacitive loads on the reference, no other precautions are necessary and the reference is stable with nominal stray capacitances.

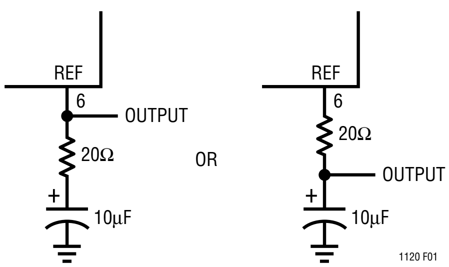


Figure 1. Bypassing Reference

Overload Protection

The main regulator in the LT1120 is current limited at approximately 250mA. The current limit is stable with both input voltage and temperature.

Like most other IC regulators, a minimum load is required on the output of the LT1120 to maintain regulation. For most standard regulators this is normally specified at 5mA. Of course, for a micropower regulator this would be a tremendously large current. The output must be large enough to absorb all the leakage current of the pass transistor at the maximum operating temperature. It also effects the transient response; low output currents have long recovery times from load transients. At high operating temperatures the minimum load current increases and having too low of a load current may cause the output to go unregulated. Devices are tested for minimum load current at high temperature. The output voltage setting resistors to the feedback terminal can usually be used to provide the minimum load current.

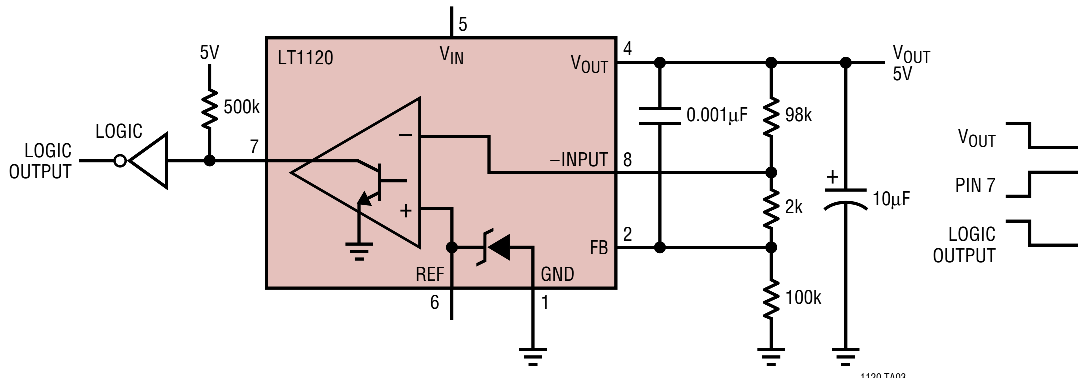
Frequency Compensation

The LT1120 is frequency compensated by a dominant pole on the output. An output capacitor of 10µF is usually large enough to provide good stability. Increasing the output capacitor above 10µF further improves stability. In order to ensure stability, a feedback capacitor is needed between the output pin and the feedback pin. This is because stray capacitance can form another pole with the large value of feedback resistors used with the LT1120. Also, a feedback capacitor minimizes noise pickup and improves ripple rejection.

With the large dynamic operating range of the output current, 10000:1, frequency response changes widely. Low AC impedance capacitors are needed to insure stability. While solid tantalum are best, aluminum electrolytics can be used but larger capacitor values may be needed.

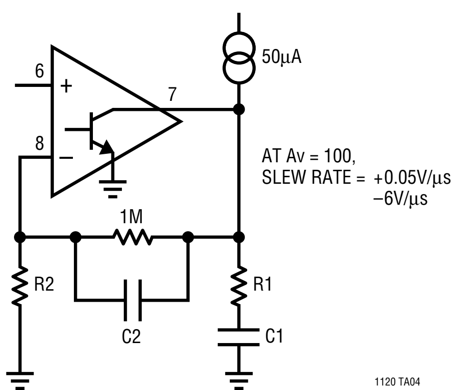
TYPICAL APPLICATIONS

Regulator with Output Voltage Monitor



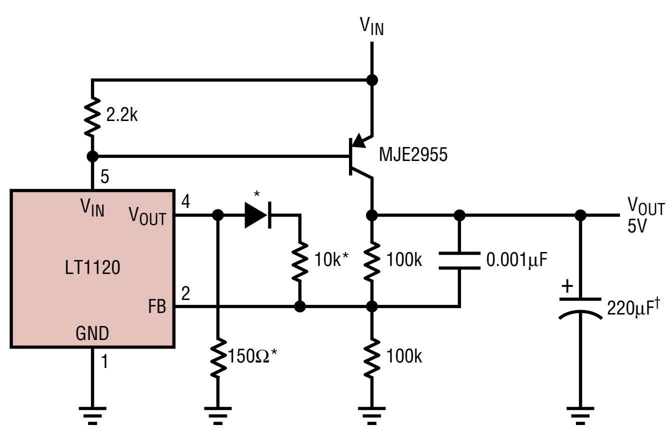
LOGIC OUTPUT GOES LOW WHEN V_{OUT} DROPS BY 100mV

Compensating the Comparator as an Op Amp



Av	R1	C1	C2	R2
1	33Ω	0.1µF	0.001µF	—
10	100Ω	0.047µF	—	100k
100	10k	0.002µF	—	10k

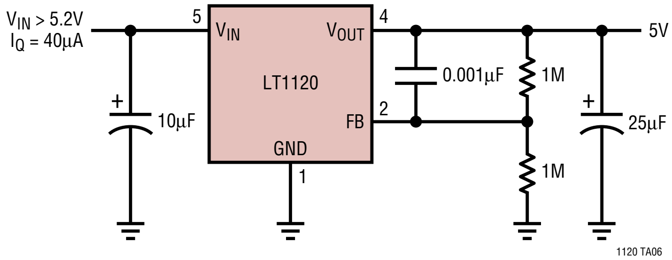
1A Low Dropout Regulator



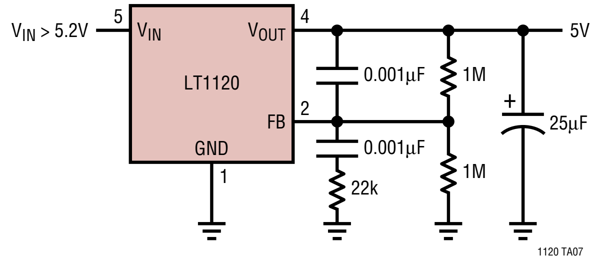
* FOR CURRENT LIMIT ≈ 1.5A
† MUST HAVE LOW ESR. SEVERAL 100µF CAPACITORS CAN BE PARALLELED.

TYPICAL APPLICATIONS

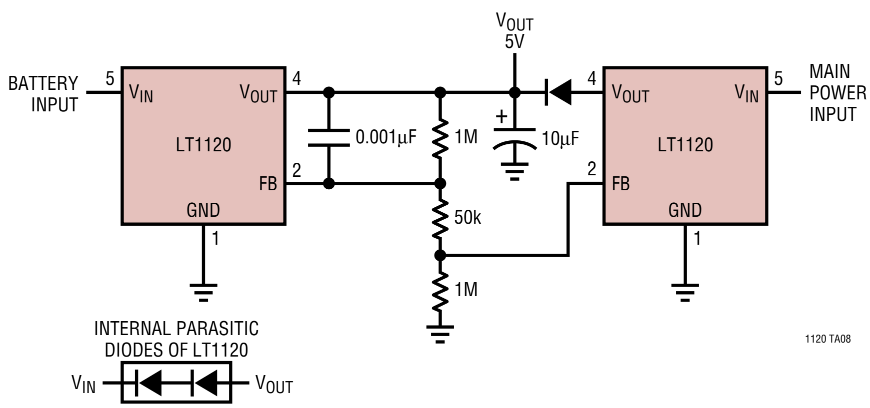
5V Regulator



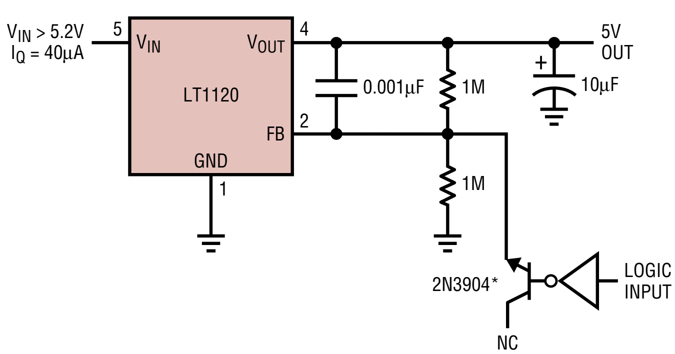
Regulator with Improved Transient Response



Battery-Backup Regulator

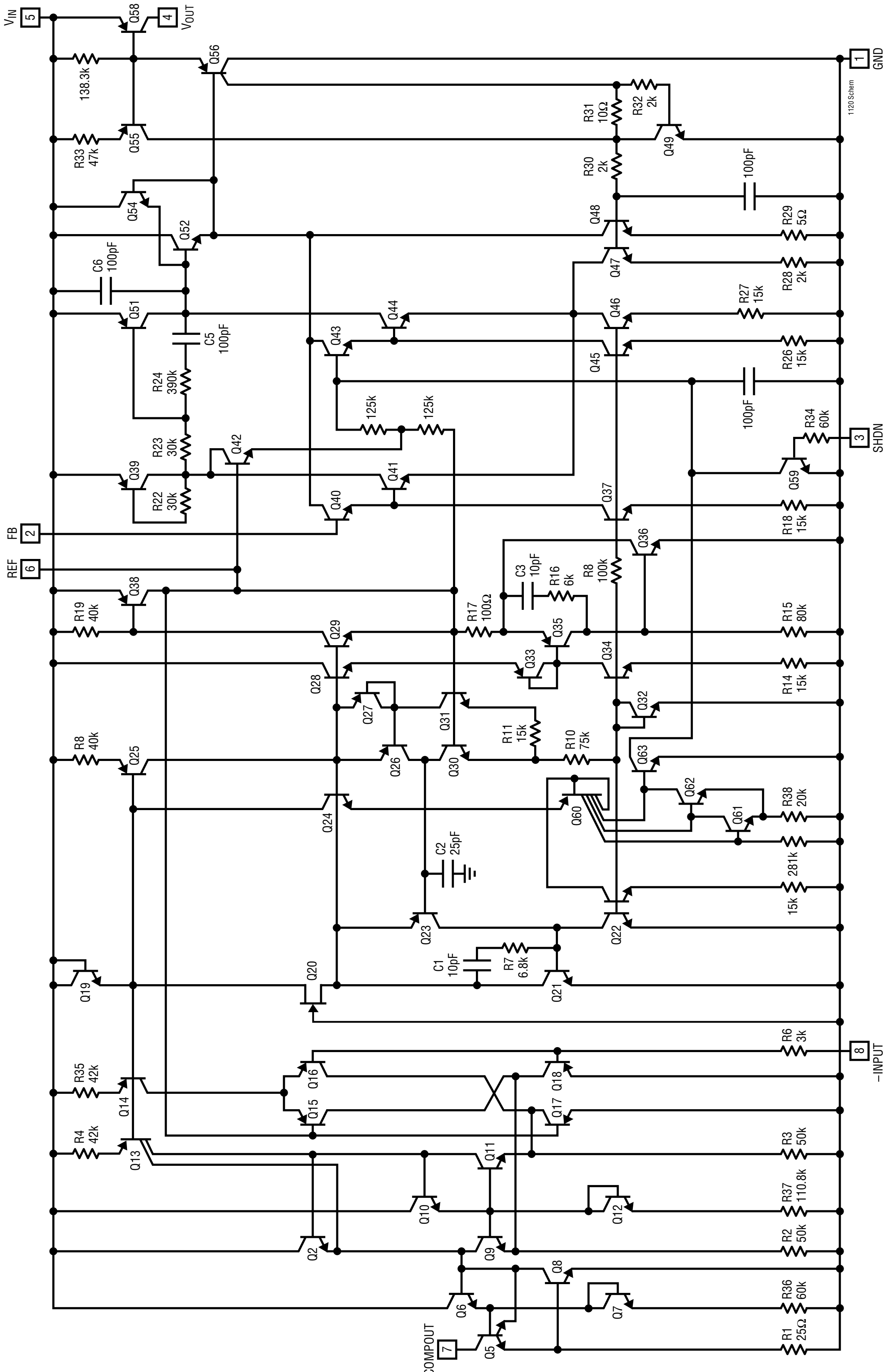


5V Regulator with Feedback Shutdown



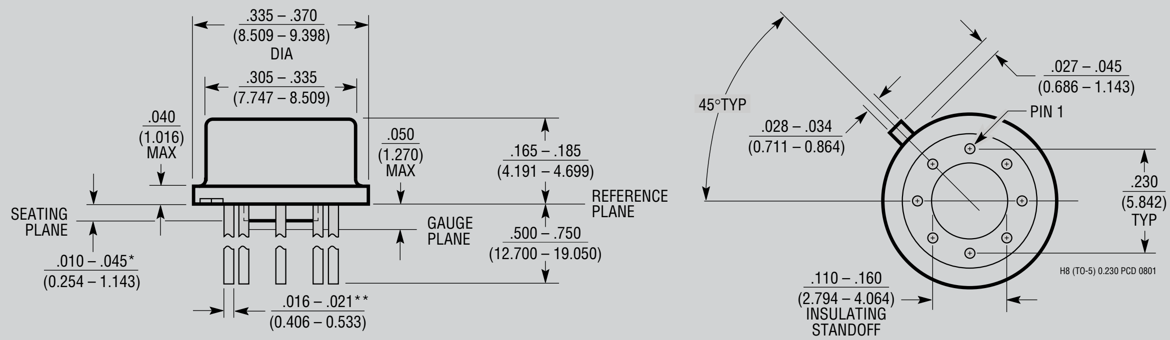
* TRANSISTOR USED BECAUSE OF LOW LEAKAGE CHARACTERISTICS.
TO TURN OFF THE OUTPUT OF THE LT1120 FORCE FB (PIN 2) > 2.5V.

SCHEMATIC DIAGRAM



PACKAGE DESCRIPTION

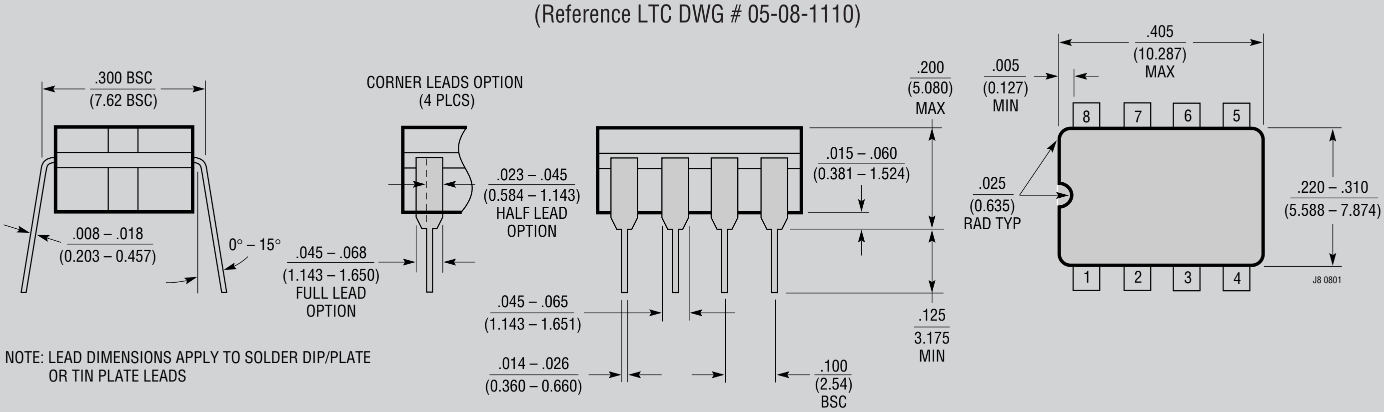
H Package
8-Lead TO-5 Metal Can (.230 Inch PCD)
(Reference LTC DWG # 05-08-1321)



*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $\frac{.016 – .024}{(0.406 – 0.610)}$

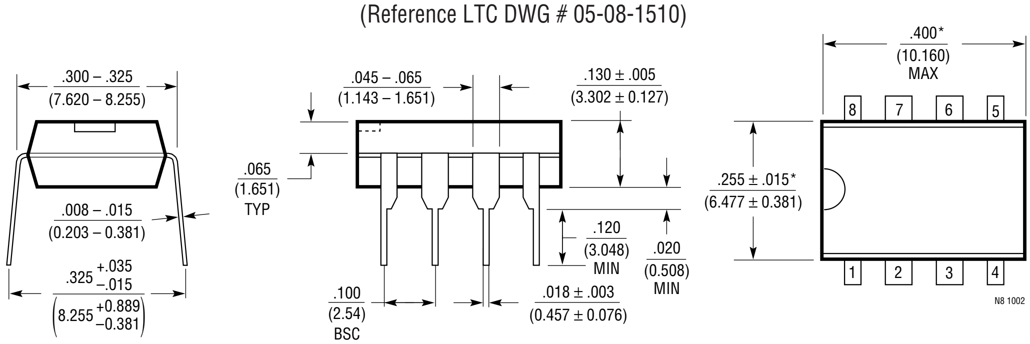
J8 Package
8-Lead CERDIP (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)



NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS

OBSOLETE PACKAGES

N8 Package
8-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

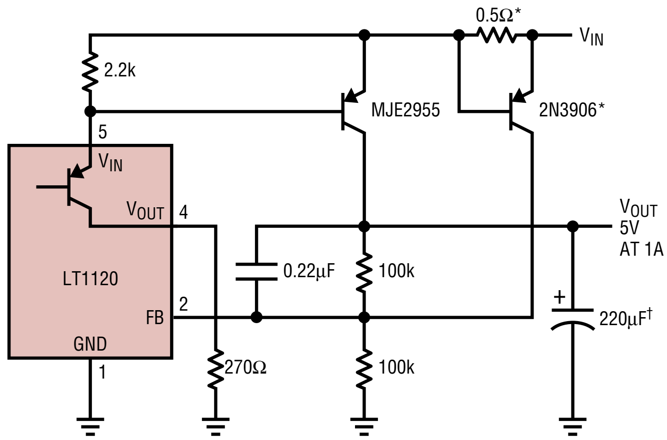


NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

TYPICAL APPLICATION

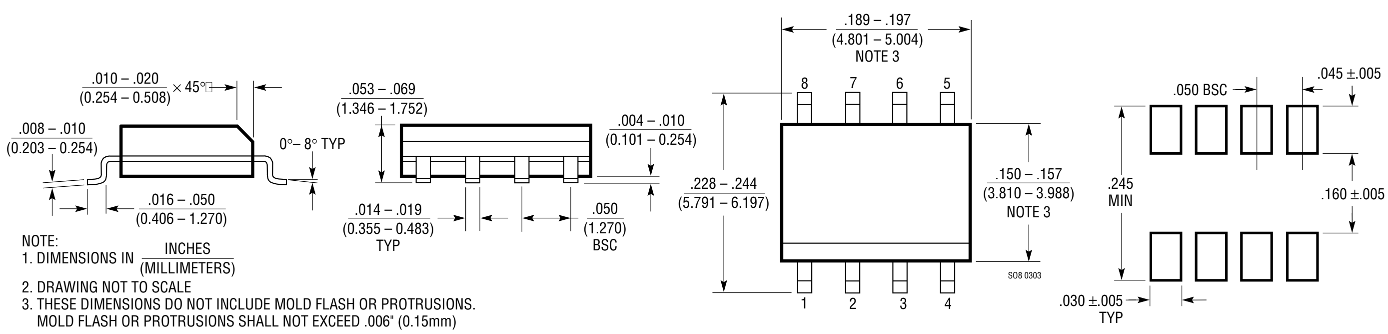
Current Limited 1A Regulator



* SETS CURRENT LIMIT BUT INCREASES DROPOUT VOLTAGE BY 0.5V
† MUST HAVE LOW ESR. SEVERAL 100µF CAPACITORS CAN BE PARALLELED

PACKAGE DESCRIPTION

S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
(Reference LTC DWG # 05-08-1610)



NOTE:
1. DIMENSIONS IN INCHES (MILLIMETERS)
2. DRAWING NOT TO SCALE
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1121	150mA Micropower Low Dropout Regulator	0.4V Dropout Voltage, Includes Shutdown, SOT-223, S8 Packages
LT1521	300mA Mircopower Low Dropout Regulator	Lowest I_Q Low Dropout Regulator, SOT-223, S8, MS8 Packages
LT1761	100mA Micropower Low Noise, Low Dropout Regulator	SOT-23, 20µV_{RMS} Noise, 20µA I_Q, ThinSOT Package

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