12V, 60mA Flash Memory Programming Supply

FEATURES

- **Guaranteed 60mA Output**
- **Regulated 12V ±5% Output Voltage**
- **No Inductors**
- Supply Voltage Range: 4.75V to 5.5V
- I_{CC} 0.5µA Typ in Shutdown
- Low Power: I_{CC} = 300µA
- 8-Pin SO Package
- Same Pinout as LTC1262 and MAX662

APPLICATIONS

- 12V Flash Memory Programming Supplies
- Compact 12V Op Amp Supplies
- Battery-Powered Systems

DESCRIPTION

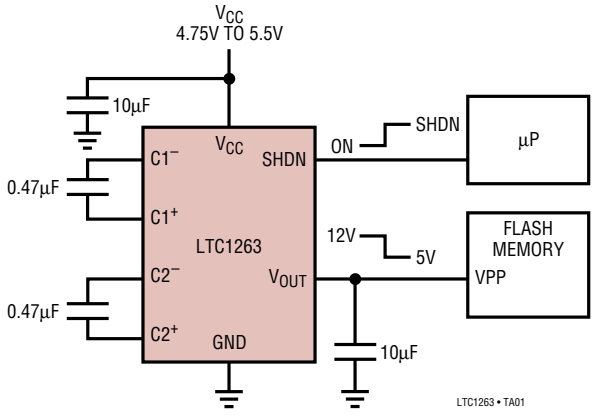
The LTC®1263 is a regulated 12V, 60mA output DC/DC converter. It provides the 12V ±5% output necessary to program double byte-wide flash memories. The output provides 60mA from input voltages as low as 4.75V without using any inductors. Only four external capacitors are required to complete an extremely small, surface mountable circuit. The output can be momentarily shorted to ground without damaging the part.

The active high TTL compatible Shutdown pin can be directly connected to a microprocessor. In the shutdown mode, the supply current typically drops to 0.5µA.

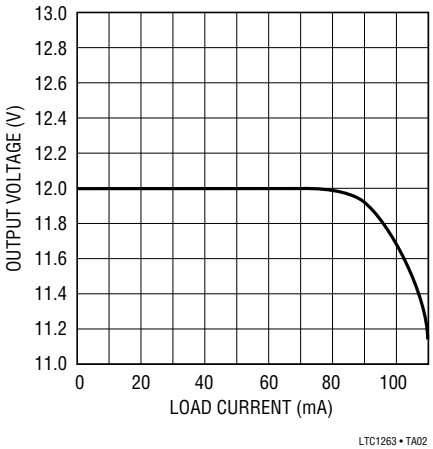
The LTC1263 is available in an 8-pin SO package.

TYPICAL APPLICATION

Flash Memory Programming Supply



Output Voltage vs Load

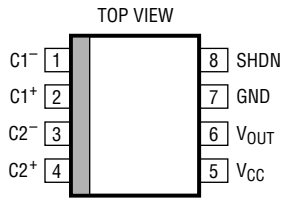


ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V_{DD}) 6V
Input Voltage (SHDN) ..... –0.3V to V_{CC} + 0.3V
I_{OUT} Continuous 90mA
Operating Temperature Range ..... 0°C to 70°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



S8 PACKAGE
8-LEAD PLASTIC SO

T_{JMAX} = 125°C, θ_{JA} = 150°C/W

ORDER PART NUMBER
LTC1263CS8

Consult factory for Industrial and Military grade parts and TSSOP package option.

ELECTRICAL CHARACTERISTICS

4.75V ≤ V_{CC} ≤ 5.5V, T_A = 0°C to 70°C (Notes 2, 3).

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{OUT}	Output Voltage	0mA ≤ I_{OUT} ≤ 60mA, V_{SHDN} = 0V	●	11.4		12.6	V
I_{CC}	Supply Current	No Load, V_{SHDN} = 0V	●		0.32	1.0	mA
I_{SHDN}	Shutdown Supply Current	No Load, V_{SHDN} = V_{CC}	●		0.5	10	µA
f_{OSC}	Oscillator Frequency	V_{CC} = 5V, I_{OUT} = 60mA			300		kHz
	Power Efficiency	V_{CC} = 5V, I_{OUT} = 60mA			76		%
R_{SW}	V_{CC} to V_{OUT} Switch Impedance	V_{CC} = V_{SHDN} = 5V, I_{OUT} = 0mA	●		0.3	1	kΩ
V_{IH}	SHDN Input High Voltage		●	2.4			V
V_{IL}	SHDN Input Low Voltage		●			0.8	V
	SHDN Input Current	V_{CC} = 5V, V_{SHDN} = 0V	●	– 40	– 20	–5	µA
		V_{CC} = 5V, V_{SHDN} = 5V	●	–10	0	10	µA
t_{ON}	Turn-On Time	C1 = C2 = 0.47µF, C3 = C4 = 10µF (Note 4) (Figures 1, 2)			600		µs
t_{OFF}	Turn-Off Time	C1 = C2 = 0.47µF, C3 = C4 = 10µF (Figures 1, 2)			10		ms

The ● denotes specifications which apply over the full operating temperature range.

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

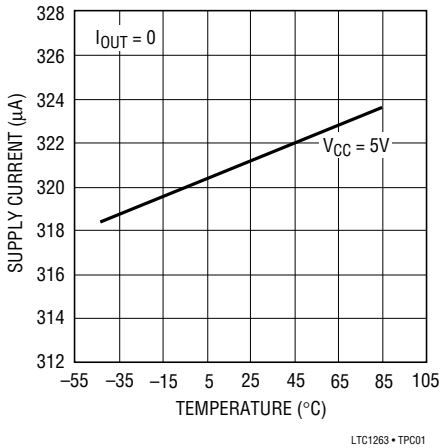
Note 2: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

Note 3: All typicals are given at V_{CC} = 5V, T_A = 25°C.

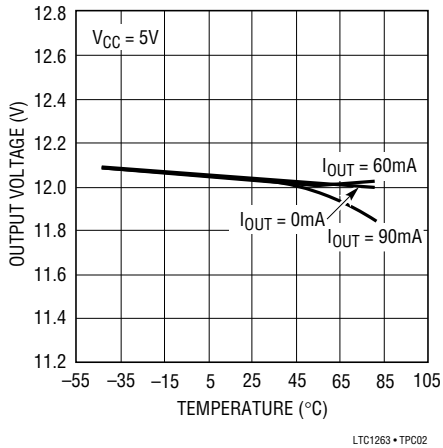
Note 4: A higher value output capacitor can be used but the "turn-on" and "turn-off" time will increase proportionally.

TYPICAL PERFORMANCE CHARACTERISTICS

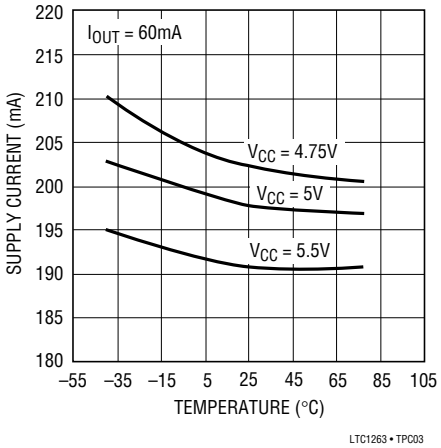
Supply Current



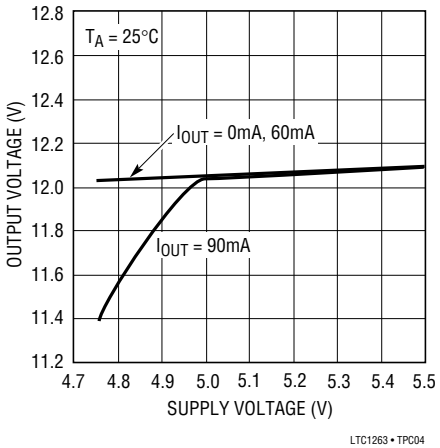
Output Voltage



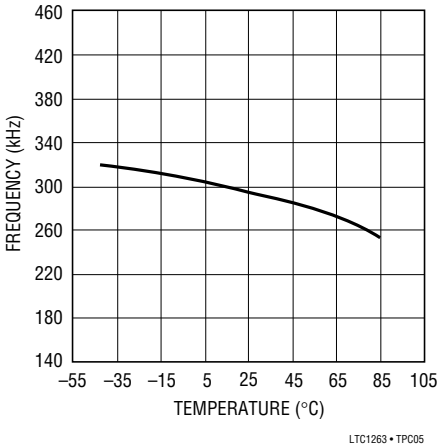
Supply Current



Output Voltage



Oscillator Frequency



PIN FUNCTIONS

$C1^-$ (Pin 1): First Charge Capacitor Negative Input. Connect a 0.47µF capacitor (C1) between $C1^+$ and $C1^-$.

$C1^+$ (Pin 2): First Charge Capacitor Positive Input. Connect a 0.47µF capacitor (C1) between $C1^+$ and $C1^-$.

$C2^-$ (Pin 3): Second Charge Capacitor Negative Input. Connect a 0.47µF capacitor (C2) between $C2^+$ and $C2^-$.

$C2^+$ (Pin 4): Second Charge Capacitor Positive Input. Connect a 0.47µF capacitor (C2) between $C2^+$ and $C2^-$.

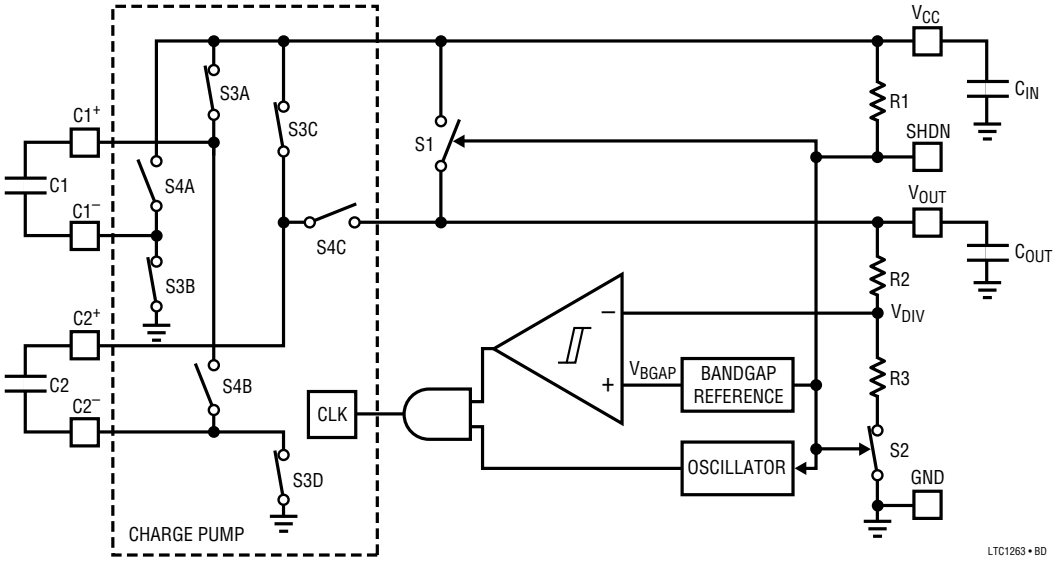
V_{CC} (Pin 5): Positive Supply Input. $4.75V \leq V_{CC} \leq 5.5V$. Requires a 10µF bypass capacitor to ground (C4).

V_{OUT} (Pin 6): 12V Output. Requires a 10µF or a higher value bypass capacitor to ground (C3). $V_{OUT} = V_{CC}$ when in the shutdown mode.

GND (Pin 7): Ground.

SHDN (Pin 8): Active-High TTL Logic Level Shutdown Pin. SHDN is internally pulled up to V_{CC}. Connect to GND for normal operation. In shutdown mode, the charge pump is turned off and $V_{OUT} = V_{CC}$.

BLOCK DIAGRAM



S1 AND S2 SHOWN WITH SHDN PIN LOW. S3A, S3B, S3C, S3D, S4A, S4B AND S4C SHOWN CHARGING C1 AND C2 WITH OSCILLATOR OUTPUT LOW AND $V_{DIV} < V_{BGAP} – V_{HYST}$. AT OSCILLATOR OUTPUT HIGH, S3A, S3B, S3C AND S3D OPEN WHILE S4A, S4B AND S4C CLOSE TO CHARGE V_{OUT}. COMPARATOR HYSTERESIS IS $\pm V_{HYST}$

TIMING DIAGRAMS

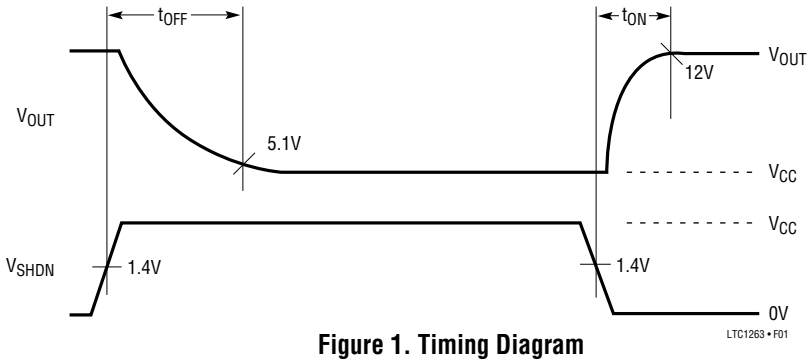


Figure 1. Timing Diagram

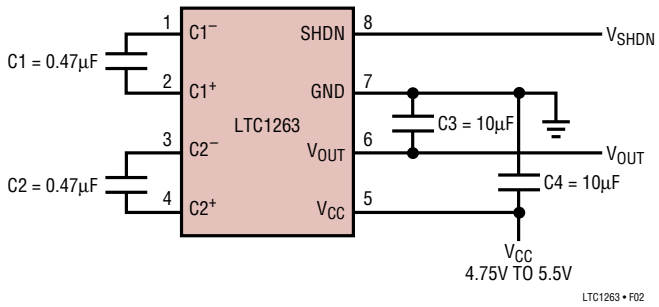


Figure 2. Timing Circuit

OPERATION

The LTC1263 uses a charge pump tripler to generate 12V from a V_{CC} of 5V. The charge pump is clocked by an internal oscillator. The oscillator frequency is not critical and may vary from the typical value of 300kHz. When the oscillator output is low, C1 and C2 are each connected between V_{CC} and GND, charging them to V_{CC} (see Figure 3). When the oscillator output goes high, C1 and C2 are stacked in series with the bottom plate of C1 pulled to V_{CC} (see Figure 4). The top plate of C2 is switched to charge C_{OUT}, which enables V_{OUT} to rise.

V_{OUT} is regulated to within 5% of 12V by an oscillator pulse gating scheme that turns the charge pump on and off based on the comparator results of V_{OUT} and a reference voltage. First, a resistor divider senses V_{OUT}; if the output of the divider (V_{DIV}) is less than the output of a bandgap (V_{BGAP}) by the hysteresis voltage (V_{HYST}) of the comparator, then oscillator pulses are applied to the charge pump to raise V_{OUT}. When V_{DIV} is above V_{BGAP} by V_{HYST}, the oscillator pulses are prevented from clocking the charge pump. As a result, V_{OUT} drops until V_{DIV} is below V_{BGAP} by V_{HYST} again.

To ensure proper start-up when V_{OUT} is lower than V_{CC} and maintain proper operation when V_{OUT} is higher than V_{CC}, the gates of all internal switches are driven between GND and the higher of either V_{OUT} or V_{CC}.

To reduce supply current, the LTC1263 may be put into shutdown mode by "floating" the SHDN pin or connecting it to V_{CC}. In this mode, the bandgap, comparator, oscillator and resistor divider are switched off to reduce the supply current to typically 0.5µA. At the same time an internal switch shorts V_{OUT} to V_{CC}; V_{OUT} takes 10ms (typ) to reach 5.1V (see t_{OFF} in Figure 1). When the SHDN pin is low, the LTC1263 exits shutdown and the charge pump operates to raise V_{OUT} to 12V. V_{OUT} takes 600µs (typ) to reach the lower regulation limit of 11.4V (see t_{ON} in Figure 1).

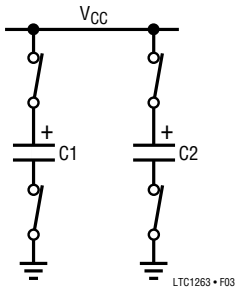


Figure 3. C1 and C2 Charge to V_{CC}

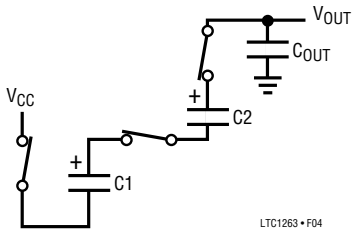


Figure 4. C1 and C2 Stacked in Series with C1⁻ Tied to V_{CC}

APPLICATIONS INFORMATION

Choice of Capacitors

The LTC1263 is tested with the capacitors shown in Figure 2. C1 and C2 are 0.47µF ceramic capacitors and C_{IN} and C_{OUT} are 10µF tantalum capacitors. Refer to Table 1 if other choices are desired.

Table 1. Recommended Capacitor Types and Values

CAPACITOR	CERAMIC	TANTALUM	ALUMINUM
C1, C2	0.47µF to 1µF	Not Recommended	Not Recommended
C_{OUT}	10µF (Min)	10µF (Min)	10µF (Min)
C_{IN}	10µF (Min)	10µF (Min)	10µF (Min)

C1 and C2 should be ceramic capacitors with values in the range of 0.47µF to 1µF. Higher values provide better load regulation. Tantalum capacitors are not recommended as the higher ESR of these capacitors degrades performance at high load currents and V_{CC} = 4.75V.

C_{IN} and C_{OUT} can be ceramic, tantalum or electrolytic capacitors. The ESR of C_{OUT} introduces steps in the V_{OUT} waveform whenever the charge pump charges C_{OUT}. This tends to increase V_{OUT} ripple. Ceramic or tantalum capacitors are recommended for C_{OUT} if minimum ripple is

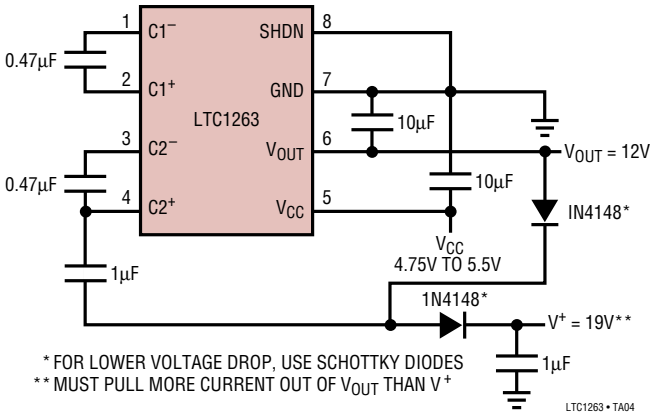
APPLICATIONS INFORMATION

desired. (The LTC1263 does not require a 0.1µF capacitor between V_{CC} and V_{OUT} for stability.)

Besides using it to program flash memories, the LTC1263 can also provide multiple supply voltages with the help of two diodes and two capacitors. Output voltages of 19V and –7V can easily be obtained. In other words, the LTC1263 can power dual supply (±5V) and single supply (15V) op amps.

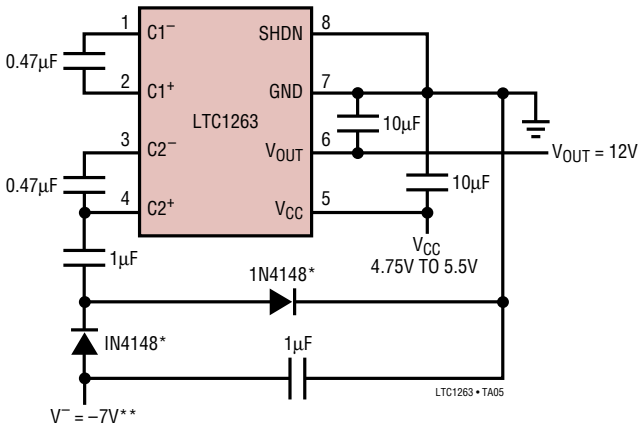
TYPICAL APPLICATIONS

Dual Voltage Supply Output at 12V and 19V



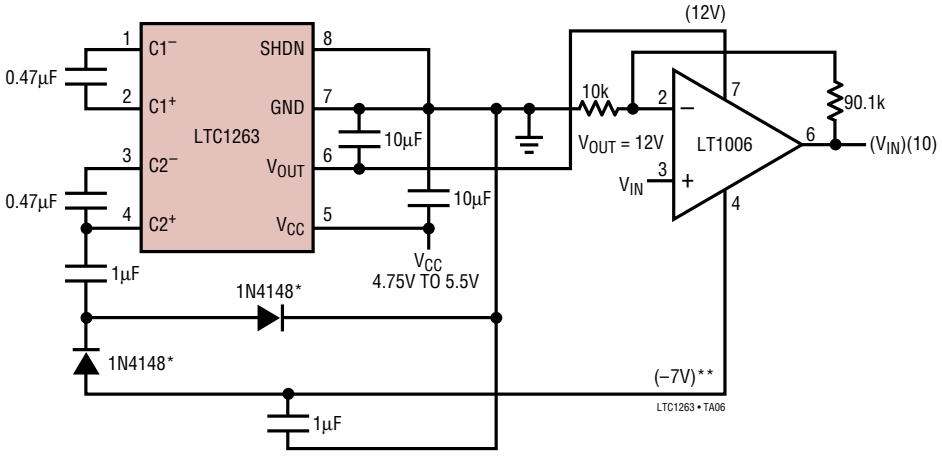
* FOR LOWER VOLTAGE DROP, USE SCHOTTKY DIODES
** MUST PULL MORE CURRENT OUT OF V_{OUT} THAN V^+

Dual Supply Voltage Output at 12V and –7V



*FOR LOWER VOLTAGE DROP, USE SCHOTTKY DIODES
**MUST PULL MORE CURRENT OUT OF V_{OUT} THAN V^-

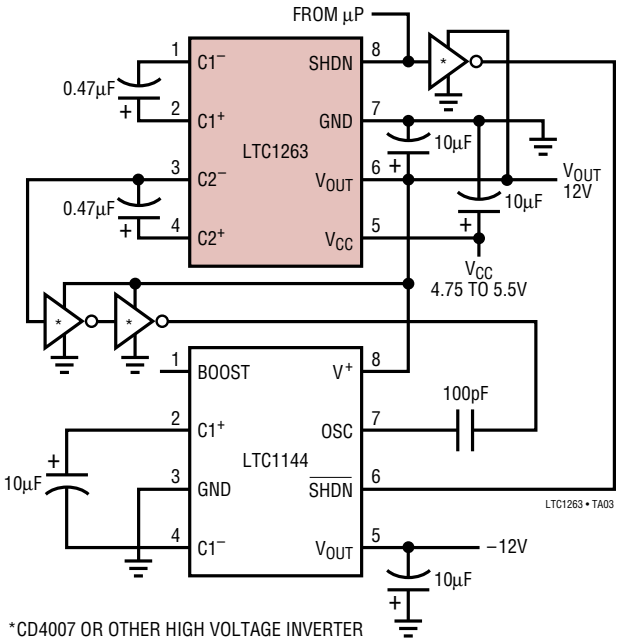
Gain of 10 Amplifier Using LT®1006 Powered by LTC1263



* FOR LOWER VOLTAGE DROP, USE SCHOTTKY DIODES
** MUST PULL MORE CURRENT OUT OF V_{OUT} THAN V^-

TYPICAL APPLICATIONS

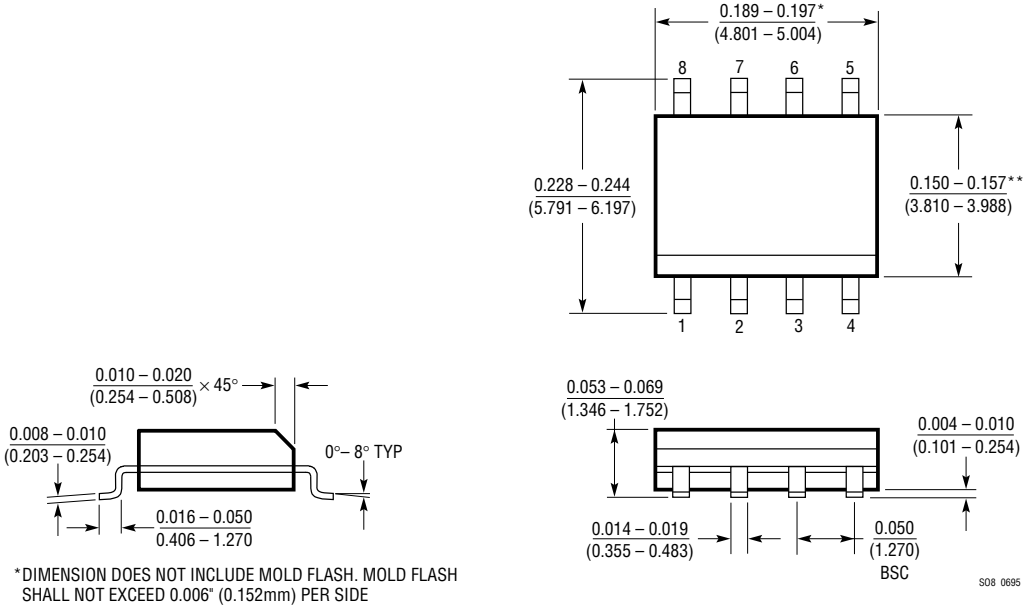
Dual Voltage Supply Output at 12V and –12V



PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

S8 Package
8-Lead Plastic Small Outline (Narrow 0.150)
(LTC DWG # 05-08-1610)

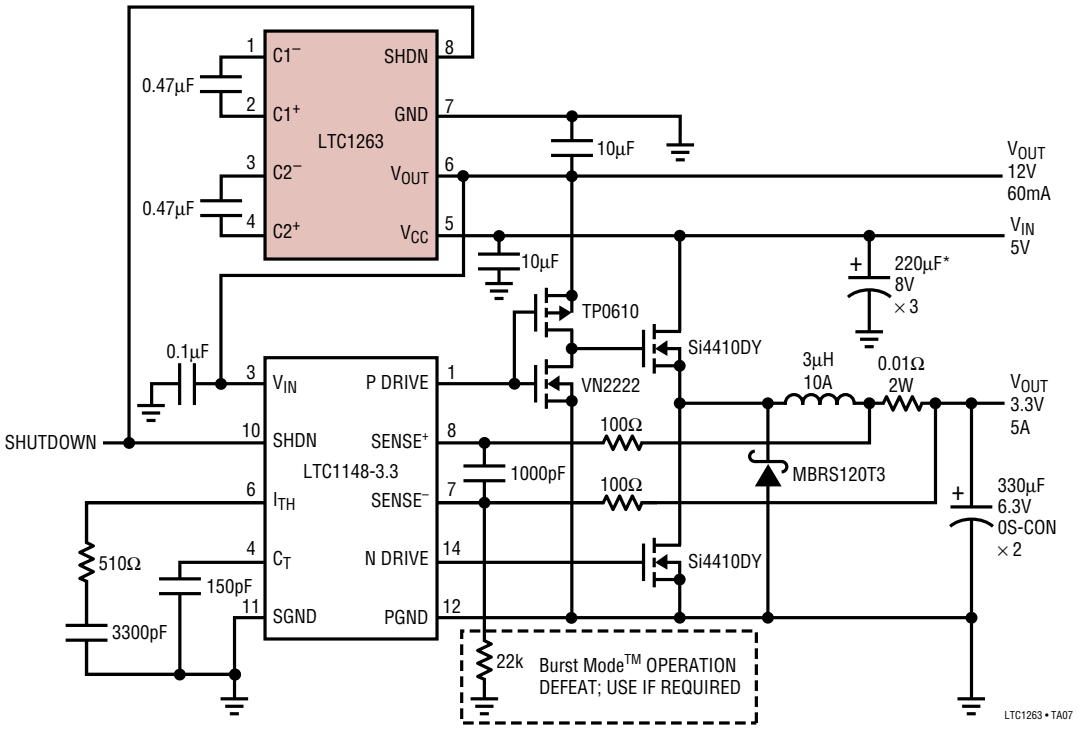


*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

TYPICAL APPLICATION

5V to 3.3V/5A Converter with 12V/60mA Auxiliary Output



*PANASONIC BCGCOKB220R OR EQUIVALENT

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RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC1044A	12V CMOS Voltage Converter	1.5V to 12V Supply Range, 95% Efficiency, $\pm V_{OUT}$
LT1106/LT1107/LT1108	Micropower DC/DC Converter, 5V and 12V	Adjustable V_{OUT} from V_{IN} = 3V, Use Inductor
LTC1262	12V, 30mA Flash Memory Program Supply	1/2 Source Current as LTC1263, Cannot Short V_{OUT} to GND
LT1301/LT1302/LT1303	Micropower High Efficiency 5V/12V, DC/DC Converter	5V at 600mA or 12V at 120mA, Use Inductor
LT1312	Single PCMCIA VPP Driver/Regulator	120mA Output, Current Limit, Thermal Shutdown
LTC1429	Regulating Positive to Negative Charge Pump	Fixed –4.1V or Adjustable Output, No Inductors

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