

1.3MHz Step-Up DC/DC Converter in SC70 and ThinSOT

March 2003

FEATURES

- 1.3MHz Switching Frequency
- High Output Voltage: Up to 36V
- 300mA Integrated Switch
- 12V at 70mA from 5V Input
- 5V at 60mA from 3.3V Input
- Wide Input Range: 2.5V to 16V
- Uses Small Surface Mount Components
- Low Shutdown Current: <1 μ A
- SC70 and Low Profile (1mm) ThinSOT™ Packages

APPLICATIONS

- Digital Cameras
- CCD Bias Supply
- XDSL Power Supply
- TFT-LCD Bias Supply
- Local 5V or 12V Supply
- Medical Diagnostic Equipment
- Battery Backup

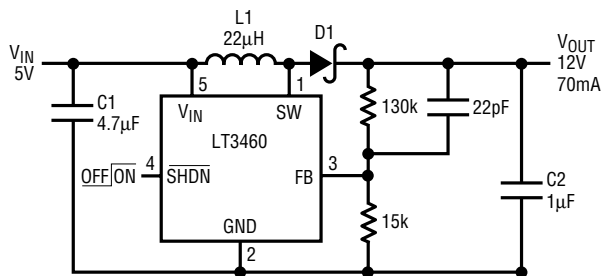
DESCRIPTION

The LT[®]3460 is a general purpose step-up DC/DC converter. The LT3460 switches at 1.3MHz, allowing the use of tiny, low cost and low height capacitors and inductors. The constant frequency results in low, predictable output noise that is easy to filter. The high voltage switch in the LT3460 is rated at 38V, making the device ideal for boost converters up to 36V. The LT3460 can generate 12V at up to 70mA from a 5V supply.

The LT3460 is available in SC70 and ThinSOT packages.

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ThinSOT is a trademark of Linear Technology Corporation

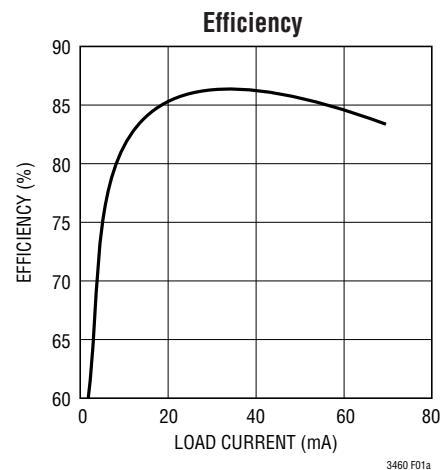
TYPICAL APPLICATION



C1: TAIYO YUDEN X5R JMK212BJ475KG
C2: TAIYO YUDEN X5R EMK316BJ105
D1: CENTRAL SEMICONDUCTOR CMDSH2-3
L1: MURATA LQH32CN-220 OR EQUIVALENT

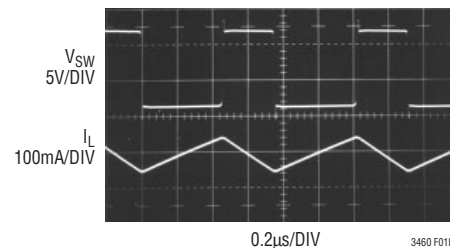
3460 F01

Figure 1. 5V to 12V, 70mA Step-Up DC/DC Converter



3460 F01a

Switching Waveforms



0.2 μ s/DIV

3460 F01b

ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Voltage (V_{IN})	16V	Operating Ambient Temperature Range (Note 2)	-40°C to 85°C
SW Voltage	38V	Maximum Junction Temperature	125°C
FB Voltage	5V	Storage Temperature Range	-65°C to 150°C
SHDN Voltage	16V	Lead Temperature (Soldering, 10 sec)	300°C

PACKAGE/ORDER INFORMATION

<p>S5 PACKAGE 5-LEAD PLASTIC TSOT-23</p> <p>$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 256^{\circ}C/W$ IN FREE AIR $\theta_{JA} = 120^{\circ}C/W$ ON BOARD OVER GROUND PLANE</p>	ORDER PART NUMBER	<p>S6 PACKAGE 6-LEAD PLASTIC SC70</p> <p>$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 400^{\circ}C/W$ IN FREE AIR $\theta_{JA} = 270^{\circ}C/W$ ON BOARD OVER GROUND PLANE</p>	ORDER PART NUMBER
	LT3460ES5		LT3460ESC6
	S5 PART MARKING		SC6 PART MARKING
LTB1	LAAF		

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 $T_A = 25^{\circ}C$, $V_{IN} = 3V$, $V_{SHDN} = 3V$, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Minimum Operating Voltage		2.5			V
Maximum Operating Voltage				16	V
Feedback Voltage		● 1.235 1.225	1.255	1.275 1.280	V V
Feedback Line Regulation			0.0015		%/V
FB Pin Bias Current		● 5	25	80	nA
Supply Current	$\overline{SHDN} = 0V$		2.0 0.1	3.0 0.5	mA μA
Switching Frequency		1.0	1.3	1.7	MHz
Maximum Duty Cycle		85	90		%
Switch Current Limit		300	420	600	mA
Switch V_{CESAT}	$I_{SW} = 250mA$		320	450	mV
Switch Leakage Current	$V_{SW} = 5V$		0.01	1	μA
SHDN Voltage High		1.5			V
SHDN Voltage Low				0.4	V
SHDN Pin Bias Current			40		μA

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

Note 2: The LT3460E is guaranteed to meet specifications from 0°C to 70°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

PIN FUNCTIONS (ThinSOT/SC70 Packages)

SW (Pin 1/Pin 1): Switch Pin. Connect inductor/diode here. Minimize trace at this pin to reduce EMI.

GND (Pin 2/Pins 2 and 5): Ground Pin. Tie directly to local ground plane.

FB (Pin 3/Pin 3): Feedback Pin. Reference voltage is 1.255V. Connect resistor divider tap here. Minimize trace area at FB. Set V_{OUT} according to $V_{OUT} = 1.255V (1 + R1/R2)$.

SHDN (Pin 4/Pin 4): Shutdown Pin. Tie to 1.5V or higher to enable device; 0.4V or less to disable device. Also functions as soft-start. Use RC filter (47k, 47nF typ) as shown in Figure 2.

V_{IN} (Pin 5/Pin 6): Input Supply Pin. Must be locally bypassed.

BLOCK DIAGRAM

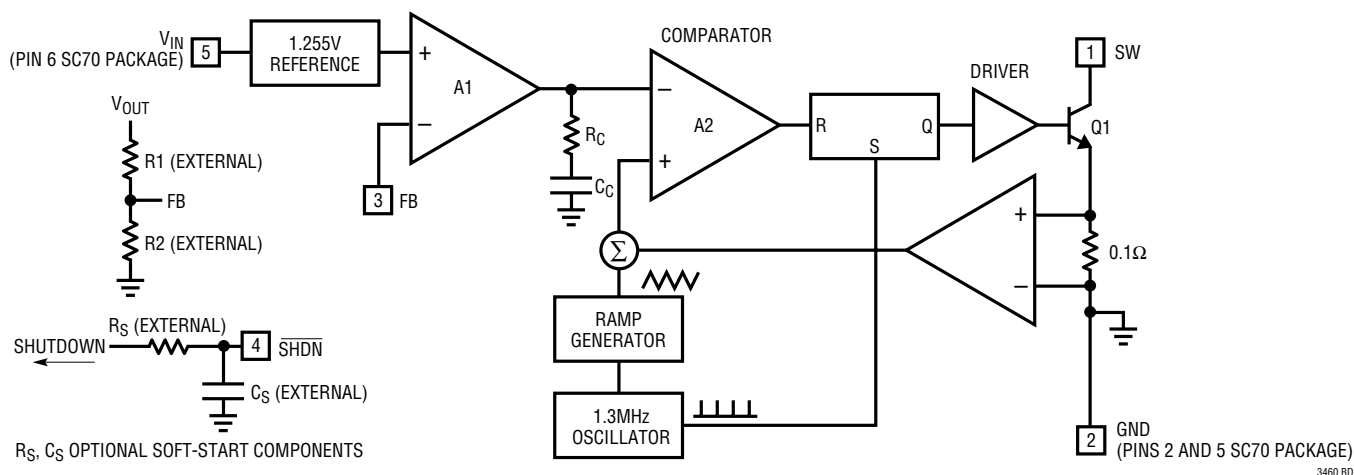


Figure 2. Block Diagram

OPERATION

The LT3460 uses a constant frequency, current mode control scheme to provide excellent line and load regulation. Operation can be best understood by referring to the block diagram in Figure 2. At the start of each oscillator cycle, the SR latch is set, which turns on the power switch Q1. A voltage proportional to the switch current is added to a stabilizing ramp and the resulting sum is fed into the positive terminal of the PWM comparator A2. When this voltage exceeds the level at the negative input of A2, the SR

latch is reset turning off the power switch. The level at the negative input of A2 is set by the error amplifier A1, and is simply an amplified version of the difference between the feedback voltage and the reference voltage of 1.255V. In this manner, the error amplifier sets the correct peak current level to keep the output in regulation. If the error amplifier's output increases, more current is delivered to the output; if it decreases, less current is delivered.

OPERATION

Layout Hints

The high speed operation of the LT3460 demands careful attention to board layout. You will not get advertised

performance with careless layout. Figure 3 shows the recommended component placement.

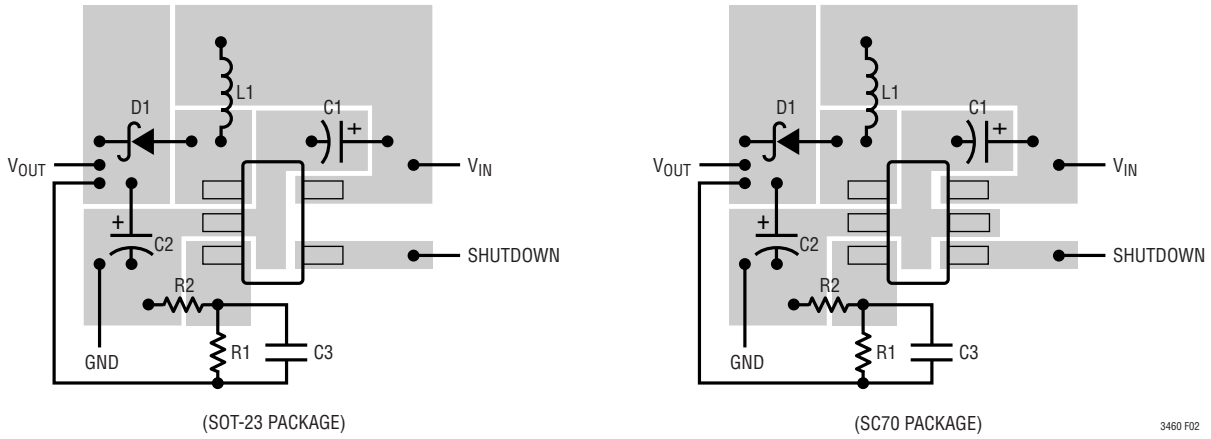
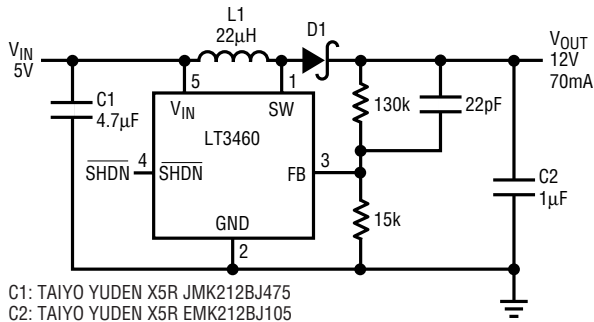


Figure 3. Suggested Layout

TYPICAL APPLICATIONS

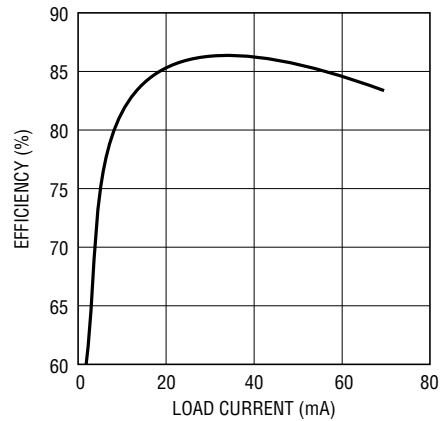
5V to 12V Step-Up Converter



C1: TAIYO YUDEN X5R JMK212BJ475
 C2: TAIYO YUDEN X5R EMK212BJ105
 D1: CENTRAL SEMICONDUCTOR CMDSH2-3
 L1: MURATA LQH32CN-220 OR EQUIVALENT

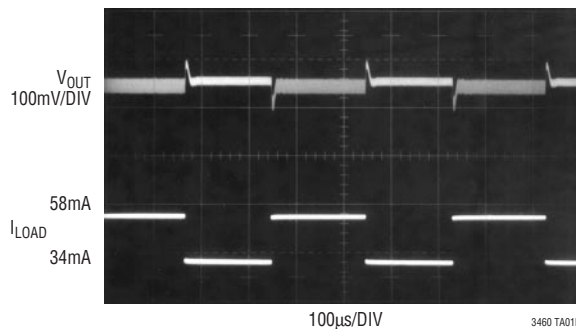
3460 TA01

Efficiency



3460 TA01a

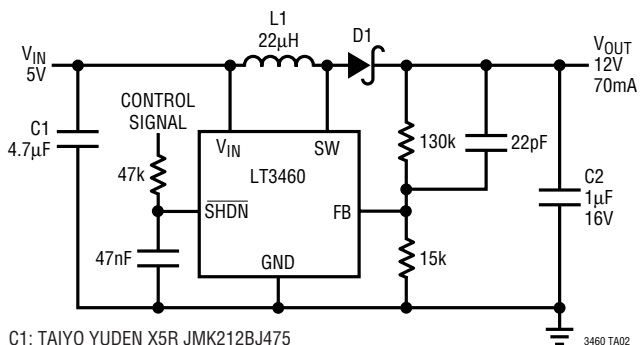
Load Step Response



3460 TA01b

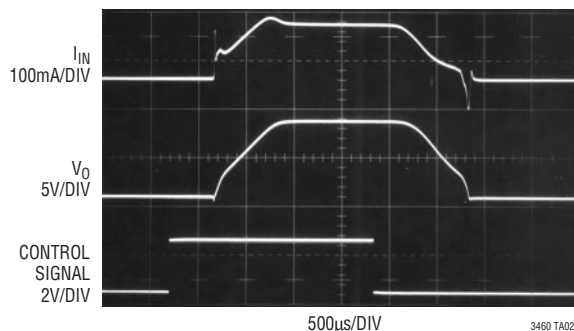
TYPICAL APPLICATIONS

5V to 12V with Soft-Start Circuit

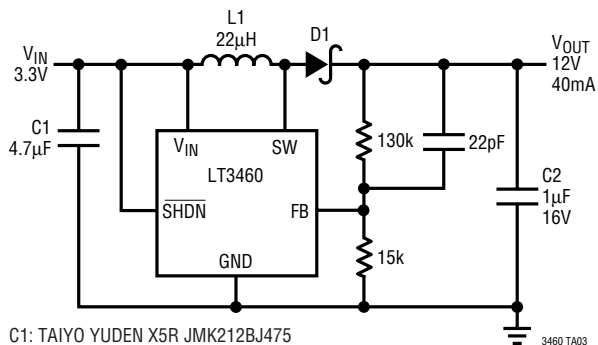


- C1: TAIYO YUDEN X5R JMK212BJ475
- C2: TAIYO YUDEN X5R EMK212BJ105
- D1: CENTRAL SEMICONDUCTOR CMDSH2-3
- L1: MURATA LQH32CN-220 OR EQUIVALENT

Input Current and Output Voltage

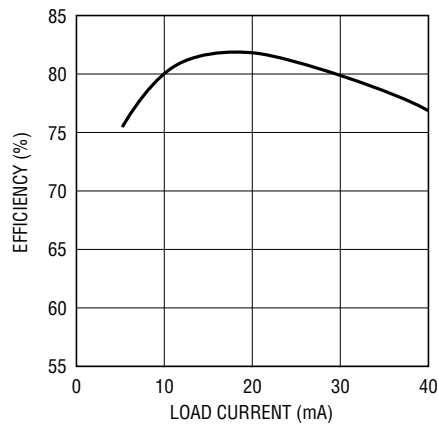


3.3V to 12V Step-Up Converter



- C1: TAIYO YUDEN X5R JMK212BJ475
- C2: TAIYO YUDEN X5R EMK212BJ105
- D1: CENTRAL SEMICONDUCTOR CMDSH2-3
- L1: MURATA LQH32CN-220 OR EQUIVALENT

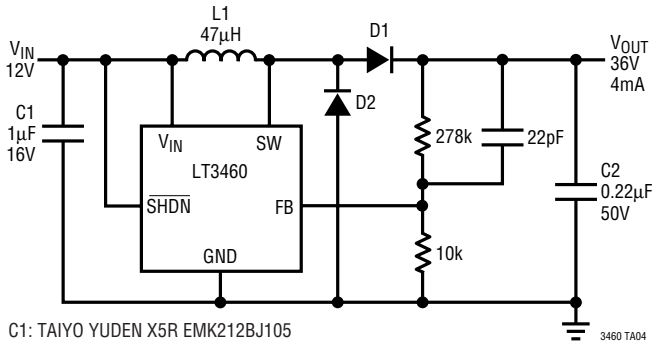
Efficiency



3460 TA03a

TYPICAL APPLICATIONS

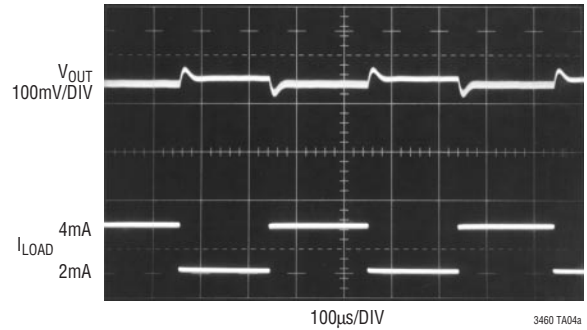
12V to 36V Step-Up Converter



C1: TAIYO YUDEN X5R EMK212BJ105
 C2: TAIYO YUDEN X7R UMK212BJ224
 D1, D2: CENTRAL SEMICONDUCTOR CMOD4448
 L1: TAIYO YUDEN LB2012

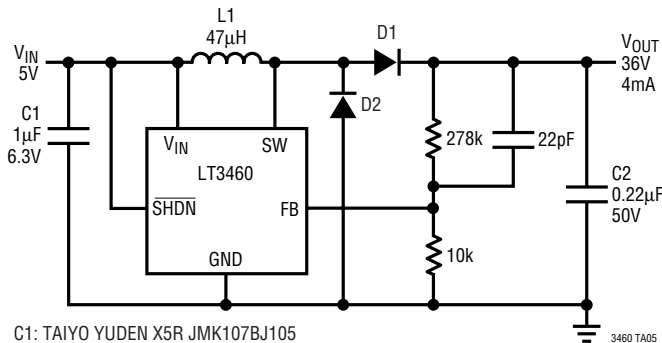
3460 TA04

Load Step Response



3460 TA04a

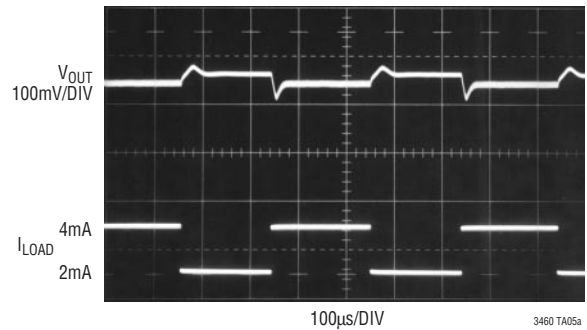
5V to 36V Step-Up Converter



C1: TAIYO YUDEN X5R JMK107BJ105
 C2: TAIYO YUDEN X7R UMK212BJ224
 D1, D2: CENTRAL SEMICONDUCTOR CMOD4448
 L1: TAIYO YUDEN LB2012

3460 TA05

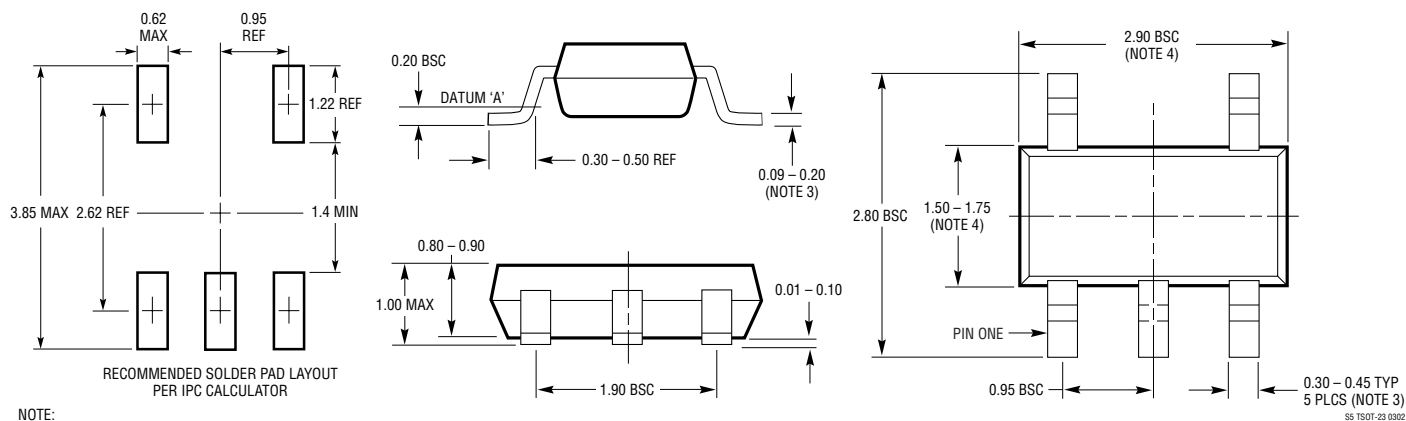
Load Step Response



3460 TA05a

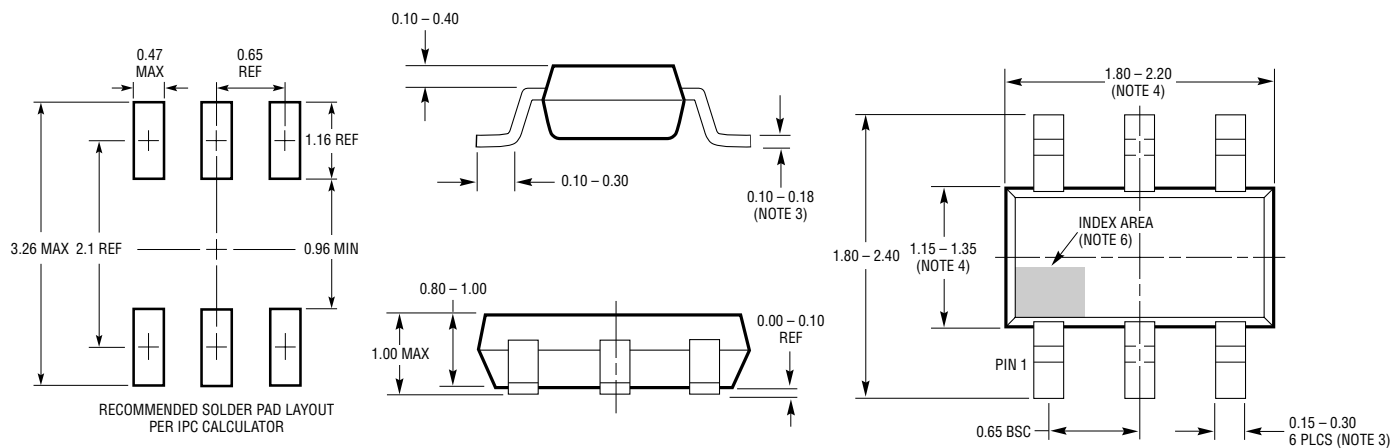
PACKAGE DESCRIPTION

S5 Package 5-Lead Plastic TSOT-23 (Reference LTC DWG # 05-08-1635)



- NOTE:
1. DIMENSIONS ARE IN MILLIMETERS
 2. DRAWING NOT TO SCALE
 3. DIMENSIONS ARE INCLUSIVE OF PLATING
 4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
 5. MOLD FLASH SHALL NOT EXCEED 0.254mm
 6. JEDEC PACKAGE REFERENCE IS MO-193

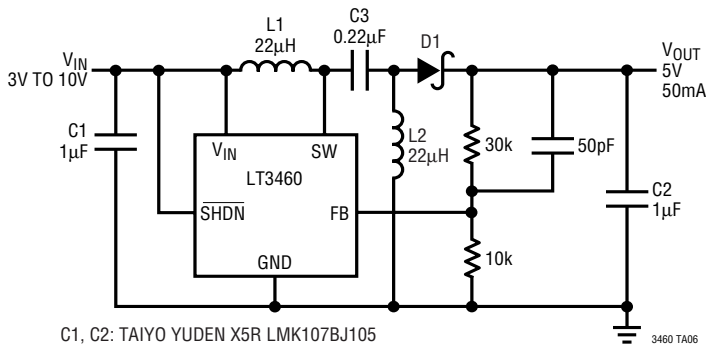
SC6 Package 6-Lead Plastic SC70 (Reference LTC DWG # 05-08-1638)



- NOTE:
1. DIMENSIONS ARE IN MILLIMETERS
 2. DRAWING NOT TO SCALE
 3. DIMENSIONS ARE INCLUSIVE OF PLATING
 4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
 5. MOLD FLASH SHALL NOT EXCEED 0.254mm
 6. DETAILS OF THE PIN 1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE INDEX AREA
 7. EIAJ PACKAGE REFERENCE IS EIAJ SC-70

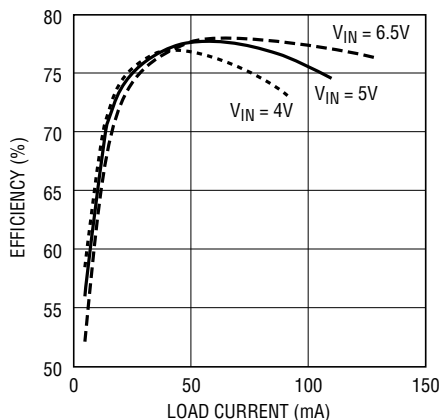
TYPICAL APPLICATIONS

5V to 5V SEPIC



C1, C2: TAIYO YUDEN X5R LMK107BJ105
 C3: TAIYO YUDEN X7R LMK107BJ224
 D1: ON SEMICONDUCTOR MBR0520
 L1, L2: MURATA LQH32CN-220 OR EQUIVALENT

Efficiency



3460 TA06a

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1615/LT1615-1	Constant Off-Time, Step-Up DC/DC Converter	350mA Switch, V_{OUT} to 36V, $I_Q = 20\mu A$, ThinSOT Package
LT1944/LT1944-1	Dual Off-Time, Step-Up DC/DC Converter	350mA Switch $\times 2$, V_{OUT} to 36V, $I_Q = 20\mu A$, MS10 Package
LTC3400/LTC3400B	1.2MHz, Synchronous Step-Up DC/DC Converter	600mA Switch, V_{IN} : 0.85V to 5V, $I_Q = 19\mu A$, ThinSOT Package
LTC3401	3MHz, Synchronous Step-Up DC/DC Converter	1A Switch, V_{IN} : 0.5V to 5V, $I_Q = 38\mu A$, MS10 Package
LTC3402	3MHz, Synchronous Step-Up DC/DC Converter	2A Switch, V_{IN} : 0.5V to 5V, $I_Q = 38\mu A$, MS10 Package
LT3464	Micropower Step-Up DC/DC Converter	85mA Switch, Contains Diode and Output Disconnect PNP, $I_Q = 25\mu A$