

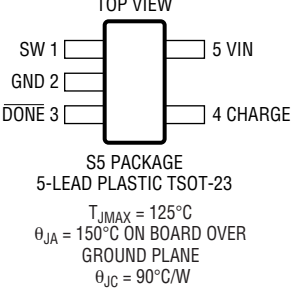
# LT3468/LT3468-1/LT3468-2

## ABSOLUTE MAXIMUM RATINGS

(Note 1)

|                                            |                |
|--------------------------------------------|----------------|
| $V_{IN}$ Voltage .....                     | 16V            |
| SW Voltage .....                           | -0.4V to 50V   |
| CHARGE Voltage .....                       | 10V            |
| DONE Voltage .....                         | 10V            |
| Current into DONE Pin .....                | $\pm 1$ mA     |
| Maximum Junction Temperature .....         | 125°C          |
| Operating Temperature Range (Note 2) ...   | -40°C to 85°C  |
| Storage Temperature Range .....            | -65°C to 150°C |
| Lead Temperature (Soldering, 10 sec) ..... | 300°C          |

## PACKAGE/ORDER INFORMATION

|                                                                                    |                                         |
|------------------------------------------------------------------------------------|-----------------------------------------|
|  | ORDER PART NUMBER                       |
|                                                                                    | LT3468ES5<br>LT3468ES5-1<br>LT3468ES5-2 |
|                                                                                    | S5 PART MARKING                         |
|                                                                                    | LTAEC<br>LTAGQ<br>LTBCH                 |

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  $T_A = 25^\circ\text{C}$ .  $V_{IN} = 3\text{V}$ ,  $V_{CHARGE} = V_{IN}$  unless otherwise noted. (Note 2) Specifications are for the LT3468, LT3468-1 and LT3468-2 unless otherwise noted.

| PARAMETER                         | CONDITIONS                                                                                             | MIN                 | TYP                 | MAX                 | UNITS          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|----------------|
| Quiescent Current                 | Not Switching<br>$V_{CHARGE} = 0\text{V}$                                                              |                     | 5<br>0              | 8<br>1              | mA<br>μA       |
| Input Voltage Range               |                                                                                                        | ● 2.5               |                     | 16                  | V              |
| Switch Current Limit              | LT3468 (Note 3)<br>LT3468-2<br>LT3468-1                                                                | 1.1<br>0.77<br>0.45 | 1.2<br>0.87<br>0.55 | 1.3<br>0.97<br>0.65 | A<br>A<br>A    |
| Switch $V_{CESAT}$                | LT3468, $I_{SW} = 1\text{A}$<br>LT3468-2, $I_{SW} = 650\text{mA}$<br>LT3468-1, $I_{SW} = 400\text{mA}$ |                     | 330<br>210<br>150   | 430<br>280<br>200   | mV<br>mV<br>mV |
| $V_{OUT}$ Comparator Trip Voltage | Measured as $V_{SW} - V_{IN}$                                                                          | ● 31                | 31.5                | 32                  | V              |
| $V_{OUT}$ Comparator Overdrive    | 300ns Pulse Width                                                                                      |                     | 200                 | 400                 | mV             |
| DCM Comparator Trip Voltage       | Measured as $V_{SW} - V_{IN}$                                                                          | ● 10                | 36                  | 80                  | mV             |
| CHARGE Pin Current                | $V_{CHARGE} = 3\text{V}$<br>$V_{CHARGE} = 0\text{V}$                                                   |                     | 15<br>0             | 40<br>0.1           | μA<br>μA       |
| Switch Leakage Current            | $V_{IN} = V_{SW} = 5\text{V}$ , in Shutdown                                                            | ●                   | 0.01                | 1                   | μA             |
| CHARGE Input Voltage High         |                                                                                                        | ● 1                 |                     |                     | V              |
| CHARGE Input Voltage Low          |                                                                                                        | ●                   |                     | 0.3                 | V              |
| Minimum Charge Pin Low Time       | High→Low→High                                                                                          |                     | 20                  |                     | μs             |
| DONE Output Signal High           | 100kΩ from $V_{IN}$ to $\overline{\text{DONE}}$                                                        |                     | 3                   |                     | V              |
| DONE Output Signal Low            | 33μA into $\overline{\text{DONE}}$ Pin                                                                 |                     | 100                 | 200                 | mV             |
| DONE Leakage Current              | $V_{\overline{\text{DONE}}} = 3\text{V}$ , $\overline{\text{DONE}}$ NPN Off                            |                     | 20                  | 100                 | nA             |

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

**Note 2:** The LT3468E/LT3468E-1/LT3468E-2 are guaranteed to meet performance 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.

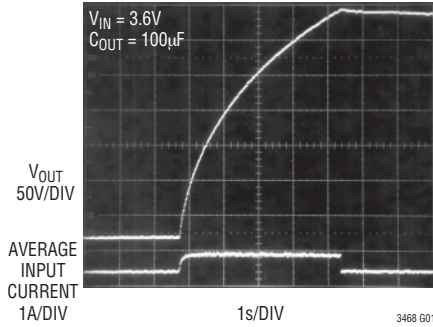
**Note 3:** Specifications are for static test. Current limit in actual application will be slightly higher.

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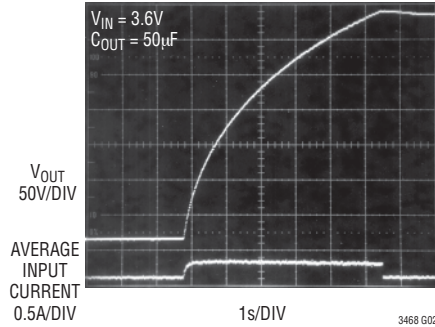
# TYPICAL PERFORMANCE CHARACTERISTICS

LT3468 curves use the circuit of Figure 6, LT3468-1 curves use the circuit of Figure 7 and LT3468-2 use the circuit of Figure 8 unless otherwise noted.

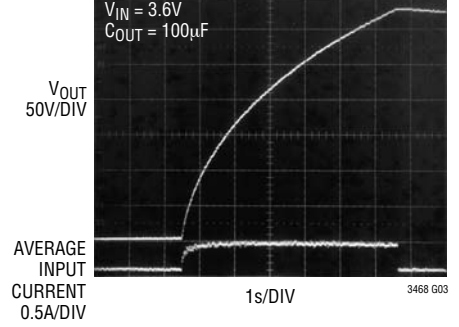
LT3468 Charging Waveform



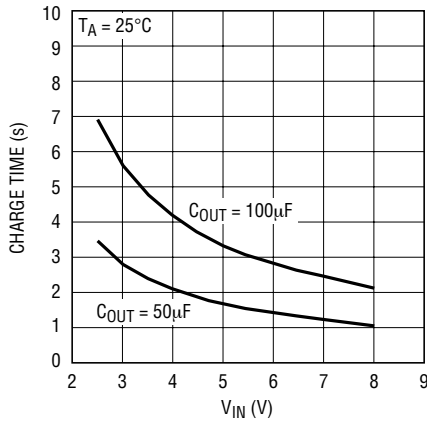
LT3468-1 Charging Waveform



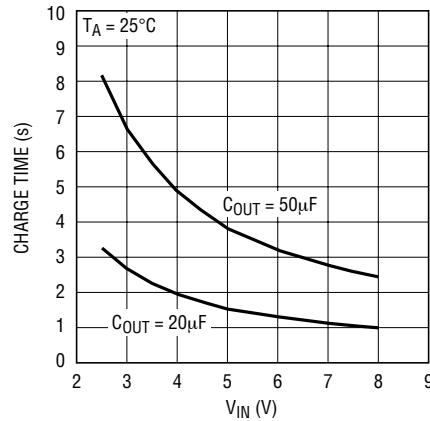
LT3468-2 Charging Waveform



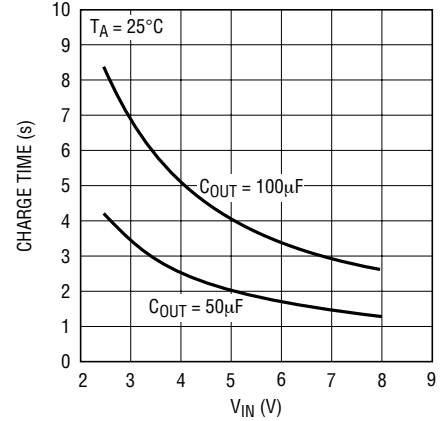
LT3468 Charge Time



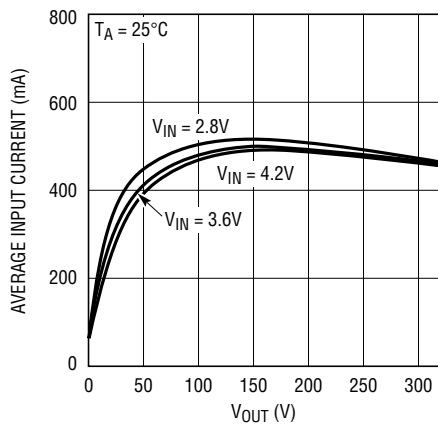
LT3468-1 Charge Time



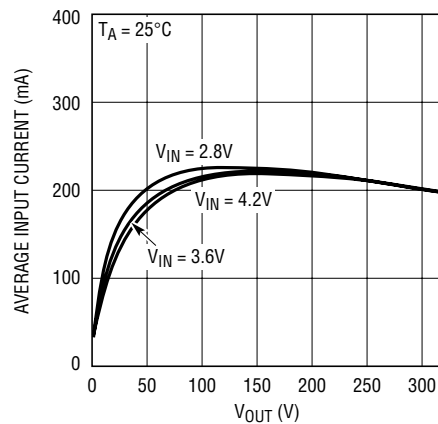
LT3468-2 Charge Time



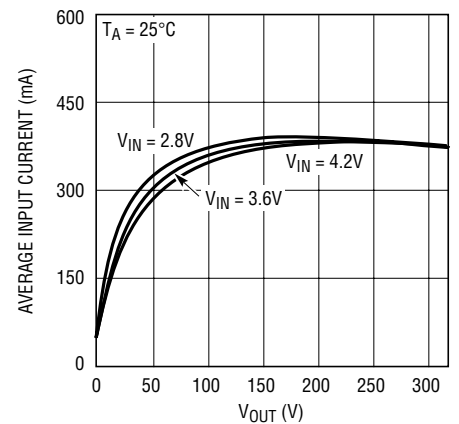
LT3468 Input Current



LT3468-1 Input Current



LT3468-2 Input Current

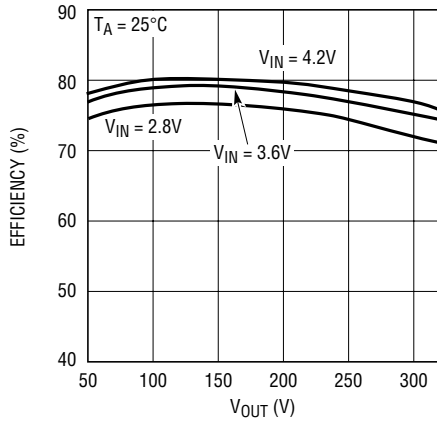


# LT3468/LT3468-1/LT3468-2

## TYPICAL PERFORMANCE CHARACTERISTICS

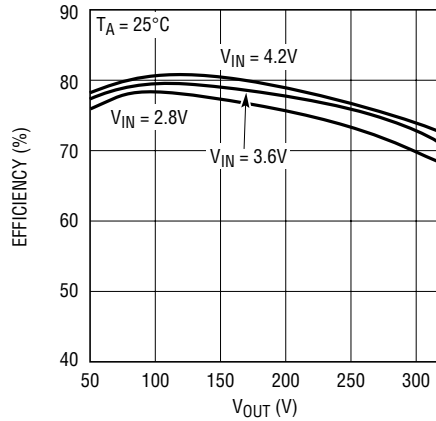
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LT3468 Efficiency



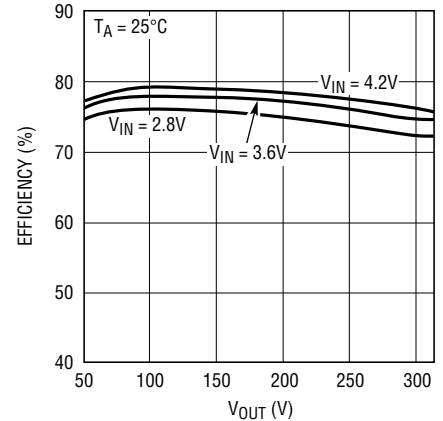
3468 G10

LT3468-1 Efficiency



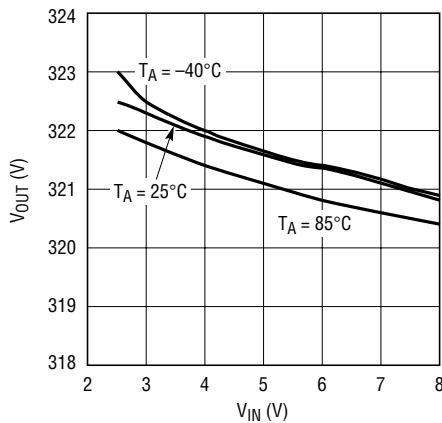
3468 G11

LT3468-2 Efficiency



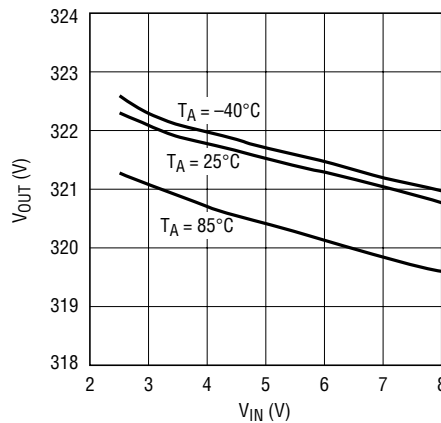
3468 G12

LT3468 Output Voltage



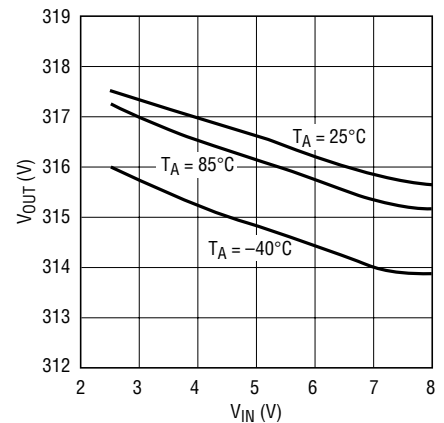
3468 G13

LT3468-1 Output Voltage



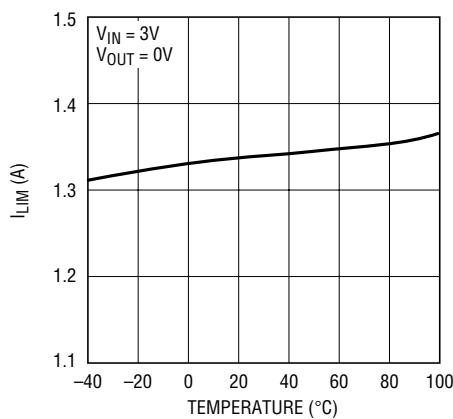
3468 G14

LT3468-2 Output Voltage



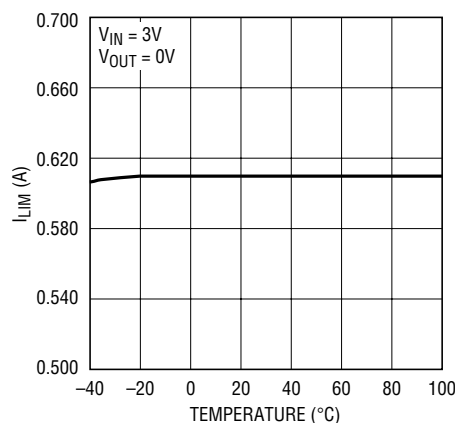
3468 G15

LT3468 Switch Current Limit



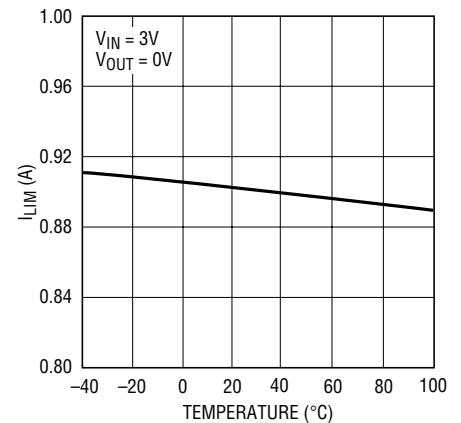
3468 G16

LT3468-1 Switch Current Limit



3468 G17

LT3468-2 Switch Current Limit



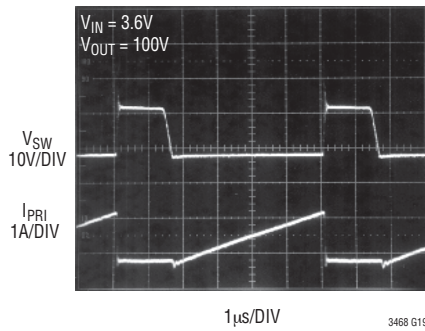
3468 G18

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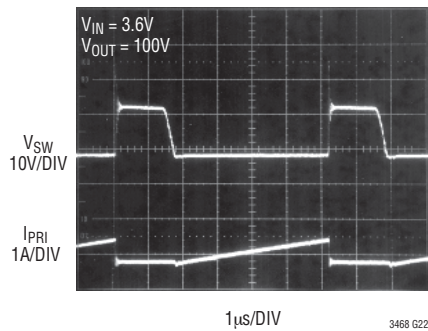
## TYPICAL PERFORMANCE CHARACTERISTICS

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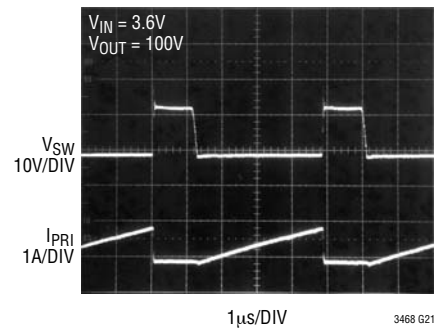
LT3468 Switching Waveform



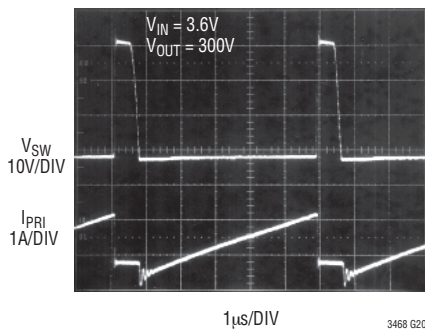
LT3468-1 Switching Waveform



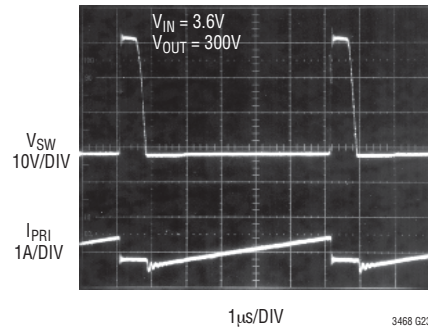
LT3468-2 Switching Waveform



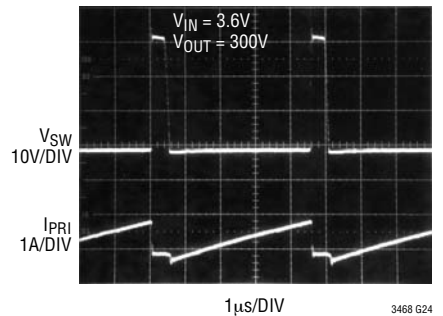
LT3468 Switching Waveform



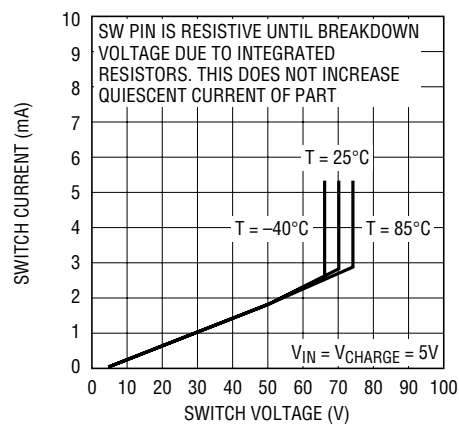
LT3468-1 Switching Waveform



LT3468-2 Switching Waveform



LT3468/LT3468-1/LT3468-2  
Switch Breakdown Voltage



## PIN FUNCTIONS

**SW (Pin 1):** Switch Pin. This is the collector of the internal NPN Power switch. Minimize the metal trace area connected to this pin to minimize EMI. Tie one side of the primary of the transformer to this pin. The target output voltage is set by the turns ratio of the transformer.

Choose Turns Ratio N by the following equation:

$$N = \frac{V_{OUT} + 2}{31.5}$$

Where:  $V_{OUT}$  is the desired output voltage.

*You must tie a Schottky diode from GND to SW, with the anode at GND for proper operation of the circuit. Please refer to the applications section for further information.*

**GND (Pin 2):** Ground. Tie directly to local ground plane.

**DONE (Pin 3):** Open NPN Collector Indication Pin. When target output voltage is reached, NPN turns on. This pin needs a pull-up resistor or current source.

**CHARGE (Pin 4):** Charge Pin. This pin must be brought high (>1V) to enable the part. A low (<0.3V) to high (>1V) transition on this pin puts the part into power delivery mode. Once the target output voltage is reached, the part will stop charging the output. Toggle this pin to start charging again. **Ground to shut down.** You may bring this pin low during a charge cycle to halt charging at any time.

**V<sub>IN</sub> (Pin 5):** Input Supply Pin. Must be locally bypassed with a good quality ceramic capacitor. Input supply must be 2.5V or higher.

## BLOCK DIAGRAM

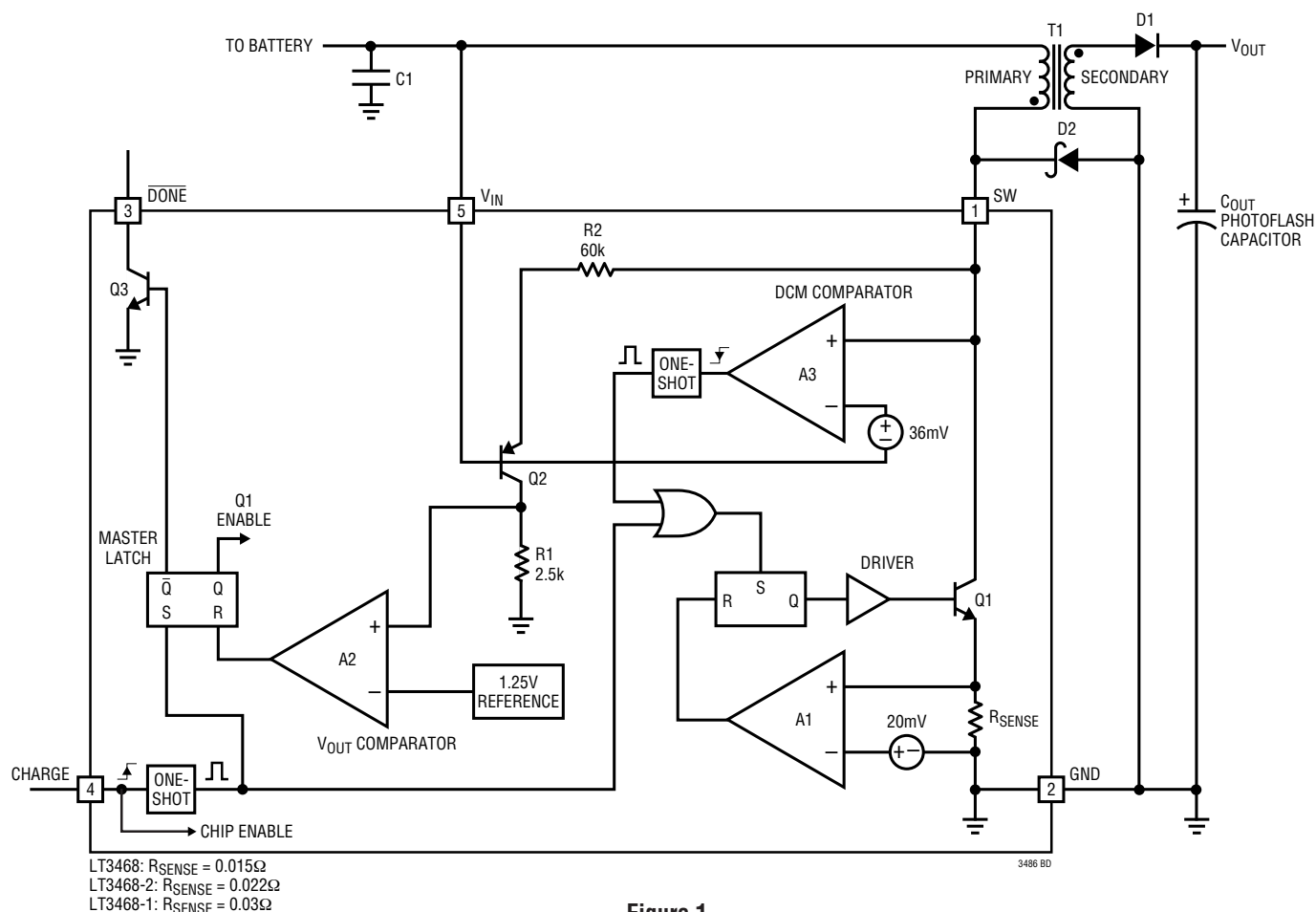


Figure 1

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## OPERATION

The LT3468/LT3468-1/LT3468-2 are designed to charge photoflash capacitors quickly and efficiently. The operation of the part can be best understood by referring to Figure 1. When the CHARGE pin is first driven high, a one shot sets both SR latches in the correct state. The power NPN device, Q1, turns on and current begins ramping up in the primary of transformer T1. Comparator A1 monitors the switch current and when the peak current reaches 1.4A (LT3468), 1A (LT3468-2) or 0.7A (LT3468-1), Q1 is turned off. Since T1 is utilized as a flyback transformer, the flyback pulse on the SW pin will cause the output of A3 to be high. The voltage on the SW pin needs to be at least 36mV higher than  $V_{IN}$  for this to happen.

During this phase, current is delivered to the photoflash capacitor via the secondary and diode D1. As the secondary current decreases to zero, the SW pin voltage will begin to collapse. When the SW pin voltage drops to 36mV above  $V_{IN}$  or lower, the output of A3 (DCM Comparator) will go low. This fires a one shot which turns Q1 back on. This cycle will continue to deliver power to the output.

Output voltage detection is accomplished via R2, R1, Q2, and comparator A2 ( $V_{OUT}$  Comparator). Resistors R1 and R2 are sized so that when the SW voltage is 31.5V above  $V_{IN}$ , the output of A2 goes high which resets the master latch. This disables Q1 and halts power delivery. NPN transistor Q3 is turned on pulling the  $\overline{DONE}$  pin low,

indicating that the part has finished charging. Power delivery can only be restarted by toggling the CHARGE pin.

The CHARGE pin gives full control of the part to the user. The charging can be halted at any time by bringing the CHARGE pin low. Only when the final output voltage is reached will the  $\overline{DONE}$  pin go low. Figure 2 shows these various modes in action. When CHARGE is first brought high, charging commences. When CHARGE is brought low during charging, the part goes into shutdown and  $V_{OUT}$  no longer rises. When CHARGE is brought high again, charging resumes. When the target  $V_{OUT}$  voltage is reached, the  $\overline{DONE}$  pin goes low and charging stops. Finally the CHARGE pin is brought low again so the part enters shutdown and the  $\overline{DONE}$  pin goes high.

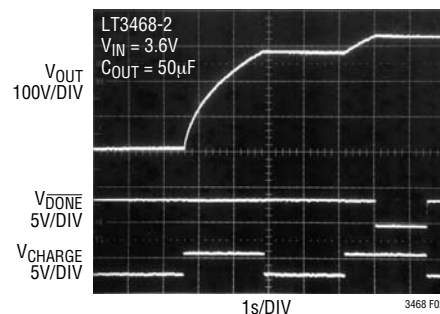


Figure 2. Halting the Charging Cycle with the CHARGE Pin

## APPLICATIONS INFORMATION

### Choosing The Right Device (LT3468/LT3468-1/LT3468-2)

The only difference between the three versions of the LT3468 is the peak current level. For the fastest possible charge time, use the LT3468. The LT3468-1 has the lowest peak current capability, and is designed for applications that need a more limited drain on the batteries. Due to the lower peak current, the LT3468-1 can use a physically smaller transformer. The LT3468-2 has a current limit in between that of the LT3468 and the LT3468-1.

### Transformer Design

The flyback transformer is a key element for any LT3468/LT3468-1/LT3468-2 design. It must be designed carefully

and checked that it does not cause excessive current or voltage on any pin of the part. The main parameters that need to be designed are shown in Table 1.

The first transformer parameter that needs to be set is the turns ratio  $N$ . The LT3468/LT3468-1/LT3468-2 accomplish output voltage detection by monitoring the flyback waveform on the SW pin. When the SW voltage reaches 31.5V higher than the  $V_{IN}$  voltage, the part will halt power delivery. Thus, the choice of  $N$  sets the target output voltage as it changes the amplitude of the reflected voltage from the output to the SW pin. Choose  $N$  according to the following equation:

$$N = \frac{V_{OUT} + 2}{31.5}$$

APPLICATIONS INFORMATION

Where:  $V_{OUT}$  is the desired output voltage. The number 2 in the numerator is used to include the effect of the voltage drop across the output diode(s).

Thus for a 320V output, N should be 322/31.5 or 10.2. For a 300V output, choose N equal to 302/31.5 or 9.6.

The next parameter that needs to be set is the primary inductance,  $L_{PRI}$ . Choose  $L_{PRI}$  according to the following formula:

$$L_{PRI} \geq \frac{V_{OUT} \cdot 200 \cdot 10^{-9}}{N \cdot I_{PK}}$$

Where:  $V_{OUT}$  is the desired output voltage. N is the transformer turns ratio.  $I_{PK}$  is 1.4 (LT3468), 0.7 (LT3468-1), and 1.0 (LT3468-2).

$L_{PRI}$  needs to be equal or larger than this value to ensure that the LT3468/LT3468-1/LT3468-2 has adequate time to respond to the flyback waveform.

All other parameters need to meet or exceed the recommended limits as shown in Table 1. A particularly important parameter is the leakage inductance,  $L_{LEAK}$ . When the power switch of the LT3468/LT3468-1/LT3468-2 turns

off, the leakage inductance on the primary of the transformer causes a voltage spike to occur on the SW pin. **The height of this spike must not exceed 40V**, even though the absolute maximum rating of the SW Pin is 50V. The 50V absolute maximum rating is a DC blocking voltage specification, which assumes that the current in the power NPN is zero. Figure 3 shows the SW voltage waveform for the circuit of Figure 6(LT3468). Note that the absolute maximum rating of the SW pin is not exceeded. Make sure to check the SW voltage waveform with  $V_{OUT}$  near the target output voltage, as this is the worst case condition for SW voltage. Figure 4 shows the various limits on the SW voltage during switch turn off.

It is important not to minimize the leakage inductance to a very low level. Although this would result in a very low leakage spike on the SW pin, the parasitic capacitance of the transformer would become large. This will adversely effect the charge time of the photoflash circuit.

Linear Technology has worked with several leading magnetic component manufacturers to produce pre-designed flyback transformers for use with the LT3468/LT3468-1/LT3468-2. Table 2 shows the details of several of these transformers.

Table 1. Recommended Transformer Parameters

| PARAMETER  | NAME                                   | TYPICAL RANGE<br>LT3468 | TYPICAL RANGE<br>LT3468-1 | TYPICAL RANGE<br>LT3468-2 | UNITS      |
|------------|----------------------------------------|-------------------------|---------------------------|---------------------------|------------|
| $L_{PRI}$  | Primary Inductance                     | >5                      | >10                       | >7                        | $\mu$ H    |
| $L_{LEAK}$ | Primary Leakage Inductance             | 100 to 300              | 200 to 500                | 200 to 500                | nH         |
| N          | Secondary: Primary Turns Ratio         | 8 to 12                 | 8 to 12                   | 8 to 12                   |            |
| $V_{ISO}$  | Secondary to Primary Isolation Voltage | >500                    | >500                      | >500                      | V          |
| $I_{SAT}$  | Primary Saturation Current             | >1.6                    | >0.8                      | >1.0                      | A          |
| $R_{PRI}$  | Primary Winding Resistance             | <300                    | <500                      | <400                      | m $\Omega$ |
| $R_{SEC}$  | Secondary Winding Resistance           | <40                     | <80                       | <60                       | $\Omega$   |

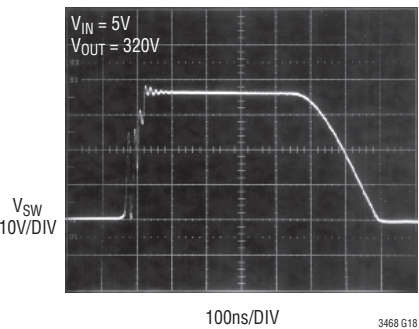


Figure 3. LT3468 SW Voltage Waveform

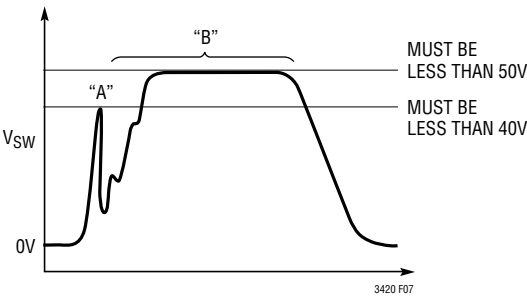


Figure 4. New Transformer Design Check (Not to Scale).

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## APPLICATIONS INFORMATION

**Table 2. Pre-Designed Transformers - Typical Specifications Unless Otherwise Noted.**

| FOR USE WITH                   | TRANSFORMER NAME                                   | SIZE<br>(W × L × H) mm                                | L <sub>PRI</sub><br>(μH) | LPRI-LEAKAGE<br>(nH)          | N                    | R <sub>PRI</sub><br>(mΩ)      | R <sub>SEC</sub><br>(Ω)      | VENDOR                                                                                    |
|--------------------------------|----------------------------------------------------|-------------------------------------------------------|--------------------------|-------------------------------|----------------------|-------------------------------|------------------------------|-------------------------------------------------------------------------------------------|
| LT3468/LT3468-2<br>LT3468-1    | SBL-5.6-1<br>SBL-5.6S-1                            | 5.6 × 8.5 × 4.0<br>5.6 × 8.5 × 3.0                    | 10<br>24                 | 200 Max<br>400 Max            | 10.2<br>10.2         | 103<br>305                    | 26<br>55                     | Kijima Musen<br>Hong Kong Office<br>852-2489-8266 (ph)<br>kijimahk@netvigator.com (email) |
| LT3468<br>LT3468-1<br>LT3468-2 | LDT565630T-001<br>LDT565630T-002<br>LDT565630T-003 | 5.8 × 5.8 × 3.0<br>5.8 × 5.8 × 3.0<br>5.8 × 5.8 × 3.0 | 6<br>14.5<br>10.5        | 200 Max<br>500 Max<br>550 Max | 10.4<br>10.2<br>10.2 | 100 Max<br>240 Max<br>210 Max | 10 Max<br>16.5 Max<br>14 Max | TDK<br>Chicago Sales Office<br>(847) 803-6100 (ph)<br>www.components.tdk.com              |
| LT3468/LT3468-1<br>LT3468-1    | T-15-089<br>T-15-083                               | 6.4 × 7.7 × 4.0<br>8.0 × 8.9 × 2.0                    | 12<br>20                 | 400 Max<br>500 Max            | 10.2<br>10.2         | 211 Max<br>675 Max            | 27 Max<br>35 Max             | Tokyo Coil Engineering<br>Japan Office<br>0426-56-6262 (ph)<br>www.tokyo-coil.co.jp       |

### Capacitor Selection

For the input bypass capacitor, a high quality X5R or X7R type should be used. Make sure the voltage capability of the part is adequate.

### Output Diode Selection

The rectifying diode(s) should be low capacitance type with sufficient reverse voltage and forward current ratings. The peak reverse voltage that the diode(s) will see is approximately:

$$V_{PK-R} = V_{OUT} + (N \cdot V_{IN})$$

The peak current of the diode is simply:

$$I_{PK-SEC} = \frac{1.4}{N} \text{ (LT3468)}$$

$$I_{PK-SEC} = \frac{1.0}{N} \text{ (LT3468-2)}$$

$$I_{PK-SEC} = \frac{0.7}{N} \text{ (LT3468-1)}$$

For the circuit of Figure 6 with  $V_{IN}$  of 5V,  $V_{PK-R}$  is 371V and  $I_{PK-SEC}$  is 137mA. The GSD2004S dual silicon diode is recommended for most LT3468/LT3468-1/LT3468-2 applications. Another option is to use the BAV23S dual silicon diodes. Diodes Incorporated makes a dual diode named MMBD3004S which also meets all the requirements. Table 3 shows the various diodes and relevant specifications. Use the appropriate number of diodes to achieve the necessary reverse breakdown voltage.

### SW Pin Clamp Diode Selection

The diode D2 in Figure 6 is needed to clamp the SW node. Due to the new control scheme of the LT3468/LT3468-1/LT3468-2, the SW node may go below ground during a switch cycle. The clamp diode prevents the SW node from going too far below ground. The diode is required for proper operation of the circuit. The recommended diode

**Table 3. Recommended Output Diodes**

| PART                     | MAX REVERSE VOLTAGE<br>(V) | MAX FORWARD CONTINUOUS CURRENT<br>(mA) | CAPACITANCE<br>(pF) | VENDOR                                                     |
|--------------------------|----------------------------|----------------------------------------|---------------------|------------------------------------------------------------|
| GSD2004S<br>(Dual Diode) | 2x300                      | 225                                    | 5                   | Vishay<br>(402) 563-6866<br>www.vishay.com                 |
| BAV23S<br>(Dual Diode)   | 2x250                      | 225                                    | 5                   | Philips Semiconductor<br>(800) 234-7381<br>www.philips.com |
| MMBD3004S                | 2x350                      | 225                                    | 5                   | Diodes Incorporated<br>(805) 446-4800<br>www.diodes.com    |

## APPLICATIONS INFORMATION

should be a Schottky diode with at least a 500mA peak forward current capability. The diode forward voltage drop should be 600mV or less at 500mA of forward current. Reverse voltage rating should be 40V or higher. Table 4 shows various recommended clamping diodes.

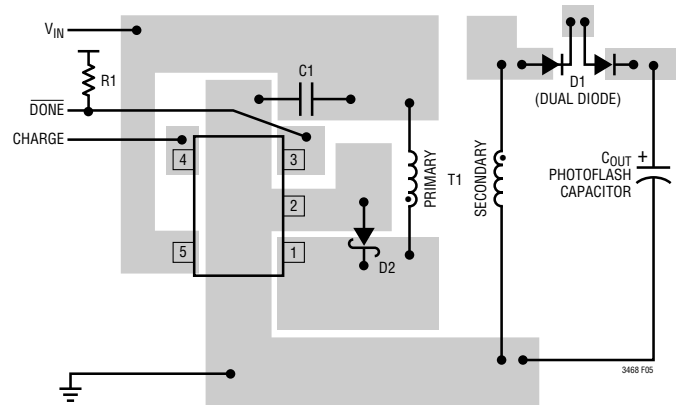
**Table 4. Recommended Clamp Diodes**

| PART    | MAX REVERSE VOLTAGE (V) | VENDOR                                             |
|---------|-------------------------|----------------------------------------------------|
| ZHCS400 | 40                      | Zetex<br>(631) 360-2222<br>www.zetex.com           |
| B0540W  | 40                      | Diodes Inc.<br>(805) 446-4800<br>www.diodes.com    |
| MA2Z720 | 40                      | Panasonic<br>(408) 487-9510<br>www.panasonic.co.jp |

### Board Layout

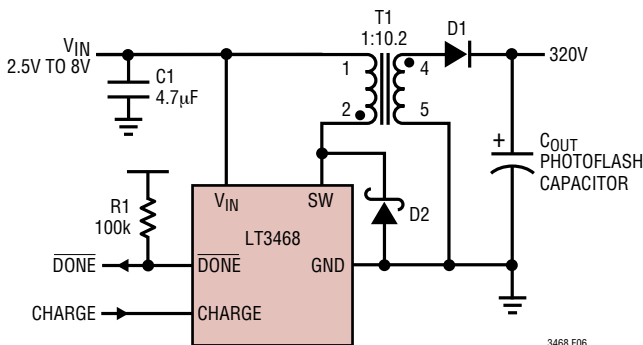
The high voltage operation of the LT3468/LT3468-1/LT3468-2 demands careful attention to board layout. You will not get advertised performance with careless layout. Figure 5 shows the recommended component placement.

Keep the area for the high voltage end of the secondary as small as possible. Also note the larger than minimum spacing for all high voltage nodes in order to meet break-down voltage requirements for the circuit board. *It is imperative to keep the electrical path formed by C1, the primary of T1, and the LT3468/LT3468-1/LT3468-2 as short as possible.* If this path is haphazardly made long, it will effectively increase the leakage inductance of T1, which may result in an overvoltage condition on the SW pin.



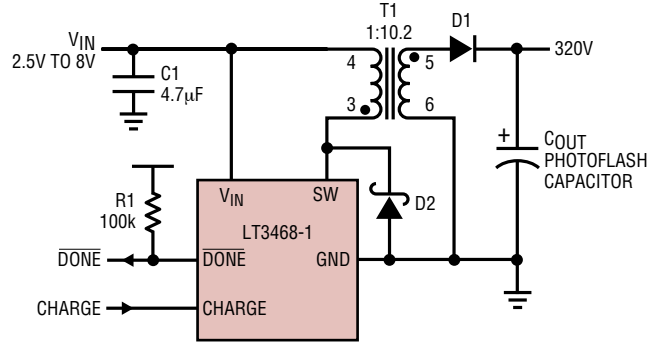
**Figure 5. Suggested Layout: Keep Electrical Path Formed by C1, Transformer Primary and LT3468/LT3468-1/LT3468-2 Short**

## TYPICAL APPLICATIONS



C1: 4.7µF, X5R OR X7R, 10V  
T1: KIJIMA MUSEN PART# SBL-5.6-1,  $L_{PRI} = 10\mu\text{H}$ ,  $N = 10.2$   
D1: VISHAY GSD2004S DUAL DIODE CONNECTED IN SERIES  
D2: ZETEX ZHCS400 OR EQUIVALENT  
R1: PULL UP RESISTOR NEEDED IF DONE PIN USED

**Figure 6. LT3468 Photoflash Charger Uses High Efficiency 4mm Tall Transformer**



C1: 4.7µF, X5R OR X7R, 10V  
T1: KIJIMA MUSEN PART# SBL-5.6S-1,  $L_{PRI} = 24\mu\text{H}$ ,  $N = 10.2$   
D1: VISHAY GSD2004S DUAL DIODE CONNECTED IN SERIES  
D2: ZETEX ZHCS400 OR EQUIVALENT  
R1: PULL UP RESISTOR NEEDED IF DONE PIN USED

**Figure 7. LT3468-1 Photoflash Charger Uses High Efficiency 3mm Tall Transformer**

# TYPICAL APPLICATIONS

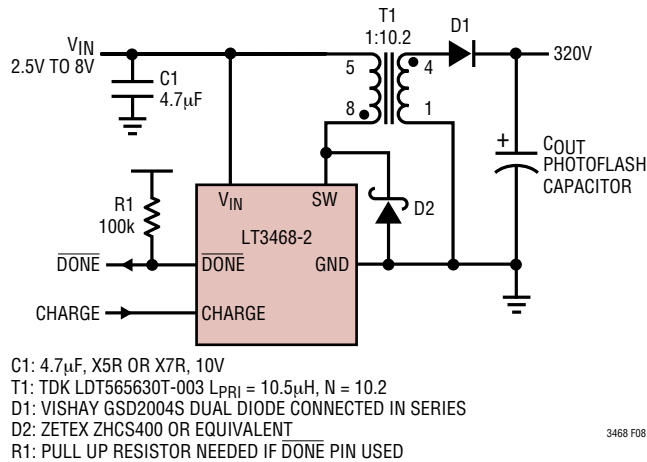
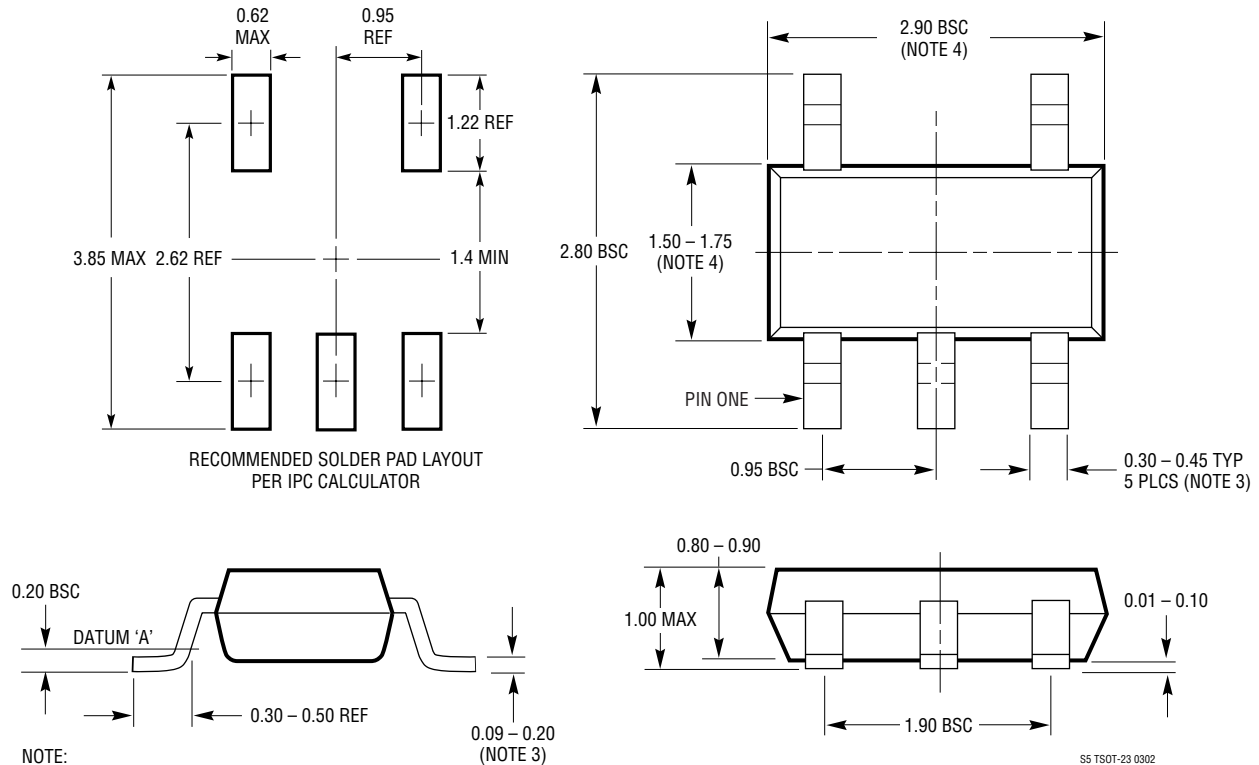


Figure 8. LT3468-2 Photoflash Charger Uses High Efficiency 3mm Tall Transformer

# PACKAGE DESCRIPTION

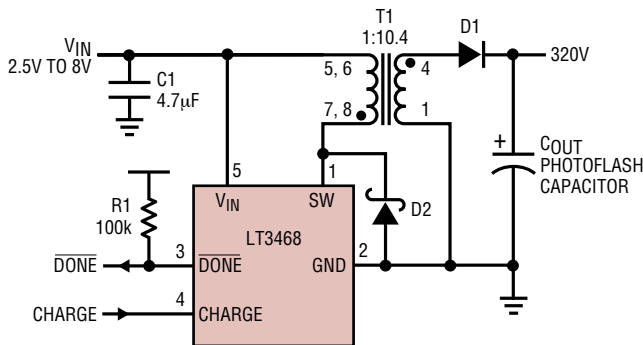
## S5 Package 5-Lead Plastic TSOT-23 (Reference LTC DWG # 05-08-1635)



# LT3468/LT3468-1/LT3468-2

## TYPICAL APPLICATIONS

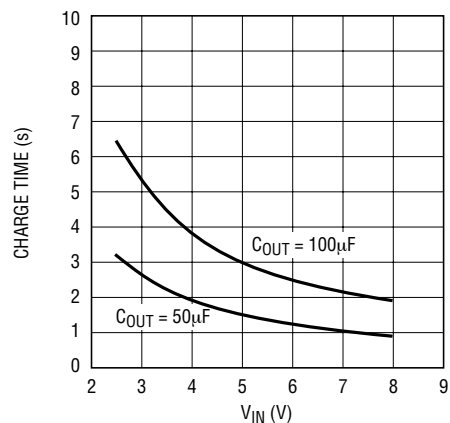
LT3468 Photoflash Circuit uses Tiny 3mm Tall Transformer



C1: 4.7µF, X5R OR X7R, 10V  
T1: TDK PART# LDT565630T-001,  $L_{PRI} = 6\mu\text{H}$ ,  $N = 10.4$   
D1: VISHAY GSD2004S DUAL DIODE CONNECTED IN SERIES  
D2: ZETEX ZHCS400 OR EQUIVALENT  
R1: PULL UP RESISTOR NEEDED IF DONE PIN USED

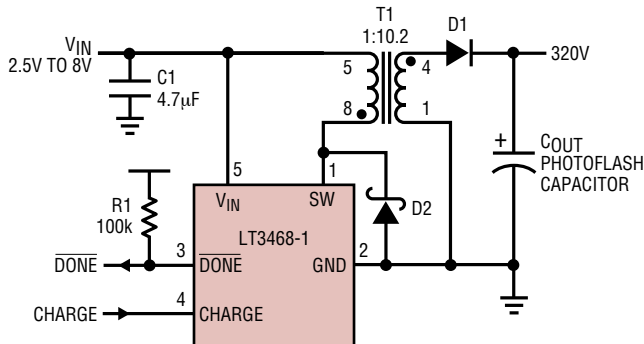
3468 TA03

Charge Time



3468 TA05

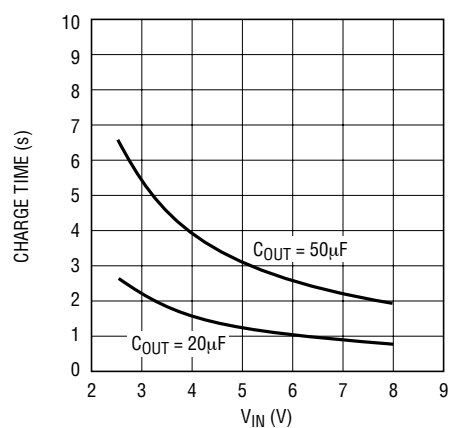
LT3468-1 Photoflash Circuit uses Tiny 3mm Tall Transformer



C1: 4.7µF, X5R OR X7R, 10V  
T1: TDK PART# LDT565630T-002,  $L_{PRI} = 14.5\mu\text{H}$ ,  $N = 10.2$   
D1: VISHAY GSD2004S DUAL DIODE CONNECTED IN SERIES  
D2: ZETEX ZHCS400 OR EQUIVALENT  
R1: PULL UP RESISTOR NEEDED IF DONE PIN USED

3468 TA04

Charge Time



3468 TA06

## RELATED PARTS

| PART NUMBER     | DESCRIPTION                                                             | COMMENTS                                                                                                             |
|-----------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| LTC3407         | Dual 600mA ( $I_{OUT}$ ), 1.5MHz, Synchronous Step-Down DC/DC Converter | 96% Efficiency, $V_{IN}$ : 2.5V to 5.5V, $V_{OUT(MIN)}$ : 0.6V, $I_Q$ : 40µA, $I_{SD}$ : <1µA, MS10E                 |
| LT3420/LT3420-1 | 1.4A/1A, Photoflash Capacitor Chargers with Automatic Top-Off           | Charges 220µF to 320V in 3.7 seconds from 5V, $V_{IN}$ : 2.2V to 16V, $I_Q$ : 90µA, $I_{SD}$ : <1µA, MS10            |
| LTC3425         | 5A $I_{SW}$ , 8MHz, Multi-Phase Synchronous Step-Up DC/DC Converter     | 95% Efficiency, $V_{IN}$ : 0.5V to 4.5V, $V_{OUT(MIN)}$ : 5.25V, $I_Q$ : 12µA, $I_{SD}$ : <1µA, QFN-32               |
| LTC3440/LTC3441 | 600mA/1A ( $I_{OUT}$ ), Synchronous Buck-Boost DC/DC Converter          | 95% Efficiency, $V_{IN}$ : 2.5V to 5.5V, $V_{OUT(MIN)}$ : 2.5V to 5.5V, $I_Q$ : 25µA, $I_{SD}$ : <1µA, MS-10, DFN-12 |

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