



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at

[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# FAN7602C

## Green Current Mode PWM Controller

### Features

- Green Current Mode PWM Controller
- Random Frequency Fluctuation for Low EMI
- Internal High-Voltage Startup Switch
- Burst Mode Operation
- Line Voltage Feedforward to Limit Maximum Power
- Line Under-Voltage Protection
- Latch Protection & Internal Soft-Start (10ms) Function
- Overload Protection (OLP)
- Over-Voltage Protection (OVP)
- Over-Temperature Protection (OTP)
- Low Operation Current: 1 mA Typical
- Available in the 8-Lead SOP Package

### Applications

- Adapter
- LCD Monitor Power
- Auxiliary Power Supply

### Related Resources

- [AN-6014- Green Current Mode PWM Controller](#)  
(*Except for frequency fluctuation part in AN-6014*)

### Description

The FAN7602C is a green current-mode PWM controller. It is specially designed for off-line adapter applications; DVDP, VCR, LCD monitor applications; and auxiliary power supplies.

The internal high-voltage startup switch and the burst mode operation reduce the power loss in standby mode. As a result, the input power is lower than 1 W when the input line voltage is 265 V<sub>AC</sub> and the load is 0.5 W. At no-load condition, input power is under 0.15 W.

The maximum power can be limited constantly, regardless of the line voltage change, using the power limit function.

The switching frequency is not fixed and has random frequency fluctuation.

The FAN7602C includes various protections for the system reliability and the internal soft-start prevents the output voltage over-shoot at startup.

### Ordering Information

| Part Number | Operating Junction Temperature | Package                            | Packing Method | Top Mark |
|-------------|--------------------------------|------------------------------------|----------------|----------|
| FAN7602CMX  | -40°C to +150°C                | 8-Lead Small Outline Package (SOP) | Tape and Reel  | FAN7602C |

### Typical Application Diagram

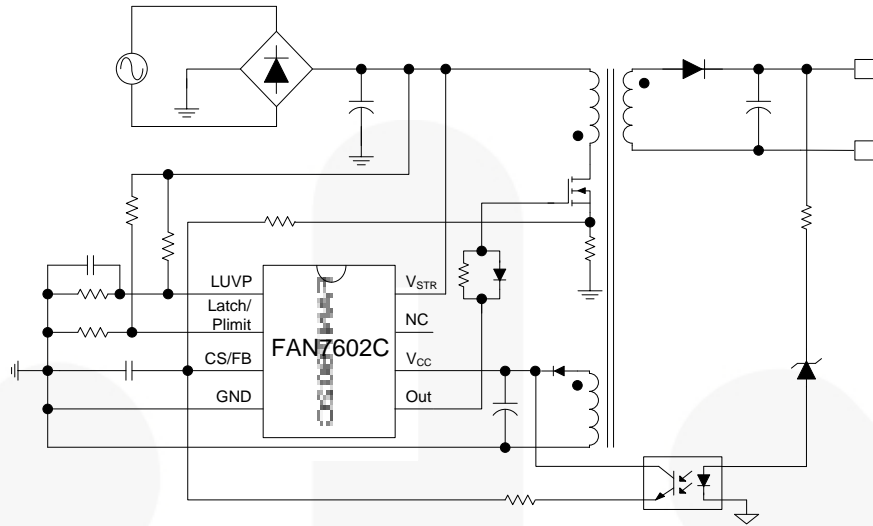


Figure 1. Typical Flyback Application

### Internal Block Diagram

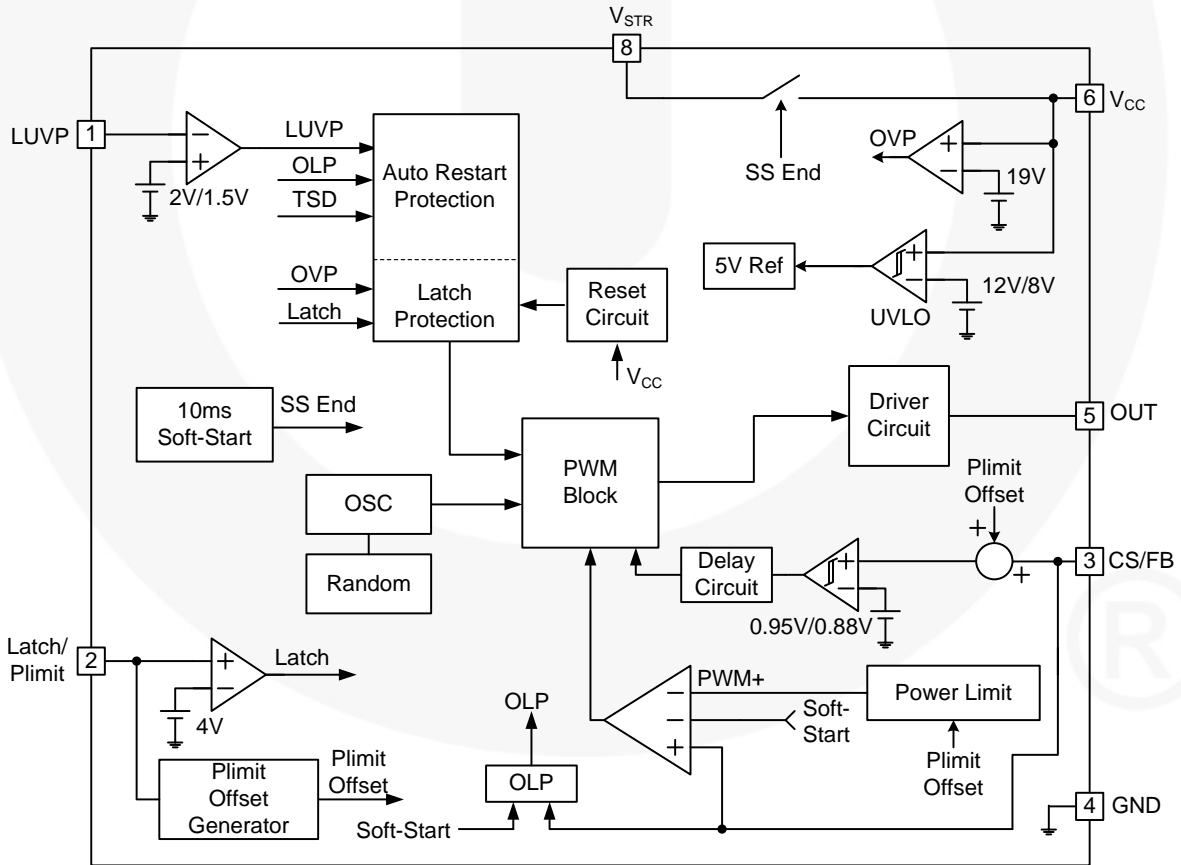


Figure 2. Functional Block Diagram

## Pin Configuration

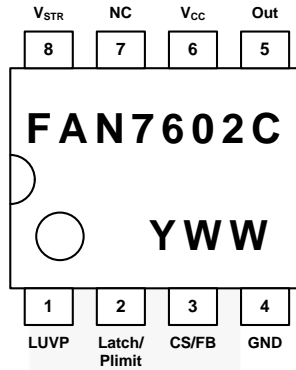


Figure 3. Pin Configuration (Top View)

## Pin Definitions

| Pin # | Name         | Description   |
|-------|--------------|---|
| 1     | LUVP         | <b>Line Under-Voltage Protection Pin.</b> This pin is used to protect the set when the input voltage is lower than the rated input voltage range.   |
| 2     | Latch/Plimit | <b>Latch Protection and Power Limit Pin.</b> When the pin voltage exceeds 4 V, the latch protection works. The latch protection is reset when the $V_{CC}$ voltage is lower than 5 V. For the power limit function, the OCP level decreases as the pin voltage increases. |
| 3     | CS/FB        | <b>Current Sense and Feedback Pin.</b> This pin is used to sense the MOSFET current for the current mode PWM and OCP. The output voltage feedback information and the current sense information are added using an external RC filter.                                    |
| 4     | GND          | <b>Ground Pin.</b> This pin is used for the ground potential of all the pins. For proper operation, the signal ground and the power ground should be separated.   |
| 5     | OUT          | <b>Gate Drive Output Pin.</b> This pin is an output pin to drive an external MOSFET. The peak sourcing current is 450 mA and the peak sinking current is 600 mA. For proper operation, the stray inductance in the gate driving path must be minimized.                   |
| 6     | $V_{CC}$     | <b>Supply Voltage Pin.</b> IC operating current and MOSFET driving current are supplied using this pin.   |
| 7     | NC           | <b>No Connection.</b>   |
| 8     | $V_{STR}$    | <b>Startup Pin.</b> This pin is used to supply IC operating current during IC startup. After startup, the internal JFET is turned off to reduce power loss.   |

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol      | Parameter                                  | Min.                              | Max. | Unit |
|-------------|--|-----------------------------------|------|------|
| $V_{CC}$    | Supply Voltage                             |                                   | 25   | V    |
| $I_O$       | Output Current                             | -600                              | +450 | mA   |
| $V_{CS/FB}$ | CS/FB Input Voltage                        | -0.3                              | 20.0 | V    |
| $V_{LUVP}$  | LUVP Input Voltage                         | -0.3                              | 10.0 | V    |
| $V_{LATCH}$ | Latch/Plimit Input Voltage                 | -0.3                              | 10.0 | V    |
| $V_{STR}$   | $V_{STR}$ Input Voltage                    |                                   | 600  | V    |
| $T_J$       | Junction Temperature                       |                                   | +150 | °C   |
|             | Recommended Operating Junction Temperature | -40                               | +150 |      |
| $T_{STG}$   | Storage Temperature Range                  | -55                               | +150 | °C   |
| $P_D$       | Power Dissipation                          |                                   | 1.2  | W    |
| ESD         | Electrostatic Discharge Capability         | Human Body Model, JESD22-A114     |      | V    |
|             |  | Charged Device Model, JESD22-C101 |      |      |

## Thermal Impedance

| Symbol        | Parameter   | Value | Unit |
|---------------|---|-------|------|
| $\theta_{JA}$ | Thermal Resistance <sup>(1)</sup> , Junction-to-Ambient | 150   | °C/W |

### Note:

- Regarding the test environment and PCB type, please refer to JESD51-2 and JESD51-10.

## Electrical Characteristics

$V_{CC} = 14V$ ,  $T_A = -25^{\circ}C \sim 125^{\circ}C$ , unless otherwise specified.

| Symbol                                | Parameter                                  | Condition                                      | Min. | Typ.    | Max. | Unit    |
|---------------------------------------|--|--|------|---------|------|---------|
| <b>Startup Section</b>                |  |  |      |         |      |         |
| $I_{STR}$                             | $V_{STR}$ Startup Current                  | $V_{STR} = 30 V$ , $T_A = 25^{\circ}C$         | 0.7  | 1.0     | 1.4  | mA      |
| <b>Under Voltage Lock Out Section</b> |  |  |      |         |      |         |
| $V_{th\_start}$                       | Start Threshold Voltage                    | $V_{CC}$ Increasing                            | 11   | 12      | 13   | V       |
| $V_{th\_stop}$                        | Stop Threshold Voltage                     | $V_{CC}$ Decreasing                            | 7    | 8       | 9    | V       |
| $HY_{UVLO}$                           | UVLO Hysteresis                            |  | 3.6  | 4.0     | 4.4  | V       |
| <b>Supply Current Section</b>         |  |  |      |         |      |         |
| $I_{ST}$                              | Startup Supply Current                     | $T_A = 25^{\circ}C$                            |      | 250     | 320  | $\mu A$ |
| $I_{CC}$                              | Operating Supply Current                   | Output Not Switching                           |      | 1.0     | 1.5  | mA      |
| <b>Soft-Start Section</b>             |  |  |      |         |      |         |
| $t_{SS}$                              | Soft-Start Time <sup>(2)</sup>             |  | 5    | 10      | 15   | ms      |
| <b>PWM Section</b>                    |  |  |      |         |      |         |
| $f_{OSC}$                             | Operating Frequency                        | $V_{CS/FB} = 0.2 V$ , $T_A = 25^{\circ}C$      | 59   | 65      | 73   | kHz     |
| $\Delta f_{OSC}$                      | Frequency Fluctuation <sup>(2)</sup>       |  |      | $\pm 3$ |      | kHz     |
| $V_{CS/FB1}$                          | CS/FB Threshold Voltage                    | $T_A = 25^{\circ}C$                            | 0.9  | 1.0     | 1.1  | V       |
| $t_D$                                 | Propagation Delay to Output <sup>(2)</sup> |  |      | 100     | 150  | ns      |
| $D_{MAX}$                             | Maximum Duty Cycle                         |  | 70   | 75      | 80   | %       |
| $D_{MIN}$                             | Minimum Duty Cycle                         |  |      |         | 0    | %       |
| <b>Burst Mode Section</b>             |  |  |      |         |      |         |
| $V_{CS/FB2}$                          | Burst On Threshold Voltage                 | $T_A = 25^{\circ}C$                            | 0.84 | 0.95    | 1.06 | V       |
| $V_{CS/FB3}$                          | Burst Off Threshold Voltage                | $T_A = 25^{\circ}C$                            | 0.77 | 0.88    | 0.99 | V       |
| <b>Power Limit Section</b>            |  |  |      |         |      |         |
| $K_{Plimit}$                          | Offset Gain                                | $V_{Latch/Plimit} = 2 V$ , $T_A = 25^{\circ}C$ | 0.12 | 0.16    | 0.20 |         |
| <b>Output Section</b>                 |  |  |      |         |      |         |
| $V_{OH}$                              | Output Voltage High                        | $T_A = 25^{\circ}C$ , $I_{source} = 100 mA$    | 11.5 | 12.0    | 14.0 | V       |
| $V_{OL}$                              | Output Voltage Low                         | $T_A = 25^{\circ}C$ , $I_{sink} = 100 mA$      |      | 1.0     | 2.5  | V       |
| $t_R$                                 | Rising Time <sup>(2)</sup>                 | $T_A = 25^{\circ}C$ , $C_L = 1 nF$             |      | 45      | 150  | ns      |
| $t_F$                                 | Falling Time <sup>(2)</sup>                | $T_A = 25^{\circ}C$ , $C_L = 1 nF$             |      | 35      | 150  | ns      |

Continued on the following page...

**Electrical Characteristics** (Continued)

$V_{CC} = 14V$ ,  $T_A = -25^{\circ}C \sim 125^{\circ}C$ , unless otherwise specified.

| Symbol                    | Parameter                               | Condition           | Min. | Typ. | Max. | Unit        |
|---------------------------|---|---------------------|------|------|------|-------------|
| <b>Protection Section</b> |   |                     |      |      |      |             |
| $V_{LATCH}$               | Latch Voltage                           |                     | 3.6  | 4.0  | 4.4  | V           |
| $t_{OLP}$                 | Overload Protection Time <sup>(2)</sup> |                     | 20   | 22   | 24   | ms          |
| $t_{OLP\_ST}$             | Overload Protection Time at Startup     |                     | 30   | 37   | 44   | ms          |
| $V_{OLP}$                 | Overload Protection Level               |                     |      | 0    | 0.1  | V           |
| $V_{LUVPOff}$             | Line Under-Voltage Protection On to Off | $T_A = 25^{\circ}C$ | 1.9  | 2.0  | 2.1  | V           |
| $V_{LUVPOn}$              | Line Under-Voltage Protection Off to On | $T_A = 25^{\circ}C$ | 1.4  | 1.5  | 1.6  | V           |
| $V_{OVP}$                 | Over-Voltage Protection                 | $T_A = 25^{\circ}C$ | 18   | 19   | 20   | V           |
| $T_{SD}$                  | Shutdown Temperature <sup>(2)</sup>     |                     |      | 170  |      | $^{\circ}C$ |
| HYS                       |   |                     |      | 60   |      | $^{\circ}C$ |

**Note:**

- These parameters, although guaranteed, are not 100% tested in production.

## Typical Performance Characteristics

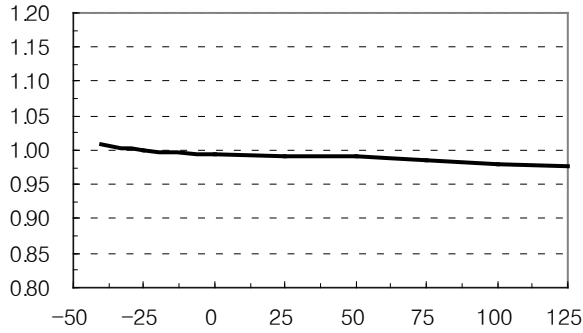


Figure 4. Start Threshold Voltage vs. Temperature

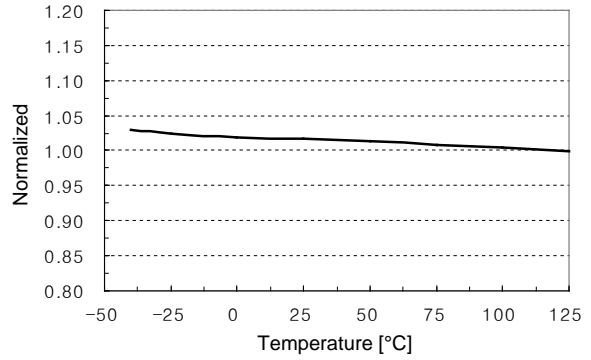


Figure 5. Stop Threshold Voltage vs. Temperature

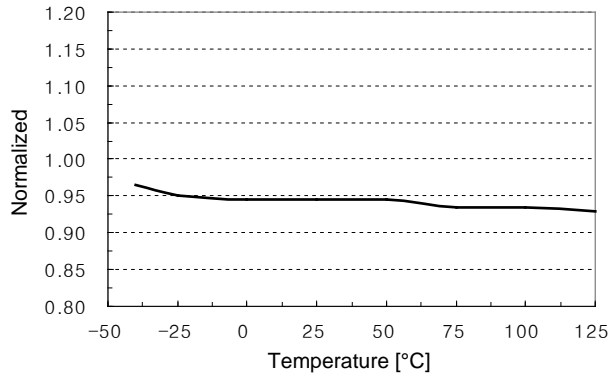


Figure 6. UVLO Hysteresis vs. Temperature

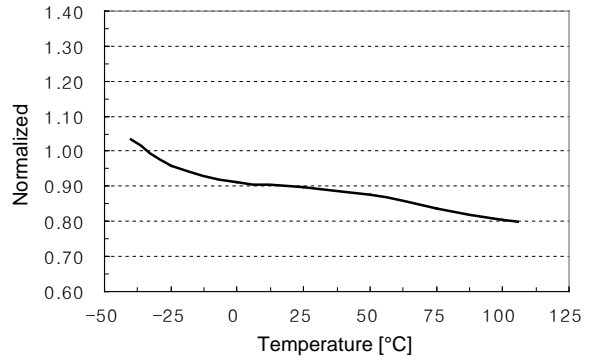


Figure 7. Startup Threshold Current vs. Temperature

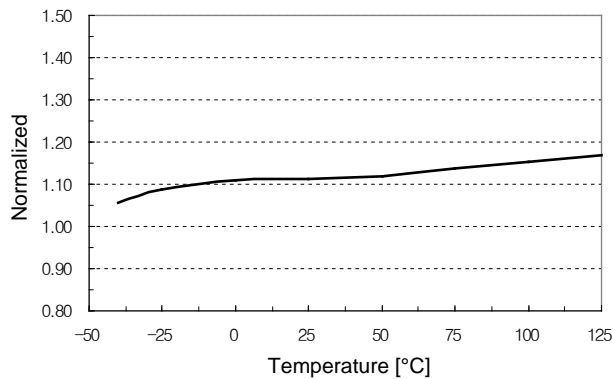


Figure 8. Operating Supply Current vs. Temperature

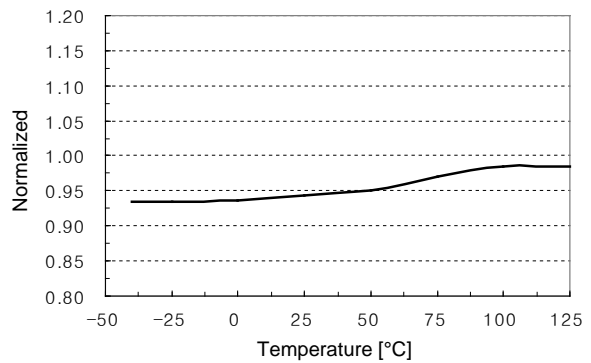
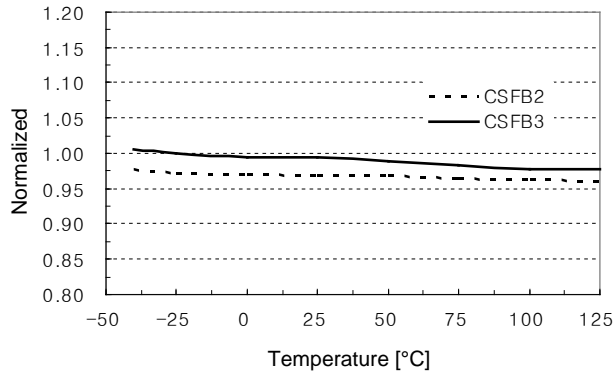


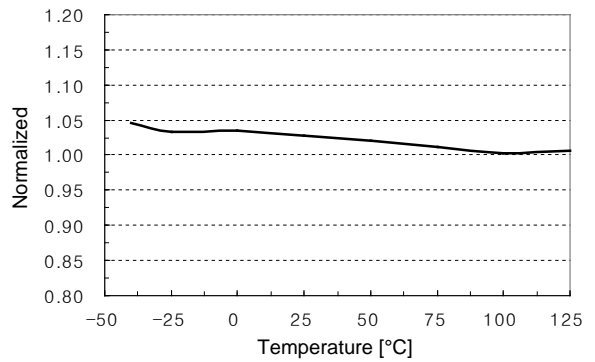
Figure 9.  $V_{STR}$  Startup Current vs. Temperature



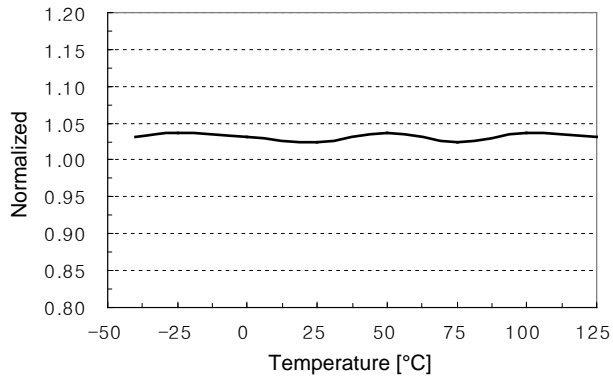
**Typical Performance Characteristics (Continued).**



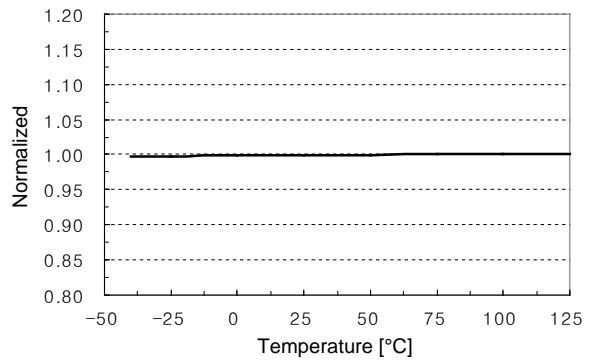
**Figure 10. Burst On/Off Voltage vs. Temperature**



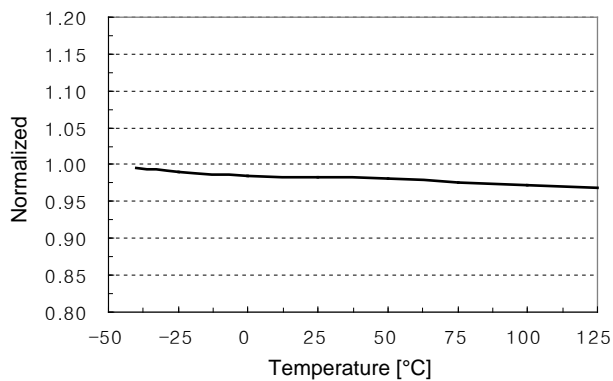
**Figure 11. Operating Frequency vs. Temperature**



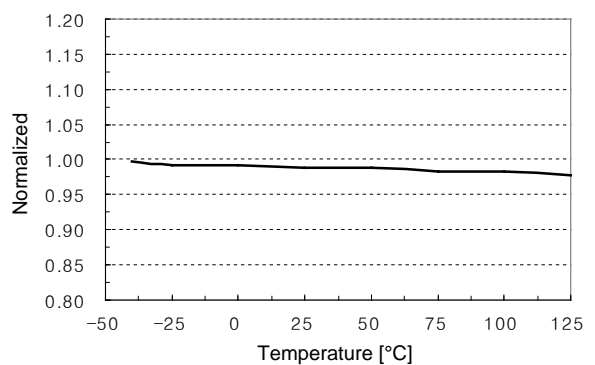
**Figure 12. Offset Gain vs. Temperature**



**Figure 13. Maximum Duty Cycle vs. Temperature**



**Figure 14. OVP Voltage vs. Temperature**



**Figure 15. Latch Voltage vs. Temperature**

Typical Performance Characteristics (Continued)

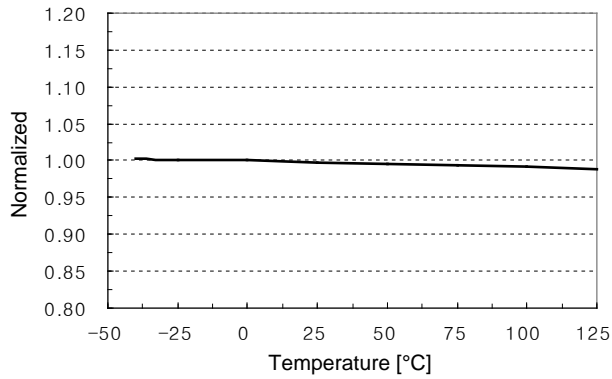


Figure 16. LUVP On-to-Off Voltage vs. Temperature

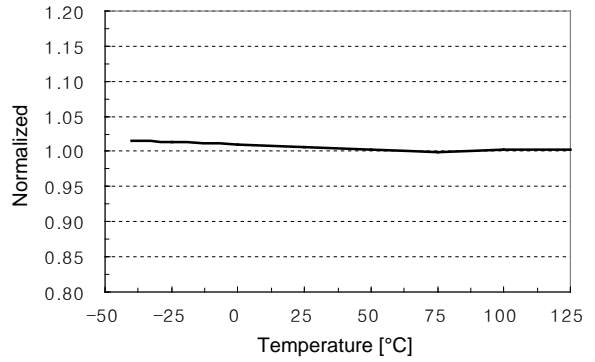


Figure 17. LUVP Off-to-On Voltage vs. Temperature

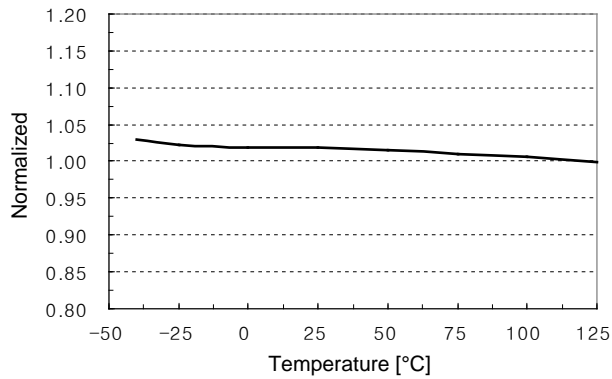


Figure 18. CS/FB Threshold Voltage vs. Temperature

## Application Information

### 1. Startup Circuit and Soft-Start Block

The FAN7602C contains a startup switch to reduce the power loss of the external startup circuit of the conventional PWM converters. The internal startup circuit charges the  $V_{CC}$  capacitor with 0.9 mA current source if the AC line is connected. The startup switch is turned off 15 ms after IC starts up, as shown in Figure 19. The soft-start function starts when the  $V_{CC}$  voltage reaches the start threshold voltage of 12 V and ends when the internal soft-start voltage reaches 1 V. The internal startup circuit starts charging the  $V_{CC}$  capacitor again if the  $V_{CC}$  voltage is lowered to the minimum operating voltage, 8 V. The UVLO block shuts down the output drive circuit and some blocks to reduce the IC operating current and the internal soft-start voltage drops to zero. If the  $V_{CC}$  voltage reaches the start threshold voltage, the IC starts switching again and the soft-start block works as well.

During the soft-start, pulse-width modulated (PWM) comparator compares the CS/FB pin voltage with the soft-start voltage. The soft-start voltage starts from 0.5 V and the soft-start ends when it reaches 1 V and the soft-start time is 10 ms. The startup switch is turned off when the soft-start voltage reaches 1.3 V.

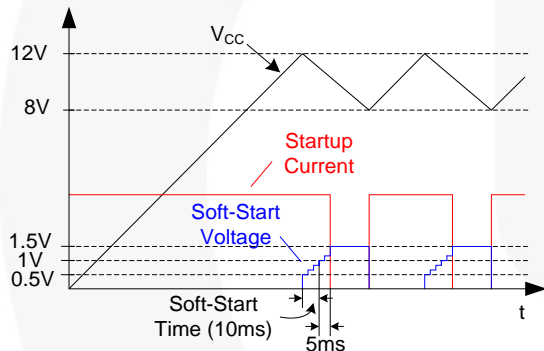


Figure 19. Startup Current and  $V_{CC}$  Voltage

### 2. Oscillator Block

The oscillator frequency is set internally and FAN7602C has a random frequency fluctuation function.

Fluctuation of the switching frequency of a switched power supply can reduce EMI by spreading the energy over a wider frequency range than the bandwidth measured by the EMI test equipment. The amount of EMI reduction is directly related to the range of the frequency variation. The range of frequency variation is fixed internally; however, its selection is randomly chosen by the combination of external feedback voltage and internal free-running oscillator. This randomly chosen switching frequency effectively spreads the EMI noise nearby switching frequency and allows the use of a cost-effective inductor instead of an AC input line filter to satisfy the world-wide EMI requirements.

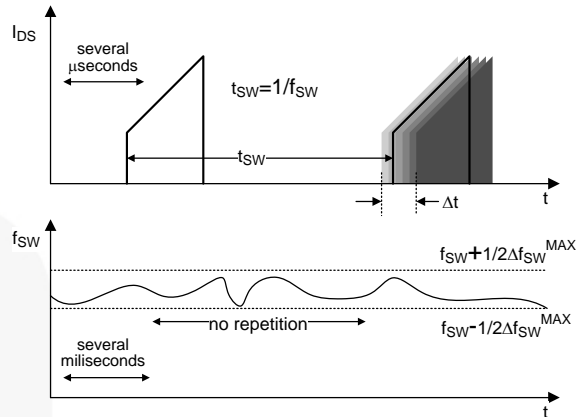


Figure 20. Frequency Fluctuation Waveform

### 3. Current Sense and Feedback Block

The FAN7602C performs the current sensing for the current mode PWM and the output voltage feedback with only one pin, pin 3. To achieve the two functions with one pin, an internal Leading-Edge Blanking (LEB) circuit to filter the current sense noise is not included because the external RC filter is necessary to add the output voltage feedback information and the current sense information.

Figure 21 shows the current sense and feedback circuits.  $R_S$  is the current sense resistor to sense the switch current. The current sense information is filtered by an RC filter composed of  $R_F$  and  $C_F$ . According to the output voltage feedback information,  $I_{FB}$  charges or stops charging  $C_F$  to adjust the offset voltage. If  $I_{FB}$  is zero,  $C_F$  is discharged through  $R_F$  and  $R_S$  to lower the offset voltage.

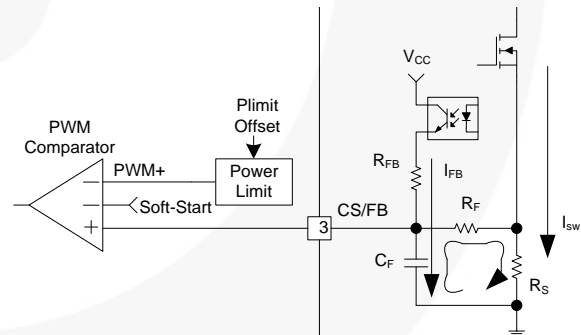
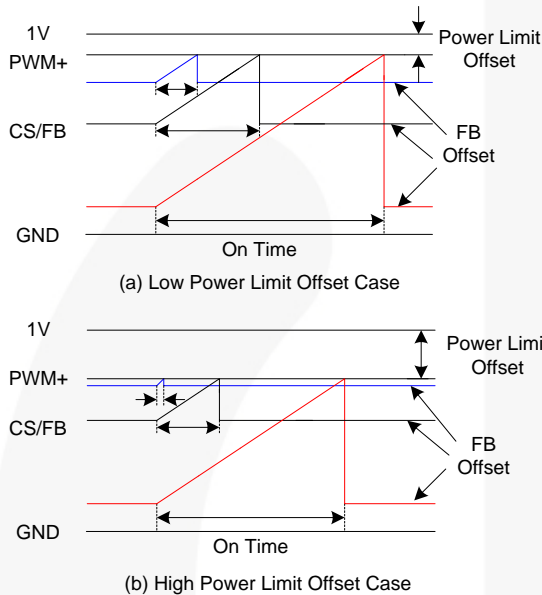


Figure 21. Current Sense and Feedback Circuits

Figure 22 shows typical voltage waveforms of the CS/FB pin. The current sense waveform is added to the offset voltage, as shown in the Figure 22. The CS/FB pin voltage is compared with PWM that is 1 V - Plimit offset. If the CS/FB voltage meets PWM+, the output drive is shut off. If the feedback offset voltage is LOW, the switch on-time is increased. If the feedback offset voltage is HIGH, the switch on-time is decreased. In this way, the duty cycle is controlled according to the output load condition. Generally, the maximum output power increases as input voltage increases because the current slope during switch on-time increases.

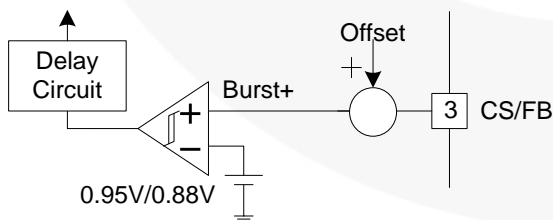
To limit the output power of the converter constantly, the power limit function is included in FAN7602C. Sensing the converter input voltage through the Latch/Plimit pin, the Plimit offset voltage is subtracted from 1 V. As shown in Figure 22, the Plimit offset voltage is subtracted from 1 V and the switch on-time decreases as the Plimit offset voltage increases. If the converter input voltage increases, the switch on-time decreases, keeping the output power constant. The offset voltage is proportional to the Latch/Plimit pin voltage and the gain is 0.16. If the Latch/Plimit voltage is 1 V, the offset voltage is 0.16 V.



**Figure 22. CS/FB Pin Voltage Waveforms**

#### 4. Burst-Mode Block

The FAN7602C contains the burst-mode block to reduce the power loss at a light-load and no load. A hysteresis comparator senses the offset voltage of the Burst+ for the burst mode, as shown in Figure 23. The Burst+ is the sum of the CS/FB voltage and Plimit offset voltage. The FAN7602C enters the burst mode when the offset voltage of the Burst+ is higher than 0.95 V and exits the burst mode when the offset voltage is lower than 0.88 V. The offset voltage is sensed during the switch off time.



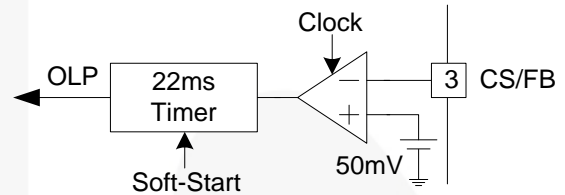
**Figure 23. Burst-Mode Block**

#### 5. Protection Block

The FAN7602C contains several protection functions to improve system reliability.

#### 5.1 Overload Protection (OLP)

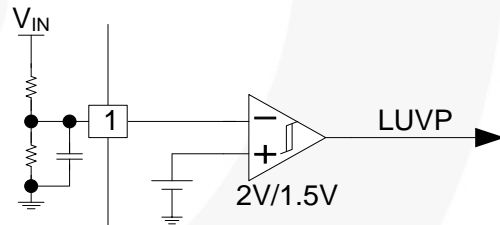
The FAN7602C contains the overload protection function. If the output load is higher than the rated output current, the output voltage drops and the feedback error amplifier is saturated. The offset of the CS/FB voltage representing the feedback information is almost zero. As shown in Figure 24, the CS/FB voltage is compared with 50 mV reference when the internal clock signal is HIGH and, if the voltage is lower than 50 mV, the OLP timer starts counting. If the OLP condition persists for 22 ms, the timer generates the OLP signal. The protection is reset by the UVLO. The OLP block is enabled after the soft-start finishes.



**Figure 24. Overload Protection Circuit**

#### 5.2 Line Under-Voltage Protection

If the input voltage of the converter is lower than the minimum operating voltage, the converter input current increases too much, causing components failure. Therefore, if the input voltage is LOW, the converter should be protected. The LUVV circuit senses the input voltage using the LUVV pin and, if this voltage is lower than 2 V, the LUVV signal is generated. The comparator has 0.5 V hysteresis. If the LUVV signal is generated, the output drive block is shut down, the output voltage feedback loop is saturated, and the OLP works if the LUVV condition persists more than 22 ms.



**Figure 25. Line UVP Circuit**

#### 5.3 Latch Protection

The latch protection is provided to protect the system against abnormal conditions using the Latch/Plimit pin. The Latch/Plimit pin can be used for the output over-voltage protection and/or other protections. If the Latch/Plimit pin voltage is made higher than 4 V by an external circuit, the IC is shut down. The latch protection is reset when the  $V_{CC}$  voltage is lower than 5 V.

#### 5.4 Over-Voltage Protection (OVP)

If the  $V_{CC}$  voltage reaches 19 V, the IC shuts down and the OVP protection is reset when the  $V_{CC}$  voltage is lower than 5 V.

## 6. Output Drive Block

The FAN7602C contains a single totem-pole output stage to drive a power MOSFET. The drive output is capable of up to 450 mA sourcing current and 600 mA

sinking current with typical rise and fall time of 45 ns and 35 ns, respectively, with a 1 nF load.

### Typical Application Circuit

| Application | Output Power | Input Voltage                               | Output Voltage |
|-------------|--------------|---|----------------|
| Adaptor     | 48 W         | Universal Input (85 ~ 265 V <sub>AC</sub> ) | 12V            |

### Features

- Low stand-by power (<0.15 W at 265 V<sub>AC</sub>)
- Constant output power control

### Key Design Notes

- All the IC-related components should be placed close to IC, especially C107 and C110.
- If R106 value is too low, there can be subharmonic oscillation.
- R109 should be designed carefully to make the V<sub>CC</sub> voltage higher than 8 V when the input voltage is 265 V<sub>AC</sub> at no load.
- R110 should be designed carefully to make the V<sub>CC</sub> voltage lower than OVP level when the input voltage is 85 V<sub>AC</sub> at full load.
- R103 should be designed to keep the MOSFET V<sub>DS</sub> voltage lower than maximum rating when the output is shorted.

### 1. Schematic

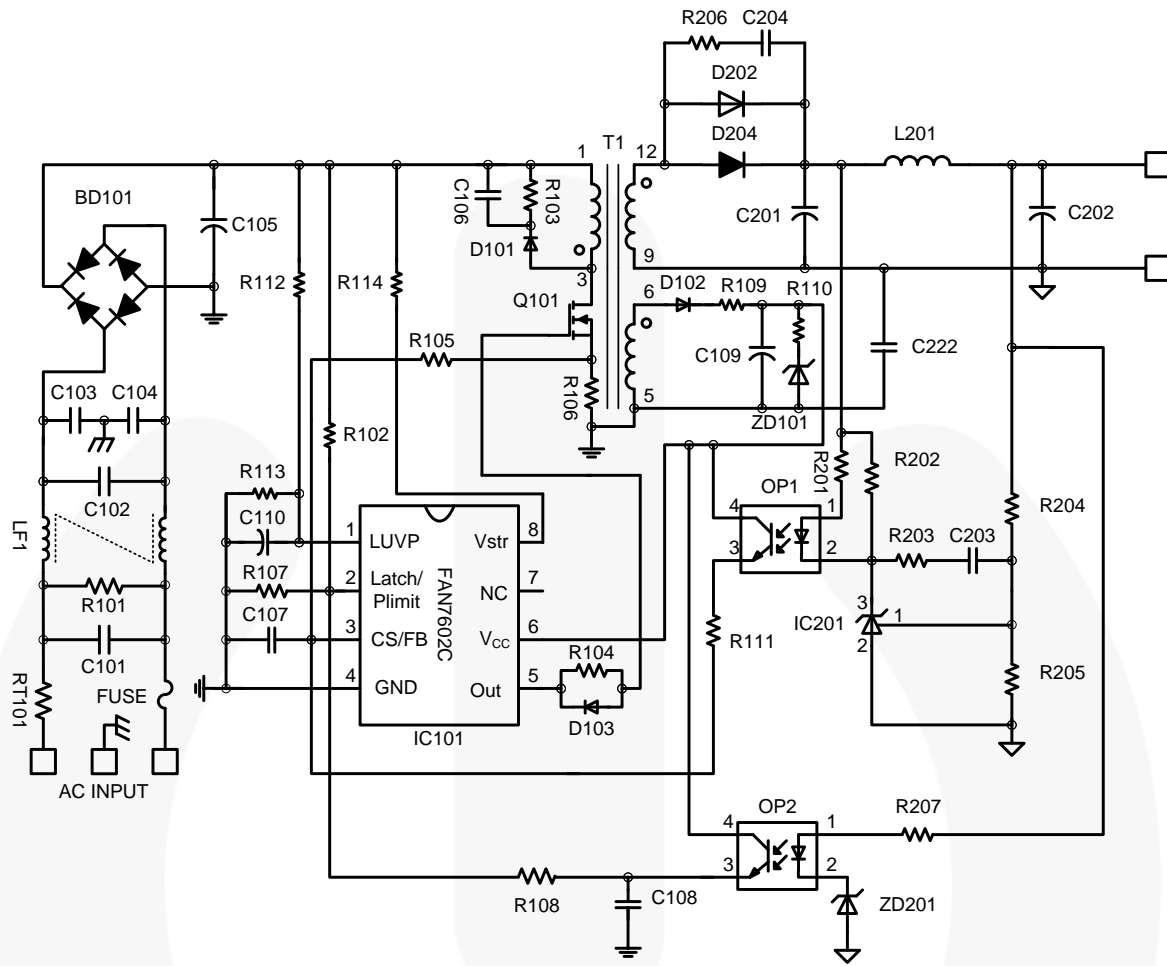


Figure 26. Schematic

### 2. Inductor Schematic Diagram

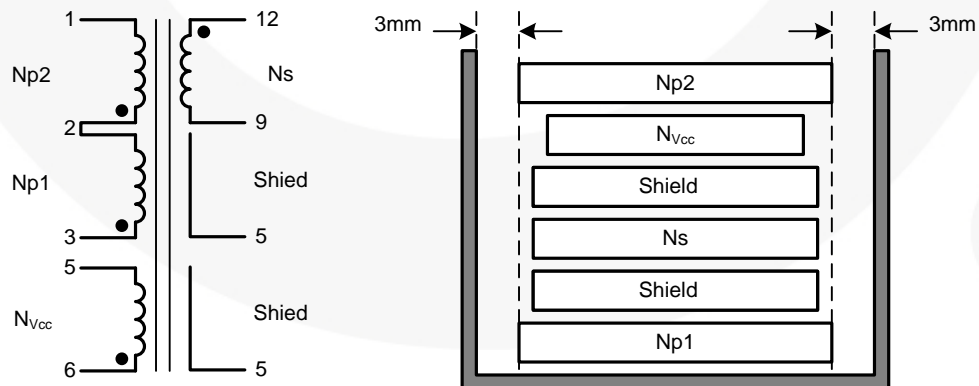


Figure 27. Inductor Schematic Diagram

### 3. Winding Specification

| No.   | Pin ( S → F) | Wire                  | Turns | Winding Method   |
|---|--------------|-----------------------|-------|------------------|
| N <sub>p1</sub>                                       | 3 → 2        | 0.3 <sup>ϕ</sup> x 2  | 31    | Solenoid Winding |
| Insulation: Polyester Tape t = 0.03 mm, 2-Layer       |              |                       |       |                  |
| Shield  | 5            | Copper Tape           | 0.9   | Not Shorted      |
| Insulation: Polyester Tape t = 0.03 mm, 2-Layer       |              |                       |       |                  |
| N <sub>s</sub>  | 12 → 9       | 0.65 <sup>ϕ</sup> x 3 | 10    | Solenoid Winding |
| Insulation: Polyester Tape t = 0.03 mm, 2-Layer       |              |                       |       |                  |
| Shield  | 5            | Copper Tape           | 0.9   | Not Shorted      |
| Insulation: Polyester Tape t = 0.03 mm, 2-Layer       |              |                       |       |                  |
| N <sub>Vcc</sub>                                      | 6 → 5        | 0.2 <sup>ϕ</sup> x 1  | 10    | Solenoid Winding |
| Insulation: Polyester Tape t = 0.03 mm, 2-Layer       |              |                       |       |                  |
| N <sub>p2</sub>                                       | 2 → 1        | 0.3 <sup>ϕ</sup> x 2  | 31    | Solenoid Winding |
| Outer Insulation: Polyester Tape t = 0.03 mm, 2-Layer |              |                       |       |                  |

### 4. Electrical Characteristics

|            | Pin   | Specification | Remarks        |
|------------|-------|---------------|----------------|
| Inductance | 1 - 3 | 607 μH        | 100 kHz, 1 V   |
| Inductance | 1 - 3 | 15 μH         | 9 - 12 Shorted |

### 5. Core & Bobbin

- Core: EER2828
- Bobbin: EER2828
- Ae(mm<sup>2</sup>): 82.1

## 6. Demo Circuit Part List

| Part            | Value          | Note                    | Part             | Value               | Note                    |
|-----------------|----------------|-------------------------|------------------|---------------------|-------------------------|
| <b>Fuse</b>     |                |                         | <b>Capacitor</b> |                     |                         |
| FUSE            | 1 A/250 V      |                         | C101             | 220 nF / 275 V      | Box Capacitor           |
| <b>NTC</b>      |                |                         | C102             | 150 nF / 275 V      | Box Capacitor           |
| RT101           | 5D-9           |                         | C103, C104       | 102 / 1 kV          | Ceramic                 |
| <b>Resistor</b> |                |                         | C105             | 150 $\mu$ F / 400 V | Electrolytic            |
| R102, R112      | 10 M $\Omega$  | 1/4 W                   | C106             | 103 / 630 V         | Film                    |
| R103            | 56 k $\Omega$  | 1/2 W                   | C107             | 271                 | Ceramic                 |
| R104            | 150 $\Omega$   | 1/4 W                   | C108             | 103                 | Ceramic                 |
| R105            | 1 k $\Omega$   | 1/4 W                   | C109             | 22 $\mu$ F / 25 V   | Electrolytic            |
| R106            | 0.5 $\Omega$   | 1/2 W                   | C110             | 473                 | Ceramic                 |
| R107            | 56 k $\Omega$  | 1/4 W                   | C201, C202       | 1000 $\mu$ F / 25 V | Electrolytic            |
| R108            | 10 k $\Omega$  | 1/4 W                   | C203             | 102                 | Ceramic                 |
| R109            | 0 $\Omega$     | 1/4 W                   | C204             | 102                 | Ceramic                 |
| R110            | 1 k $\Omega$   | 1/4 W                   | C222             | 222 / 1 kV          | Ceramic                 |
| R111            | 6 k $\Omega$   | 1/4 W                   | <b>MOSFET</b>    |                     |                         |
| R113            | 180 k $\Omega$ | 1/4 W                   | Q101             | FQPF8N60C           | Fairchild Semiconductor |
| R114            | 50 k $\Omega$  | 1/4 W                   | <b>Diode</b>     |                     |                         |
| R201            | 1.5 k $\Omega$ | 1/4 W                   | D101, D102       | UF4007              | Fairchild Semiconductor |
| R202            | 1.2 k $\Omega$ | 1/4 W                   | D103             | 1N5819              | Fairchild Semiconductor |
| R203            | 20 k $\Omega$  | 1/4 W                   | D202, D204       | FYPF2010DN          | Fairchild Semiconductor |
| R204            | 27 k $\Omega$  | 1/4 W                   | ZD101, ZD201     | 1N4744              | Fairchild Semiconductor |
| R205            | 7 k $\Omega$   | 1/4 W                   | BD101            | KBP06               | Fairchild Semiconductor |
| R206            | 10 $\Omega$    | 1/2 W                   | <b>TNR</b>       |                     |                         |
| R207            | 10 k $\Omega$  | 1/4 W                   | R101             | 471                 | 470 V                   |
| <b>IC</b>       |                |                         | <b>Filter</b>    |                     |                         |
| IC101           | FAN7602C       | Fairchild Semiconductor | LF101            | 23 mH               | 0.8 A                   |
| IC201           | KA431          | Fairchild Semiconductor | L201             | 10 $\mu$ H          | 4.2 A                   |
| OP1, OP2        | H11A817B       | Fairchild Semiconductor |                  |                     |                         |



## 7. PCB Layout

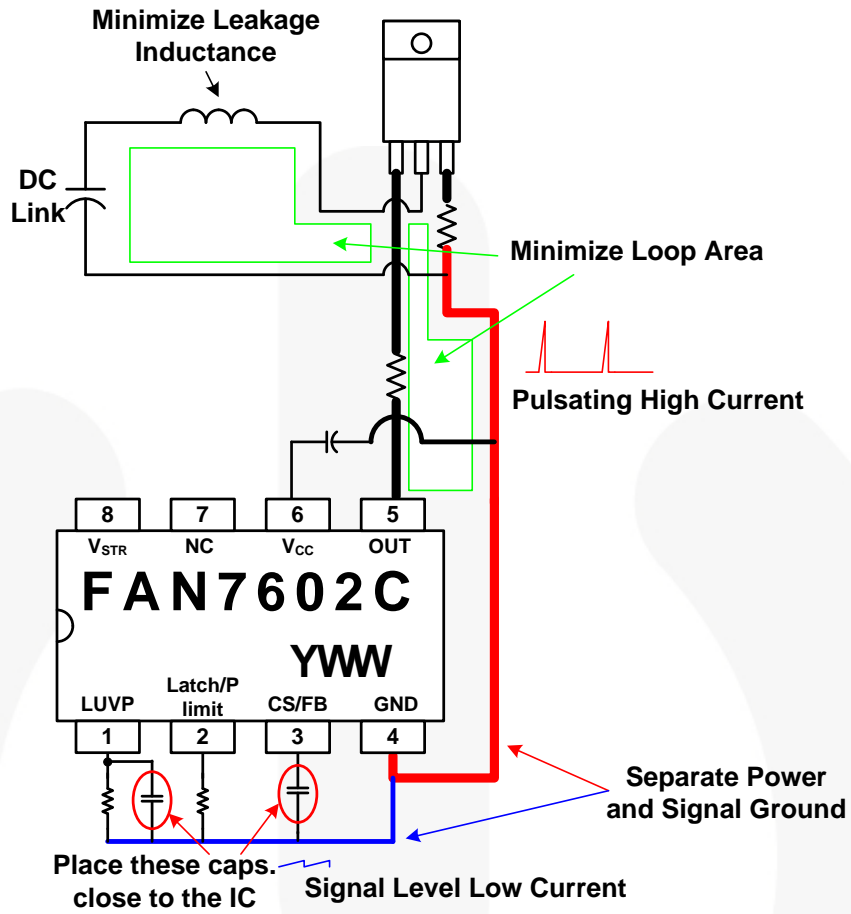
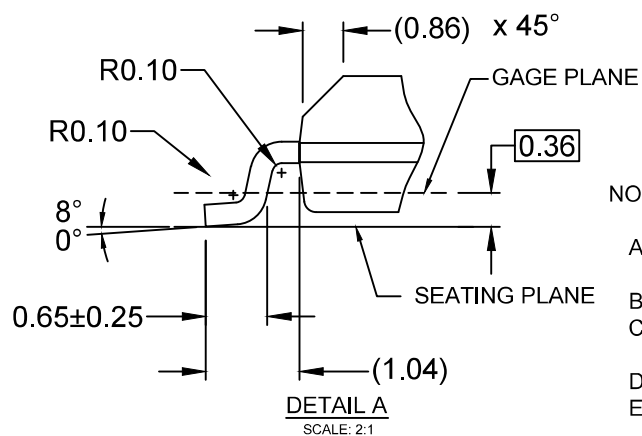
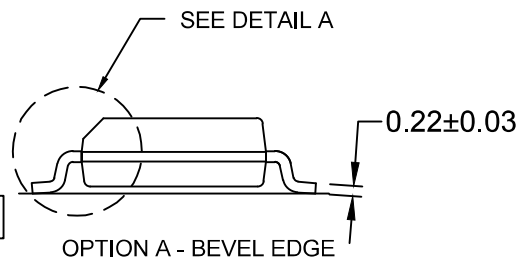
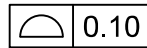
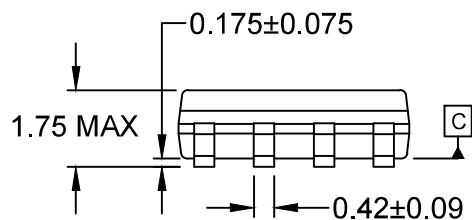
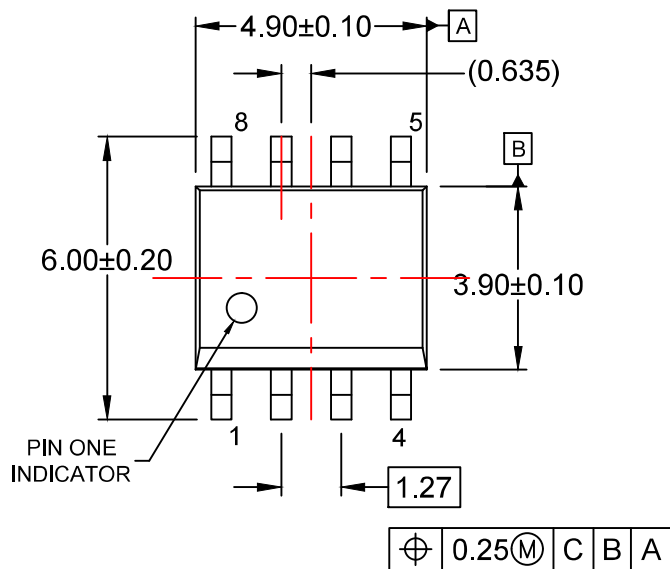


Figure 28. PCB Layout Recommendations

## 8. Performance Data

|                           | 85 V <sub>AC</sub> | 110 V <sub>AC</sub> | 220 V <sub>AC</sub> | 265 V <sub>AC</sub> |
|---------------------------|--------------------|---------------------|---------------------|---------------------|
| Input Power at No Load    | 72 mW              | 76 mW               | 92 mW               | 107 mW              |
| Input Power at 0.5 W Load | 760 mW             | 760 mW              | 785 mW              | 805 mW              |
| OLP Point                 | 4.73 A             | 5.07 A              | 5.11 A              | 4.91 A              |



NOTES:

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M
- E) DRAWING FILENAME: M08Arev16



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative