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# SG5841J — Highly Integrated Green-Mode PWM Controller

## Features

- Green-Mode PWM Controller
- Low Startup Current : 14μA
- Low Operating Current: 4mA
- Programmable PWM Frequency with Hopping
- Peak-Current-Mode Control
- Cycle-by-Cycle Current Limiting
- Synchronized Slope Compensation
- Leading-Edge Blanking (LEB)
- Constant Output Power Limit
- Totem Pole Output with Soft Driving
- V<sub>DD</sub> Over-Voltage Clamping
- Programmable Over-Temperature Protection (OTP)
- Internal Open-Loop Protection
- V<sub>DD</sub> Under-Voltage Lockout (UVLO)
- GATE Output Maximum Voltage Clamp:18V

## Applications

General-purpose, switch-mode, power supplies and flyback power converters, including:

- Power Adapters
- Open-Frame SMPS

## Description

The highly integrated SG5841/J series of PWM controllers provides several features to enhance the performance of flyback converters.

To minimize standby power consumption, a proprietary green-mode function provides off-time modulation to continuously decrease the switching frequency at light-load conditions. This green-mode function enables the power supply to meet international power conservation requirements. To further reduce power consumption, SG5841/J is manufactured using the BiCMOS process. This allows a low startup current, around 14μA, and an operating current of only 4mA. As a result, a large startup resistance can be used.

The built-in synchronized slope compensation achieves stable peak-current-mode control. The proprietary internal sawtooth power-limiter ensures a constant output power limit over a wide range of AC input voltages, from 90V<sub>AC</sub> to 264V<sub>AC</sub>.

SG5841/J provides many protections. In addition to cycle-by-cycle current limiting, the internal open-loop protection circuit ensures safety should an open-loop or output-short-circuit failure occur. PWM output is disabled until V<sub>DD</sub> drops below the UVLO lower limit, then the controller restarts. An external NTC thermistor can be applied for over-temperature protection.

SG5841/J is available in an 8-pin DIP or SOP package.

## Ordering Information

| Part Number | Ambient Operating Temperature Range | Frequency Hopping | Package                           |
|-------------|-------------------------------------|-------------------|-----------------------------------|
| SG5841JSZ   | -20 to +85°C                        | Yes               | 8-Pin Small Outline Package (SOP) |
| SG5841JSY   | -20 to +85°C                        | Yes               | 8-Pin Small Outline Package (SOP) |
| SG5841SZ    | -20 to +85°C                        | No                | 8-Pin Small Outline Package (SOP) |
| SG5841SY    | -20 to +85°C                        | No                | 8-Pin Small Outline Package (SOP) |

### Typical Application

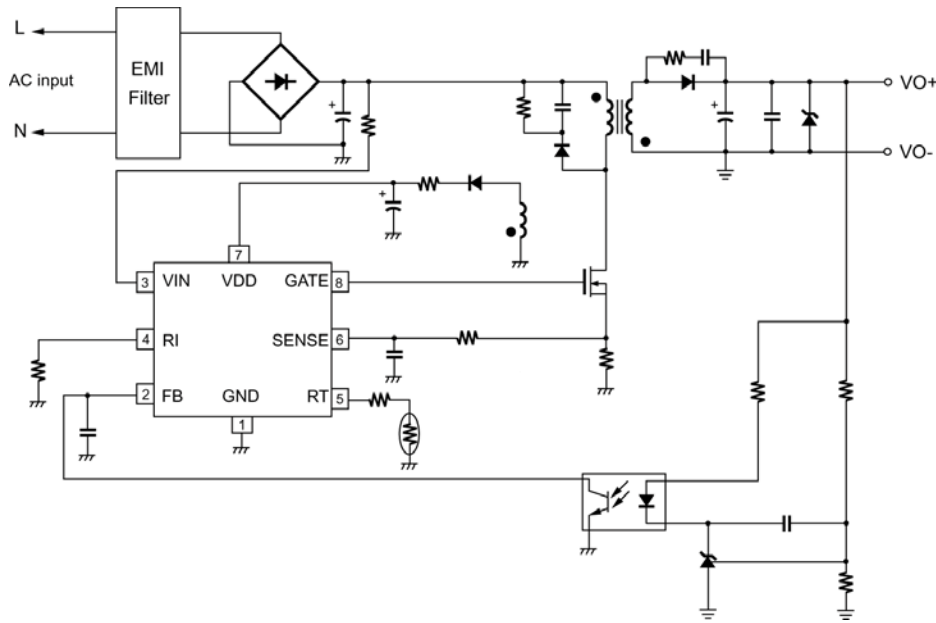


Figure 1. Application Diagram

### Block Diagram

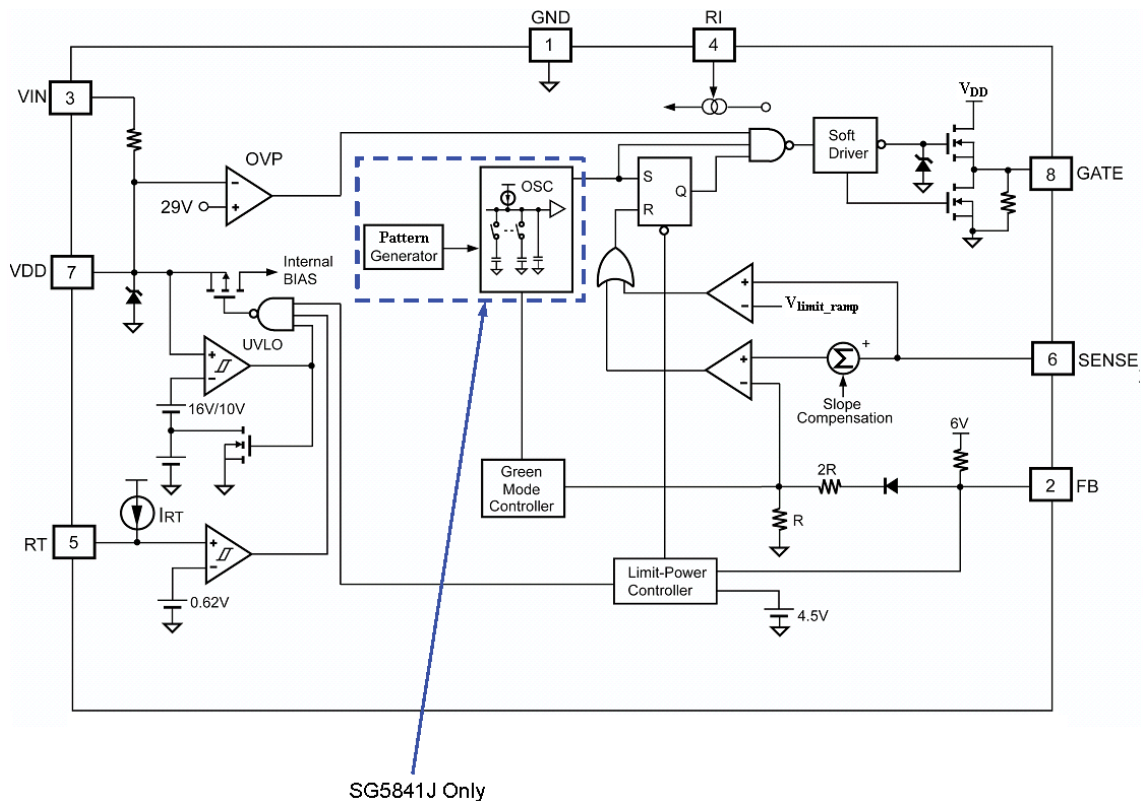


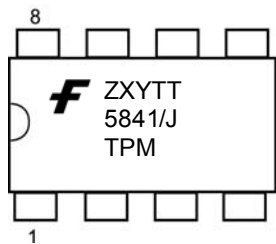
Figure 2. Block Diagram

## Marking Information



marking for SG5841JSZ (pb-free)  
 marking for SG5841JDZ (pb-free)  
 marking for SG5841SZ (pb-free)  
 marking for SG5841DZ (pb-free)

**H:** J = with Frequency Hopping  
 Null = without Frequency Hopping  
**T:** D = DIP, S = SOP  
**P:** Z = Lead Free  
 Null = regular package  
**XXXXXXXX** : Wafer Lot  
**Y:** Year; **WW:** Week  
**V:** Assembly Location



marking for SG5841JSY (green-compound)  
 marking for SG5841SY (green-compound)

**F:** Fairchild Logo  
**Z:** Plant Code  
**X:** 1 Digit Year Code  
**Y:** 1 Digit Week Code  
**TT:** 2 Digit Die Run Code  
**T:** Package Type (D:DIP, S:SOP)  
**P:** Y = Green Package  
**M:** Manufacturing Flow Code

Figure 3. Top Mark

## Pin Configuration

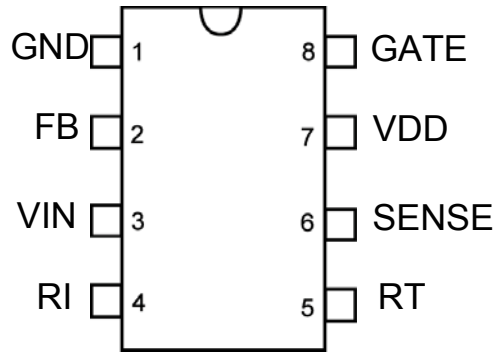


Figure 4. Pin Configuration

## Pin Definitions

| Pin # | Name  | Function              | Description  |
|-------|-------|-----------------------|--|
| 1     | GND   | Ground                | Ground.  |
| 2     | FB    | Feedback              | The signal from the external compensation circuit is fed into this pin. The PWM duty cycle is determined in response to the signal from this pin and the current-sense signal from pin 6. If FB voltage exceeds the threshold, the internal protection circuit disables PWM output after a predetermined delay time. |
| 3     | VIN   | Startup Input         | For startup, this pin is pulled HIGH to the rectified line input via a resistor. Since the startup current requirement is very small, a large startup resistance is used to minimize power loss.   |
| 4     | RI    | Reference Setting     | A resistor connected from the RI to GND provides a constant current source. This determines the center PWM frequency. Increasing the resistance reduces PWM frequency. Using a 26K $\Omega$ resistor results in a 65KHz center PWM frequency.  |
| 5     | RT    | Temperature Detection | For over-temperature protection. An external NTC thermistor is connected from this pin to the GND pin. The impedance of the NTC decreases at high temperatures. Once the voltage of the RT pin drops below a fixed limit, PWM output is disabled.  |
| 6     | SENSE | Current Sense         | Current sense. The sensed voltage is used for peak-current-mode control and cycle-by-cycle current limiting.   |
| 7     | VDD   | Power Supply          | Power supply. If V <sub>DD</sub> exceeds a threshold, the internal protection circuit disables PWM output.   |
| 8     | GATE  | Driver Output         | The totem-pole output driver for the power MOSFET, which is internally clamped below 18V.  |

## 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. All voltage values, except differential voltages, are given with respect to GND pin.

| Symbol             | Parameter   | Min. | Max. | Unit |
|--------------------|---|------|------|------|
| V <sub>DD</sub>    | Supply Voltage  |      | 30   | V    |
| V <sub>IN</sub>    | Input Terminal  |      | 30   | V    |
| V <sub>FB</sub>    | Input Voltage to FB Pin                                   | -0.3 | 7.0  | V    |
| V <sub>SENSE</sub> | Input Voltage to SENSE Pin                                | -0.3 | 7.0  | V    |
| V <sub>RT</sub>    | Input Voltage to RT Pin                                   | -0.3 | 7.0  | V    |
| V <sub>RI</sub>    | Input Voltage to RI Pin                                   | -0.3 | 7.0  | V    |
| P <sub>D</sub>     | Power Dissipation (T <sub>A</sub> < 50°C )                | DIP  | 800  | mW   |
|                    |   | SOP  | 400  |      |
| θ <sub>JA</sub>    | Thermal Resistance (Junction-to-Air)                      | DIP  | 82.5 | °C/W |
|                    |   | SOP  | 141  |      |
| θ <sub>JC</sub>    | Thermal Resistance (Junction-to-Case)                     | DIP  | 59.7 | °C/W |
|                    |   | SOP  | 80.8 |      |
| T <sub>J</sub>     | Operating Junction Temperature                            | -40  | +125 | °C   |
| T <sub>STG</sub>   | Storage Temperature Range                                 | -55  | +150 | °C   |
| T <sub>L</sub>     | Lead Temperature (Wave Soldering or Infrared, 10 Seconds) |      | 260  | °C   |
| ESD                | Human Body Model, JESD22-A114                             |      | 3    | kV   |
|                    | Charged Device Model, JESD22-C101                         |      | 250  | V    |

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol         | Parameter                      | Min. | Max. | Unit |
|----------------|--------------------------------|------|------|------|
| T <sub>A</sub> | Operating Ambient Temperatures | -20  | +85  | °C   |

## Electrical Characteristics

$V_{DD} = 15V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

| Symbol                        | Parameter   | Conditions  | Min.                                | Typ.                   | Max.   | Units |     |
|-------------------------------|---|---|-------------------------------------|------------------------|--------|-------|-----|
| <b>V<sub>DD</sub> Section</b> |   |   |                                     |                        |        |       |     |
| V <sub>DD-OP</sub>            | Continuously Operating Voltage                      |   |                                     |                        | 24.7   | V     |     |
| V <sub>DD-ON</sub>            | Start Threshold Voltage                             |   | 15                                  | 16                     | 17     | V     |     |
| V <sub>DD-OFF</sub>           | Minimum Operating Voltage                           |   | 9                                   | 10                     | 11     | V     |     |
| I <sub>DD-ST</sub>            | Startup Current                                     | V <sub>DD</sub> =V <sub>DD-ON</sub> -0.16V            |                                     | 14                     | 30     | μA    |     |
| I <sub>DD-OP</sub>            | Operating Supply Current                            | V <sub>DD</sub> =15V, R <sub>I</sub> =26KΩ, GATE=OPEN |                                     | 4                      | 5      | mA    |     |
| V <sub>DD-CLAMP</sub>         | V <sub>DD</sub> Over-Voltage-Clamping Level         |   | 28                                  | 29                     |        | V     |     |
| t <sub>D-VDDCLAMP</sub>       | V <sub>DD</sub> Over-Voltage-Clamping Debounce Time | R <sub>I</sub> =26KΩ                                  | 50                                  | 100                    | 200    | μs    |     |
| <b>R<sub>I</sub> Section</b>  |   |   |                                     |                        |        |       |     |
| R <sub>I-NOR</sub>            | R <sub>I</sub> Operating Range                      |   | 15.5                                |                        | 36.0   | KΩ    |     |
| R <sub>I-MAX</sub>            | Maximum R <sub>I</sub> Value for Protection         |   |                                     | 230                    |        | KΩ    |     |
| R <sub>I-MIN</sub>            | Minimum R <sub>I</sub> Value for Protection         |   |                                     | 10                     |        | KΩ    |     |
| <b>Oscillator Section</b>     |   |   |                                     |                        |        |       |     |
| f <sub>OSC</sub>              | Normal PWM Frequency                                | Center Frequency                                      | R <sub>I</sub> =26KΩ                | 62                     | 65     | 68    | KHz |
|                               |   | Hopping Range   | R <sub>I</sub> =26KΩ (SG5841J only) | ±3.7                   | ±4.2   | ±4.7  |     |
| t <sub>HOP</sub>              | Hopping Period                                      |   | R <sub>I</sub> =26KΩ (SG5841J only) | 3.9                    | 4.4    | 4.9   | ms  |
| f <sub>OSC-G</sub>            | Green-Mode Frequency                                |   | R <sub>I</sub> =26KΩ                | 18                     | 22     | 25    | KHz |
| f <sub>DV</sub>               | Frequency Variation vs. V <sub>DD</sub> Deviation   |   | V <sub>DD</sub> =11.5V to 24.7V     |                        |        | 5     | %   |
| f <sub>DT</sub>               | Frequency Variation vs. Temperature Deviation       |   | T <sub>A</sub> =-20 to +85°C        |                        |        | 5     | %   |
| <b>Feedback Input Section</b> |   |   |                                     |                        |        |       |     |
| A <sub>V</sub>                | FB Input to Current Comparator Attenuation          |   | 1/3.75                              | 1/3.20                 | 1/2.75 | V/V   |     |
| Z <sub>FB</sub>               | Input Impedance                                     |   | 4                                   |                        | 7      | KΩ    |     |
| V <sub>FB-OPEN</sub>          | FB Output High Voltage                              | FB pin open   | 5                                   | 6                      |        | V     |     |
| V <sub>FB-OLP</sub>           | FB Open-Loop Trigger Level                          |   | 4.2                                 | 4.5                    | 4.8    | V     |     |
| t <sub>D-OLP</sub>            | Delay Time of FB Pin Open-Loop Protection           | R <sub>I</sub> =26KΩ                                  | 26                                  | 29                     | 32     | ms    |     |
| V <sub>FB-N</sub>             | Green-Mode Entry FB Voltage                         | R <sub>I</sub> =26KΩ                                  | 1.9                                 | 2.1                    | 2.3    | V     |     |
| V <sub>FB-G</sub>             | Green-Mode Ending FB Voltage                        | R <sub>I</sub> =26KΩ                                  |                                     | V <sub>FB-N</sub> -0.5 |        | V     |     |

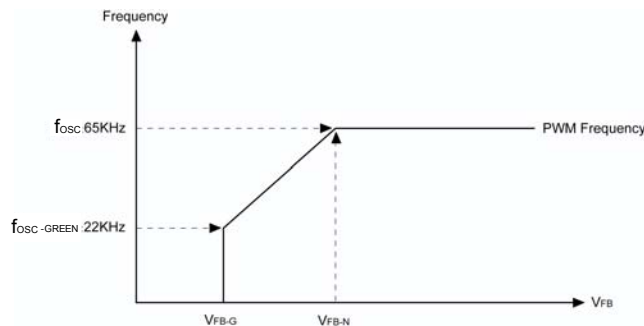


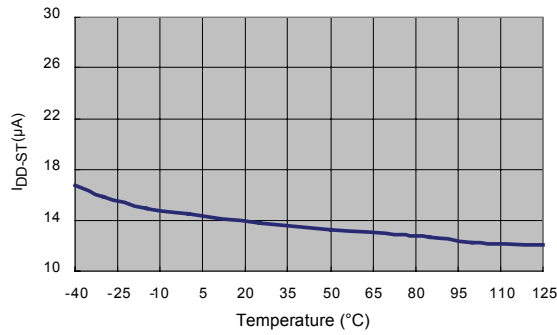
Figure 5. PWM Frequency



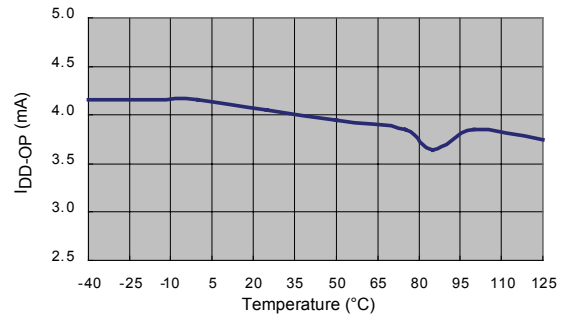
**Electrical Characteristics** (Continued) $V_{DD} = 15V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

| Symbol                       | Parameter                                       | Conditions                      | Min.  | Typ.              | Max.  | Unit       |
|------------------------------|---|---------------------------------|-------|-------------------|-------|------------|
| <b>Current-Sense Section</b> |   |                                 |       |                   |       |            |
| $Z_{SENSE}$                  | Input Impedance                                 |                                 |       | 12                |       | K $\Omega$ |
| $V_{STHFL}$                  | Current Limit Flatten Threshold Voltage         |                                 | 0.85  | 0.90              | 0.95  | V          |
| $V_{STHVA}$                  | Current Limit Valley Threshold Voltage          | $V_{STHFL} - V_{STHVA}$         |       | 0.22              |       | V          |
| $t_{PD}$                     | Propagation Delay to GATE Output                | $R_I = 26K\Omega$               |       | 150               | 200   | ns         |
| $t_{LEB}$                    | Leading-Edge Blanking Time                      | $R_I = 26K\Omega$               | 200   | 270               | 350   | ns         |
| <b>GATE Section</b>          |   |                                 |       |                   |       |            |
| $DCY_{MAX}$                  | Maximum Duty Cycle                              |                                 | 60    | 65                | 70    | %          |
| $V_{GATE-L}$                 | Output Voltage Low                              | $V_{DD} = 15V$ , $I_O = 50mA$   |       |                   | 1.5   | V          |
| $V_{GATE-H}$                 | Output Voltage High                             | $V_{DD} = 12.5V$ , $I_O = 50mA$ | 7.5   |                   |       | V          |
| $t_r$                        | Rising Time                                     | $V_{DD} = 15V$ , $C_L = 1nF$    | 150   | 250               | 350   | ns         |
| $t_f$                        | Falling Time                                    | $V_{DD} = 15V$ , $C_L = 1nF$    | 30    | 50                | 90    | ns         |
| $I_O$                        | Peak Output Current                             | $V_{DD} = 15V$ , GATE=6V        | 230   |                   |       | mA         |
| $V_{GATE-CLAMP}$             | Gate Output Clamping Voltage                    | $V_{DD} = 24.7V$                |       | 18                | 19    | V          |
| <b>RT Section</b>            |   |                                 |       |                   |       |            |
| $I_{RT}$                     | Output Current of RT Pin                        | $R_I = 26K\Omega$               | 92    | 100               | 108   | $\mu A$    |
| $V_{RTTH}$                   | Trigger Voltage for Over-Temperature Protection |                                 | 0.585 | 0.620             | 0.655 | V          |
| $V_{RT-RLS}$                 | OTP Release Voltage                             |                                 |       | $V_{RTTH} + 0.03$ |       | V          |
| $t_{D-OTP}$                  | Over-Temperature Debounce                       | $R_I = 26K\Omega$               | 60    | 100               | 140   | $\mu s$    |

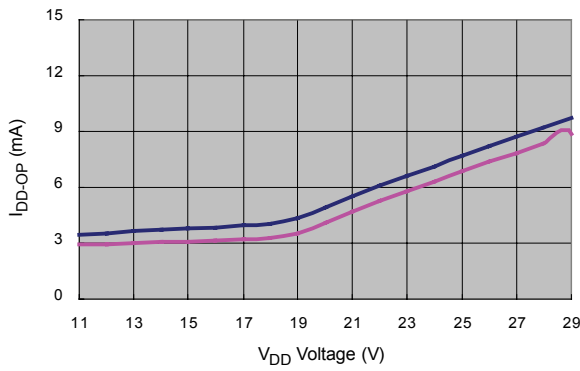
## Typical Performance Characteristics



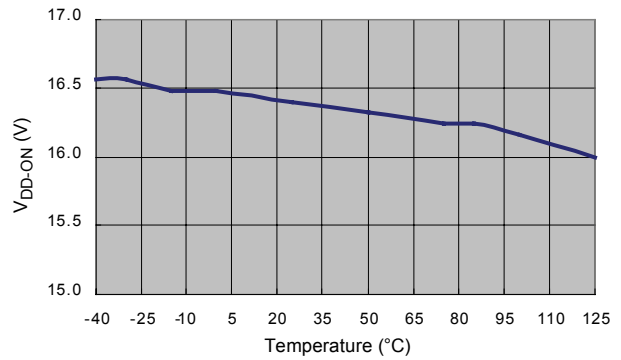
**Figure 6. Startup Current ( $I_{DD-ST}$ ) vs. Temperature**



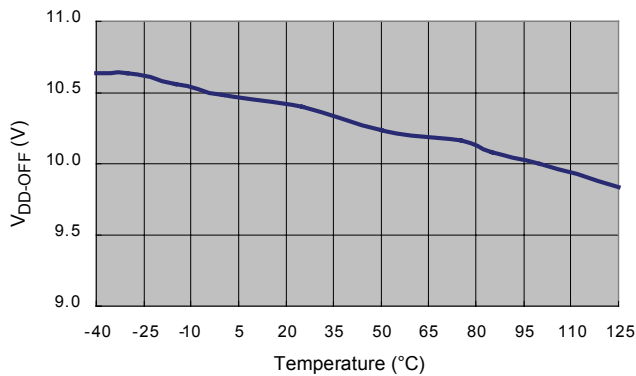
**Figure 7. Operating Supply Current ( $I_{DD-OP}$ ) vs. Temperature**



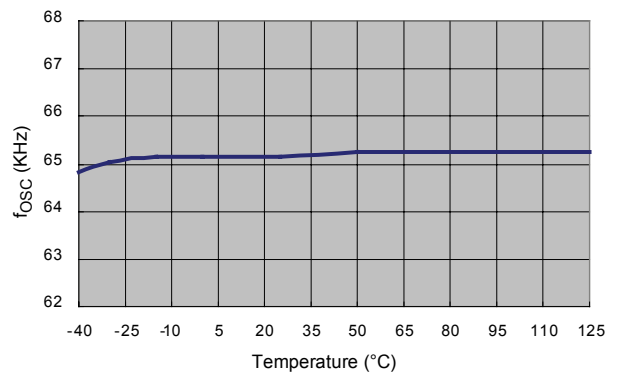
**Figure 8. Operating Current ( $I_{DD-OP}$ ) vs.  $V_{DD}$  Voltage**



**Figure 9. Start Threshold Voltage ( $V_{DD-ON}$ ) vs. Temperature**

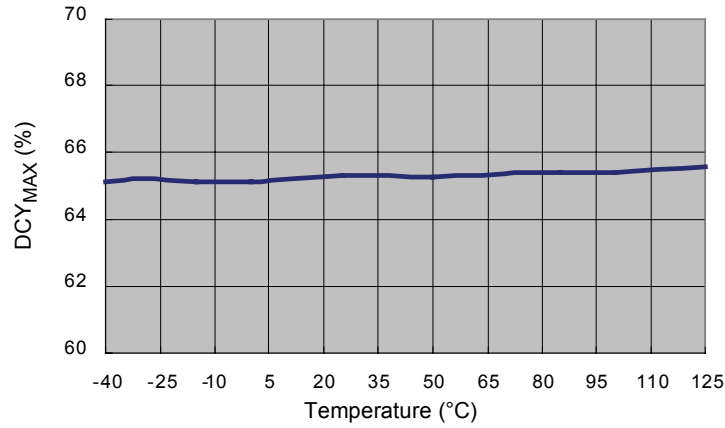


**Figure 10. Minimum Operating Voltage ( $V_{DD-ON}$ ) vs. Temperature**

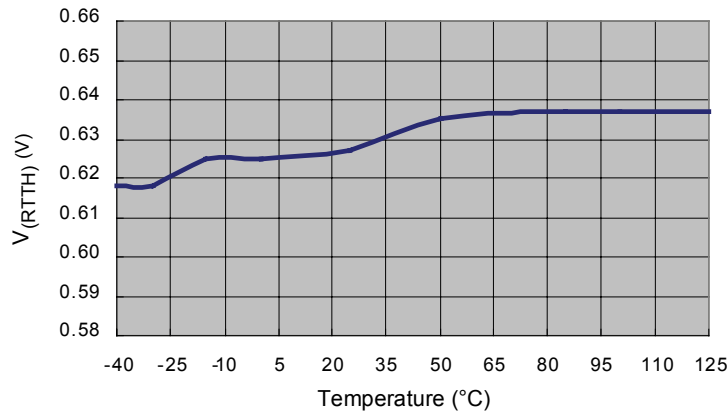


**Figure 11. PWM Frequency ( $f_{osc}$ ) vs. Temperature**

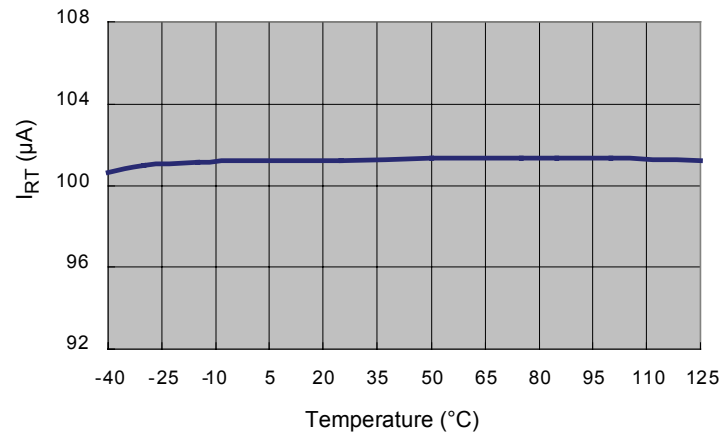
**Typical Performance Characteristics** (Continued)



**Figure 12. Maximum Duty Cycle (DCY<sub>MAX</sub>) vs. Temperature**



**Figure 13. Trigger Voltage for Over-Temperature Protection V<sub>RTTH</sub> vs. Temperature**



**Figure 14. Output Current of RT Pin (I<sub>RT</sub>) vs. Temperature**

## Functional Description

### Startup Current

Typical startup current is only 14μA, which allows a high-resistance and low-wattage startup resistor to minimize power loss. For an AC/DC adapter with universal input range, a 1.5MΩ, 0.25W startup resistor and a 10μF/25V V<sub>DD</sub> hold-up capacitor are enough for this application.

### Operating Current

Operating current is around 4mA. The low operating current enables better efficiency and reduces the requirement of V<sub>DD</sub> hold-up capacitance.

### Green-Mode Operation

The proprietary green-mode function provides off-time modulation to continuously decrease the PWM frequency under light-load conditions. To avoid acoustic noise problems, the minimum PWM frequency is set above 22KHz. Green mode dramatically reduces power consumption under light-load and zero-load conditions. Power supplies using a SG5841/J controller can meet restrictive international regulations regarding standby power consumption.

### Oscillator Operation

A resistor connected from the RI pin to the GND pin generates a constant current source for the SG5841/J controller. This current is used to determine the center PWM frequency. Increasing the resistance reduces PWM frequency. Using a 26KΩ resistor, R<sub>I</sub>, results in a corresponding 65KHz PWM frequency. The relationship between R<sub>I</sub> and the switching frequency is:

$$f_{PWM} = \frac{1690}{R_I \text{ (K}\Omega\text{)}} \text{ (KHz)} \quad (1)$$

The range of the PWM oscillation frequency is designed as 47KHz ~ 109KHz.

SG5841J also integrates a frequency hopping function internally. The frequency variation ranges from around 62KHz to 68KHz for a center frequency of 65KHz. The frequency-hopping function helps reduce EMI emission of a power supply with minimum line filters.

### Current Sensing / PWM Current Limiting

Peak-current-mode control is utilized in to regulate output voltage and provide pulse-by-pulse current limiting. The switch current is detected by a sense resistor into the SENSE pin. The PWM duty cycle is determined by this current-sense signal and the feedback voltage. When the voltage on the SENSE pin reaches around V<sub>COMP</sub> = (V<sub>FB</sub> - 1.0)/3.2, a switch cycle is terminated immediately. V<sub>COMP</sub> is internally clamped to a variable voltage around 0.85V for output power limit.

### Leading-Edge Blanking (LEB)

Each time the power MOSFET is switched on, a turn-on spike occurs at the sense-resistor. To avoid premature termination of the switching pulse, a leading-edge blanking time is built in. During this blanking period, the current-limit comparator is disabled and cannot switch off the gate drive.

### Under-Voltage Lockout (UVLO)

The turn-on and turn-off thresholds are fixed internally at 16V and 10V. During startup, the hold-up capacitor must be charged to 16V through the startup resistor to enable the IC. The hold-up capacitor continues to supply V<sub>DD</sub> before the energy can be delivered from auxiliary winding of the main transformer. V<sub>DD</sub> must not drop below 10V during this startup process. This UVLO hysteresis window ensures that hold-up capacitor is adequate to supply V<sub>DD</sub> during startup.

### Gate Output / Soft Driving

The SG5841/J BiCMOS output stage is a fast totem-pole gate driver. Cross conduction has been avoided to minimize heat dissipation, increase efficiency, and enhance reliability. The output driver is clamped by an internal 18V Zener diode to protect power MOSFET transistors against undesirable gate over-voltage. A soft driving waveform is implemented to minimize EMI.

### Built-in Slope Compensation

The sensed voltage across the current-sense resistor is used for peak-current-mode control and pulse-by-pulse current limiting. Built-in slope compensation improves stability or prevents sub-harmonic oscillation. SG5841/J inserts a synchronized, positive-going ramp at every switching cycle.

### Constant Output Power Limit

When the SENSE voltage across the sense resistor, R<sub>S</sub>, reaches the threshold voltage, around 0.85V, the output GATE drive is turned off after delay, t<sub>PD</sub>. This delay introduces additional current, proportional to t<sub>PD</sub> • V<sub>IN</sub> / L<sub>P</sub>. The delay is nearly constant, regardless of the input voltage V<sub>IN</sub>. Higher input voltage results in larger additional current and the output power limit is higher than under low-input line voltage. To compensate this variation for a wide AC input range, a sawtooth power-limiter (saw limiter) is designed to solve the unequal power-limit problem. The saw limiter is designed as a positive ramp signal (V<sub>limit\_ramp</sub>) and fed to the inverting input of the OCP comparator. This results in a lower current limit at high-line inputs than at low-line inputs.

### V<sub>DD</sub> Over-Voltage Clamping

V<sub>DD</sub> over-voltage clamping prevents damage due to abnormal conditions. If V<sub>DD</sub> voltage is over the V<sub>DD</sub> over-voltage clamping voltage (V<sub>DD-CLAMP</sub>) and lasts for t<sub>D-VDDCLAMP</sub>, the PWM pulses are disabled until the V<sub>DD</sub> drops below the V<sub>DD</sub> over-voltage clamping voltage.

### Thermal Protection

An NTC thermistor  $R_{NTC}$  in series with a resistor  $R_A$  can be connected from the RT pin to ground. A constant current  $I_{RT}$  is output from pin RT. The voltage on the RT pin can be expressed as  $V_{RT} = I_{RT} \times (R_{NTC} + R_A)$ , in which  $I_{RT} = 2 \times (1.3V / R_i)$ . At high ambient temperature,  $R_{NTC}$  is smaller, such that  $V_{RT}$  decreases. When  $V_{RT}$  is less than 0.62V, the PWM is completely turned off.

### Limited Power Control

The FB voltage increases every time the output of the power supply is shorted or overloaded. If the FB voltage remains higher than a built-in threshold for longer than  $t_{D-OLP}$ , PWM output is turned off. As PWM output is turned off, the supply voltage  $V_{DD}$  begins decreasing.

$$t_{D-OLP} \text{ (ms)} = 1.115 \times R_f \text{ (K}\Omega\text{)} \quad (2)$$

When  $V_{DD}$  goes below the turn-off threshold (e.g. 10V) the controller totally shuts down.  $V_{DD}$  is charged up to the turn-on threshold voltage of 16V through the startup resistor until PWM output is restarted. This protection remains activated as long as the overloading condition persists. This prevents the power supply from overheating due to overloading conditions.

### Noise Immunity

Noise on the current-sense or control signal may cause significant pulse-width jitter, particularly in the continuous-conduction mode. Slope compensation helps alleviate this problem. Good placement and layout practices should be followed. Avoiding long PCB traces and component leads, locating compensation and filter components near SG5841/J, and increasing power MOS gate resistance improve performance.

## Reference Circuit

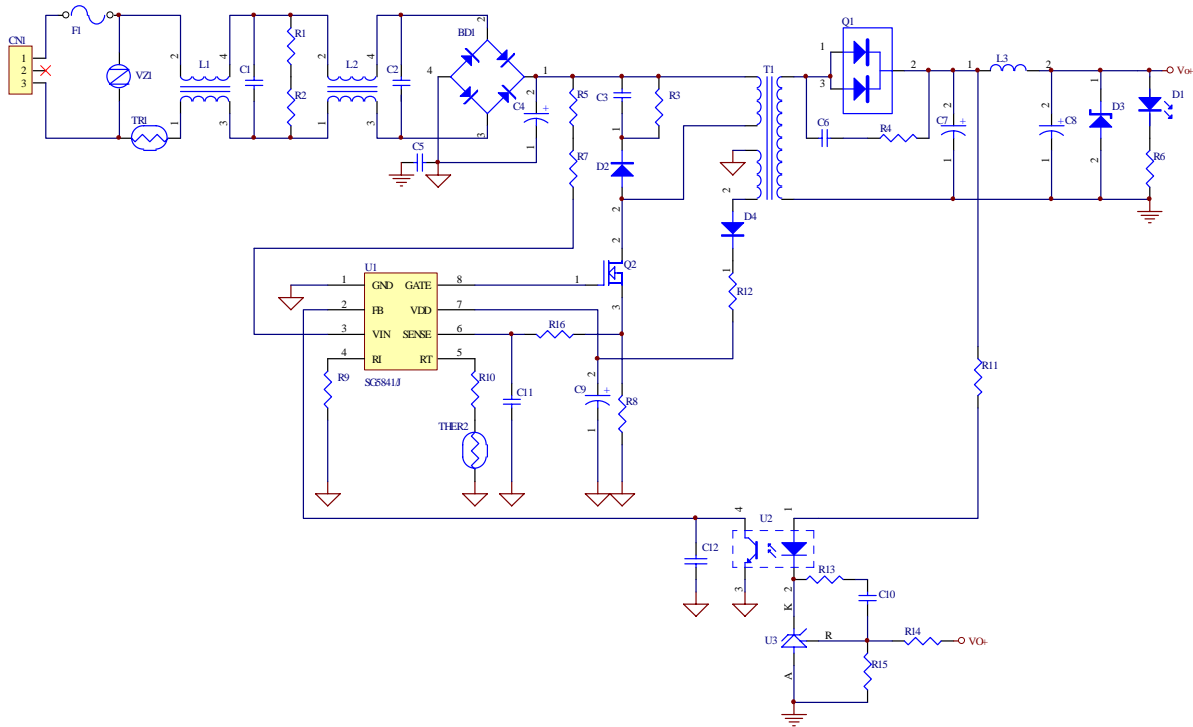


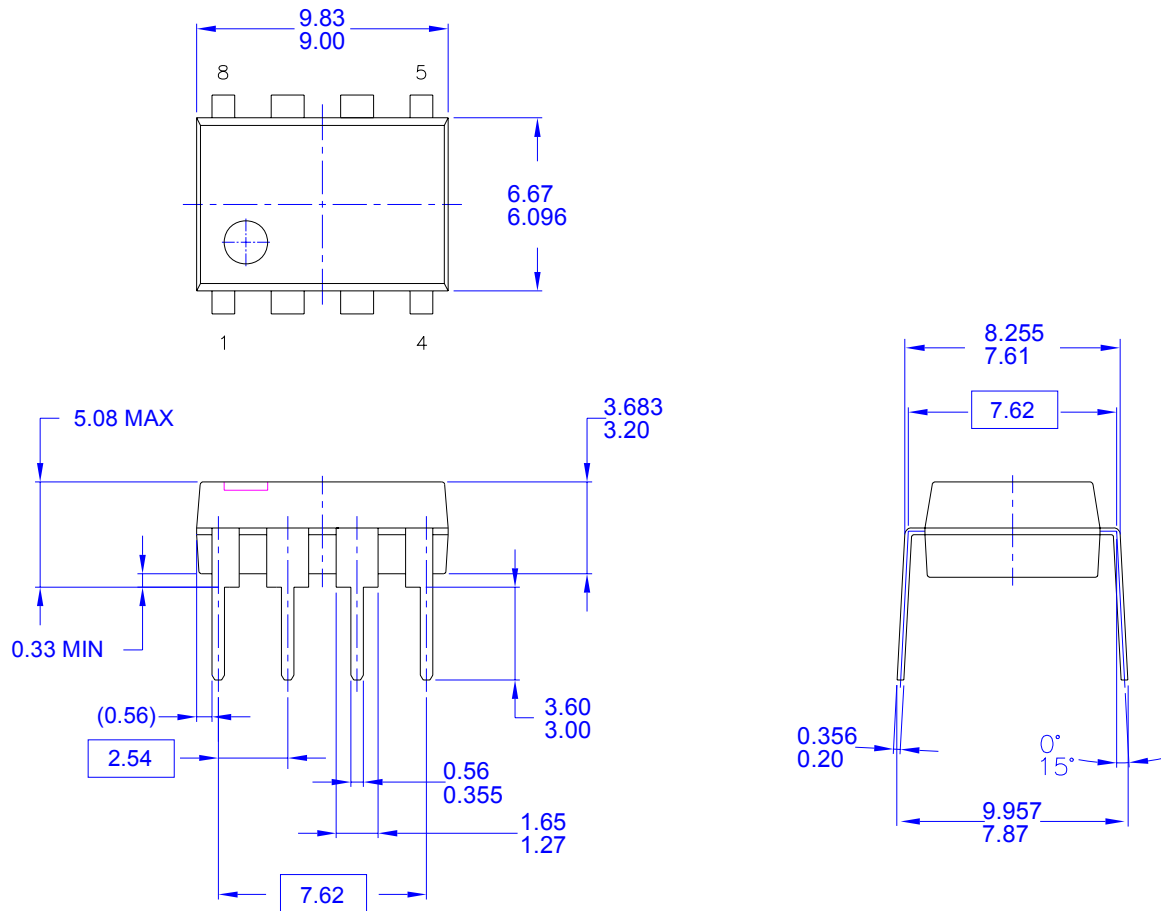
Figure 15. Reference Circuit

## BOM

| Reference | Component             | Reference | Component                        |
|-----------|-----------------------|-----------|----------------------------------|
| BD1       | BD 4A/600V            | Q2        | MOS 7A/600V                      |
| C1        | XC 0.68 $\mu$ F/300V  | R1, R2    | R 1M $\Omega$ 1/4W               |
| C2        | XC 0.1 $\mu$ F/300V   | R3        | R 100K $\Omega$ 1/2W             |
| C3        | CC 0.01 $\mu$ F/500V  | R4        | R 47 $\Omega$ 1/4W               |
| C4        | EC 120 $\mu$ /400V    | R5, R7    | R 750K $\Omega$ 1/4W             |
| C5        | YC 222p/250V          | R6        | R 2K $\Omega$ 1/8W               |
| C6        | CC 1000pF/100V        | R8        | R 0.3 $\Omega$ 2W                |
| C7        | EC 1000 $\mu$ F/25V   | R9        | R 33K $\Omega$ 1/8W              |
| C8        | EC 470 $\mu$ F/25V    | R10       | R 4.7K $\Omega$ 1/8W 1%          |
| C9        | EC 10 $\mu$ F/50V     | R11       | R 470 $\Omega$ 1/8W              |
| C10       | CC 222pF/50V          | R12       | R 0 $\Omega$ 1/8W                |
| C11       | CC 470pF/50V          | R13       | R 4.7K $\Omega$ 1/8W             |
| C12       | CC 102pF/50V (Option) | R14       | R 154K $\Omega$ 1/8W             |
| D1        | LED                   | R15       | R 39K $\Omega$ 1/8W              |
| D2        | Diode BYV95C          | R16       | R 100 $\Omega$ 1/8W              |
| D3        | TVS P6KE16A           | THER2     | Thermistor TTC104                |
| D4        | Diode FR103           | T1        | Transformer (600 $\mu$ H-PQ2620) |
| F1        | FUSE 4A/250V          | U1        | IC SG5841/J                      |
| L1        | Choke (900 $\mu$ H)   | U2        | IC PC817                         |
| L2        | Choke (10mH)          | U3        | IC TL431                         |
| L3        | Inductor (2 $\mu$ H)  | VZ1       | VZ 9G                            |
| Q1        | Diode 20A/100V        |           |                                  |



**Physical Dimensions (Continued)**



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC MS-001 VARIATION BA
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - D) DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994
  - E) DRAWING FILENAME AND REVISION: MKT-N08FREV2.

**Figure 17. 8-Pin Dual In-line Package (DIP)**

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