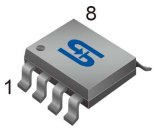


**SOP-8**

**Pin Definition:**

- |        |          |
|--------|----------|
| 1. EN  | 8. NC    |
| 2. Vcc | 7. GND   |
| 3. FB  | 6. Gate  |
| 4. SS  | 5. Sense |

### General Description

The TS19375 is high efficient PWM step-up controller. Designed to drive an external N-channel MOSFET, Output voltage is programmable with 1.0V of standard voltage supply internal, and using externally connected components, output voltage (FB) can be set up at will.

The TS19375 can be operated at switching frequencies of 500kHz allowing for easy filtering and low noise, the size of the external components can be reduced. An enable function and thermal shutdown functions are built inside. The soft-start time can be programmed by outside capacitor; the function prevents overshoot at startup.

### Features

- Input voltage range 3V ~ 24V
- Output voltage: Define by N-CH MOSFET
- Duty ratio: 0% ~ 85% PWM control
- Oscillation frequency: 500kHz
- Soft-start time programmed by external capacitor
- Thermal shutdown protection
- Internal current limit
- External SW N-CH MOSFET

### Ordering Information

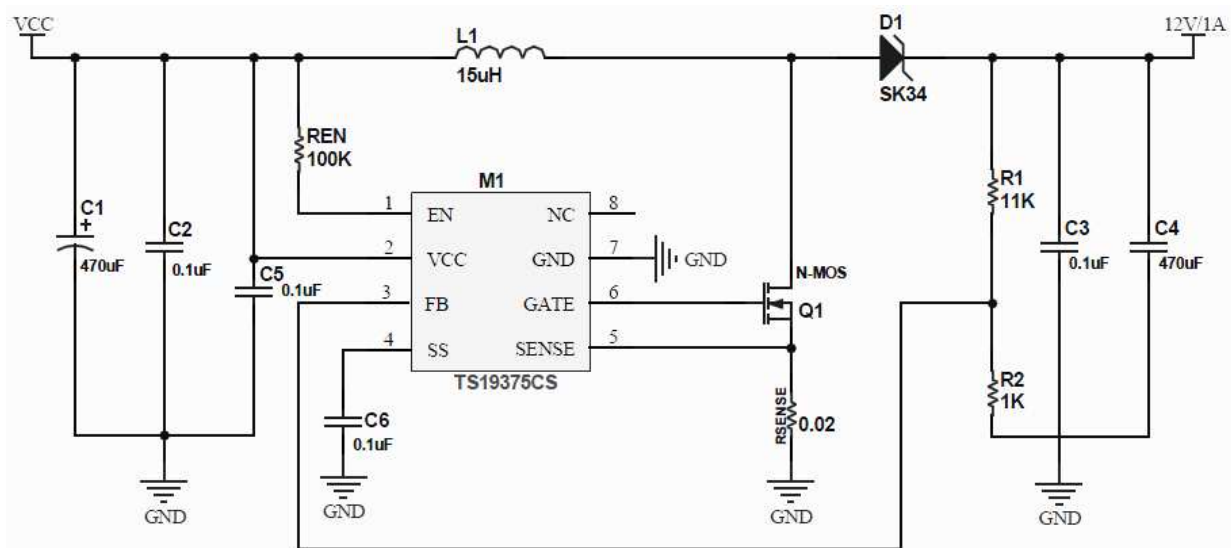
| Part No.      | Package | Packing            |
|---------------|---------|--------------------|
| TS19375CS RLG | SOP-8   | 2.5Kpcs / 13" Reel |

Note: "G" denotes for Halogen Free

### Application

- LED Panel Display Backlighting
- PDA and Portable Media Players
- Local Boost Regulator

### Typical Application Circuit



$$V_{OUT} = V_{FB} \times (1 + R1/R2), V_{FB} = 1V, R2 = 1k \sim 3k$$

C4 Capacitor ESR suggest 30mΩ ~ 100mΩ

### Absolute Maximum Rating

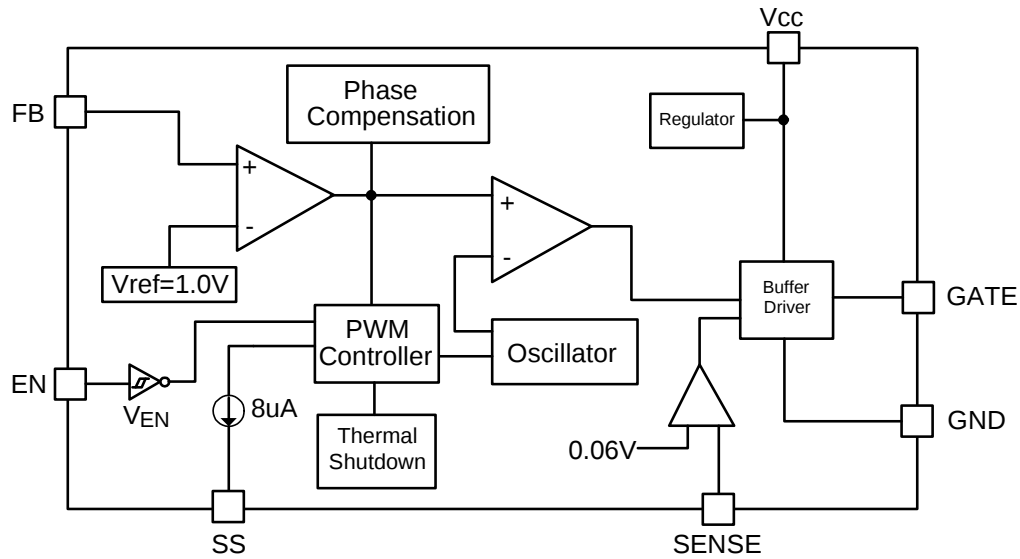
| Characteristics                             | Symbol        | Rating                | Unit |
|---------------------------------------------|---------------|-----------------------|------|
| VCC Pin Voltage                             | $V_{CC}$      | VSS - 0.3 to VSS + 26 | V    |
| Feedback Pin Voltage                        | $V_{FB}$      | VSS - 0.3 to 12       | V    |
| EN Voltage                                  | $V_{EN}$      | VSS - 0.3 to VCC      | V    |
| SENSE Voltage                               | $V_{SENSE}$   | VSS - 0.3 to VCC      | V    |
| SS Pin Voltage                              | $V_{SS}$      | VSS - 0.3 to VCC      | V    |
| Gate Pin Voltage                            | $V_{GATE}$    | VSS - 0.3 to VCC      | V    |
| Power Dissipation                           | $P_D$         | Internally limited    | mW   |
| Storage Temperature Range                   | $T_{STG}$     | -40 to +150           | °C   |
| Operating Junction Temperature Range        | $T_{OPJ}$     | -20 to +125           | °C   |
| Operating Supply Voltage                    | $V_{OP}$      | +3 to +24             | V    |
| Thermal Resistance from Junction to case    | $\theta_{JC}$ | 40                    | °C/W |
| Thermal Resistance from Junction to ambient | $\theta_{JA}$ | 120                   | °C/W |

Note: Stresses exceed those rating may damage the device

### Electrical Specifications ( $T_A=25^{\circ}\text{C}$ , $V_{IN}=5\text{V}$ , $V_{OUT}=12\text{V}$ unless otherwise noted)

| Characteristics                      | Symbol      | Conditions                                                         | Min   | Typ   | Max   | Units |
|--------------------------------------|-------------|--------------------------------------------------------------------|-------|-------|-------|-------|
| Feedback Voltage                     | $V_{FB}$    | $I_{OUT}=0.1\text{A}$                                              | 0.975 | 1.000 | 1.025 | V     |
| Quiescent Current                    | $I_{CCQ}$   | $V_{FB}=1.5\text{V}$ force driver off                              | -     | 4     | 6     | mA    |
| Feedback Bias Current                | $I_{FB}$    | $I_{OUT}=0.1\text{A}$                                              | -     | 0.1   | 0.5   | uA    |
| Shutdown Supply Current              | $I_{SD}$    | $V_{EN}=0\text{V}$                                                 | -     | 1     | 10    | uA    |
| Oscillation Frequency                | $F_{OSC}$   | SW pin                                                             | 400   | 500   | 600   | KHz   |
| Sense Voltage                        | $V_{SENSE}$ |                                                                    | 0.05  | 0.06  | 0.07  | V     |
| Soft Start Current                   | $I_{SS}$    | $V_{SS}=0\text{V}$                                                 | -     | 8     | -     | uA    |
| EN Pin Logic input threshold voltage | $V_{SH}$    | High (regulator ON)                                                | 2.0   | -     | -     | V     |
|                                      | $V_{SL}$    | Low (regulator OFF)                                                | -     | -     | 0.8   |       |
| EN Pin Input Current                 | $I_{SH}$    | $V_{EN}=2.5\text{V}$ (ON)                                          | -     | 20    | -     | uA    |
|                                      | $I_{SL}$    | $V_{EN}=0.3\text{V}$ (OFF)                                         | -     | -1    | -     | uA    |
| LX Rise Time                         | $T_{LXR}$   | $C_{LX}=1000\text{pF}$                                             | -     | 60    | -     | nS    |
| LX Fall Time                         | $T_{LXF}$   | $C_{LX}=1000\text{pF}$                                             | -     | 60    | -     |       |
| Efficiency                           | EFFI        | $V_{CC}=5\text{V}$ ,<br>$V_{OUT}=12\text{V}$   $I_{OUT}=1\text{A}$ | -     | 91    | -     | %     |
| Maximum Duty Cycle                   | $DC_{MAX}$  | $V_{FB}=0\text{V}$                                                 | -     | 85    | -     | %     |
| Minimum Duty Cycle                   | $DC_{MIN}$  | $V_{FB}=1.5\text{V}$                                               | -     | 0     | -     |       |
| Thermal shutdown Temp                | TSD         |                                                                    | -     | 145   | -     | °C    |

### Block Diagram



### Pin Function Description

| Pin NO. | Pin Name           | Pin Description                                                   |
|---------|--------------------|-------------------------------------------------------------------|
| 1       | EN                 | Shutdown Control Input<br>H: Normal Operation<br>L: Shutdown Mode |
| 2       | V <sub>CC</sub>    | VCC Supply pin                                                    |
| 3       | FB                 | Feedback Pin                                                      |
| 4       | SS                 | Soft-Start pin                                                    |
| 5       | V <sub>SENSE</sub> | Current Limit Sense Voltage                                       |
| 6       | Gate               | Gate drive for external N-CH MOSFET                               |
| 7       | GND                | Signal Ground Pin                                                 |
| 8       | NC                 | Non Connect                                                       |

### Function Description

#### PWM Control

The TS19375 is high efficient PWM step-up controller, the pulse width varies in a range from 0 to 85%. According to the load current, the ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant. Therefore, TS19375 provide a low-ripple power over broad ranges of input voltage and load current.

#### Setting the Output Voltage

Application circuit shows the basic application circuit with adjustable output version. The external resistor sets the output voltage according to the following formula:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R1}{R2}\right)$$

Table 1: Resistor select for output voltage setting

| V <sub>OUT</sub> | R2   | R1  |
|------------------|------|-----|
| 12V              | 1K   | 11K |
| 15V              | 1.5K | 21K |
| 18V              | 1K   | 17K |
| 24V              | 1.3K | 30K |

#### Current Limit Setting

The current limit threshold is setting by the external resistor (R<sub>SENSE</sub>) connecting from SENSE pin to GND (refer the application circuit). The internal current limit compared voltage is 60mV. When the SENSE voltage is larger than 60mV, an over-current condition is triggered. Please refer to the formula for setting the minimum current limit value:

$$I_{SW(MAX)} = \frac{60mV}{R_{SENSE}}$$

Note: I<sub>SW(MAX)</sub> is the maximum N-MOSFET current

#### Inductor Selection

For most designs, Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following formula:

$$L = \frac{V_{IN} \times (V_{OUT} - V_{IN})}{V_{OUT} \times \Delta L \times F_{LX}}$$

Large value inductors lower ripple current and small value inductors result in high ripple currents. Choose inductor ripple current approximately 15% of the maximum input current 3A, ΔIL=0.45A.

Table 2: Inductor select for output voltage setting (V<sub>CC</sub>=5V)

| V <sub>OUT</sub> | 9V   | 12V  | 15V  | 18V  |
|------------------|------|------|------|------|
| L1 Value         | 18uH | 15uH | 10uH | 10uH |

The DC current rating of the inductor should be at least equal to the maximum load current plus half the ripple current to prevent core saturation (3A+0.25A).

**Function Description (Continue)****Input Capacitor Selection**

The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency shall be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used.

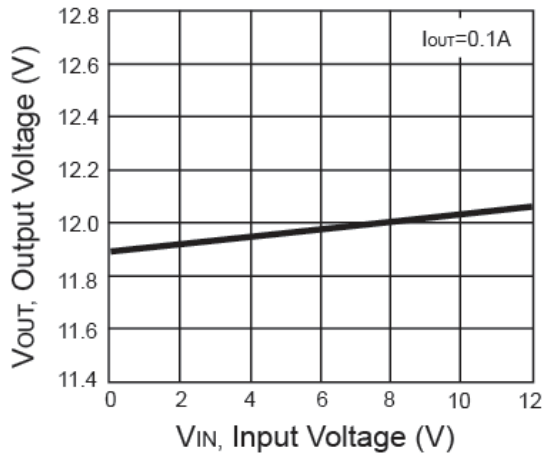
The capacitor voltage rating should be at least 1.5 times greater than the input voltage, and often much higher voltage ratings are needed to satisfy.

**Output Capacitor Selection**

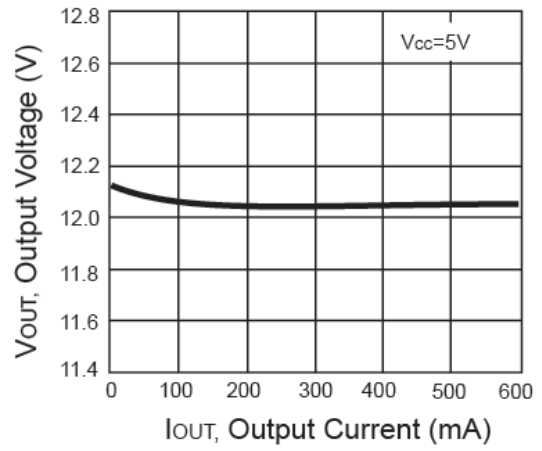
The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. A low ESR capacitor sized for maximum RMS current must be used. The low ESR requirements needed for low output ripple voltage. The capacitor voltage rating should be at least 1.5 times greater than the input voltage, and often much higher voltage ratings are needed to satisfy.

The ESR range of output capacitor is 30m~100m $\Omega$  at switch current more than 1.5A. Add a 4.7uF output bypass capacitor in order to reduce output ripple effectively

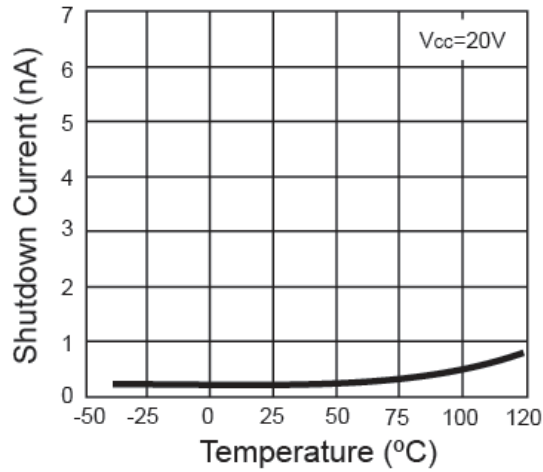
**Electrical Characteristics Curve** ( $T_A=25^{\circ}\text{C}$ ,  $V_{\text{IN}}=5\text{V}$ ,  $V_{\text{FORWARD-LED}}=3.3\text{V}$ , unless otherwise noted)



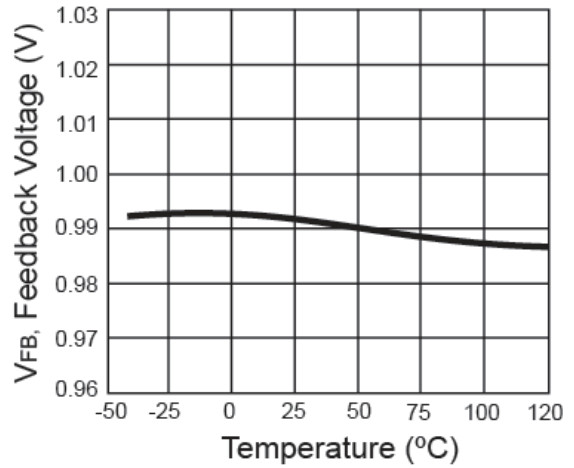
**Input Voltage vs. Output Voltage**



**Output Current vs. Output Voltage**

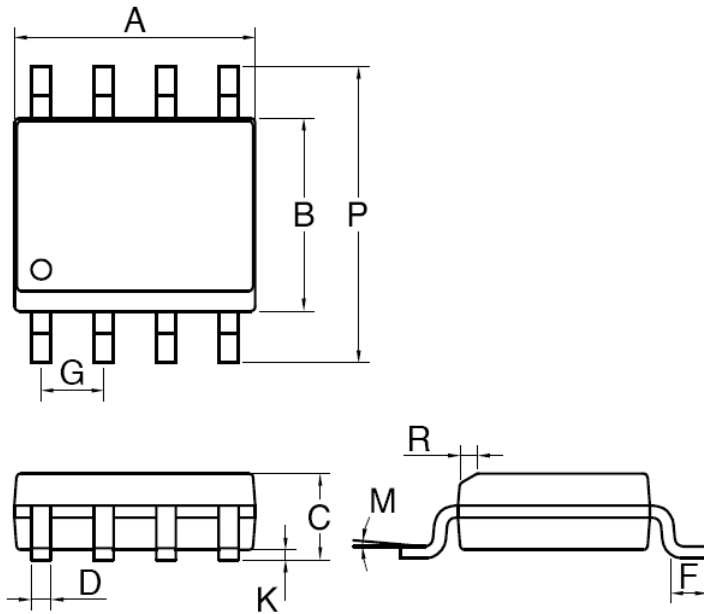


**Shutdown Current vs. Temperature**



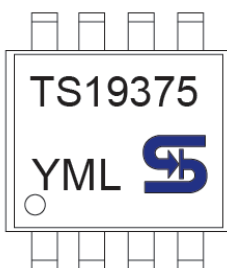
**Feedback Voltage vs. Temperature**

### SOP-8 Mechanical Drawing



| SOP-8 DIMENSION |             |      |         |       |
|-----------------|-------------|------|---------|-------|
| DIM             | MILLIMETERS |      | INCHES  |       |
|                 | MIN         | MAX  | MIN     | MAX.  |
| A               | 4.80        | 5.00 | 0.189   | 0.196 |
| B               | 3.80        | 4.00 | 0.150   | 0.157 |
| C               | 1.35        | 1.75 | 0.054   | 0.068 |
| D               | 0.35        | 0.49 | 0.014   | 0.019 |
| F               | 0.40        | 1.25 | 0.016   | 0.049 |
| G               | 1.27BSC     |      | 0.05BSC |       |
| K               | 0.10        | 0.25 | 0.004   | 0.009 |
| M               | 0°          | 7°   | 0°      | 7°    |
| P               | 5.80        | 6.20 | 0.229   | 0.244 |
| R               | 0.25        | 0.50 | 0.010   | 0.019 |

### Marking Diagram



- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apr, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
- L** = Lot Code

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