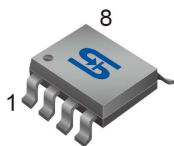
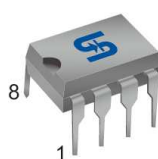




SOP-8



DIP-8



**Pin Definition:**

- |        |            |
|--------|------------|
| 1. SC  | 5. Comp    |
| 2. SE  | 6. Vcc     |
| 3. CT  | 7. Ipk     |
| 4. Gnd | 8. Vdriver |

**General Description**

TS34063 is a monolithic switching regulator and subsystem intended for use as DC to DC converter. It contains an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active peak current limit circuit, drive and a high current output switch. The TS34063 is specifically designed to be incorporated in step-up, step-down and voltage inverting converter applications. TS34063 is offered in SOP-8 and DIP-8 package

**Features**

- Power forward control circuit
- Operating voltage from 3V to 40V
- Low standby current
- Current limit adjustable
- Output switch current up to 1.5A
- Variable oscillator frequency up to 100kHz(max.)
- Output voltage adjustable

**Pin Description**

| Name                | Description                |
|---------------------|----------------------------|
| SC                  | Switch Collector           |
| SE                  | Switch Emitter             |
| CT                  | Timing Capacitor           |
| GND                 | Ground                     |
| COMP.               | Comparator Inverting Input |
| V <sub>CC</sub>     | V <sub>CC</sub> Collector  |
| I <sub>PK</sub>     | IPK Sense                  |
| V <sub>DRIVER</sub> | Driver                     |

**Applications**

- Charger
- xD-ROM, xDSL products
- DC to DC converter

**Ordering Information**

| Part No.     | Package | Packing            |
|--------------|---------|--------------------|
| TS34063CD C3 | DIP-8   | 50pcs / Tube       |
| TS34063CS RL | SOP-8   | 2.5Kpcs / 13" Reel |

**Absolute Maximum Rating**

| Parameter                           | Symbol                 | Maximum    | Unit |
|-------------------------------------|------------------------|------------|------|
| Supply Voltage                      | V <sub>CC</sub>        | 40         | V    |
| Comparator Input Voltage Range      | V <sub>FB</sub>        | - 0.3 ~ 40 | V    |
| Switch Collector Output Voltage     | V <sub>C(SW)</sub>     | 40         | V    |
| Switch Emitter Voltage              | V <sub>E(SW)</sub>     | 40         | V    |
| Switch Collector to Emitter Voltage | V <sub>CE(SW)</sub>    | 40         | V    |
| Driver Collector Voltage            | V <sub>C(DRIVER)</sub> | 40         | V    |
| Driver Collector Current (note 1)   | I <sub>C(DRIVER)</sub> | 100        | mA   |
| Output Switching Current            | I <sub>SW</sub>        | 1.5        | A    |
| Power Dissipation                   | DIP-8                  | 1.0        | W    |
|                                     | SOP-8                  | 0.5        |      |
| Operating Ambient Temperature Range | T <sub>OPR</sub>       | -40 ~ +85  | °C   |
| Junction Temperature Range          | T <sub>J</sub>         | 0 ~ +125   | °C   |
| Storage Temperature Range           | T <sub>STG</sub>       | -65 ~ +150 | °C   |

**Note:** Maximum package power dissipation limits must be observed

### Electrical Characteristics ( $V_{CC} = 5V$ , $T_a = 25^\circ C$ ; unless otherwise noted.)

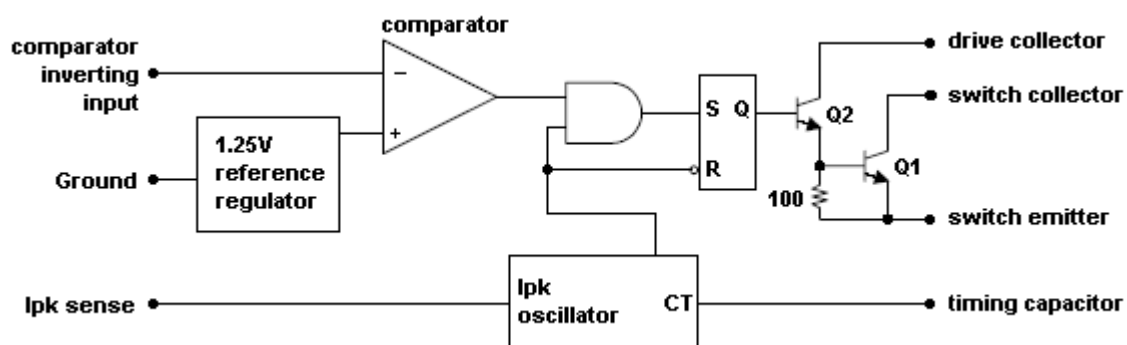
| Parameter                         | Symbol                       | Test Conditions   | Min   | Typ  | Max   | Unit    |
|-----------------------------------|------------------------------|---|-------|------|-------|---------|
| <b>Oscillator (OSC)</b>           |                              |   |       |      |       |         |
| Frequency                         | $F_{OSC}$                    | $C_T = 1nF$ , $V_{pin5} = 0V$   | 24    | 33   | 42    | KHz     |
| Charge Current                    | $I_{CHARGE}$                 | $V_{CC} = 5V \sim 40V$  | 24    | 30   | 42    | $\mu A$ |
| Discharge Current                 | $I_{DISCHARGE}$              | $V_{CC} = 5V \sim 40V$  | 140   | 200  | 260   | $\mu A$ |
| Discharge to Charge current ratio | $I_{DISCHARGE} / I_{CHARGE}$ | Pin7 to $V_{CC}$  | 5.2   | 6.5  | 7.5   | --      |
| Current Limit Sense Voltage       | $V_{IPK(SENSE)}$             | $I_{DISCHARGE} = I_{CHARGE}$  | 250   | --   | 350   | mV      |
| <b>Output switch (note1)</b>      |                              |   |       |      |       |         |
| Saturation Voltage                | $V_{CE(SAT)}$                | $I_{SW} = 1A$ , pin1, 8 connected   | --    | 1.0  | 1.3   | V       |
| Saturation Voltage                | $V_{CE(SAT)}$                | $I_{SW} = 1A$ , $I_d = 50mA$  | --    | 0.45 | 0.7   | V       |
| DC current gain                   | $H_{FE}$                     | $I_{SW} = 1A$ , $V_{CE} = 0.5V$   | 50    | 75   | --    | --      |
| Collector off-state current       | $I_{C(OFF)}$                 | $V_{CE} = 40V$  | --    | 0.01 | 100   | $\mu A$ |
| <b>Comparator</b>                 |                              |   |       |      |       |         |
| Threshold Voltage                 | $V_{REF}$                    |   | 1.225 | 1.25 | 1.275 | V       |
| Line regulation                   | $REG_{LINE}$                 | $V_{CC} = 3V \sim 40V$  | --    | --   | 6     | mV      |
| <b>Total device</b>               |                              |   |       |      |       |         |
| Supply Current                    | $I_{CC}$                     | $V_{CC} = 5V \sim 40V$ , $C_T = 1nF$ ,<br>pin7= $V_{CC}$ , pin5> $V_{TH}$ ,<br>pin2=Gnd, remaining pins<br>open | --    | 3    | 5     | mA      |

**Notes1:** Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible

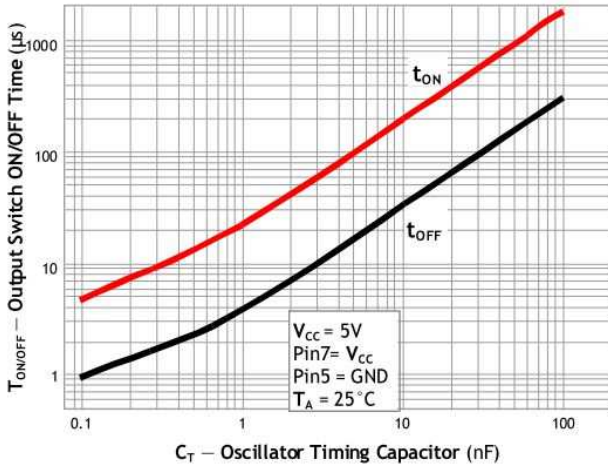
**Note 2:** If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents ( $\leq 300mA$ ) and high driver currents ( $\geq 30mA$ ), it may take up to 2 $\mu s$  for it to come out of saturation. This condition will shorten the off time at frequencies  $\geq 30KHz$ , and is magnified at high temperature. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non-darlington configuration is used, the following output drive condition is recommended: Forced Beta of output switch:  $I_C \text{ output} / (I_C \text{ driver} - 7mA^*) \geq 10$

\* The 100ohm resistor in the emitter of the driver divide requires about 7mA before the output switch conducts.

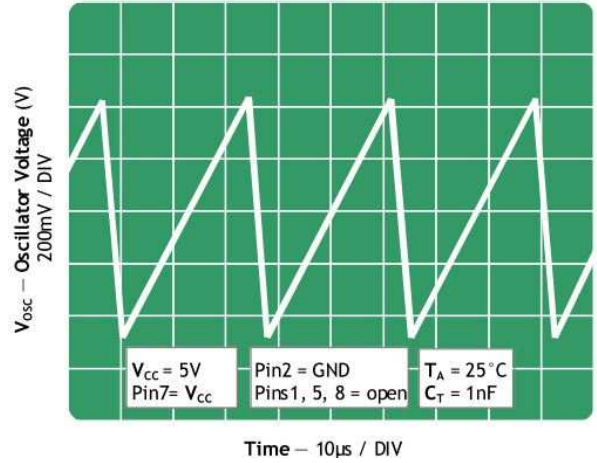
### Block Diagram



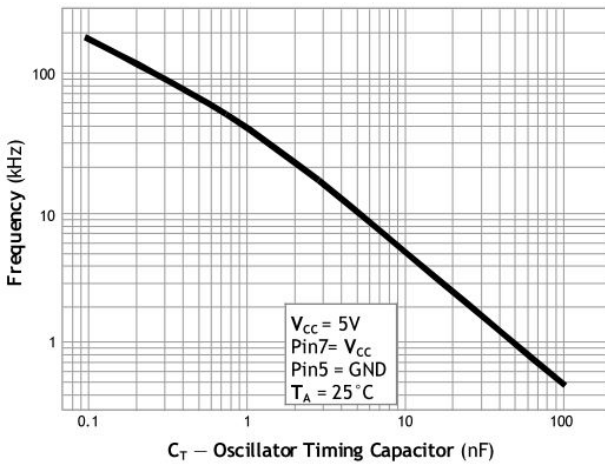
**Electrical Characteristics Curve**



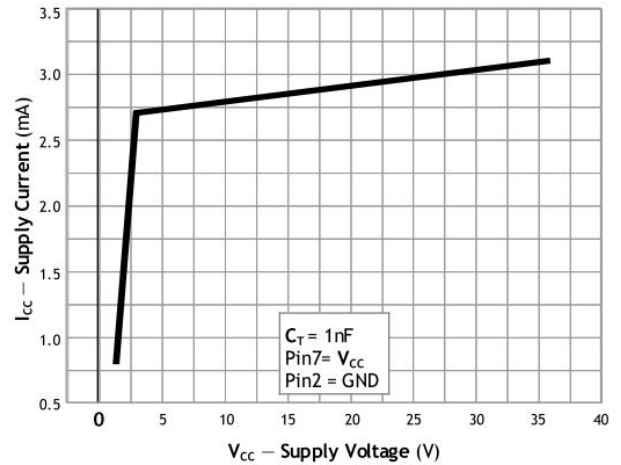
**Fig 1. Output Switch ON-OFF TIME vs. Oscillator Timing Capacitor**



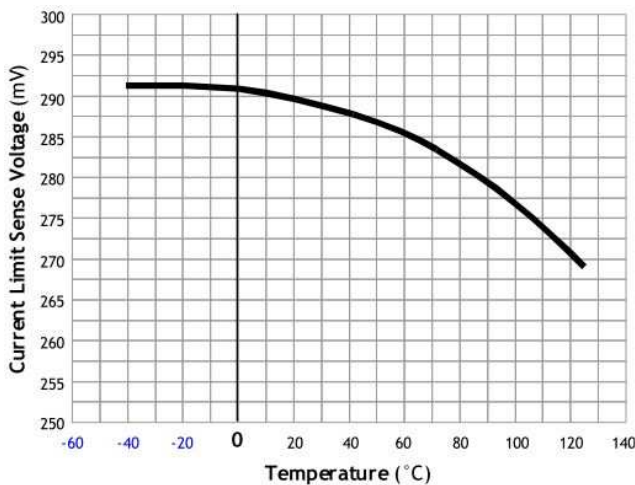
**Fig 2. Timing Capacitor Wave Form**



**Fig 3. Oscillator Frequency vs. Timing Capacitor**

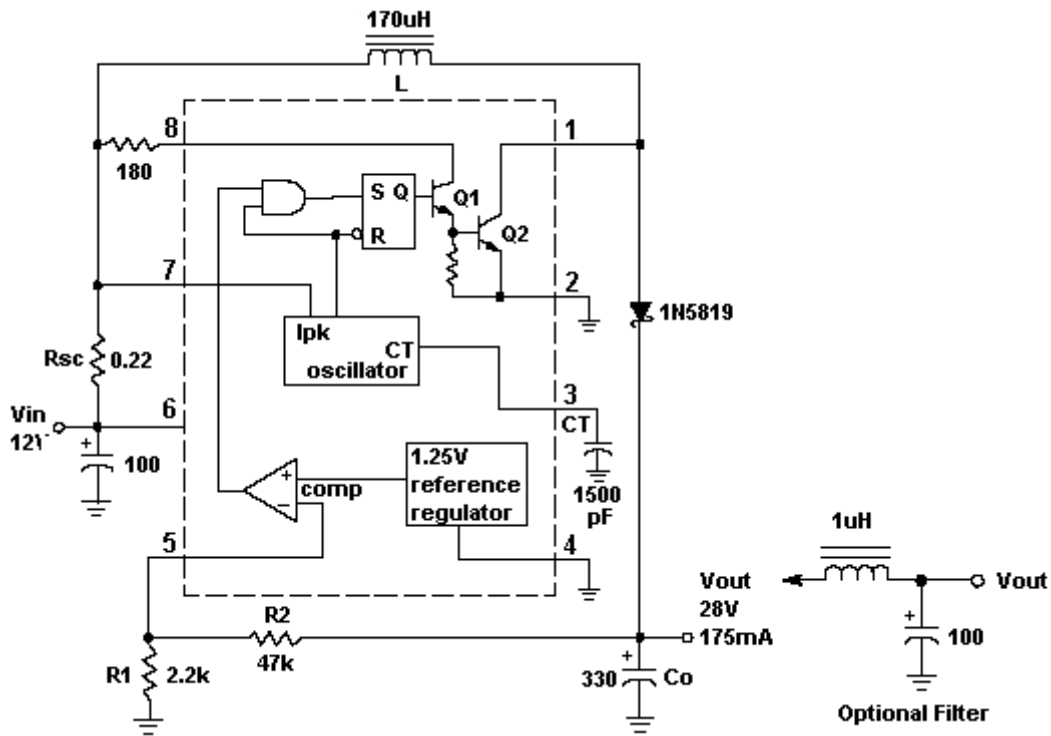


**Fig 4. Standby Supply Current vs. Supply Voltage**



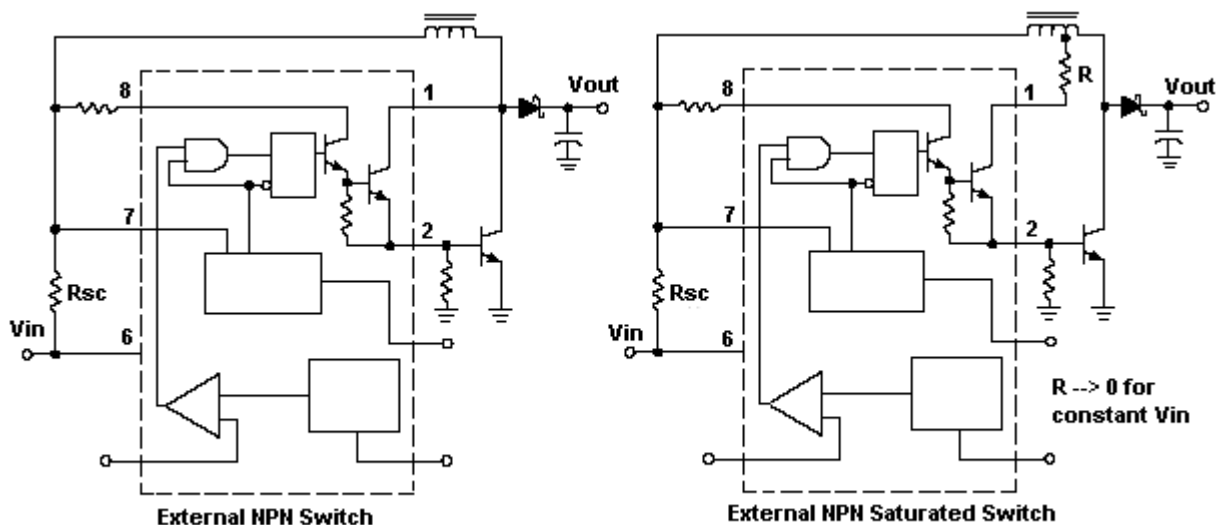
**Fig 5. Current Limit Sense Voltage vs. Temperature**

**Typical Application Circuit**



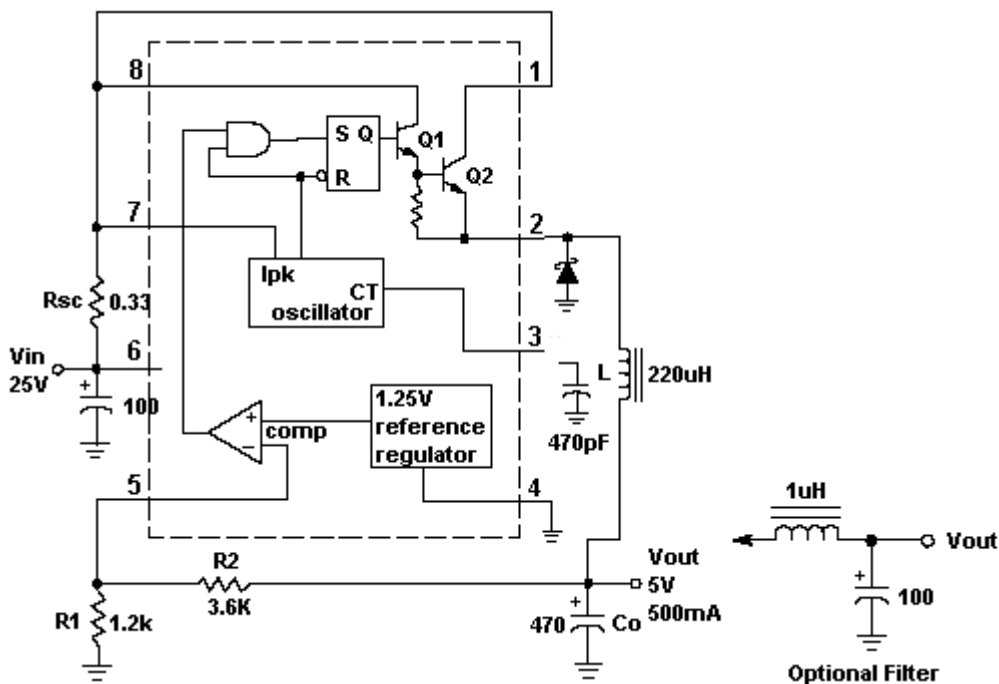
| Test                               | Conditions                                   | Results              |
|------------------------------------|--|----------------------|
| Line Regulation                    | $V_{IN} = 8V \sim 16V, I_o = 175mA$          | $30mV = \pm 0.05\%$  |
| Load Regulation                    | $V_{IN} = 12V, I_o = 75mA \text{ to } 175mA$ | $10mV = \pm 0.017\%$ |
| Output Ripple                      | $V_{IN} = 12V, I_o = 175mA$                  | $400mV_{pp}$         |
| Efficiency                         | $V_{IN} = 12V, I_o = 175mA$                  | $87.7\%$             |
| Output Ripple with Optional Filter | $V_{IN} = 12V, I_o = 175mA$                  | $40mV_{pp}$          |

**Figure 7. Step Up Converter**



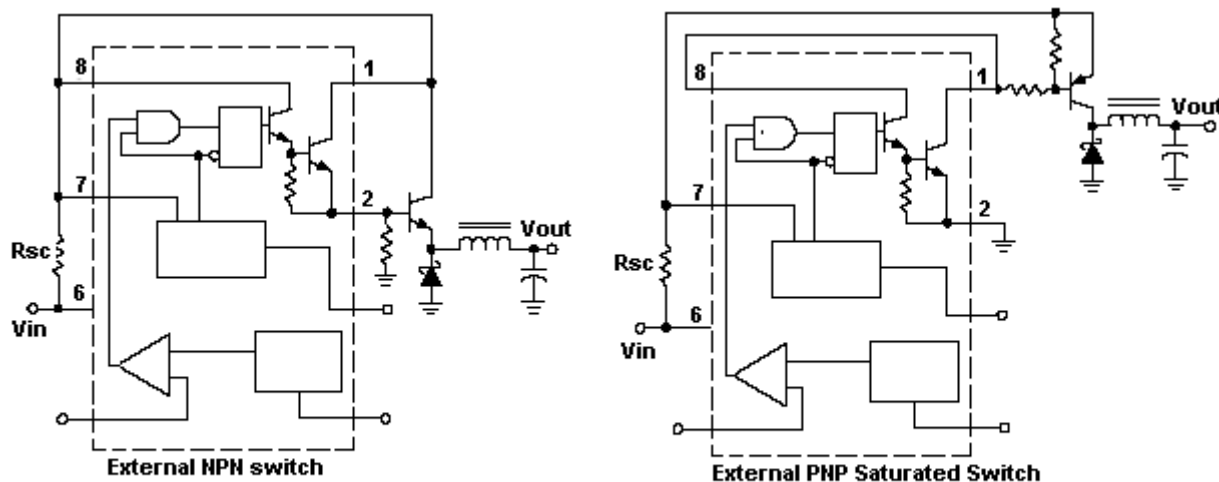
**Figure 8. External Current Boost Connections for  $I_c$  Peak Greater than 1.5A**

**Typical Application Circuit (Continue)**



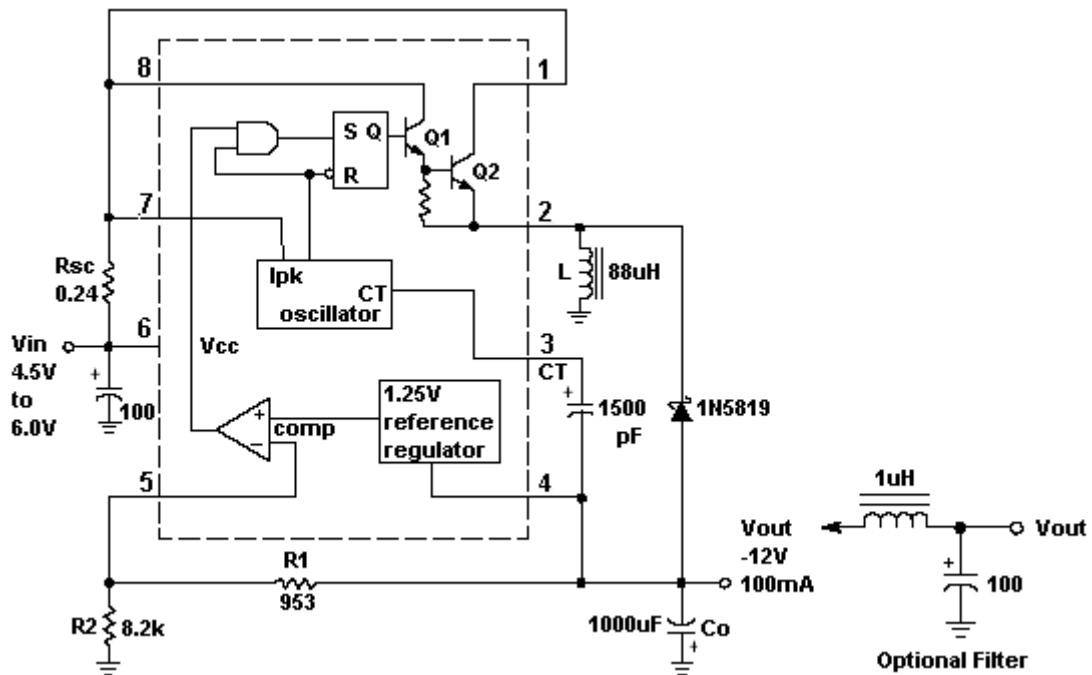
| Test                               | Conditions                                   | Results            |
|------------------------------------|--|--------------------|
| Line Regulation                    | $V_{IN} = 15V \sim 25V, I_o = 500mA$         | $12mV = \pm 12\%$  |
| Load Regulation                    | $V_{IN} = 25V, I_o = 50mA \text{ to } 500mA$ | $3mV = \pm 0.03\%$ |
| Output Ripple                      | $V_{IN} = 25V, I_o = 500mA$                  | $120mV_{pp}$       |
| Short Circuit Current              | $V_{IN} = 25V, R_L = 0.1m\Omega$             | $1.1A$             |
| Efficiency                         | $V_{IN} = 25V, I_o = 500mA$                  | $83.7\%$           |
| Output Ripple with Optional Filter | $V_{IN} = 25V, I_o = 500mA$                  | $40mV_{pp}$        |

**Figure 9. Step Down Converter**



**Figure 10. External Current Boost Connections for  $I_c$  Peak Greater than 1.5A**

Typical Application Circuit (Continue)



| Test                               | Conditions                              | Results               |
|------------------------------------|---|-----------------------|
| Line Regulation                    | $V_{IN} = 4.5V \sim 6V$ , $I_o = 100mA$ | $3mV = \pm 120.012\%$ |
| Load Regulation                    | $V_{IN} = 5V$ , $I_o = 10mA$ to $100mA$ | $0.022V = \pm 0.09\%$ |
| Output Ripple                      | $V_{IN} = 5V$ , $I_o = 100mA$           | $500mV_{pp}$          |
| Short Circuit Current              | $V_{IN} = 5V$ , $R_L = 0.1 \Omega$      | $910mA$               |
| Efficiency                         | $V_{IN} = 5V$ , $I_o = 100mA$           | $62.2\%$              |
| Output Ripple with Optional Filter | $V_{IN} = 5V$ , $I_o = 100mA$           | $70mV_{pp}$           |

Figure 11. Voltage Inverting Converter

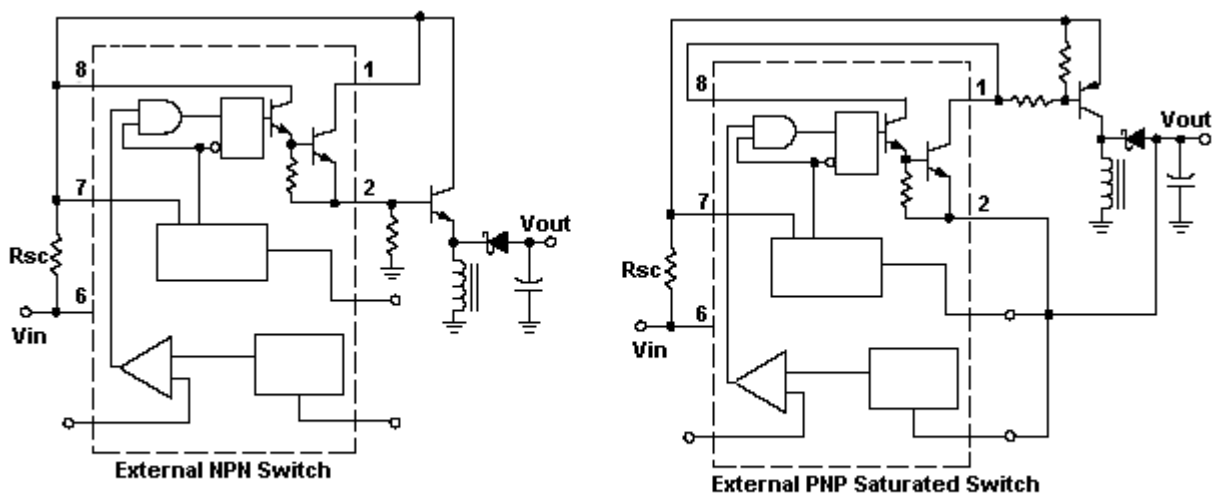


Figure 12. External Current Boost Connections for  $I_c$  Peak Greater than 1.5A

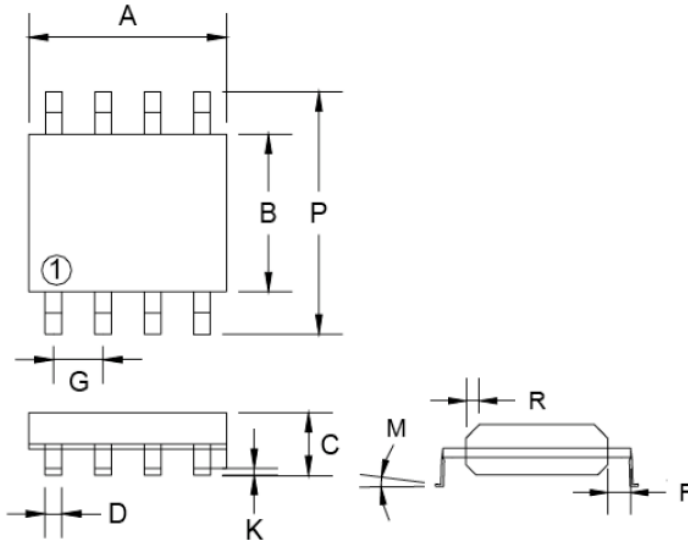
### Design Formula Table

| Test                   | Step Up   | Step Down   | Voltage Inverting   |
|------------------------|---|---|---|
| $t_{on}$<br>$t_{off}$  | $\frac{V_{out} + V_f - V_{in(min)}}{V_{cc(min)} - V_{sat}}$                 | $\frac{V_{out} + V_f}{V_{cc} - V_{sat} - V_{out}}$                                    | $\frac{ V_{out}  + V_f}{V_{cc} - V_{sat}}$                                  |
| ( $t_{on} + t_{off}$ ) | $\frac{1}{f_{min}}$   | $\frac{1}{f_{min}}$   | $\frac{1}{f_{min}}$   |
| CT                     | $4.0 \times 10^{-5} t_{on}$   | $4.0 \times 10^{-5} t_{on}$   | $4.0 \times 10^{-5} t_{on}$   |
| $I_{pk}(switch)$       | $2I_{out(max)} \left( \frac{t_{on}}{t_{off}} + 1 \right)$                   | $2I_{out(max)}$   | $2I_{out(max)} \left( \frac{t_{on}}{t_{off}} + 1 \right)$                   |
| Rsc                    | $\left( \frac{0.3}{I_{pk}(switch)} \right)$                                 | $\left( \frac{0.3}{I_{pk}(switch)} \right)$   | $\left( \frac{0.3}{I_{pk}(switch)} \right)$                                 |
| L(min)                 | $\left( \frac{V_{in(min)} - V_{sat}}{I_{pk}(switch)} \right) * t_{on(max)}$ | $\left( \frac{V_{in(min)} - V_{sat} - V_{out}}{I_{pk}(switch)} \right) * t_{on(max)}$ | $\left( \frac{V_{in(min)} - V_{sat}}{I_{pk}(switch)} \right) * t_{on(max)}$ |
| Co                     | $\left( 9 \frac{I_{out} * t_{on}}{V_{ripple(pp)}} \right)$                  | $\left( \frac{I_{pk}(switch)(t_{on} + t_{off})}{8V_{ripple(pp)}} \right)$             | $\left( 9 \frac{I_{out} * t_{on}}{V_{ripple(pp)}} \right)$                  |

### Terms and Definitions

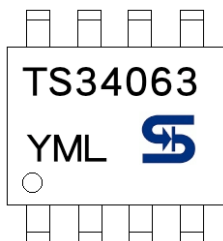
- $V_{sat}$  = Saturation Voltage of the output switch.
- $V_f$  = Forward Voltage drop of the rectifier.  
The following power supply characteristics must be chosen:
- $V_{in}$  = Normal input voltage
- $V_{out}$ : Desired Output voltage,  $|V_{out}| = 1.25 (1 + R_2 / R_1)$
- $I_{out}$  : Desired output current.
- $f_{min}$  : Minimum desired output switching frequency at the selected values for  $V_{in}$  and  $I_o$ .
- $V_{ripple(p-p)}$ : Desired peak-to-peak output ripple voltage. in practice, the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

### 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 |

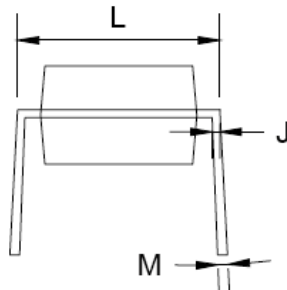
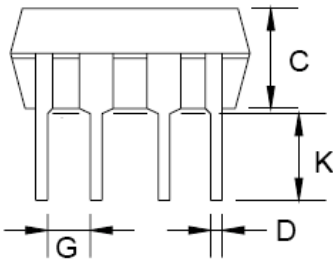
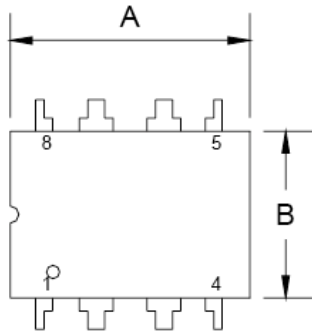
### Marking Diagram



- Y** = Year Code
- M** = Month Code  
(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L** = Lot Code



**DIP-8 Mechanical Drawing**



| DIP-8 DIMENSION |             |      |            |       |
|-----------------|-------------|------|------------|-------|
| DIM             | MILLIMETERS |      | INCHES     |       |
|                 | MIN         | MAX  | MIN        | MAX   |
| A               | 9.07        | 9.32 | 0.357      | 0.367 |
| B               | 6.22        | 6.48 | 0.245      | 0.255 |
| C               | 3.18        | 4.45 | 0.125      | 0.135 |
| D               | 0.35        | 0.55 | 0.019      | 0.020 |
| G               | 2.54 (typ)  |      | 0.10 (typ) |       |
| J               | 0.29        | 0.31 | 0.011      | 0.012 |
| K               | 3.25        | 3.35 | 0.128      | 0.132 |
| L               | 7.75        | 8.00 | 0.305      | 0.315 |
| M               | -           | 10°  | -          | 10°   |

**Marking Diagram**



- Y = Year Code
- M = Month Code  
(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
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