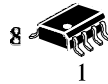
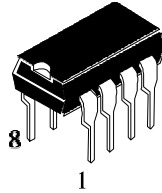


## Description

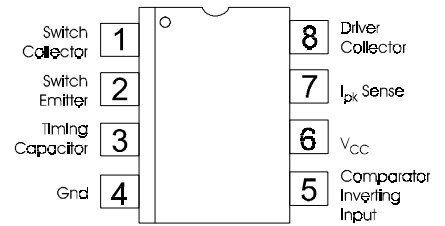
The MC34063A Series is a monolithic control circuit containing the primary functions required for DC-to-DC converters. These devices consist of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This series was specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

## Features

- Operation from 3.0 V to 40 V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5 A
- Output Voltage Adjustable
- Frequency Operation to 100 kHz
- Precision 2% Reference

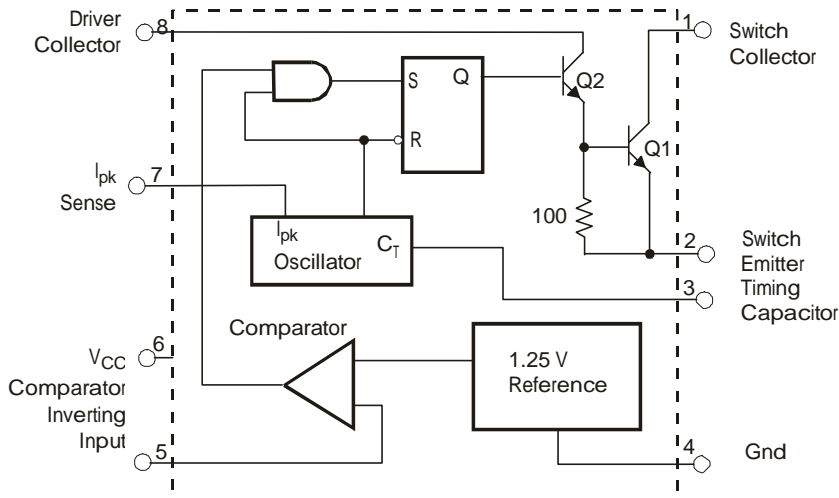


Plastic Package



Pin Connections

## Internal Block Diagram



## Absolute Maximum Ratings

| Symbol           | Parameter   | Maximum     | Units |
|------------------|---|-------------|-------|
| $V_{CC}$         | Power Supply Voltage                                | 40          | Vdc   |
| $V_{IR}$         | Comparator Input Voltage Range                      | -0.3 to +40 | Vdc   |
| $V_{C(switch)}$  | Switch Collector Voltage                            | 40          | Vdc   |
| $V_{E(switch)}$  | Switch Emitter Voltage ( $V_{PIN1} = 40\text{ V}$ ) | 40          | Vdc   |
| $V_{CE(switch)}$ | Switch Collector to Emitter Voltage                 | 40          | Vdc   |
| $V_{C(driver)}$  | Driver Collector Voltage                            | 40          | Vdc   |
| $I_{C(driver)}$  | Driver Collector Current (Note 1)                   | 100         | mA    |
| $I_{SW}$         | Switch Current                                      | 1.5         | A     |
| $T_J$            | Operating Junction Temperature                      | +150        | °C    |
| $T_A$            | Operating Ambient Temperature Range                 | 0 to +70    | °C    |
| $T_{stg}$        | Storage Temperature Range                           | -65 to +150 | °C    |

## Electrical Characteristics

( $V_{CC}=5.0V$ ,  $T_A=T_{low}$  to  $T_{high}$ , unless otherwise)

| Characteristics  | Symbol                 | Min           | Typ       | Max           | Units         |
|--|------------------------|---------------|-----------|---------------|---------------|
| <b>OSCILLATOR</b>  |                        |               |           |               |               |
| Frequency ( $V_{pin5} = 0V$ , $C_T = 1.0\text{ nF}$ , $T_A = 25^\circ\text{C}$ )   | $f_{osc}$              | 24            | 33        | 42            | kHz           |
| Charge Current ( $V_{CC} = 5.0V$ to $40V$ , $T_A = 25^\circ\text{C}$ )   | $I_{chg}$              | 24            | 35        | 42            | $\mu\text{A}$ |
| Discharge Current ( $V_{CC} = 5.0V$ to $40V$ , $T_A = 25^\circ\text{C}$ )  | $I_{dischg}$           | 140           | 220       | 260           | $\mu\text{A}$ |
| Discharge to Charge Current Ratio (Pin 7 to $V_{CC}$ , $T_A = 25^\circ\text{C}$ )  | $I_{dischg} / I_{cha}$ | 5.2           | 6.5       | 7.5           | –             |
| Current Limit Sense Voltage ( $I_{chg} = I_{dischg}$ , $T_A = 25^\circ\text{C}$ )  | $V_{ipk(sence)}$       | 250           | 300       | 350           | mV            |
| <b>OUTPUT SWITCH (NOTE 2)</b>  |                        |               |           |               |               |
| Saturation Voltage, Darlington Connection ( $I_{SW} = 1.0\text{ A}$ , Pins 1, 8 connected)   | $V_{CE(sat)}$          | –             | 1.0       | 1.3           | V             |
| Saturation Voltage, Darlington Connection ( $I_{SW} = 1.0\text{ A}$ , $R_{pin8} = 82\Omega$ to $V_{CC}$ , Forced $\beta \approx 20$ )                          | $V_{CE(sat)}$          | –             | 0.45      | 0.7           | V             |
| DC Current Gain ( $I_{SW} = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ V}$ , $T_A = 25^\circ\text{C}$ )   | $h_{FE}$               | 50            | 75        | –             | –             |
| Collector Off-State Current ( $V_{CE} = 40\text{ V}$ )   | $I_{C(off)}$           | –             | 40        | 100           | $\mu\text{A}$ |
| <b>COMPARATOR</b>  |                        |               |           |               |               |
| Threshold Voltage<br>( $T_A=25^\circ\text{C}$ )<br>( $T_A=T_{low}$ to $T_{high}$ )   | $V_{th}$               | 1.225<br>1.21 | 1.25<br>– | 1.275<br>1.29 | V             |
| Threshold Voltage Line Regulation<br>( $V_{CC}=3.0\text{ V}$ to $40\text{ V}$ )  | $Reg_{line}$           | –             | 1.4       | 5.0           | mV            |
| Input Bias Current<br>( $V_{in}=0\text{ V}$ )  | $I_{IB}$               | –             | -20       | -400          | nA            |
| <b>TOTAL DEVICE</b>  |                        |               |           |               |               |
| Supply Current ( $V_{CC} = 5.0\text{ V}$ to $40\text{ V}$ , $C_T = 1.0\text{ nF}$ , Pin 7 = $V_{CC}$ , $V_{pin5} > V_{th}$ , Pin 2 = Gnd, remaining pins open) | $I_{CC}$               | –             | –         | 4.0           | mA            |

NOTES : 1. Maximum package power dissipation limits must be observed.

2. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible

## Typical Performance Characteristics

Figure 1. Output Switch On-Off Time versus Oscillator Timing Capacitor

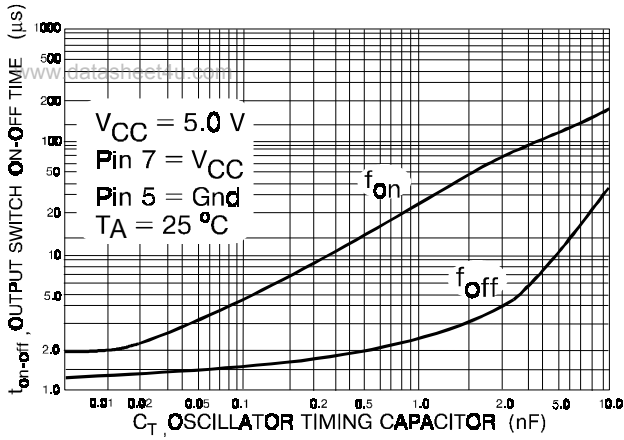


Figure 2. Timing Capacitor Waveform

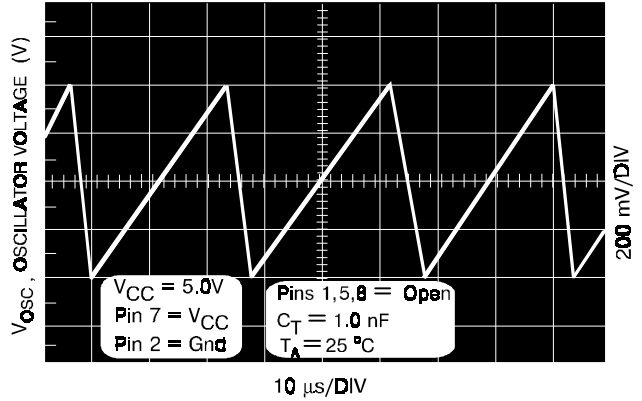


Figure 3. Emitter Follower Configuration Output Saturation Voltage versus Emitter Current versus

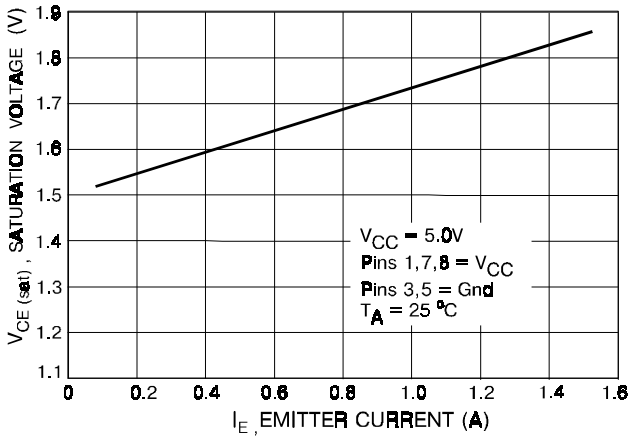


Figure 4. Common Emitter Configuration Output Switch Saturation Voltage versus

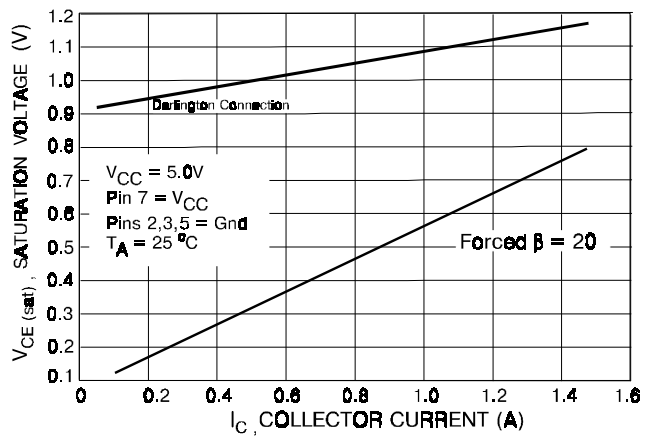


Figure 5. Current Limit Sense Voltage versus Temperature

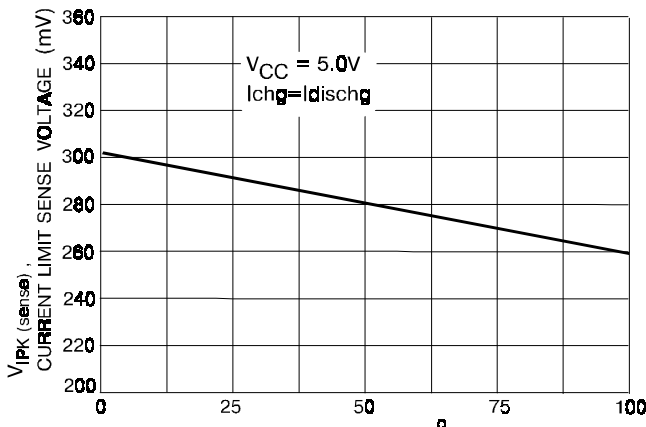
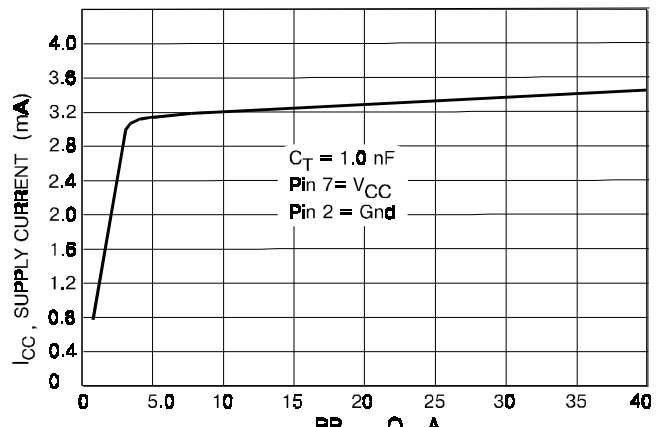


Figure 6. Standby Supply Current versus Supply Voltage



### Typical Applications Circuit

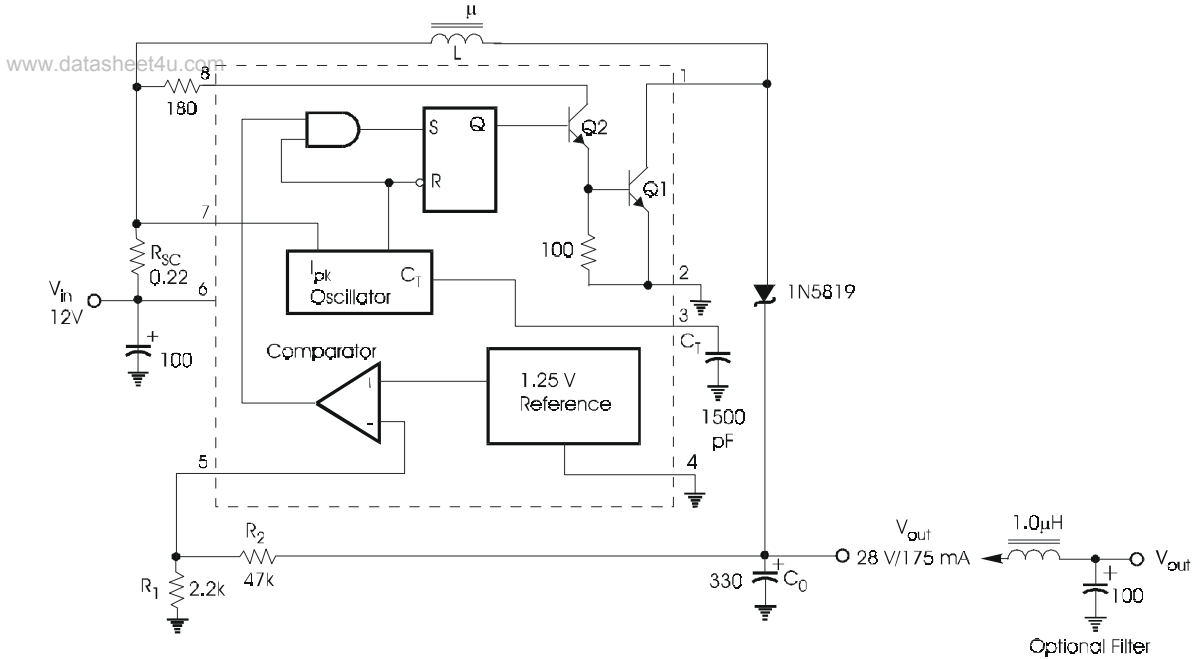


Figure 1. Step-Up Converter

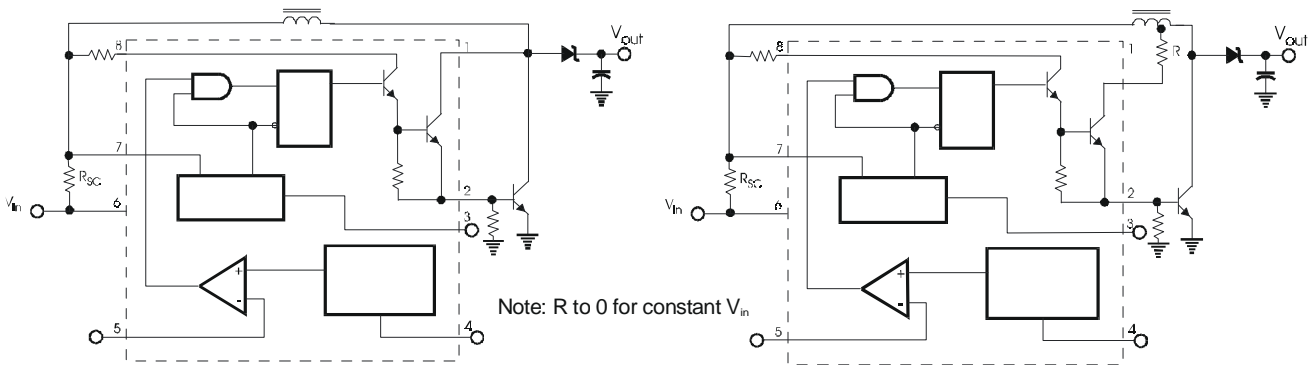


Figure 2a. External NPN Switch.

Figure 2b. External NPN Saturated Switch.

Figure 2. External Current Boost Connections for Load Current Greater than 100mA

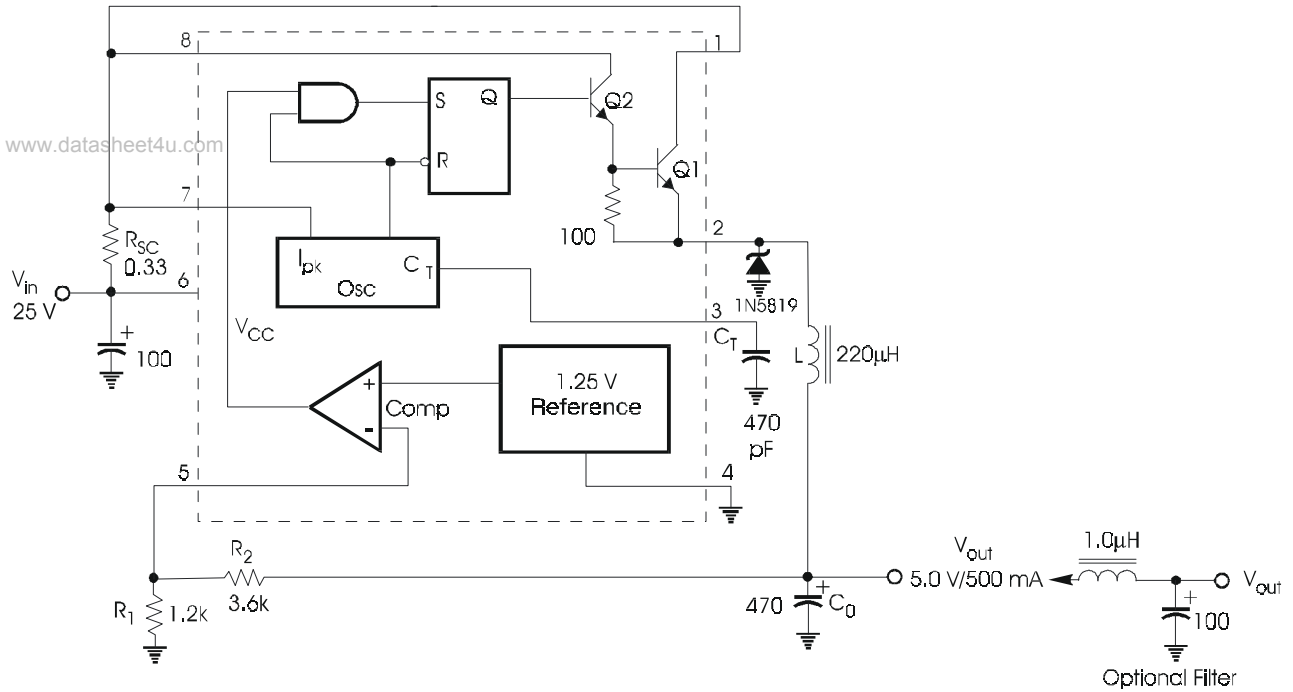


Figure 3. Step-Down Converter

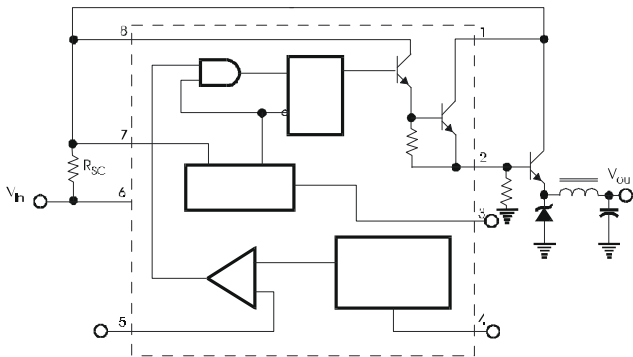


Figure 4a. External NPN Switch.

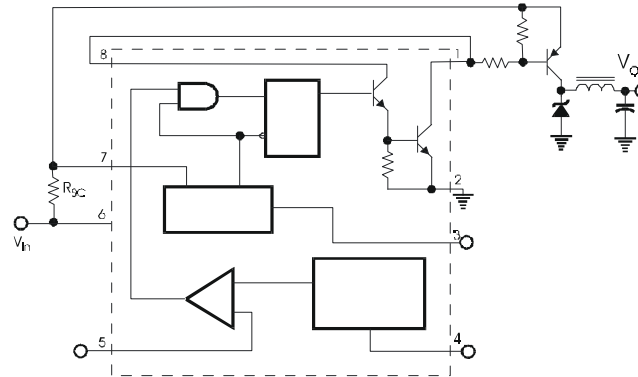


Figure 4b. External PNP Saturated Switch.

Figure 4. External Current Boost Connections for Load Current Greater than 100mA

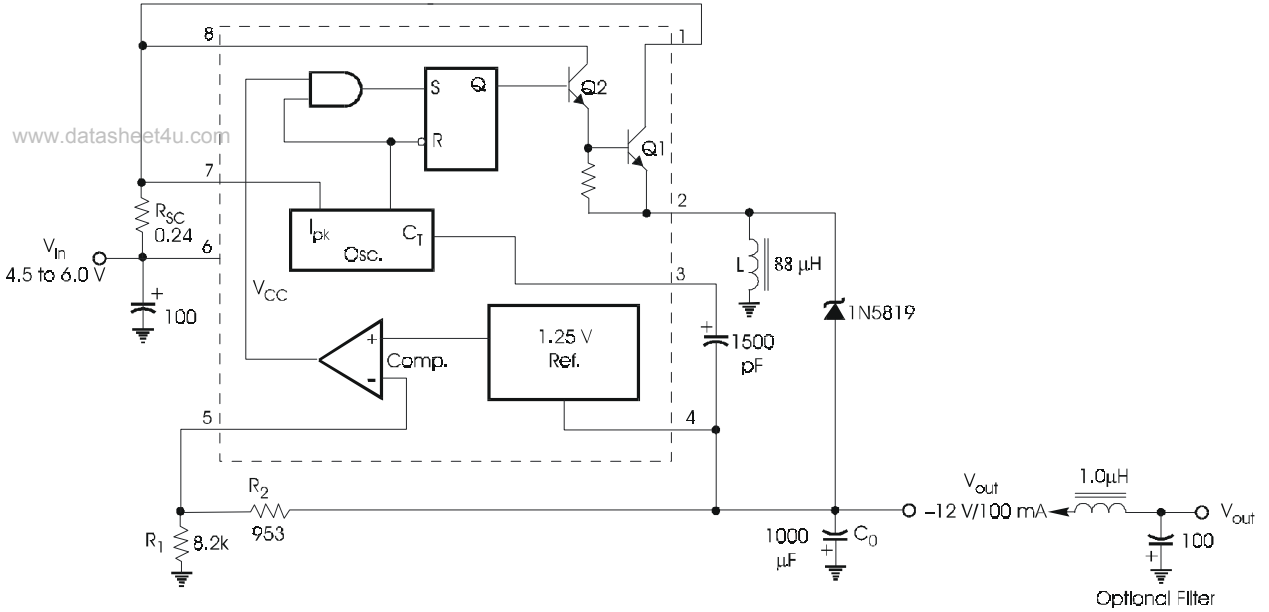


Figure 5. Voltage Inverting Converter

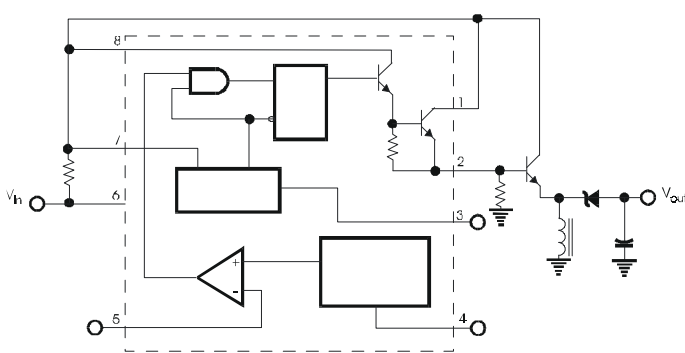


Figure 6a. External NPN Switch.

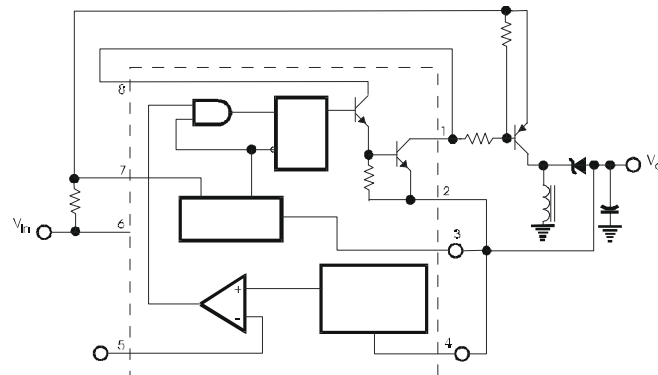


Figure 6b. External PNP Saturated Switch.

Figure 6. External Current Boost Connections for Load Current Greater than

### Design Formula Table

| Calculation                             | Step-Up  | Step-Down   | Voltage-Inverting   |
|---|--|---|---|
| $t_{on}/t_{off}$<br>www.datasheet4u.com | $\frac{V_{out} + V_F}{V_{in} - V_{sat}}$                     | $\frac{+V_F}{-V_{sat}}$   | $\frac{ V_{out}  + V_F}{+V_{sat}}$                                |
| $(t_{on}+t_{off})_{max}$                | 1  | 1   | $\frac{1}{f}$   |
| $C_T$                                   | $4.0 \times 10^{-5} t_{on}$                                  | $4.0 \times 10^{-5} t_{on}$   | $4.0 \times 10^{-5}$  |
| $I_{pk}(switch)$                        | $2 I_{out(max)} + 1$   | $2 I_{out(max)}$  | $2 I_{out(max)} + 1$  |
| $R_{SC}$                                | $0.3/I_{pk}(switch)$   | $0.3/I_{pk}(switch)$  | $0.3/I_{pk}(switch)$  |
| $L_{(min)}$                             | $\frac{V_{in} - V_{sat}}{I_{pk}(switch)} \times t_{on(max)}$ | $\frac{V_{in(min)} - V_{sat} - V_{out}}{I_{pk}(switch)} \times t_{on(max)}$ | $\frac{V_{in(min)} - V_{sat}}{I_{pk}(switch)} \times t_{on(max)}$ |
| $C_O$                                   | $9 \frac{I_{out} t_{on}}{V_{ripple(pp)}}$                    | $\frac{I_{pk}(switch)}{8V_{ripple(pp)}}$                                    | $9 \frac{tI}{V_{ripple(pp)}}$                                     |

#### TERMS AND DEFINITIONS

$V_{sat}$  - Saturation voltage of the output switch.

$V_F$  - Forward voltage drop of the output rectifier.

The following power supply characteristics must be chosen:

$$|V_{out}| = 1.25 \frac{R}{R}$$

$V_{in}$  - Nominal input voltage.

$V_{out}$  - Desired output voltage,

$I_{out}$  - Desired output current.

$f_{min}$  - Minimum desired output switching frequency at the selected values of  $V_{in}$  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.

### Ordering Information

| ORDERING NUMBER | PACKAGE     | MARKING  |
|-----------------|-------------|----------|
| 34063A          | SOP-8/DIP-8 | MC34063A |

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Rm 6A07, Changyin Office Building, No.88, Yong Ding Road, Hai Dian District, Beijing

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