

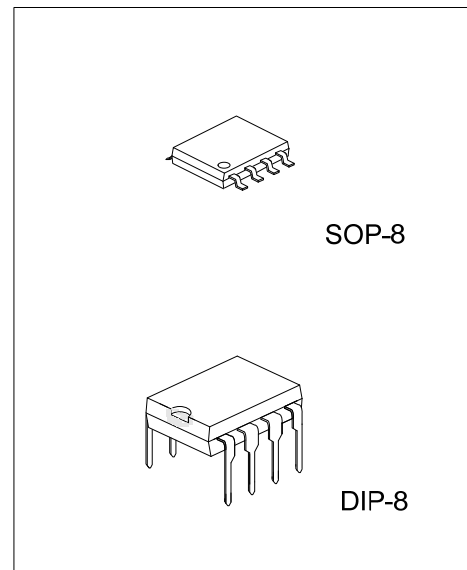
## DC TO DC CONVERTER CONTROLLER

### ■ DESCRIPTION

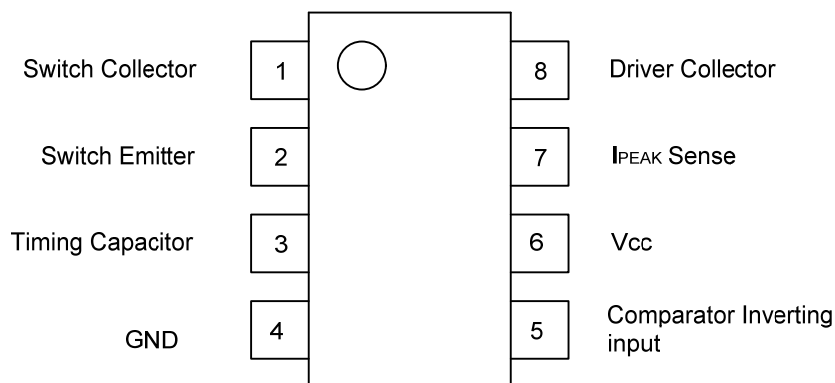
The HG MC34063 is a monolithic regulator subsystem, intended for use as DC to DC converter. This device contains a temperature compensated band gap reference, a duty-cycle control oscillator, driver and high current output switch. It can be used for step down, step-up or inverting switching regulators as well as for series pass regulators.

### ■ FEATURES

- \* Operation from 3.0V to 40V.
- \* Short circuit current limiting.
- \* Low standby current.
- \* Output switch current of 1.5A without external transistors.
- \* Frequency of operation from 100Hz to 100kHz.
- \* Step-up, step-down or inverting switch regulators.



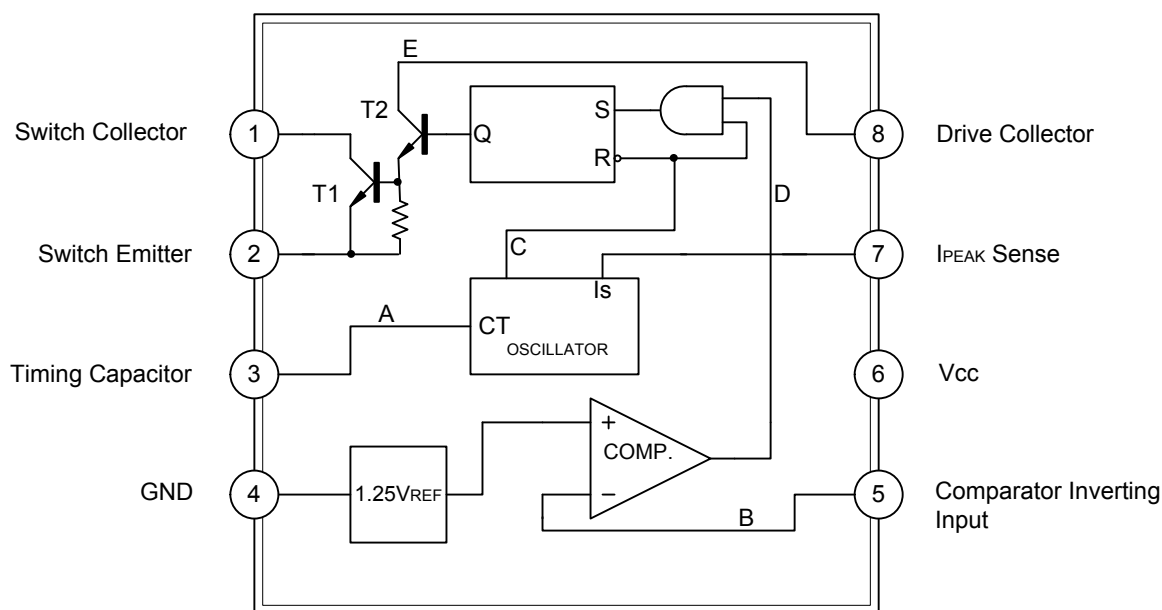
### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTION

| PIN NO | PIN NAME                   | I/O | DESCRIPTION                                                                                                       |
|--------|----------------------------|-----|-------------------------------------------------------------------------------------------------------------------|
| 1      | Switch Collector           | I   | Internal Darlington pairs T1 collector                                                                            |
| 2      | Switch Emitter             | O   | Internal Darlington pairs T1 emitter                                                                              |
| 3      | Timing Capacitor           |     | The value of selected capacitor controls the internal oscillator run rate                                         |
| 4      | GND                        |     |                                                                                                                   |
| 5      | Comparator Inverting Input | I   | Inverting input of comparator which can set & initiate the Darlington pairs output switch                         |
| 6      | V <sub>CC</sub>            |     |                                                                                                                   |
| 7      | I <sub>PEAK</sub> Sense    | I   | Current sense input to monitor the voltage drop across an external resistor placed in series with V <sub>CC</sub> |
| 8      | Driver Collector           | I   | Internal Darlington pairs T1 collector                                                                            |

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| PARAMETER                           |       | SYMBOL         | RATINGS    | UNIT |
|-------------------------------------|-------|----------------|------------|------|
| Supply Voltage                      |       | $V_{CC}$       | 40         | V    |
| Comparator Input Voltage Range      |       | $V_{IN(COMP)}$ | -0.3 ~ +40 | V    |
| Switch Collector Voltage            |       | $V_{C(SW)}$    | 40         | V    |
| Switch Emitter Voltage              |       | $V_{E(SW)}$    | 40         | V    |
| Switch Collector to Emitter Voltage |       | $V_{CE(SW)}$   | 40         | V    |
| Driver Collector Voltage            |       | $V_{C(DR)}$    | 40         | V    |
| Switch Current                      |       | $I_{SW}$       | 1.5        | A    |
| Power Dissipation (Ta=25°C)         | DIP-8 | $P_D$          | 1250       | mW   |
|                                     | SOP-8 |                | 625        |      |
| Junction Temperature                |       | $T_J$          | +150       | °C   |
| Operating Temperature               |       | $T_{OPR}$      | 0 ~ +70    | °C   |
| Storage Temperature                 |       | $T_{STG}$      | -65 ~ +150 | °C   |

Note: Absolute maximum ratings are those values beyond which the device which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ THERMAL DATA

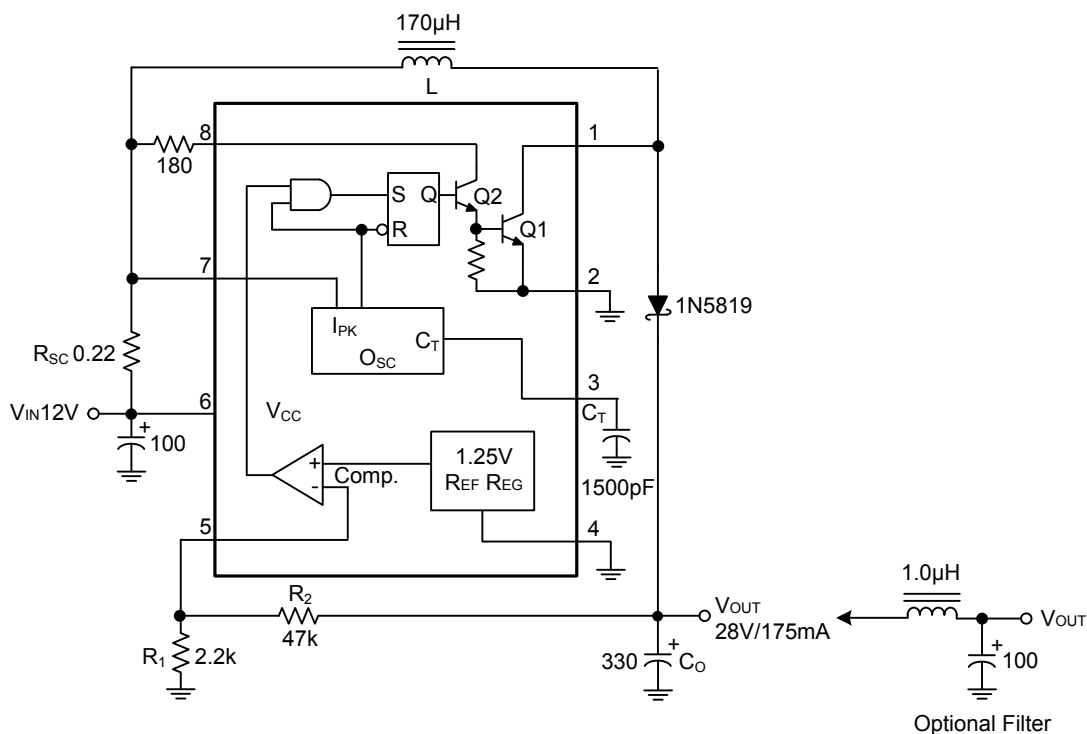
| PARAMETER           |       | SYMBOL        | RATINGS | UNIT |
|---------------------|-------|---------------|---------|------|
| Junction-to-Ambient | DIP-8 | $\theta_{JA}$ | 100     | °C/W |
|                     | SOP-8 |               | 160     |      |

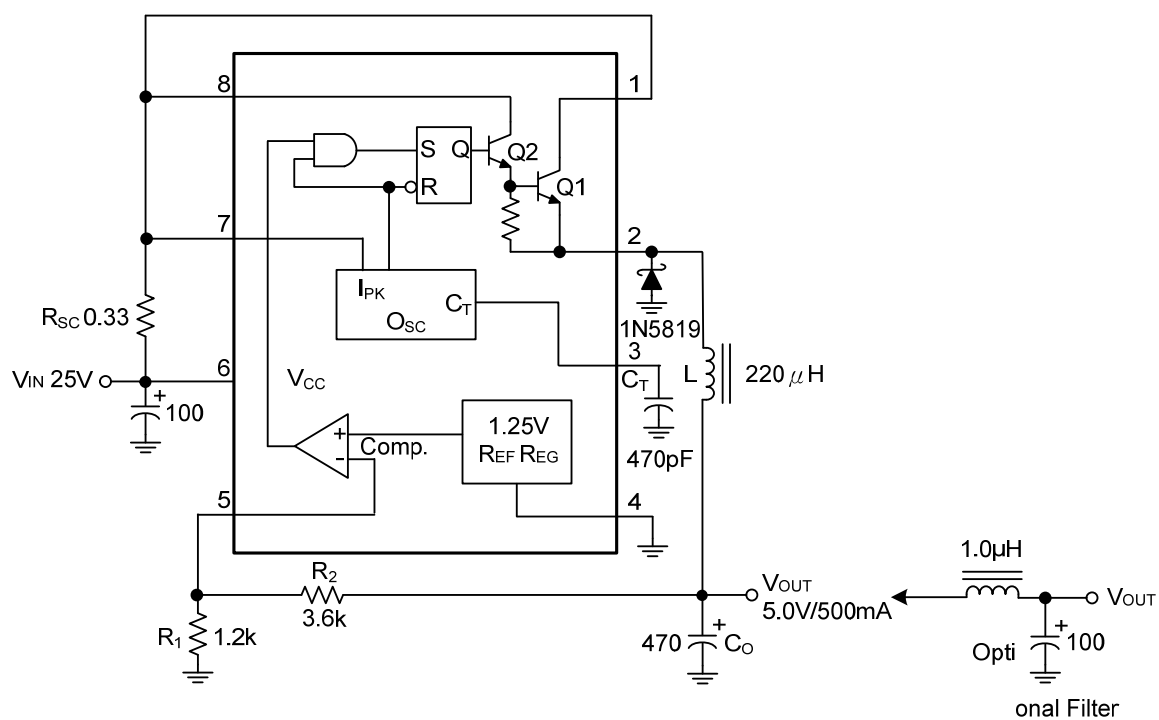
# ■ **ELECTRICAL CHARACTERISTICS** ( $V_{CC}=5.0V$ , $T_a=0\sim+70^{\circ}C$ , unless otherwise specified.)

| PARAMETER                         | SYMBOL         | TEST CONDITIONS                                                              | MIN  | TYP  | MAX  | UNIT    |
|-----------------------------------|----------------|------------------------------------------------------------------------------|------|------|------|---------|
| <b>Oscillator</b>                 |                |                                                                              |      |      |      |         |
| Charging Current                  | $I_{CHG}$      | $V_{CC}=5$ to $40V$ , $T_a=25^{\circ}C$                                      | 22   | 31   | 42   | $\mu A$ |
| Discharging Current               | $I_{DISCHG}$   | $V_{CC}=5$ to $40V$ , $T_a=25^{\circ}C$                                      | 140  | 190  | 260  | $\mu A$ |
| Oscillator Amplitude              | $V_{OSC}$      | $T_a=25^{\circ}C$                                                            |      | 0.5  |      | V       |
| Discharge to Charge Current Ratio | K              | $V_7=V_{CC}$ , $T_a=25^{\circ}C$                                             | 5.2  | 6.1  | 7.5  |         |
| Current limit Sense Voltage       | $V_{SENSE}$    | $I_{CHG}=I_{DISCHG}$ , $T_a=25^{\circ}C$                                     | 250  | 300  | 350  | mV      |
| <b>Output Switch</b>              |                |                                                                              |      |      |      |         |
| Saturation Voltage 1(Note)        | $V_{CE(SAT)1}$ | $I_{SW}=1.0A$ , $V_{C(DRIVER)}=V_{C(SW)}$                                    |      | 0.95 | 1.3  | V       |
| Saturation Voltage 2(Note)        | $V_{CE(SAT)2}$ | $I_{SW}=1.0A$ , $V_{C(DRIVER)}=50mA$                                         |      | 0.45 | 0.7  | V       |
| DC Current Gain(Note)             | $G_I(DC)$      | $I_{SW}=1.0A$ , $V_{CE}=5.0V$ , $T_a=25^{\circ}C$                            | 50   | 180  |      |         |
| Collector Off State Current(Note) | $I_{C(OFF)}$   | $V_{CE}=40.0V$ , $T_a=25^{\circ}C$                                           |      | 0.01 | 100  | $\mu A$ |
| <b>Comparator</b>                 |                |                                                                              |      |      |      |         |
| Threshold Voltage                 | $V_{THD}$      |                                                                              | 1.21 | 1.24 | 1.29 | V       |
| Threshold Voltage Line Regulation | $V_{THD}$      | $V_{CC}=3 \sim 40V$                                                          |      | 2.0  | 5.0  | mV      |
| Input Bias Current                | $I_{I(BIAS)}$  | $V_{IN}=0V$                                                                  |      | 50   | 400  | nA      |
| <b>Total Device</b>               |                |                                                                              |      |      |      |         |
| Supply Current                    | $I_{CC}$       | $V_{CC}=5\sim40V$ , $C_T=0.001$<br>$V_7=V_{CC}$ , $V_C>V_{THD}$ , $Pin2=GND$ |      | 2.7  | 4.0  | mA      |

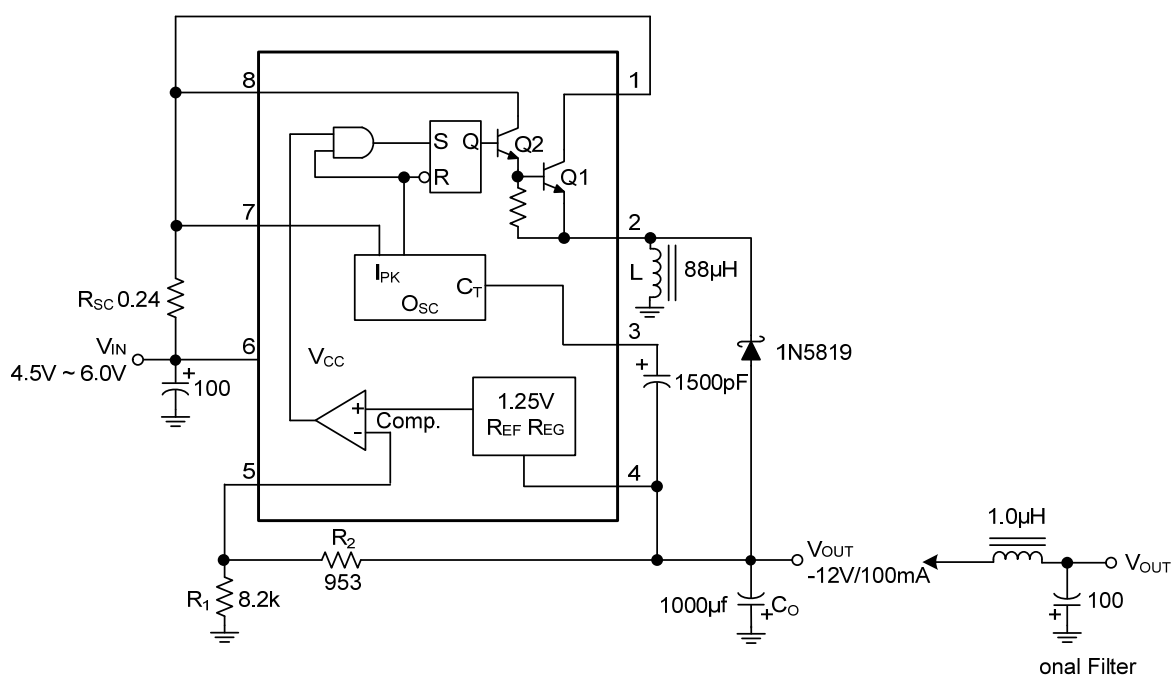
Note: Output switch tests are performed under pulsed conditions to minimize power dissipation.

## ■ **STEP-UP CONVERTER(Cont.)**





## ■ VOLTAGE INVERTING CONVERTER



# ■ DESIGN FORMULA TABLE

| CALCULATION                | STEP-DOWN                                                          | STEP-UP                                                         | VOLTAGE-INVERTING                                        |
|----------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|
| $\frac{t_{ON}}{t_{OFF}}$   | $\frac{V_{OUT} + V_F}{V_{IN(MIN)} - V_{CE(SAT)} - V_{OUT}}$        | $\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{CE(SAT)}}$ | $\frac{ V_{OUT}  + V_F}{V_{IN} - V_{CE(SAT)}}$           |
| $(t_{ON} + t_{OFF})_{MAX}$ | $\frac{1}{F_{MIN}}$                                                | $\frac{1}{F_{MIN}}$                                             | $\frac{1}{F_{MIN}}$                                      |
| $C_T$                      | $4 \times 10^{-5} t_{ON}$                                          | $4 \times 10^{-5} t_{ON}$                                       | $4 \times 10^{-5} t_{ON}$                                |
| $I_{SW}$                   | $2I_{OUT(MAX)}$                                                    | $2I_{OUT(MAX)} \frac{t_{ON} + t_{OFF}}{t_{OFF}}$                | $2I_{OUT(MAX)} \frac{t_{ON} + t_{OFF}}{t_{OFF}}$         |
| $R_S$                      | $0.3/I_{SW}$                                                       | $0.3/I_{SW}$                                                    | $0.3/I_{SW}$                                             |
| $L_{(MIN)}$                | $(\frac{V_{IN(MIN)} - V_{CE(SAT)} - V_{OUT}}{I_{SW}}) t_{ON(MAX)}$ | $(\frac{V_{IN(MIN)} - V_{CE(SAT)}}{I_{SW}}) t_{ON(MAX)}$        | $(\frac{V_{IN(MIN)} - V_{CE(SAT)}}{I_{SW}}) t_{ON(MAX)}$ |
| $C_O$                      | $\frac{I_{SW}(t_{ON} + t_{OFF})}{8V_{RIPPLE(P-P)}}$                | $\frac{I_{OUT} t_{ON}}{V_{RIPPLE(P-P)}}$                        | $\frac{I_{OUT} t_{ON}}{V_{RIPPLE(P-P)}}$                 |

$V_{CE(SAT)}$  - Saturation voltage of the output switch.

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

**The following power supply characteristics must be chosen:**

$V_{IN}$  - Nominal 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  $I_{OUT}$ .

$V_{RIPPLE(P-P)}$  - Desired peak-to-peak output ripple voltage. In practice, the calculated value will need to be increased due to the capacitor equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly effect the line and load regulation.

## ■ TYPICAL CHARACTERISTICS

