## FEATURES

- 3V to 30V Input Voltage Operation.
- Internal 1.6A Peak Current Switch.
- Internal ±1.8% Reference.
- Low Quiescent Current at 1.6mA.
- Frequency Operation from 100Hz to 100KHz.
- Current Limiting.

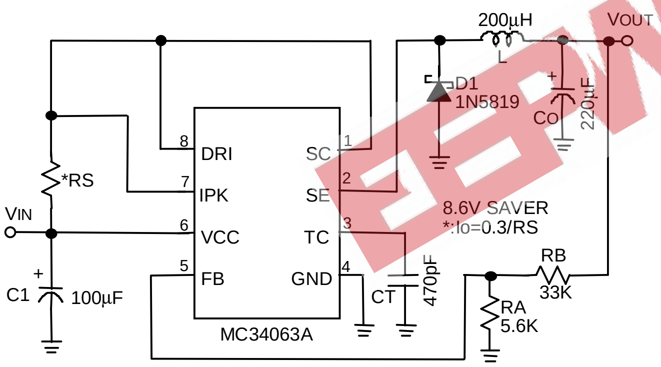
## APPLICATIONS

- Saver for Cellular phones
- DC-DC Converter Module

## DESCRIPTION

The MC34063A by Analog Integrations Corporation, an improved second source over the industrial standard MC34063A, is a monolithic control circuit containing the primary functions required for DC/DC converters. The device consists of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This device is specifically designed to be incorporated in step-down, step-up and voltage-inverting applications with a minimum number of external components. The ±1.8% internal reference and low quiescent current of 1.6mA are among the improvements of the device over the competition.

## TYPICAL APPLICATION CIRCUIT

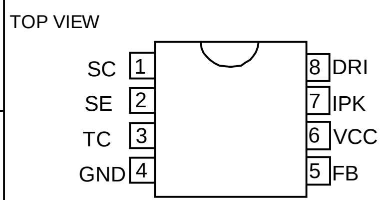



**Saver Circuit for Cellular Phone**

## ORDERING INFORMATION

MC34063A XX

- PACKAGE TYPE
  - N: PLASTIC DIP
  - S: SMALL OUTLINE
- TEMPERATURE
  - C: 0°C~+70°C

| ORDER NUMBER | PIN CONFIGURATION |
|---|---|
| MC34063ACN (PLASTIC DIP) |  |
| MC34063ACS (PLASTIC SO) | |

## ■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage ........................................................................ 30V

Comparator Input Voltage Range .................................................. -0.3V~30V

Switch Collector Voltage ..............................................................30V

Switch Emitter Voltage ................................................................30V

Switch Collector to Emitter Voltage ................................................30V

Driver Collector Voltage ...............................................................30V

Switch Current ............................................................................1.6A

Power Dissipation and Thermal Characteristics

***DIP Package***

Ta= 25°C ..........................................................1.0W

Thermal Resistance ..........................................100°C /W

***SO Package***

Ta= 25°C..........................................................625mW

Thermal Resistance ..........................................160°C /W

Operating Junction Temperature .....................................................125°C

Operating Ambient Temperature Range ..............................................0°C~70°C

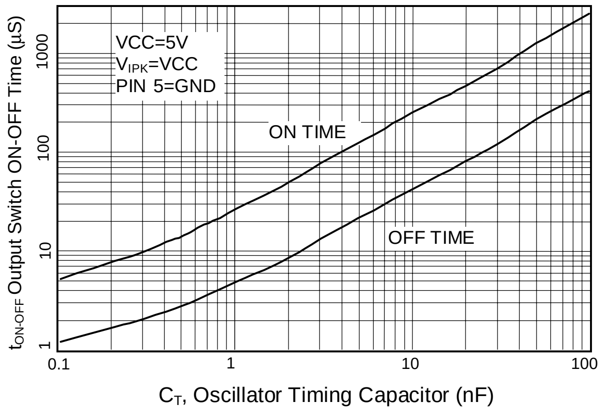
Storage Temperature Range ........................................................ - 65°C~150°C

## ■ ELECTRICAL CHARACTERISTICS (VCC= 5V, Ta=25°C, unless otherwise specified.)

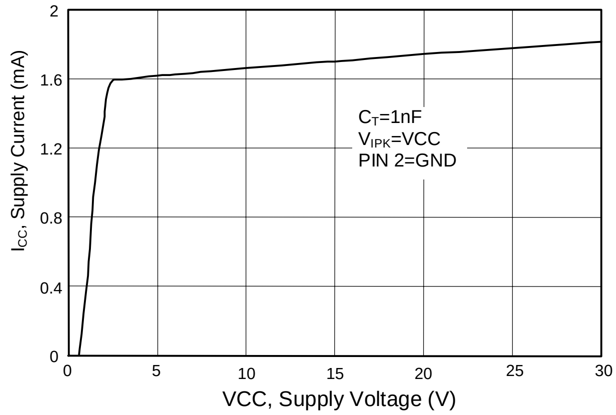
| PARAMETER | TEST CONDITIONS | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| ***Oscillator*** | | | | | | |
| Charging Current | 5.0V≤VCC≤30V | $I_{CHG}$ | 10 | 25 | 40 | µA |
| Discharge Current | 5.0V≤VCC≤30V | $I_{DISCHG}$ | 100 | 150 | 200 | µA |
| Voltage Swing | PIN 3 | $V_{OSC}$ | | 0.6 | | V |
| Discharge to Charge Current Ratio | $V_{IPK(SENSE)}$ =VCC | $I_{DISCHG}/\ I_{CHG}$ | | 6.0 | | |
| Current Limit Sense Voltage | $I_{CHG}$=$I_{DISCHG}$ | $V_{IPK(SENSE)}$ | 250 | 300 | 350 | mV |
| ***Output Switch*** | | | | | | |
| Saturation Voltage, Darlington Connection | $I_{SW}$=1.0A;<br>$V_{C(DRIVER)}$=$V_{C(SWITCH)}$ | $V_{CE(SAT)}$ | | 1.0 | 1.3 | V |
| Saturation Voltage | $I_{SW}$=1.0A; $I_{C(DRIVER)}$=50mA<br>(Forced β≅20) | $V_{CE\ (SAT)}$ | | 0.4 | 0.7 | V |
| DC Current Gain | $I_{SW}$=1.0A; $V_{CE}$=5.0V | $h_{FE}$ | 35 | 120 | | |
| Collector Off-State Current | $V_{CE}$=30V | $I_{C(OFF)}$ | | 10 | | nA |
| ***Comparator*** | | | | | | |
| Threshold Voltage<br>Threshold Voltage | 0°C≤Ta≤70°C | $V_{FB}$ | 1.227<br>1.21 | 1.25 | 1.273<br>1.29 | V<br>V |
| Threshold Voltage Line Regulation | 3.0V≤VCC≤30V | $REG_{LINE}$ | | 0.1 | 0.3 | mV/V |
| Input Bias Current | $V_{IN}$=0V | $I_{IB}$ | | 0.4 | 1 | µA |
| Supply current | $V_{IPK(SENSE)}$=VCC<br>$V_{PIN\ 5}$>$V_{FB}$<br>5.0V≤VCC≤30V<br>$C_T$=0.001µF, PIN 2=GND<br>Remaining pins open | $I_{CC}$ | | 1.6 | 3 | mA |

## TYPICAL PERFORMANCE CHARACTERISTICS

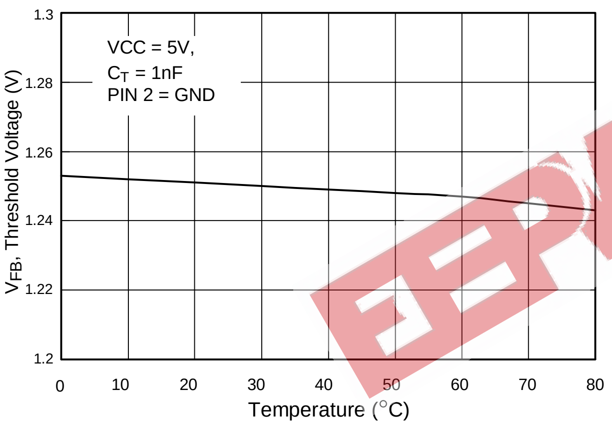
Output Switch ON-OFF Time vs. Oscillator Timing Capacitor



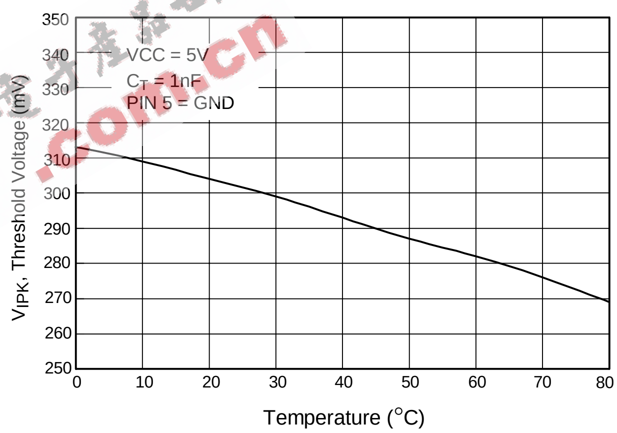

Standby Supply Current vs. Supply Voltage



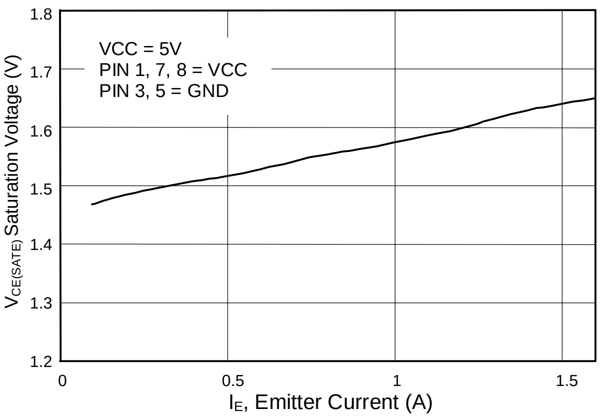

$V_{FB}$, Threshold Voltage vs Temperature



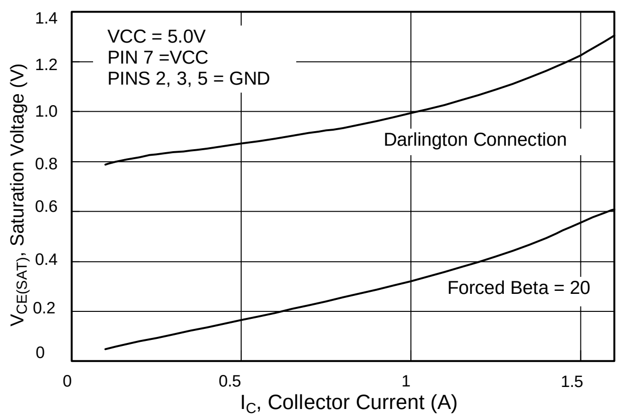

IPK Threshold Voltage vs Temperature



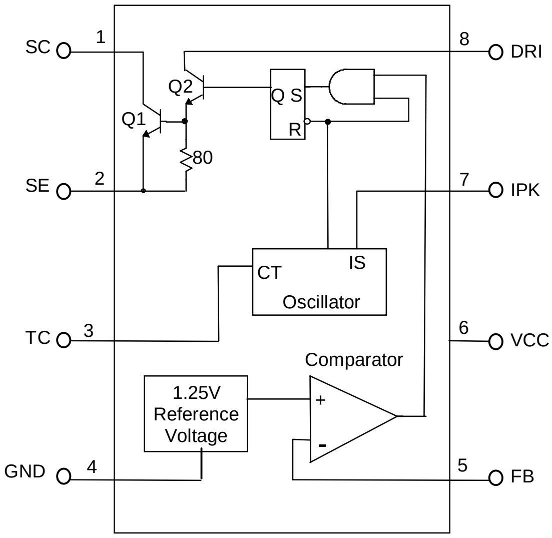

Emmiter-Follower Configuration Output Switch Saturation Voltage vs Emmiter Current




Common-Emitter Configuration Output Switch Saturation Voltage vs Collector Current



## BLOCK DIAGRAM




## PIN DESCRIPTIONS

PIN 1: SC - 1.6A switch collector

PIN 2: SE - Darlington switch emitter

PIN 3: TC - Oscillator timing capacitor

PIN 4: GND - Power GND

PIN 5: FB - Feedback comparator inverting input

PIN 6: VCC - Power supply input

PIN 7: IPK - Highside current sense input, VCC - $V_{IPK}$=300mV

PIN 8: DRI - Drive collector

## APPLICATION INFORMATION

- **DESIGN FORMULA TABLE**

| CALCULATION | STEP-DOWN | STEP-UP | VOLTAGE-INVERTING |
|---|---|---|---|
| $\frac{t_{ON}}{t_{OFF}}$ | $\frac{V_{OUT} + V_F}{V_{IN(MIN)} - V_{SAT} - V_{OUT}}$ | $\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{SAT}}$ | $\frac{\lvert V_{OUT}\rvert + V_F}{V_{IN} - V_{SAT}}$ |
| $(t_{ON} + t_{OFF})_{MAX}$ | $\frac{1}{F_{MIN}}$ | $\frac{1}{F_{MIN}}$ | $\frac{1}{F_{MIN}}$ |
| $C_T$ | $4x10^{-5}t_{ON}$ | $4 \times 10^{-5}t_{ON}$ | $4 \times 10^{-5}t_{ON}$ |
| $I_{C\ (SWITCH)}$ | $2I_{OUT(MAX)}$ | $2I_{OUT(MAX)}\left(\frac{t_{ON} + t_{OFF}}{t_{OFF}}\right)$ | $2I_{OUT(MAX)}\left(\frac{t_{ON} + t_{OFF}}{t_{OFF}}\right)$ |
| RS | $0.33/I_{C(SWITCH)}$ | $0.33/\ I_{C\ (SWITCH)}$ | $0.33/\ I_{C\ (SWITCH)}$ |
| L(MIN) | $\left(\frac{V_{IN(MIN)} - V_{SAT} - V_{OUT}}{I_{C(SWITCH)}}\right)t_{ON(MAX)}$ | $\left(\frac{V_{IN(MIN)} - V_{SAT}}{I_{C(SWITCH)}}\right)t_{ON(MAX)}$ | $\left(\frac{V_{IN(MIN)} - V_{SAT}}{I_{C(SWITCH)}}\right)t_{ON(MAX)}$ |
| Co | $\frac{I_{C(SWITCH)}(t_{ON} + t_{OFF})}{8V_{RIPPLE(P-P)}}$ | $\frac{I_{OUT}\ t_{ON}}{V_{RIPPLE(P-P)}}$ | $\frac{I_{OUT}\ t_{ON}}{V_{RIPPLE(P-P)}}$ |

$V_{SAT}$ = 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.

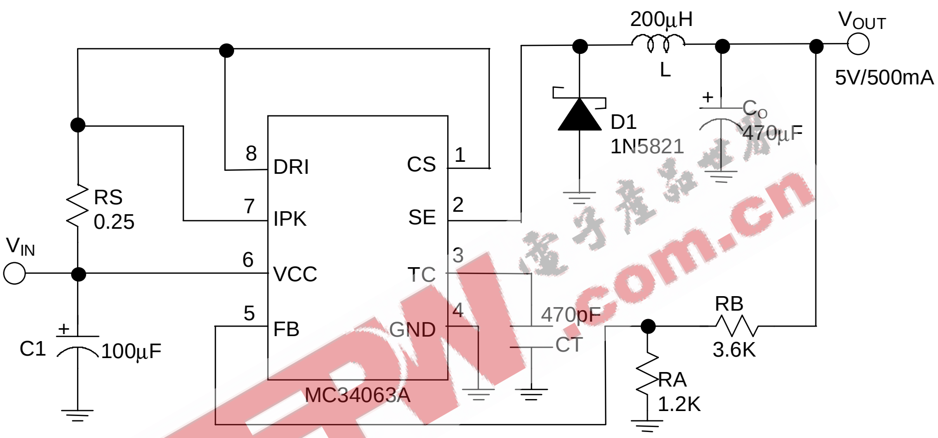
$V_{OUT}$ - Desired output voltage,
$|V_{OUT}| = 1.25\,(1 + RB/RA)$

$I_{OUT}$ - 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.

## APPLICATION EXAMPLES




| | | |
|---|---|---|
| Line Regulation | $V_{IN}$ = 10V ~20V @ $I_O$=500mA | 40mV |
| Load Regulation | $V_{IN}$ = 15V, @ $I_O$=10mA ~ 500mA | 5mV |
| Short Circuit Current | $V_{IN}$ =15V, @ $R_L$ = 0.1Ω | 1.3A |

**Fig. 1 Step-Down Converter**

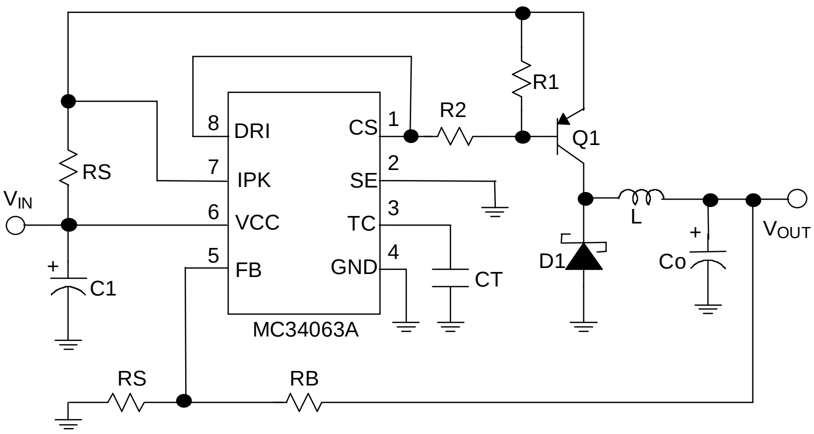
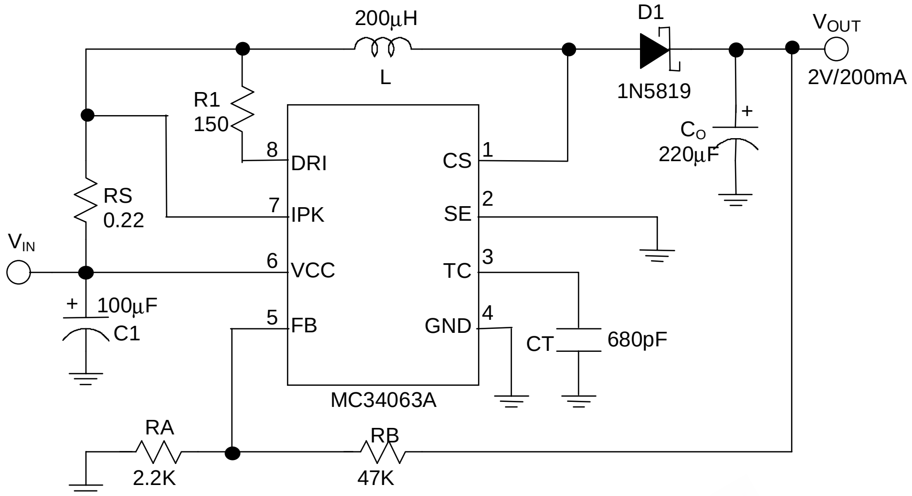



**Fig. 2 Step-Down Converter with External PNP Saturation Switch**

## ■ APPLICATION EXAMPLES (CONTINUED)




| | | |
|---|---|---|
| Line Regulation | $V_{IN}$ = 8V ~16V @ $I_O$=200mA | 100mV |
| Load Regulation | $V_{IN}$ = 12V, @ $I_O$=80mA ~ 200mA | 5mV |

**Fig. 3 Step-Up Converter**



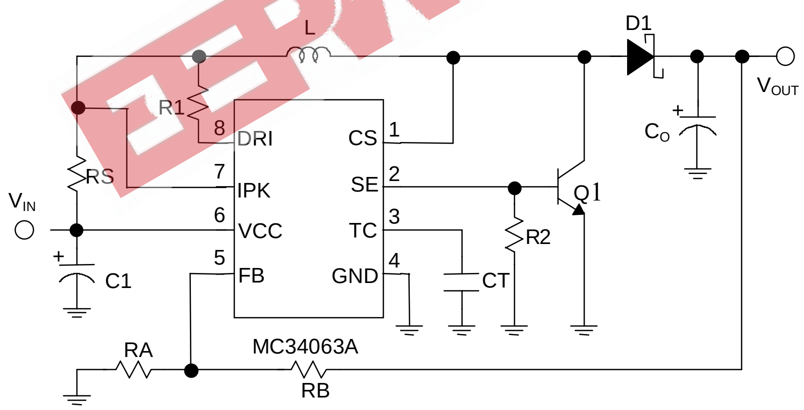
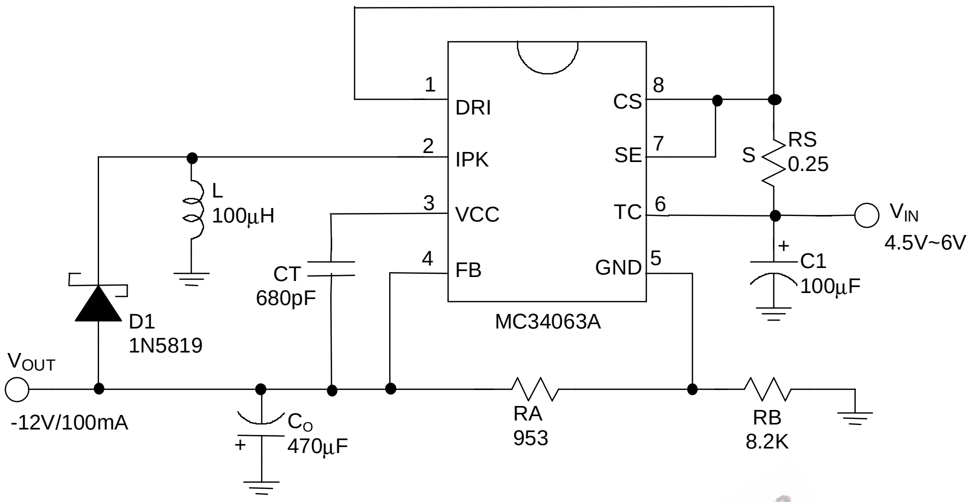



**Fig. 4 Step-Up Converter with External NPN Switch**

## APPLICATION EXAMPLES (CONTINUED)




| | | |
|---|---|---|
| Line Regulation | $V_{IN}$ = 4.5V ~6V @ $I_O$=100mA | 20mV |
| Load Regulation | $V_{IN}$ = 5V, @ $I_O$=10mA ~ 100mA | 100mV |

**Fig.5 Inverting Converter**



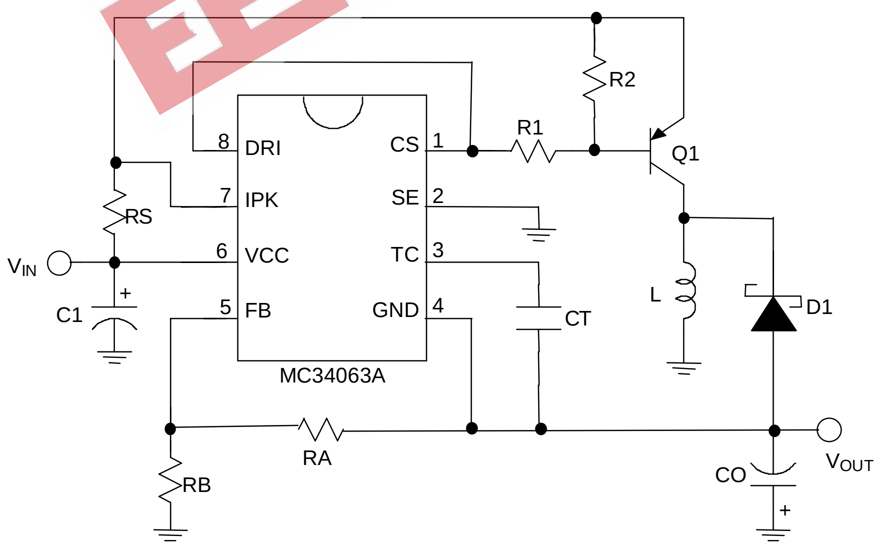
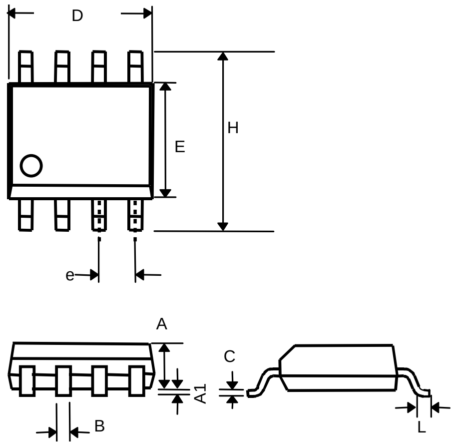



**Fig 6. Voltage Inverting Converter With PNP Saturated Switch**

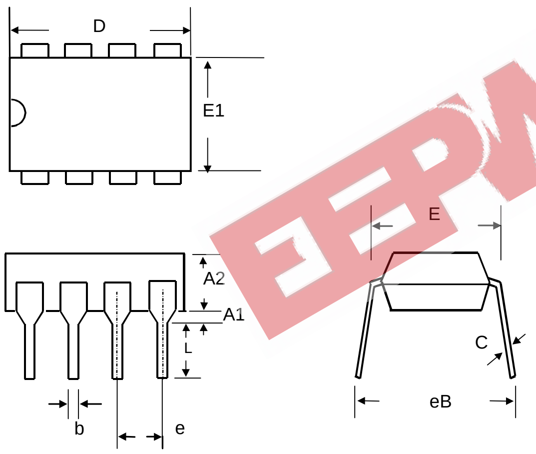
# PHYSICAL DIMENSIONS

- **8 LEAD PLASTIC SO (unit: mm)**




| SYMBOL | MIN | MAX |
|---|---|---|
| A | 1.35 | 1.75 |
| A1 | 0.10 | 0.25 |
| B | 0.33 | 0.51 |
| C | 0.19 | 0.25 |
| D | 4.80 | 5.00 |
| E | 3.80 | 4.00 |
| e | 1.27(TYP) | |
| H | 5.80 | 6.20 |
| L | 0.40 | 1.27 |

- **8 LEAD PLASTIC DIP (unit: mm)**




| SYMBOL | MIN | MAX |
|---|---|---|
| A1 | 0.381 | — |
| A2 | 2.92 | 4.96 |
| b | 0.35 | 0.56 |
| C | 0.20 | 0.36 |
| D | 9.01 | 10.16 |
| E | 7.62 | 8.26 |
| E1 | 6.09 | 7.12 |
| e | 2.54 (TYP) | |
| eB | — | 10.92 |
| L | 2.92 | 3.81 |