



## ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	40	V
Power Dissipation	$P_D$		
MC34063CD		1	W
MC34063S		500	mW
Comparator Input Voltage Range	$V_{IR}$	-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	$V_{C(driver)}$	40	V
Switch Current	$I_{SW}$	1.5	A

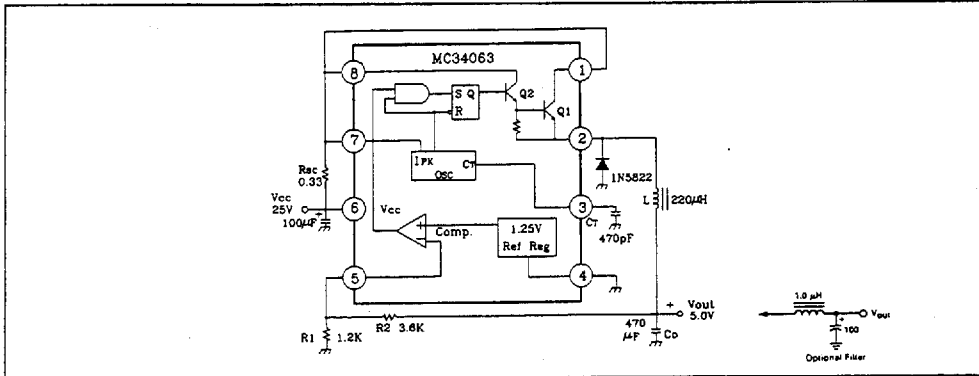
## ELECTRICAL CHARACTERISTICS

( $V_{CC} = 5.0V$ ,  $T_a = 0 \sim +70^\circ C$ , unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OSCILLATOR</b>						
Charging Current	$I_{chr}$	$V_{CC}=5$ to 40V $T_a=25^\circ C$	22	33	42	$\mu A$
Discharge Current	$I_{dischr}$	$V_{CC}=5$ to 40V $T_a=25^\circ C$	140	200	260	$\mu A$
Voltage Swing	$V_{OSC}$	$T_a=25^\circ C$		0.5		V
Discharge To Charge Current Ratio	$\frac{I_{dischr}}{I_{chr}}$	$I_{PK(SENSE)}=V_{CC}$ , $T_a=25^\circ C$	5.2	6.2	7.5	
Current Limit Sense Voltage	$V_{PK(SENSE)}$	$I_{chr} = I_{dischr}$ $T_a=25^\circ C$	250	300	350	mV
<b>OUTPUT SWITCH</b>						
Saturation Voltage I (Note)	$V_{CE(sat) I}$	$I_{SW}=1.0A$ , $V_{C(driver)} = V_C(SW)$		1.0	1.3	V
Saturation Voltage II (Note)	$V_{CE(sat) II}$	$I_{SW}=1.0A$ , $V_{C(driver)} = 50mA$		0.45	0.7	V
DC Current Gain (Note)	$h_{FE}$	$I_{SW}=1.0A$ , $V_{CE} = 5.0V$ , $T_a=25^\circ C$	50	120		
Collector off-State Current (Note)	$I_{C(off)}$	$V_{CE}=40V$ , $T_a=25^\circ C$		0.01	100	$\mu A$
<b>COMPARATOR</b>						
Threshold Voltage	$V_{TH}$		1.23	1.25	1.27	V
Threshold Voltage Line Regulation	REGline	$V_{CC} = 3$ to 40V		1.4	5.0	mV
Input Bias Current	$I_B$	$V_{IN}=0V$		40	400	nA
<b>TOTAL DEVICE</b>						
Supply Current	$I_{CC}$	$V_{CC}=5$ to 40V $C_T=0.001\mu F$ $I_{PK(sense)}=V_{CC}$ $V_{PIN} > V_{th}$ pin 2 =GND		2.5	4.0	mA

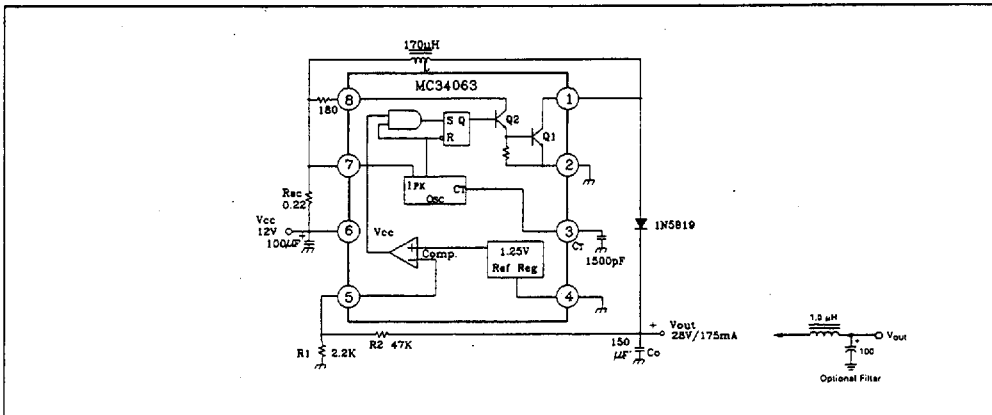
Note : Output switch tests are performed under pulsed conditions to minimize power dissipation

**FIG. 1. STEP-DOWN CONVERTER**



Test	Conditions	Results
Line Regulation	$V_{CC} = 15\text{ V to } 25\text{ V}, I_o = 500\text{ mA}$	$12\text{ mV} = \pm 0.12\%$
Load Regulation	$V_{CC} = 25\text{ V}, I_o = 50\text{ to } 500\text{ mA}$	$3.0\text{ mV} = \pm 0.03\%$
Output Ripple	$V_{CC} = 25\text{ V}, I_o = 500\text{ mA}$	$120\text{ mV}_{p-p}$
Short Circuit Current	$V_{CC} = 25\text{ V}, R_L = 0.1\ \Omega$	$1.1\text{ A}$
Efficiency	$V_{CC} = 25\text{ V}, I_o = 500\text{ mA}$	$82.5\%$
Output Ripple with Optional Filter	$V_{CC} = 25\text{ V}, I_o = 500\text{ mA}$	$40\text{ mV}_{p-p}$

**FIG. 2. STEP-UP CONVERTER**



Test	Conditions	Results
Line Regulation	$V_{CC} = 8.0\text{ V to } 16\text{ V}, I_o = 175\text{ mA}$	$30\text{ mV} = \pm 0.05\%$
Load Regulation	$V_{CC} = 12\text{ V}, I_o = 75\text{ to } 175\text{ mA}$	$10\text{ mV} = \pm 0.017\%$
Output Ripple	$V_{CC} = 12\text{ V}, I_o = 175\text{ mA}$	$400\text{ mV}_{p-p}$
Short Circuit Current	$V_{CC} = 12\text{ V}, R_L = 175\text{ mA}$	$1.1\text{ A}$
Efficiency	$V_{CC} = 12\text{ V}, I_o = 175\text{ mA}$	$89.2\%$
Output Ripple with Optional Filter	$V_{CC} = 12\text{ V}, I_o = 175\text{ mA}$	$40\text{ mV}_{p-p}$



**Table : Design Formula**

Calculation	Step-Down	Step-Up	Voltage-Inverting
$\frac{t_{on}}{t_{off}}$	$\frac{V_{out}+V_F}{V_{CC(min)}-V_{sat}-V_{out}}$	$\frac{V_{OUT}+V_F-V_{CC(min)}}{V_{CC(min)}-V_{sat}}$	$\frac{ V_{out} +V_F}{V_{CC}-V_{sat}}$
(ton+toff) max	$\frac{1}{f_{min}}$	$\frac{1}{f_{min}}$	$\frac{1}{f_{min}}$
$C_T$	$4.8 \times 10^{-3} \text{ ton}$	$4.8 \times 10^{-3} \text{ ton}$	$4.8 \times 10^{-3} \text{ ton}$
$I_{pk}(\text{switch})$	$2 I_{OUT}(\text{max})$	$2 I_{OUT}(\text{max}) \left( \frac{t_{on}}{t_{off}} + 1 \right)$	$2 I_{out}(\text{max}) \left( \frac{t_{on}}{t_{off}} + 1 \right)$
$R_{sc}$	$0.3/I_{pk}(\text{switch})$	$0.3/I_{pk}(\text{switch})$	$0.3/I_{pk}(\text{switch})$
$L(\text{min})$	$\left( \frac{V_{CC(min)}-V_{sat}-V_{out}}{I_{pk}(\text{switch})} \right) \text{ ton}(\text{max})$	$\left( \frac{V_{CC(min)}-V_{sat}}{I_{pk}(\text{switch})} \right) \text{ ton}(\text{max})$	$\left( \frac{V_{CC(min)}-V_{sat}}{I_{pk}(\text{switch})} \right) \text{ ton}(\text{max})$
$C_o$	$\frac{I_{pk}(\text{switch}) (t_{on} + t_{off})}{8 \text{ Vripple (p-p)}}$	$\approx \frac{I_{out} \text{ ton}}{\text{Vripple(p-p)}}$	$\approx \frac{I_{out} \text{ ton}}{\text{Vripple(p-p)}}$

- ♦  $V_{sat}$  = Saturation Voltage of the output switch.
- ♦  $V_F$  = Forward Voltage drop of the output rectifier.

The following power supply characteristics must be chosen:

- ♦  $V_{CC}$  : Normal input voltage, if this voltage is not constant , then use  $V_{CC(max)}$  for step-down and  $V_{CC}(\text{min})$  for step-up converter.
- ♦  $V_{out}$ : Desied Output voltage,  $V_{out}=1.25 \left( 1 + \frac{R2}{R1} \right)$
- ♦  $I_{out}$  : Desired output current.
- ♦  $f_{min}$  : Minimum desired output switching frequency at the selected values for  $V_{CC}$  and  $I_o$ .
- ♦  $\text{Vripple(p-p)}$ : Desired peak-to peak output repple 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 effect the line and load regulation.