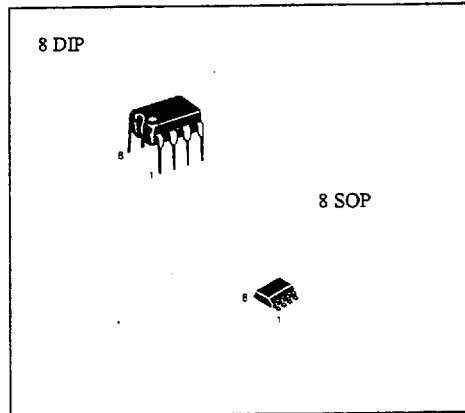


The MC34063CD/S is a monolithic switch regulator subsystem intended for use as DC to DC converter. This device contains an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active peak current limit circuit, drive and a high current output switch.

It was specifically designed to be incorporated in step-up, step-down and voltage inverting converter applications. These function are contained in an 8 pin dual in-line package.



FEATURES

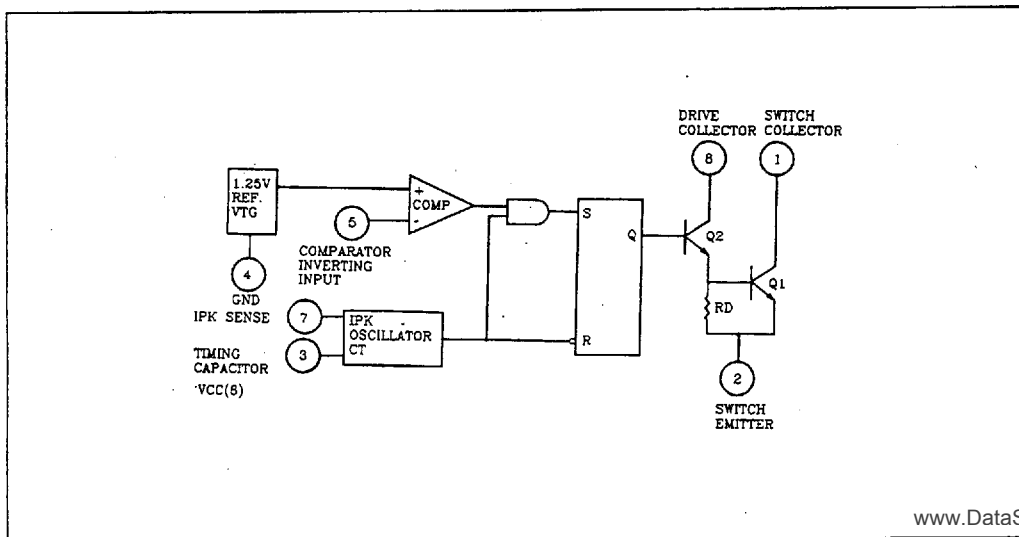
- Operation from 3.0 to 40V Input
- Short Circuit Current Limiting
- Low Standby Current
- Output Switch Current to 1.5A

ORDERING INFORMATION

Device	Package	Operating Frequency
MC34063CD	8 DIP	0 ~ +70°C
MC34063S	8 SOP	0 ~ +70°C

- Output - Voltage Adjustable
- Frequency of Operation from 100Hz to 100KHz

BLOCK DIAGRAM



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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

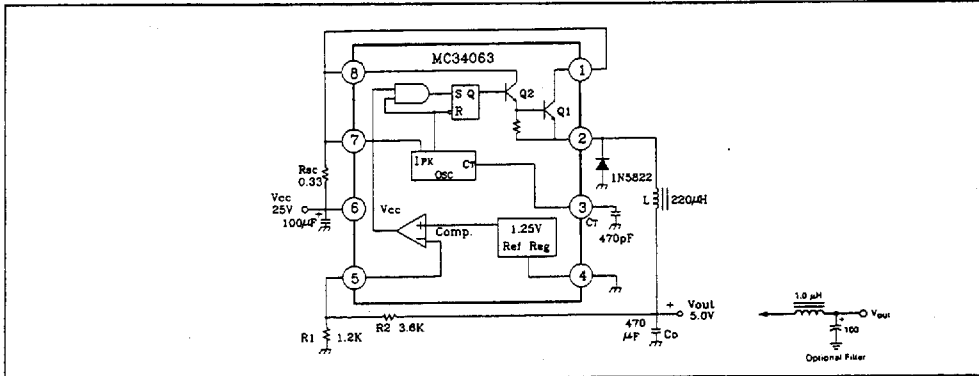
ELECTRICAL CHARACTERISTICS

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
OSCILLATOR						
Charging Current	I_{chr}	$V_{CC}=5$ to 40V $T_a=25^\circ C$	22	33	42	μA
Discharge Current	I_{dischr}	$V_{CC}=5$ to 40V $T_a=25^\circ C$	140	200	260	μA
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
OUTPUT SWITCH						
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	μA
COMPARATOR						
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
TOTAL DEVICE						
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

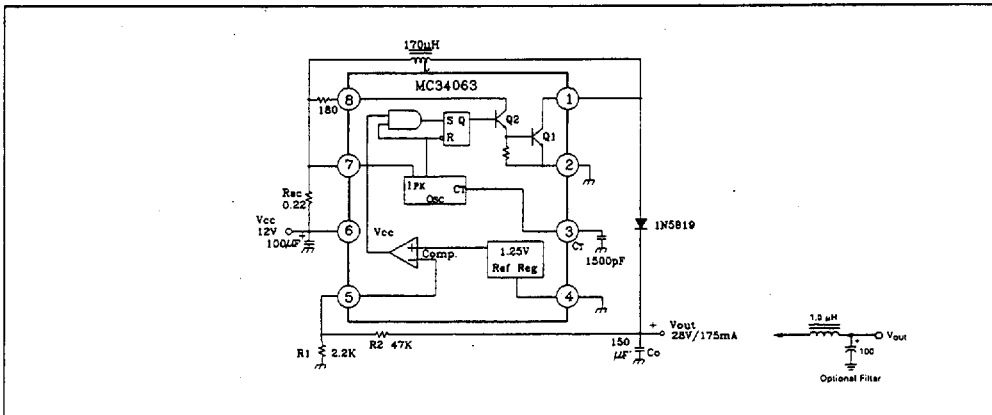
Note : Output switch tests are performed under pulsed conditions to minimize power dissipation

FIG. 1. STEP-DOWN CONVERTER



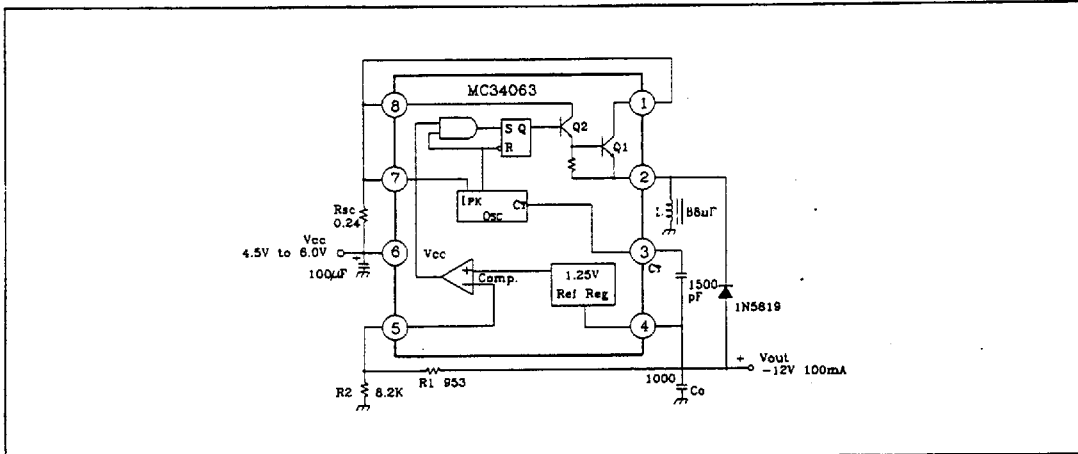
Test	Conditions	Results
Line Regulation	$V_{CC} = 15\text{ V to } 25\text{ V}, I_o = 500\text{ mA}$	$12\text{ mV} = \pm 0.12\%$
Load Regulation	$V_{CC} = 25\text{ V}, I_o = 50\text{ to } 500\text{ mA}$	$3.0\text{ mV} = \pm 0.03\%$
Output Ripple	$V_{CC} = 25\text{ V}, I_o = 500\text{ mA}$	120 mV_{p-p}
Short Circuit Current	$V_{CC} = 25\text{ V}, R_L = 0.1\ \Omega$	1.1 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 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 mV_{p-p}
Short Circuit Current	$V_{CC} = 12\text{ V}, R_L = 175\text{ mA}$	1.1 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 mV_{p-p}

FIG. 3. VOLTAGE INVERTING CONVERTER



Test	Conditions	Results
Line Regulation	$V_{CC} = 4.5 \text{ V to } 6.0 \text{ V}, I_o = 100 \text{ mA}$	$3.0 \text{ mV} = \pm 0.012\%$
Load Regulation	$V_{CC} = 5.0 \text{ V}, I_o = 10 \text{ to } 100 \text{ mA}$	$0.022 \text{ V} = \pm 0.09\%$
Output Ripple	$V_{CC} = 5.0 \text{ V}, I_o = 100 \text{ mA}$	50 mVp-p
Short Circuit Current	$V_{CC} = 5.0 \text{ V}, R_L = 0.1 \Omega$	910 mA
Efficiency	$V_{CC} = 5.0 \text{ V}, I_o = 100 \text{ mA}$	64.5%
Output Ripple with Optional Filter	$V_{CC} = 5.0 \text{ V}, I_o = 100 \text{ mA}$	70 mVp-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 .
- ♦ $V_{ripple}(p-p)$: 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.