FCI *Semiconductor*   MC34063CD/S DC to DC Converted Controller

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.
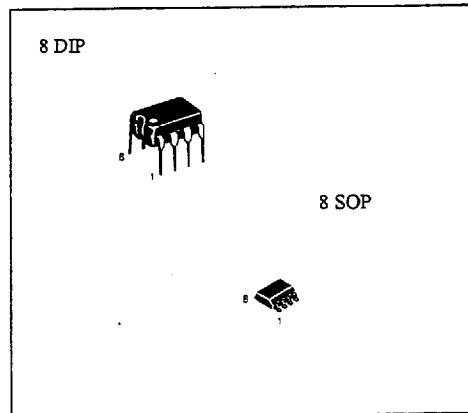
8 DIP

8 SOP

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
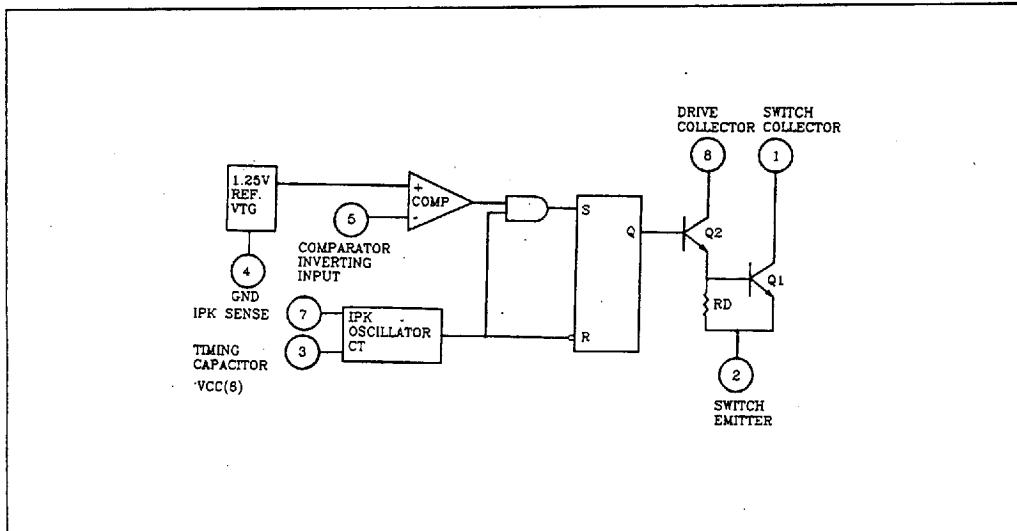
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ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	40	V
Power Dissipation MC34063CD MC34063S	P_D	 1 500	 W 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	$V_{C(drive)}$	40	V
Switch Current	I_{SW}	1.5	A

ELECTRICAL CHARACTERISTICS

(V_{CC} = 5.0V. Ta= 0 ~ + 70℃ . unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
OSCILLATOR						
Charging Current	I_{chg}	V_{CC}=5 to 40V Ta=25℃	22	33	42	μ A
Discharge Current	I_{dischg}	V_{CC}=5 to 40V Ta=25℃	140	200	260	μ A
Voltage Swing	Vosc	Ta=25℃		0.5		V
Discharge To Charge Current Ratio	I_{dischg} I_{chg}	$I_{PK(SENSE)}$=V_{CC} , Ta=25℃	5.2	6.2	7.5	
Current Limit Sense Voltage	V_{IPK} (SENSE)	I_{chg} = I_{dischg} Ta=25℃	250	300	350	mV
OUTPUT SWITCH						
Saturation Voltage I (Note)	$V_{CE(sat)}$ I	Isw=1.0A, $V_{C (driver)}$= V_C (SW)		1.0	1.3	V
Saturation Voltage II (Note)	$V_{CE(sat)}$ II	Isw=1.0A, $V_{C (driver)}$= 50mA		0.45	0.7	V
DC Current Gain (Note)	h_{FE}	Isw=1.0A, V_{CE} = 5.0V, Ta=25℃	50	120		
Collector off-State Current (Note)	$I_{C(off)}$	V_{CE} =40V, Ta=25℃		0.01	100	μ A
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_{IB}	V_{IN}=0V		40	400	nA
TOTAL DEVICE						
Supply Current	I_{CC}	V_{CC}=5 to 40V C_T=0.001μ F I_{PK}(sense) =V_{CC} V_{PIN} 5>Vth pin 2 =GND		2.5	4.0	mA

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

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FIG. 1. STEP-DOWN CONVERTER
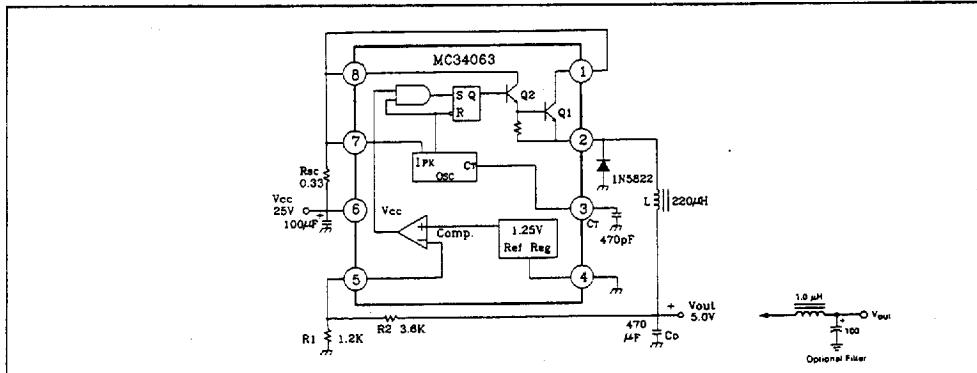
Test	Conditions	Results
Line Regulation	V_{CC} = 15 V to 25 V, Io = 500mA	12 mV = ± 0.12%
Load Regulation	V_{CC} = 25 V , Io = 50 to 500mA	3.0 mV = ± 0.03%
Output Ripple	V_{CC} = 25 V, Io = 500mA	120mVp-p
Short Circuit Current	V_{CC} = 25 V, R_L = 0.1Ω	1.1A
Efficiency	V_{CC} = 25 V, Io = 500mA	82.5%
Output Ripple with Optional Filter	V_{CC} = 25 V, Io = 500mA	40mVp-p

FIG. 2. STEP-UP CONVERTER
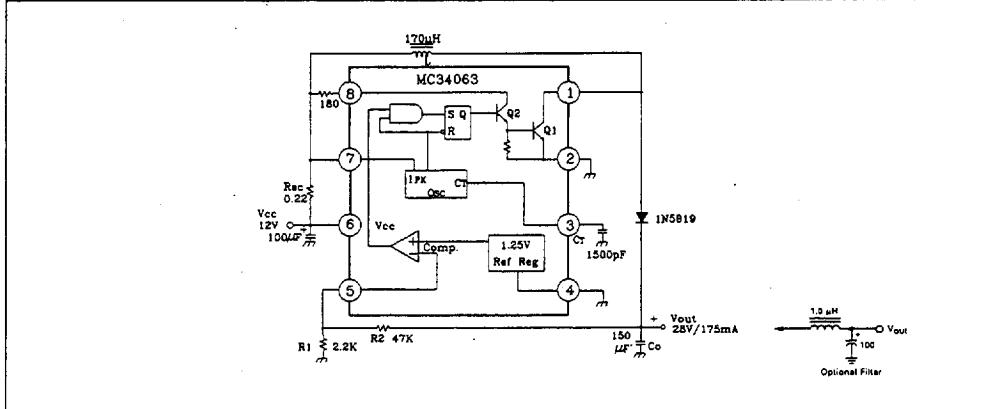
Test	Conditions	Results
Line Regulation	V_{CC} = 8.0 V to 16 V, Io = 175mA	30 mV = ± 0.05%
Load Regulation	V_{CC} =12 V , Io = 75 to 175mA	10 mV = ± 0.017%
Output Ripple	V_{CC} = 12 V, Io = 175mA	400mVp-p
Short Circuit Current	V_{CC} = 12 V, R_L = 175 mA	1.1A
Efficiency	V_{CC} = 12 V, Io = 175mA	89.2%
Output Ripple with Optional Filter	V_{CC} = 12 V, Io = 175mA	40mVp-p

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FIG. 3. VOLTAGE INVERTING CONVERTER
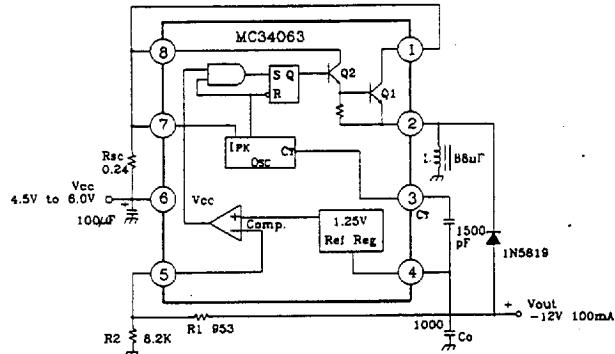
Test	Conditions	Results
Line Regulation	V_{CC}=4.5 V to 6.0 V, Io = 100mA	3.0 mV = ± 0.012%
Load Regulation	V_{CC} = 5.0 V , Io = 10 to 100mA	0.022V = ± 0.09%
Output Ripple	V_{CC}=5.0 V, Io = 100mA	50mVp-p
Short Circuit Current	V_{CC} = 5.0 V, R_L = 0.1Ω	910mA
Efficiency	V_{CC} = 5.0 V, Io = 100mA	64.5%
Output Ripple with Optional Filter	V_{CC} = 5.0 V, Io = 100mA	70mVp-p

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Table : Design Formula

Calculation	Step-Down	Step-Up	Voltage-Inverting
ton/ toff	$\dfrac{Vout+V_F}{V_{CC}(min)-Vsat-Vout}$	$\dfrac{V_{OUT}+V_F-V_{CC}(min)}{V_{CC}(min)-Vsat}$	$\dfrac{\mid Vout \mid +V_F}{V_{CC}-Vsat}$
(ton+toff) max	$\dfrac{1}{fmin}$	$\dfrac{1}{fmin}$	$\dfrac{1}{fmin}$
C_T	4.8×10^{-5} ton	4.8×10^{-5} ton	4.8×10^{-5} ton
I_{pk}(switch)	$2\,I_{OUT}$(max)	$2\,I_{OUT}$(max) $(\dfrac{ton}{toff}+1)$	$2\,Iout$(max) $(\dfrac{ton}{toff}+1)$
Rsc	$0.3/I_{PK}$(switch)	$0.3/I_{PK}$(switch)	$0.3/I_{PK}$(switch)
L (min)	$(\dfrac{V_{CC}(min)-Vsat-Vout}{I_{PK}(switch)})$ ton (max)	$(\dfrac{V_{CC}(min)-Vsat}{I_{PK}(switch)})$ ton(max)	$(\dfrac{V_{CC}(min)-Vsat}{I_{PK}(switch)})$ ton (max)
Co	$\dfrac{Ipk(switch)\,(ton+toff)}{8\,Vripple\,(p-p)}$	$\approx \dfrac{Iout\,ton}{Vripple(p-p)}$	$\approx \dfrac{Iout\,ton}{Vripple(p-p)}$

♦ Vsat = Saturation Voltage of the output switch.

♦ V_F = Forwark 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} (min) for step-up

converter.

♦ Vout: Desied Output voltage, Vout=1.25 $(1+\dfrac{R2}{R1})$

♦ Iout : Desired output current.

♦ fmin : Minimum desired output switching frequency at the selected values for V_{CC} and Io.

♦ 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.