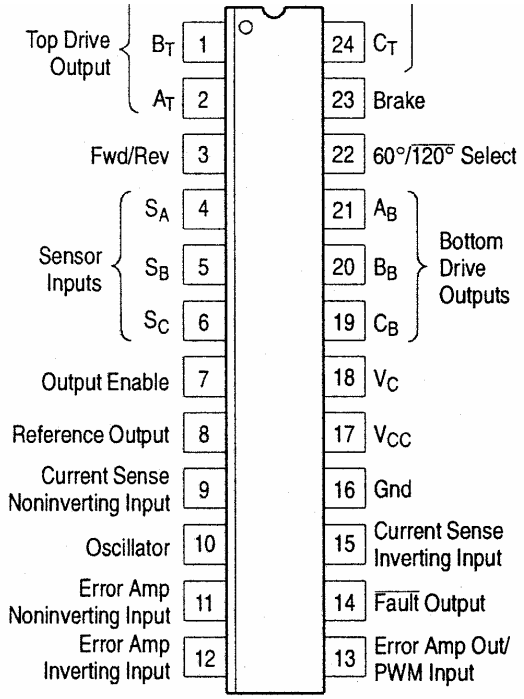
BRUSHLESS DC MOTOR CONTROLLER

The IL33035 is a high performance second generation monolithic brushless DC motor controller containing all of the active functions required to implement a full featured open loop, three or four phase motor control system. This device consists of a rotor position decoder for proper commutation sequencing, temperature compensated reference capable of supplying sensor power, frequency programmable sawtooth oscillator, three open collector top drivers, and three high current totem pole bottom drivers ideally suited for driving power MOSFETs.

Also included are protective features consisting of undervoltage lockout, cycle-by-cycle current limiting with a selectable time delayed latched shutdown mode, internal thermal shutdown, and a unique fault output that can be interfaced into microprocessor controlled systems.

Typical motor control functions include open loop speed, forward or reverse direction, run enable, and dynamic braking. The MC33035 is designed to operate with electrical sensor phasings of 60°/300° or 120°/240°, and can also efficiently control brush DC motors



FEATURES

- 10 to 30 V Operation
- Undervoltage Lockout
- 6.25V Reference Capable of Supplying Sensor Power
- Fully Accessible Error Amplifier for Closed Loop Servo Applications
- High Current Drivers Can Control External 3-Phase MOSFET Bridge
- Cycle-By-Cycle Current Limiting
- Pinned-Out Current Sense Reference
- Internal Thermal Shutdown
- Selectable 60°/300° or 120°/240° Sensor Phasings
- Can Efficiently Control Brush DC Motors with External MOSFET H-Bridge

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Power Supply Voltage	Vcc	40	V
Digital Inputs (Pins 3, 4, 5, 6, 22, 23)	-	V_{ref}	V
Oscillator Input Current (Source or Sink)	Iosc	30	mA
Error Amp Input Voltage Range (Pins 11, 12, Note 1)	V_{IR}	-0.3 to Vref	V
Error Amp Output Current (Source or Sink, Note 2)	I_{Out}	10	mA
Current Sense Input Voltage Range *(Pins* 9, 15)	V_{Sense}	-0.3 to 5.0	V
Fault Output Voltage	$V_{CE(Fault)}$	20	V
Fault Output Sink Current	$I_{Sink(Fault)}$	20	mA
Top Drive Voltage (Pins 1, 2, 24)	$V_{CE(top)}$	40	V
Top Drive Sink Current (Pins 1, 2, 24)	$I_{Sink(top)}$	50	mA
Bottom Drive Supply Voltage (Pin 18)	V_C	30	V
Bottom Drive Output Current (Source or Sink, Pins 19, 20. 21)	I_{DRV}	100	mA
Power Dissipation and Thermal Characteristics DIP package Maximum Power Dissipation T_A = 85°C Thermal Resistance. Junction-to-Air SO Package Maximum Power Dissipation T_A= 85°C Thermal Resistance, Junction-to-Air	 P_D $R_{\theta JA}$ P_D $R_{\theta JA}$	 860 75 650 100	 mW °C/W mW °C/W
Operating Junction Temperature	TJ	150	°C
Operating Ambient Temperature Range	TA	-4010+65	°C
Storage Temperature Range	Tstg	-6510+150	°C

ELECTRICAL CHARACTERISTICS

(Vcc = Vc = 20 V, Rτ-= 4.7 k, Cτ = 10 nF, T_A= 25°C, unless ofriarwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Reference Output Voltage (I_{ref} = 1.0 mA) T_A = 25°C T_A=-40°to+85°C	V_{ref}	 5.9 5.82	 6.24 -	 6.5 6.57	V
Line Regulation (Vcc = 10 to 30 V, I_{ref} = 1.0 mA)	Reg_{line}	-	1.5	30	mV
Load Regulation (I_{ref} = 1.0 to 20 mA)	Reg_{load}	-	16	30	mV
Output Short Circuit Current (Note 3)	I_{SC}	40	75	-	mA
Reference Under Voltage Lockout Threshold	V_{th}	4.0	4.5	5.0	V
Input Offset Voltage (T_A =-40° to+ 85°C)	V_{IO}	-	0.4	10	mV
Input Offset Current (T_A=-40°to +85°C)	I_{IO}	-	8.9	500	nA
Input Bias Current (T_A=-40°to +85°C)	I_{IB}	-	-46	-1000	nA
Input Common Mode Voltage Range	V_{ICR}		(OVtoV^)		V
Open Loop Voltage Gain (V_O = 3.0 V, R_L = 15 k)	A_{VOL}	70	80	-	dB
Input Common Mode Rejection Ratio	CMRR	55	86	-	dB
Power Supply Rejection Ratio (Vcc =Vc = 10 to 30 V)	PSRR	65	105	-	dB

ELECTRICAL CHARACTERISTICS

(Vcc = Vc = 20 V, R_T= 4.7 k, C_T = 10 nF, T_A= 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage Swing					
High State (R_L = 15k to Gnd)	V_{OH},	4.6	5.3	-	V
Low State (R_L=15k to V_{ref})	V_{OL}	-	0.5	1.0	
Oscillator Frequency	f_{osc}	22	25	28	kHz
Frequency Change with Voltage (Vcc = 10 to 30 V)	Δfosc/ΔV	-	0.01	5.0	%
Sawtooth Peak Voltage	$V_{OSC(P)}$	-	4.1	4.5	V
Sawtooth Valley Voltage	$V_{OSC(V)}$	1.2	1.5	-	V
Input Threshold Voltage (Pins 3, 4, 5, 6, 7, 22, 23) High Stale	V_{IH}	3.0	2.2	-	V
Low State	V_{IL}	-	1.7	0.8	
Sensor Inputs (Pins 4, 5, 6)					
High State Input Current (V_{IH} = 5.0 V)	I_{IL}	-150	-70	-20	nA
Low State Input Current (V_{IL} = 0 V)	I_{IL}	-600	-337	-150	
Forward/Reverse, 60°/120° Select (Pins 3, 22, 23) High State Input Current (V_{IH} = 5.0 V)	I_{IL}	-75	-36	-10	nA
Low State Input Current (V_{IL} = 0 V)	I_{IL}	-300	-175	-75	
Output Enable High State Input Current (V_{IH} = 5.0 V)	I_{IH}	-60	-29	-10	µA
Low btate Input Current (V_{IL} =0 V)	I_{IL}	*-60*	-29	-10	
Threshold Voltage	V_{th}	85	101	115	mV
Input Common Mode Voltage Range	V_{ICR}	-	3.0	-	V
Input Bias Current	I_{IB}	-	-0.9	-5.0	nA
Top Drive Output Sink Saturation (I_{Sink} = 25 mA)	$V_{CE(SAT)}$	-	0.5	1.5	V
Top Drive Output Off-State Leakage (V_{CE} = 30 V)	$I_{DRV(leak)}$	-	0.06	100	nA
Top Drive Output Switching Time (C_L = 47 pF, R_L. = 1.0 k)		-			
Rise Time	t_r		107	300	ns
Fall Time	t_f		26	300	
Bottom Drive Output Voltage					V
High State (Vcc=20V, Vc = 30 V, I_{source}= 50 mA) Low	V_{OH}	(Vcc-2.0)	(Vcc-1.1)	-	
State (Vcc = 20 V, Vc = 30 V, I_{sink} =50 mA)	V_{OL}	-	1.5	2.0	
Bottom Drive Output Switching Time (C_L= 1000 pF)		-			
Rise Time	t_r,		38	200	ns
Fall Time	t_f		30	200	
Fault Output Sink Saturation (I_{sink} = 16 mA)	$V_{CE(sat)}$	-	225	500	mV
Fault Output Off-State Leakage (V_{CE} = 20 V)	$I_{FLT(leak)}$	-	1.0	100	nA
Under Voltage Lockout				10 0.3	V
Drive Output Enabled (Vcc or Vc Increasing) Hysteresis	$V_{th(on)}$	8.2	8.9		
	V_H	0.1	0.2		
Power Supply Current					
Pin 17 (Vcc = Vc= 20 V)	I_{CC}	„	12	16	mA
Pin 17 (Vcc = 20V, Vc = 30V)			14	20	
Pin 18 (Vcc = Vc= 20V)	I_C		3.5	6.0	
Pin 18 (Vcc = 20 V, Vc =30V)			5.0	10	