

NE/SA/SE5570 Brushless DC Motor Controller

Product Specification

Linear Products

DESCRIPTION

The NE/SA/SE5570 is a three-phase brushless DC motor controller with a microprocessor-compatible serial input data port; 8-bit monotonic digital-to-analog converter; PWM comparator; oscillator; three Hall sensor inputs and six source/sink phase pre-drivers.

FEATURES

- 8-bit DAC
- Serial-to-parallel converter
- Output pre-drivers
- Entire switch mode conversion
- Adaptable to 60° or 120° commutation
- Overcurrent protection

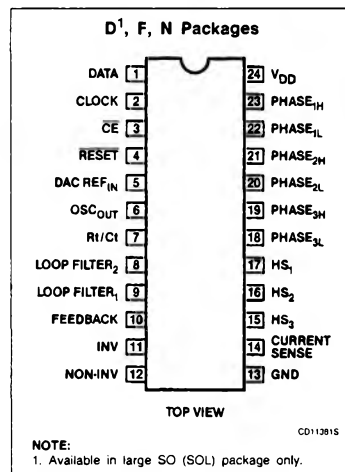
APPLICATIONS

- Motor controller for three-phase brushless DC motor
- Robotics
- Computer peripherals

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
24-Pin SOL	0 to +70°C	NE5570D
24-Pin Cerdip	0 to +70°C	NE5570F
24-Pin Plastic	0 to +70°C	NE5570N
24-Pin Cerdip	-40°C to +85°C	SA5570F
24-Pin Plastic	-40°C to +85°C	SA5570N
24-Pin Cerdip	-55°C to +125°C	SE5570F
24-Pin Plastic	-55°C to +125°C	SE5570N

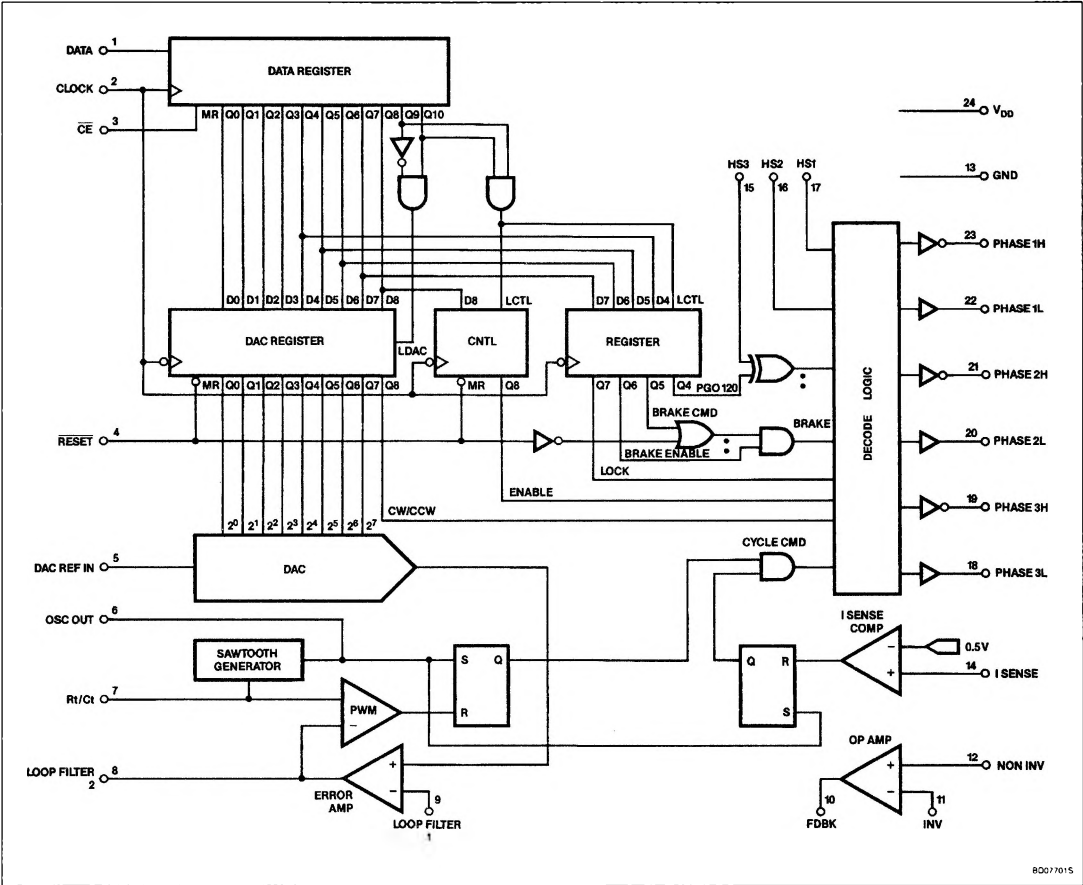
PIN CONFIGURATION



Brushless DC Motor Controller

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BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING			UNIT
		NE5570	SA5570	SE5570	
T _A	Temperature range	0 to 70	-40 to 85	-55 to 125	°C
T _J	Operating ambient	-55 to 150	-55 to 150	-55 to 150	°C
T _{STG}	Operating junction	-65 to 150	-65 to 150	-65 to 150	°C
V _{DD}	Power supply	16	16	16	V
	Logic inputs, all	-0.3 to 15	-0.3 to 15	-0.3 to 15	V

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	RATING	UNIT
T_A	Ambient temperature range		
	NE Grade	0 to 70	°C
	SA Grade	-40 to 85	°C
	SE Grade	-55 to 125	°C
T_J	Junction temperature range		
	NE Grade	0 to 90	°C
	SA Grade	-40 to 105	°C
	SE Grade	-55 to 145	°C
V_{DD}	Supply voltage	9.6 to 14.4	V

DC ELECTRICAL CHARACTERISTICS Limits apply at $V_{DD} = 12V \pm 10\%$, $V_{REF} = 5V$ and over operating temperature range unless otherwise specified. Typical data applies at $T_A = 25^\circ C$.

SYMBOL	PARAMETER	TEST CONDITIONS	SA/NE5570			SE5570			UNIT
			Min	Typ	Max	Min	Typ	Max	
Oscillator									
f _O	Frequency initial accuracy	T _A = 25°C, R _T = 2.49kΩ, C _T = 22nF	18.5	20	21	18.5	20	21	kHz
f _C	Frequency drift over temp	R _T = 2.49kΩ, C _T = 22nF	18		22	18		22	kHz
	Supply voltage sensitivity	T _A = 25°C		± 2			± 2		%/V
	Output pulse width	T _A = 25°C, R _T = 2.49kΩ, C _T = 22nF		500	1000		500	1000	ns
Motor Phase Pre-Drivers									
t _R	Rise time	R _L = 2kΩ to Gnd, C _L = 2nF [1V to 11V]			500			500	ns
t _F	Fall time	R _L = 2kΩ to V _{CC} , C _L = 2nF [1V to 11V]			500			500	ns
I _{OUT}	I _{SOURCE} I _{SINK}	V _{OH} = 8V	80			80			mA
		V _{OL} = 3.1V	80			80			mA
V _{OUT}	V _{OH}	I _{SOURCE} = 5mA	11	11.8		11	11.8		V
		I _{SOURCE} = 80mA (over temp)	8	10		8	10		V
	V _{OL}	I _{SINK} = 5mA		0.4	1		0.4	1	V
		I _{SINK} = 80mA (over temp)		2	3.1		2	3.1	V
PWM Comparator									
I _{BIAS}	Input bias current				1			1	μA
Current Sense Comparator									
I _{BIAS}	Input bias current				1			1	μA
V _{TH}	Current sense trip level		350	500	600	350	500	600	mV
t _{PD}	Propagation delay to output drivers	C _L = 2nF		250			250		ns

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DC ELECTRICAL CHARACTERISTICS (Continued) Limits apply at $V_{DD} = 12V \pm 10\%$, $V_{REF} = 5V$ and over operating temperature range unless otherwise specified. Typical data applies at $T_A = 25^\circ C$.

SYMBOL	PARAMETER	TEST CONDITIONS	SA/NE5570			SE5570			UNIT
			Min	Typ	Max	Min	Typ	Max	
Error Amplifier									
I _{BIAS}	Input bias current				1			1	μA
V _{CM}	Input common-mode voltage range		0		5	0		5	V
V _{OL}	Large-signal voltage gain	V _{OUT} = 1V to 11V	70	90		70	90		dB
PSRR	Power supply rejection ratio		60			60			dB
V _O	Output voltage swing	V _{IN} = +50mV, I _L = -150μA V _{IN} = -50mV, I _L = +150μA	11.5	11.7 0.2	0.5	11.5	11.7 0.2	0.5	V V
Operational Amplifier									
V _{OS}	Offset voltage		-20	3	+20	-20	3	+20	mV
I _{BIAS}	Input bias current				1			1	μA
V _{CM}	Input common-mode voltage range	T _A = 25°C Over temp.	-0.3 0		5 5	-0.3 0		5 5	V
V _{OL}	Large signal voltage gain	V _{OUT} = 1V to 11V	70	90		70	90		dB
PSRR	Power supply rejection ratio		60	90		60	90		dB
V _O	Output voltage swing	V _{IN} = +50mV, I _L = -150μA V _{IN} = -50mV, I _L = +150μA	11.5	11.7 0.2	0.5	11.5	11.7 0.2	0.5	V V
CMRR	Common-mode rejection ratio	R _S = 10kΩ	60	80		60	80		dB
GBW	Gain bandwidth	R _F = 100kΩ		250			250		kHz
V _{NN}	Input noise voltage	F = 1kHz							nV/√Hz
Digital-to-Analog Converter									
	Resolution				8			8	bits
INL	Integral non-linearity error			± 1	± 2		± 1	± 2	LSB
DNL	Differential non-linearity error ¹			± 0.5	± 1		± 0.5	± 1	LSB
V _{FS}	Full-scale gain error	Error amp. A _V = 1		± 0.2	± 0.8		± 0.2	± 0.8	%FS
	Full-scale temperature drift	V _{REFTC} = 0ppm/°C		20			20		ppm/°C
V _{ZS}	Zero-scale offset error	Error amp. A _V = 1		± 1	± 2		± 1	± 2	LSB
Z _{IN}	Input impedance (DAC ref. in)		30	45	60	30	45	60	kΩ
t _S	Settling time to ±0.5 LSB			5			5		μs
t _{PLH}	Propagation delay time (high)	Through DAC		200			200		ns
t _{PHL}	Propagation delay time (low)	Through DAC		200			200		ns
Logic Inputs									
V _{IH}	Input voltage: TTL high		2.0		12	2.0		12	V
V _{IL}	Input voltage: TTL low		0		0.8	0		0.8	V
I _{IH}	Input current: TTL high				± 1			± 1	μA
I _{IL}	Input current: TTL low				± 1			± 1	μA
Supply Current									
I _{DD}				1.8	5.0		1.8	5.0	mA

NOTE:

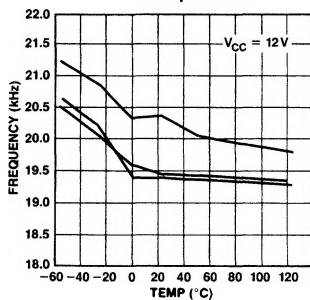
1. Monotonicity guaranteed over operating temperature range.

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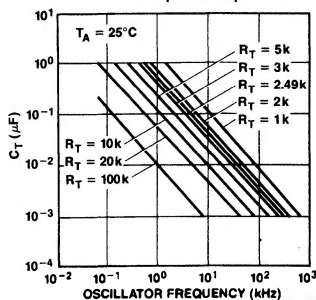
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TYPICAL PERFORMANCE CHARACTERISTICS

NE5570 Oscillator Frequency vs Temperature

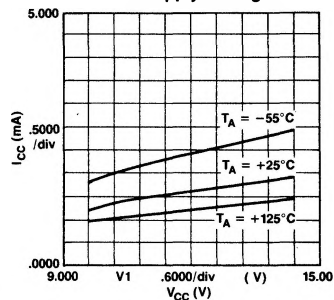


OP207005

Oscillator Frequency vs R_T and C_T 

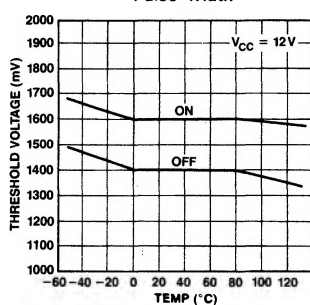
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NE5570 Oscillator Frequency vs Supply Voltage



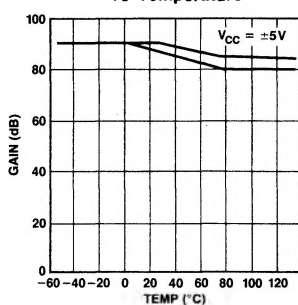
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NE5570 Oscillator Output Pulse Width



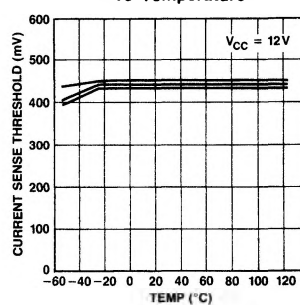
OP207305

NE5570 Op Amp Gain vs Temperature

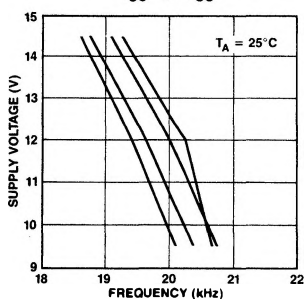


OP207405

NE5570 Current Sense Comparator Threshold vs Temperature

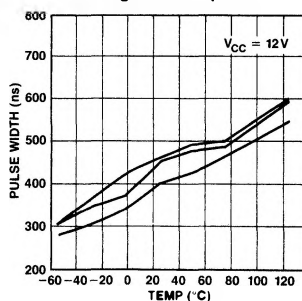


OP207505

 I_{CC} vs V_{CC} 

OP207605

NE5570 Logic Threshold Voltage vs Temperature



OP207705