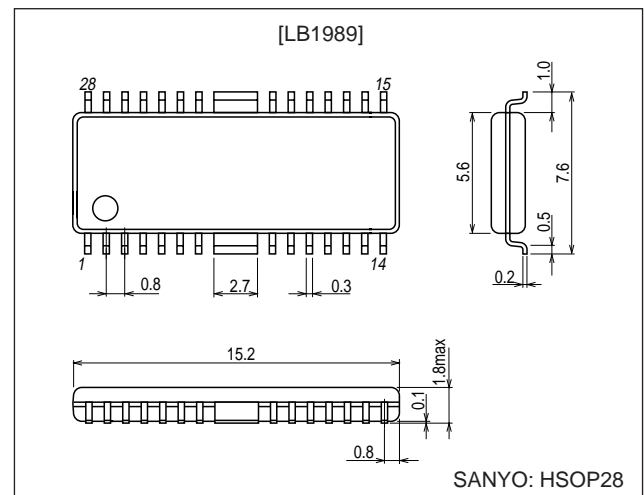


**LB1989****Three-Phase Sensorless VCR Drum Motor Driver****Functions and Features**

- Soft switching drive
- No Hall sensors required.
- No FG sensors required.
- Built-in PG amplifier
- Thermal shutdown circuit
- Current limiter circuit

Package Dimensions

unit: mm

3222-HSOP28**Specifications****Absolute Maximum Ratings at Ta = 25°C**

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{CCmax}		14.5	V
Maximum output voltage	V _{Omax}		14.5	V
Maximum input voltage	V _{I1max}		-0.3 to V _{CC} + 0.3	V
Maximum cylinder current	I _{Omax}		1.0	A
Allowable power dissipation	P _{dmax}	Independent IC	0.6	W
Operating temperature	T _{opr}		-20 to +75	°C
Storage temperature	T _{stg}		-55 to +150	°C

Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V _{CC}		8 to 13.8	V

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

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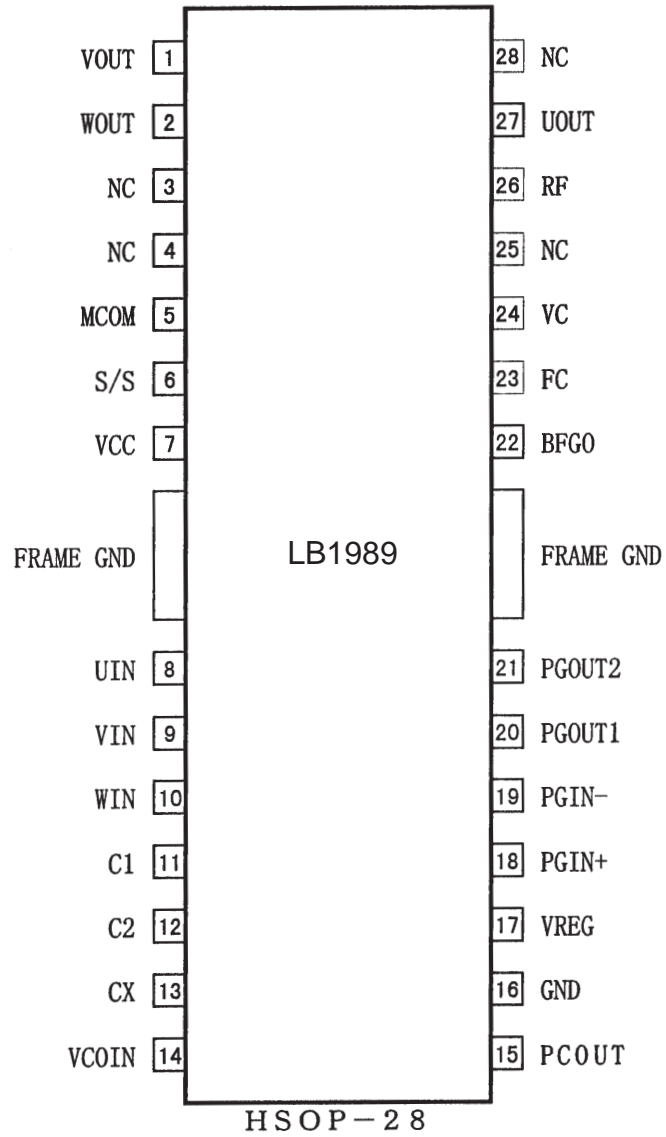
Electrical Characteristics at Ta = 25°C, VCC = 12 V

Parameter	Symbol	Conditions	Ratings			Unit	Test circuit
			min	typ	max		
Current drain	ICC	VC = 0 V		15	20	mA	1
Internal power supply	VREG	VC = 0 V	4.6	5.0	5.4	V	2
Output saturation voltage 1	VOSAT1	IO = 0.4 A, Source + Sink		1.4	2.0	V	3
Output saturation voltage 2	VOU2	IO = 0.8 A, RF = 0 Ω, Source + Sink		1.8	2.6	V	4
MC pin common-mode input voltage range	VIC		0		VCC - 2	V	5
VC pin input bias current	IVC	VC = 0 V	-2	-1		μA	6
Control start voltage	VTHVC		2.3	2.55	2.8	V	7
Closed-loop control gain	GMVC	RF = 0.5 Ω	0.75	0.95	1.15	A/V	8
PCOUT output current 1	IPCOU	Source side		-90		μA	9
PCOUT output current 2	IPCOD	Sink side		90		μA	10
VCOIN input current	IVCOIN	VCOIN = 5 V		0.1	0.2	μA	11
Minimum VCO frequency	fVCOMIN	Cx = 0.022 μF, With VCOIN open		400		Hz	12
Maximum VCO frequency	fVCOMAX	Cx = 0.022 μF, VCOIN = 5 V		18.5		kHz	13
C1/C2 source current ratio	RSOURCE	IC1SOURCE / IC2SOURCE	-12		+12	%	14
C1/C2 sink current ratio	RSINK	IC1SINK / IC2SINK	-12		+12	%	15
C1 source/sink current ratio	RC1	IC1SOURCE / IC1SINK	-35		+15	%	16
C2 source/sink current ratio	RC2	IC2SOURCE / IC2SINK	-35		+15	%	17
S/S pin high level voltage	VSSH		4			V	18
S/S pin low level voltage	VSSL				0.7	V	19
S/S pin input current	ISSI	VS/S = 5 V			200	μA	20
Thermal shutdown circuit operating temperature	TTSD		150	180	210	°C	*
Thermal shutdown circuit hysteresis	ΔTTSD			15		°C	*
[FG/PG Amplifier Block]							
Back EMF FG							
Output on voltage	VOL				0.4	V	21
Output off voltage	VOH		VREG - 0.5			V	22
PG amplifier							
Input offset voltage	VIO		-8		+8	mV	23
Input bias current	IBIN-		-250			nA	24
Common-mode input voltage range	VICOM		0		VREG - 1.5	V	*
Open-loop gain	GVPG	f = 1 kHz		55		dB	25
Output on voltage	VOL				0.4	V	26
Output off voltage	VOH		VREG - 0.5			V	27
Schmitt amplifier hysteresis	VSHIS		70	93	115	mV	28

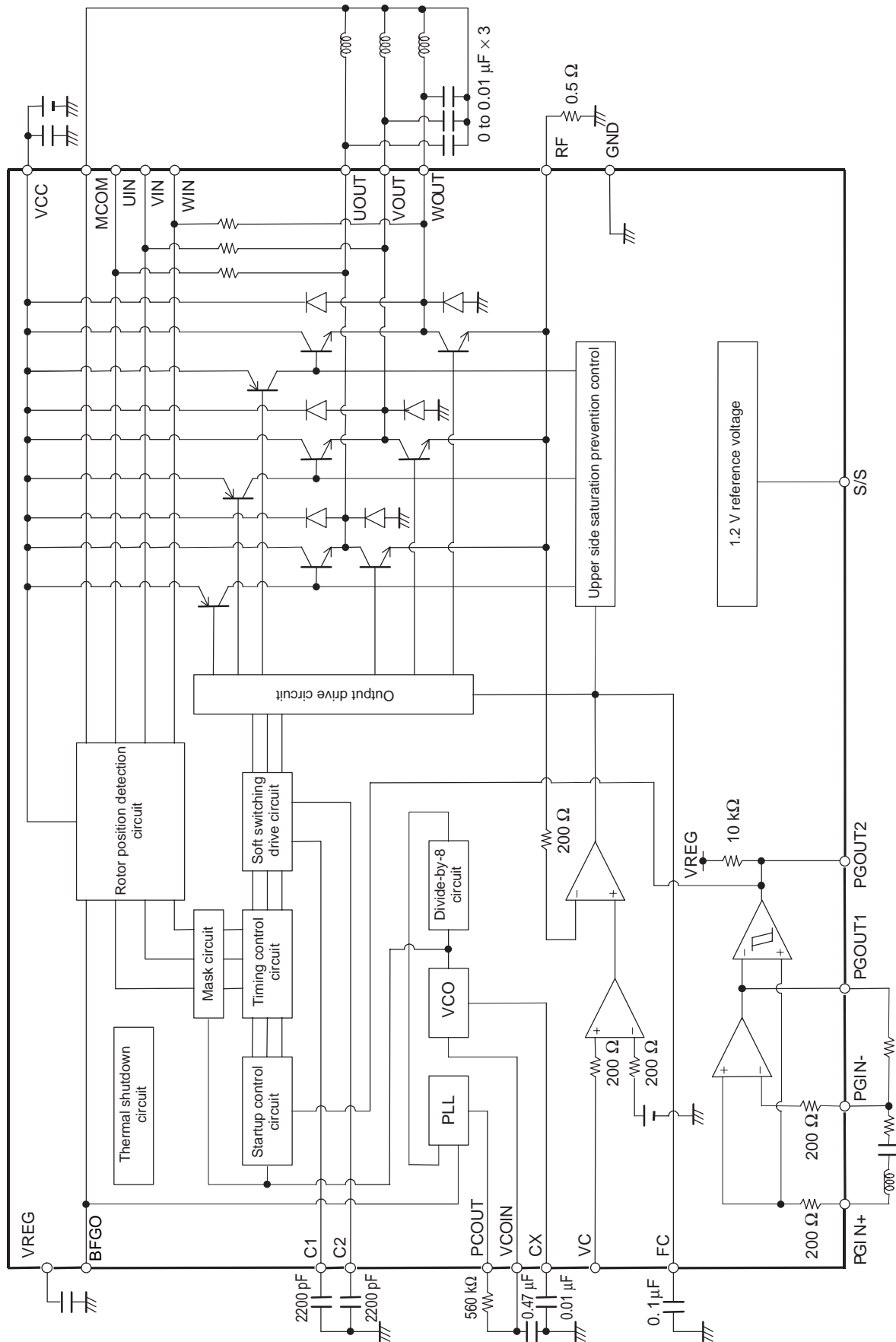
Note * : These are design target values and are not measured.

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Pin Assignment



Block Diagram (Note that the external constants will vary depending on the motor used.)



Pin Functions

Pin No.	Pin	Pin voltage	Equivalent circuit	Function	
27	UOUT			Drum motor driver outputs	
1	VOUT				
2	WOUT				
26	RF			<p>The lowest potential of the drum motor driver output transistors. Constant-current control is implemented by detecting this voltage.</p> <p>The current limiter also operates by detecting this voltage.</p>	
26	S/S			<p>Driver start/stop control</p> <p>High: Motor drives operating state</p> <p>Low: Standby state (power saving mode)</p>	
7	V _{CC}	8 to 13.8 V		Power supply	
5	MCOM			<p>Motor coil center input</p> <p>The coil voltage waveform is detected referenced to this voltage.</p>	
8	UIN				<p>Coil waveform detection comparator inputs</p> <p>Each phase output is connected through an internal 10 kΩ resistor.</p>
9	VIN				
10	WIN				
11	C1			<p>Sawtooth waveform generator capacitor connection</p> <p>This sawtooth waveform is used for soft switching in the coil output waveform.</p>	
12	C2				

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LB1989

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Pin No.	Pin	Pin voltage	Equivalent circuit	Function
13	CX			<p>The value of the capacitor connected between this pin and ground determines the operating frequency range and the minimum operating frequency for the VCO circuit.</p>
14	VCOIN			<p>VCO circuit voltage input The PCOUT pin voltage is RC filtered and the result is input to this pin.</p>
15	PCOUT			<p>VCO circuit PLL output</p>
16	GND			<p>Ground for all circuits other than the output transistor</p>
17	VREG			<p>Internal 5 V regulator This pin provides the control system power.</p>

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LB1989

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Pin No.	Pin	Pin voltage	Equivalent circuit	Function
18	PGIN+			PG amplifier positive (+) input This pin is biased internally by 1/2 VREG.
19	PGIN-			PG amplifier negative (-) input
20	PGOUT1			PG amplifier linear output
21	PGOUT2			PG Schmitt amplifier output
22	BFGO			Motor back EMF detection FG output (synthesized from 3 phases)

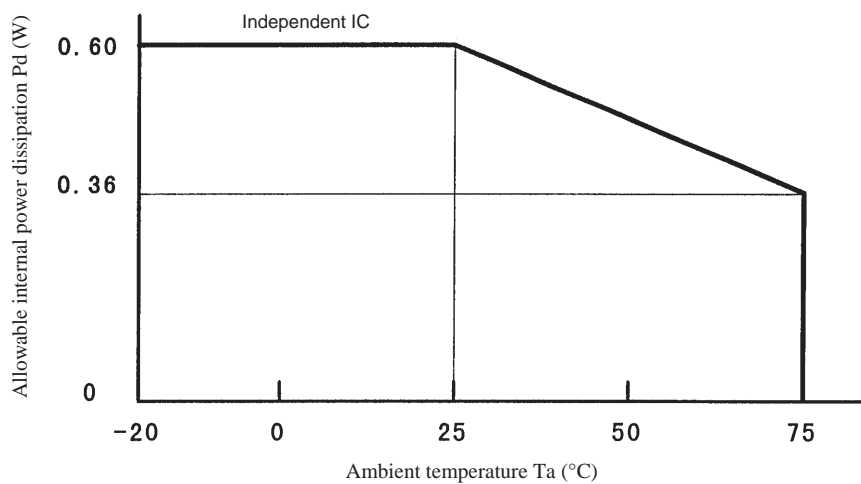
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LB1989

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Pin No.	Pin	Pin voltage	Equivalent circuit	Function
23	FC			<p>Frequency characteristics correction</p> <p>Current control system closed loop oscillation can be stopped by inserting a capacitor between this pin and ground.</p>
24	VC	0 to V _{CC}		<p>Speed control</p> <p>This IC implements constant-current control by applying feedback from RF.</p>

Allowable Internal Power Dissipation



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