

SANYO**LB1955****Three-Phase Brushless Motor Driver****Functions**

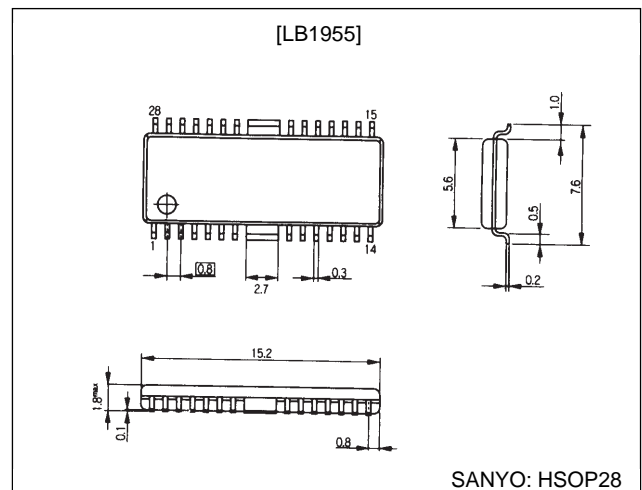
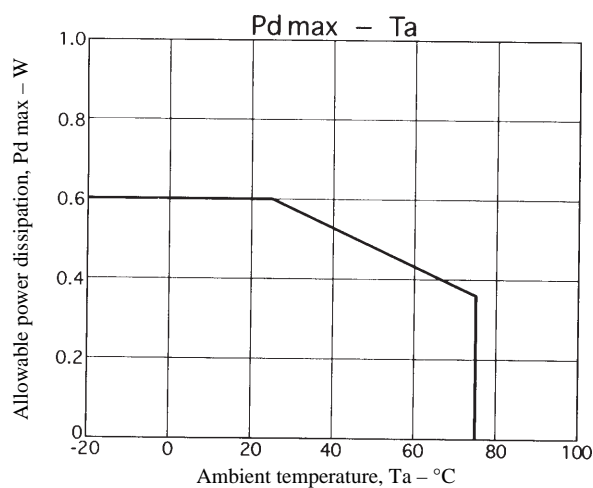
- The LB1955 is a 3-phase brushless motor driver IC that is optimal for applications such as driving the drum motor in VCRs.

Features

- Current linear drive
- FG and PG free
- Single-voltage power supply
- Built-in AGC circuit
- Built-in thermal shutdown 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 current	I_{OUT}		1.0	A
Allowable power dissipation	$Pdmax$	Independent device	0.60	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}		10.2 to 13.8	V
Hall input amplitude	V_{hall}	At the input	70 to 500	mVp-p
VC input voltage	V_C		0 to 5	V

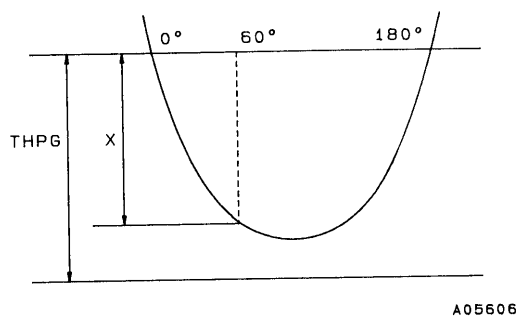
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Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{ V}$

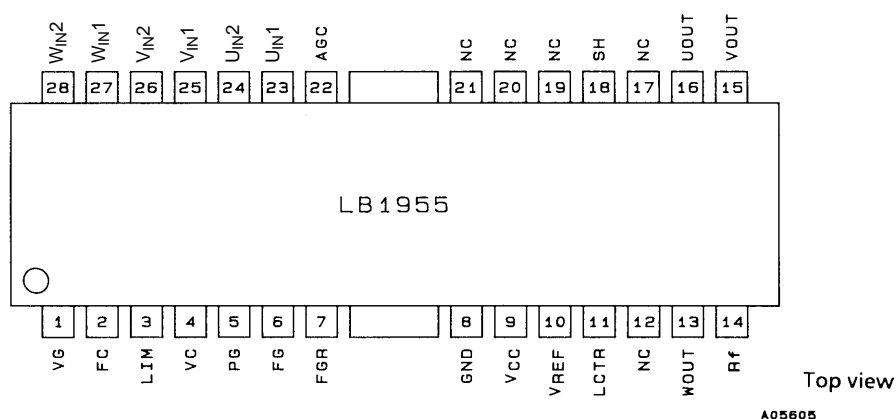
Parameter	Symbol	Conditions		Ratings			Unit
				min	typ	max	
[Power Supply]							
Current drain	I _{CC}	V _C = 0 V, LCTR = 6 V		7.0	10.0	13.0	mA
IC internal power supply	V _{REF}			4.75	5.0	5.25	V
[Output]							
Output saturation voltage	V _{O(sat)} 1	I _O = 400 mA	Sink side			0.4	V
		V _C = 5 V, R _f = 0 Ω	Source side			1.5	V
Output saturation voltage 2	V _{O(sat)} 2	I _O = 800 mA	Sink side			0.7	V
		V _C = 5 V, R _f = 0 Ω	Source side			2.0	V
3-phase output current ripple	I _{or}	I _O = 100 mA, R _f = 0.47 Ω		−5		+5	%
[Hall Amplifier]							
Input offset voltage	V _{Hoff}			−20		+20	mV
Input bias current	I _{Hb}	V _{AGC} = 1.4 V	U _{IN}			10	μA
			V _{IN} , W _{IN}			5	μA
Common-mode input voltage range	V _{HCM}			2.2		5.0	V
[Control]							
VC pin input bias current	I _{VCb}	V _C = 0 V		−10	−1.3		μA
Control start voltage	V _{THVC}	R _f = 0.47 Ω, I _O ≥ 10 mA With the Hall input logic fixed		2.25	2.5	2.75	V
Open-loop control gain	G _{MVC}	R _f = 0.47 Ω, ΔI _O = 200 mA With the Hall input logic fixed and VG shorted to RF		0.72	0.9	1.08	A/V
[PG]							
PG Hall amplifier input offset voltage	V _{PGoff}	Design target		−10		+10	mV
Peak hold charge current	I _{SHCHG}	(U, V, W) = (L, L, H)			30		μA
PG comparator threshold	THPG	Design target*			117		%
PG output high-level voltage	V _{PGH}			4.5		5.2	V
PG leakage current	I _{LEAKPG}			−10	0	+10	μA
[FG]							
Back emf Schmitt input hysteresis width	V _{SCHG}	In the back emf Schmitt input increasing direction, Design target			100		mV
		In the back emf Schmitt input decreasing direction, Design target			0		mV
Ringing canceller Schmitt input hysteresis width	V _{SCHR}	In the Schmitt input increasing direction, Design target			180		mV
		In the Schmitt input decreasing direction, Design target		−20	0	+20	mV
FG output high-level voltage	V _{FGH}	FGR = 0 V		4.5		5.2	V
FG leakage current	I _{LEAKFG}			−10	0	+10	μA
[TSD]							
Thermal shutdown operating temperature	TTSD	Design target			180		°C
Thermal shutdown temperature hysteresis width	ΔTSD	Design target			15		°C

Note: * is provided for when X is the peak value at the 60° position of the lower side of the U_{IN1} Hall amplifier input: $THPG = 1.17X$.



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Pin Assignment

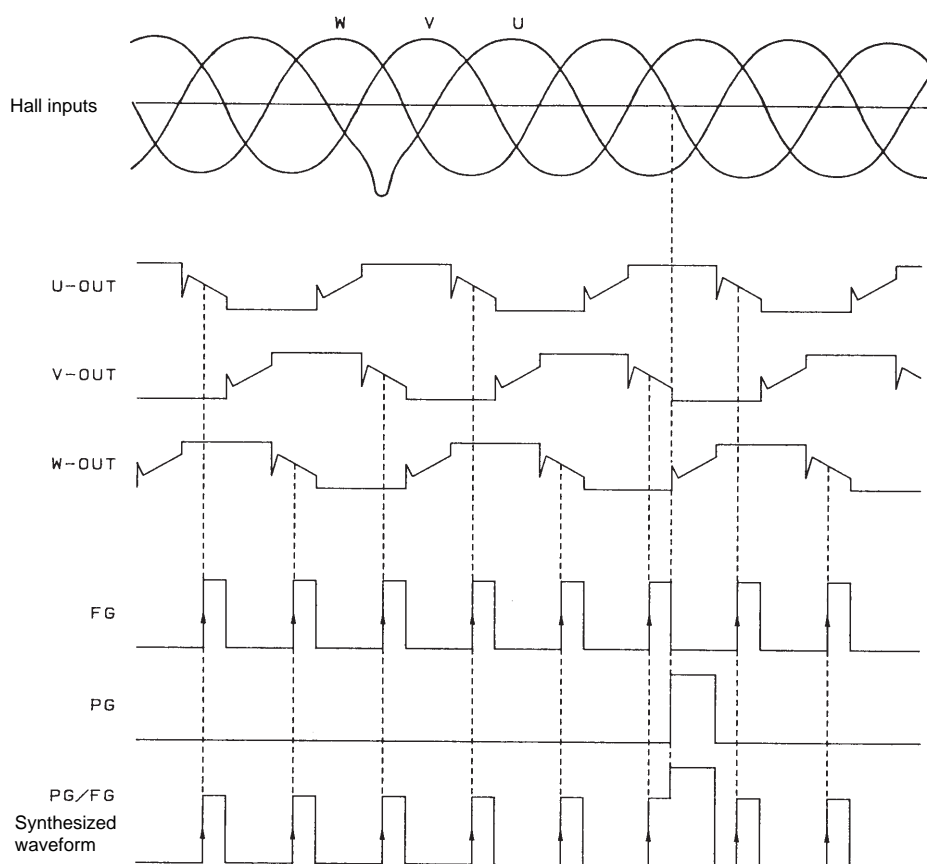


Truth table

	Source → sink	Hall input logic		
		U	V	W
1	W phase → V phase	H	H	L
2	W phase → U phase	H	L	L
3	V phase → U phase	H	L	H
4	V phase → W phase	L	L	H
5	U phase → W phase	L	H	H
6	U phase → V phase	L	H	L

Note: The Hall input "H" and "L" values are defined as follows: "H" means that for that phase the (+) input is higher than the (-) input, and "L" means that for that phase the (+) input is lower than the (-) input. However, note that an input potential difference corresponding to the Hall to output gain is required.

Timing Charts

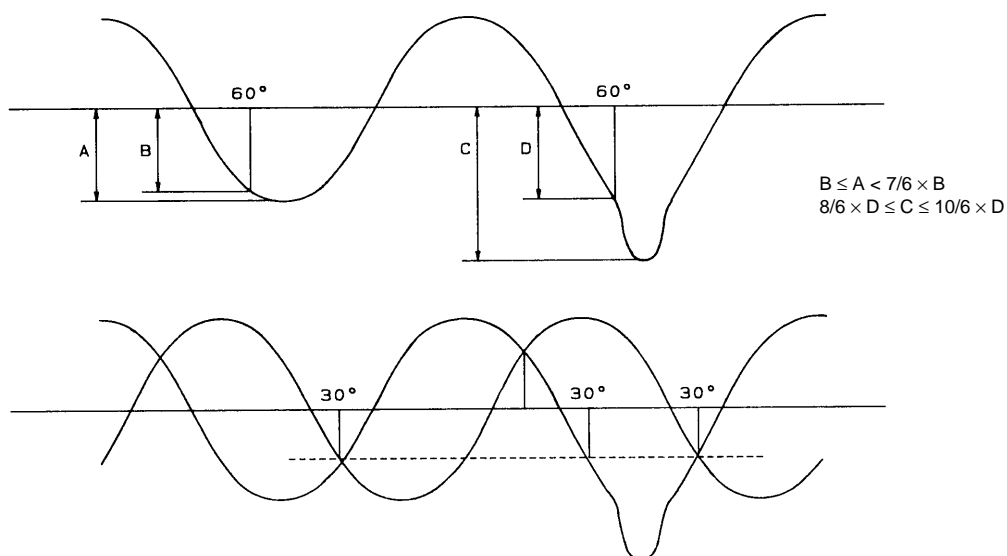


Note: The Hall inputs are defined as follows: $U = U_{IN1} - U_{IN2}$, $V = V_{IN1} - V_{IN2}$, and $W = W_{IN1} - W_{IN2}$. Inputs to the Hall input pins must be applied in the phase order shown in the timing chart.

Pin Functions

Pin No.	Pin	Function
23, 24	U_{IN1}, U_{IN2}	U phase Hall element input
25, 26	V_{IN1}, V_{IN2}	V phase Hall element input
27, 28	W_{IN1}, W_{IN2}	W phase Hall element input
16	UOUT	U phase output
15	VOUT	V phase output
13	WOUT	W phase output
11	LCTR	Pin connected to the center points of the coils that are Y-connected to the U, V, and W outputs.
9	V_{CC}	Power supply
10	V_{REF}	Reference voltage output
8	GND	GND
14	Rf	Output current detection
1	VG	Closed loop control gain switching
2	FC	Speed control loop frequency characteristics correction
3	LIM	Output current limit setting
4	VC	Speed control
5	PG	PG waveform output
6	FG	FG waveform output (FGR shorted to GND)
7	FGR	PG/FG synthesized output (FGR shorted to PG)
18	SH	PG waveform sample-and-hold circuit capacitor connection
22	AGC	Connection for the capacitor used by the AGC circuit, which holds the input gain at a fixed level.
12, 17, 19 20, 21	NC	No connection

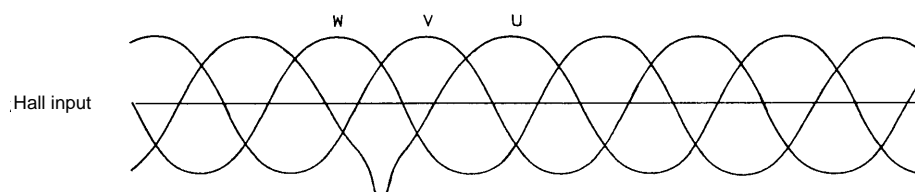
Recommended Special Magnetization Waveforms



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Note: Note that the intersections between the special magnetization and general waveforms and the intersections between pairs of general waveforms must be set up to be 30° apart.

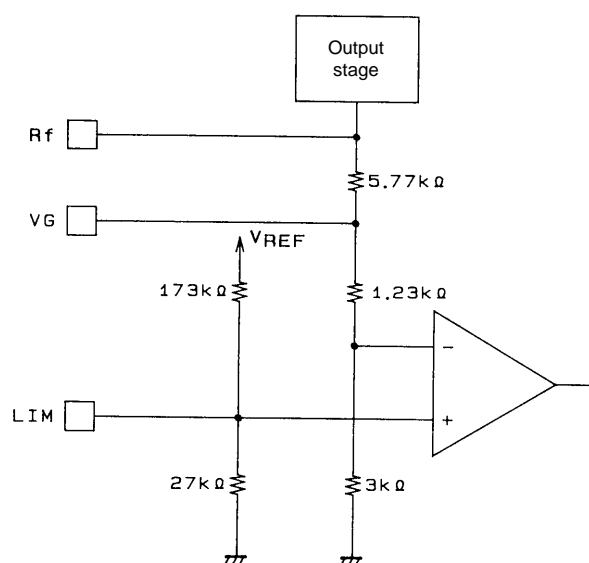
Hall Input Order



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Note: The Hall input order must be set up to be $W \rightarrow V \rightarrow U$.

VG and LIM Pin Usage



LIM pin: Open
 VG – Rf: Shorted
 $G_m = 0.423/R_f$ (A/V)
 (Closed loop control gain)
 $I_{lim} = (V_{REF} \times 27/200 - 0.2) \times 4.23/3/R_f$
 (Current limit)

VG pin: Open
 $G_m = 1/R_f$ (A/V)
 (Closed loop control gain)
 $I_{lim} = (V_{REF} \times 27/200 - 0.2) \times 10/3/R_f$
 (Current limit)

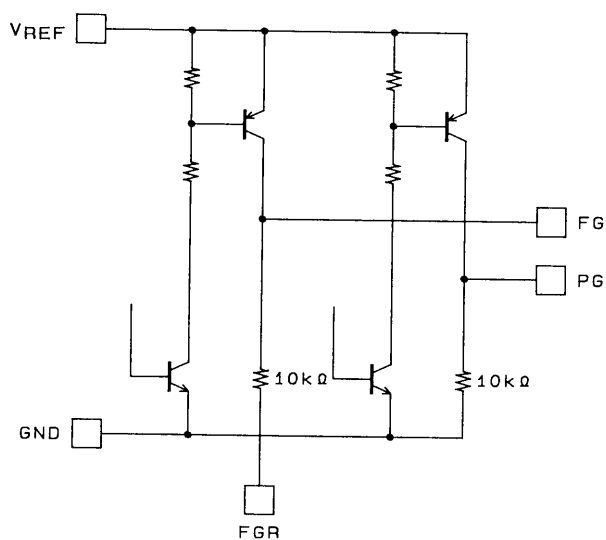
LIM – VREF: Shorted
 No current limit.

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Note: This current limiting function is for protection against unusual and abnormal currents. If a current limit level below the rated current is set, this will, inversely, result in heat generation within the IC.

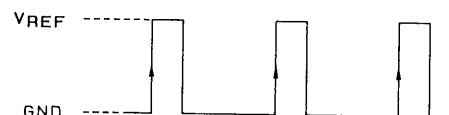
When the LIM pin is open, VG is shorted to Rf, and $R_f = 0.47 \Omega$, this will result in a current limit level of about 1.3 to 1.4 A. If this limit falls under the rated value due to mode changes or changes in the value of the Rf resistor, set the current limit to an appropriate value by applying to the LIM pin a voltage that is divided from the VREF to ground potential by resistors of a few kΩ. Alternatively, short the LIM pin to VREF to defeat the current limit function.

PG and FG Pin Output Circuits

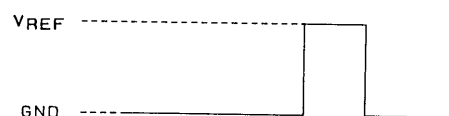


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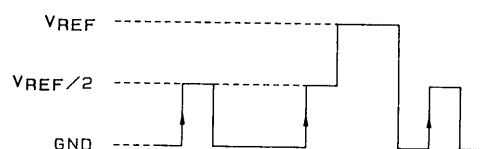
FG (FGR shorted to ground)



PG



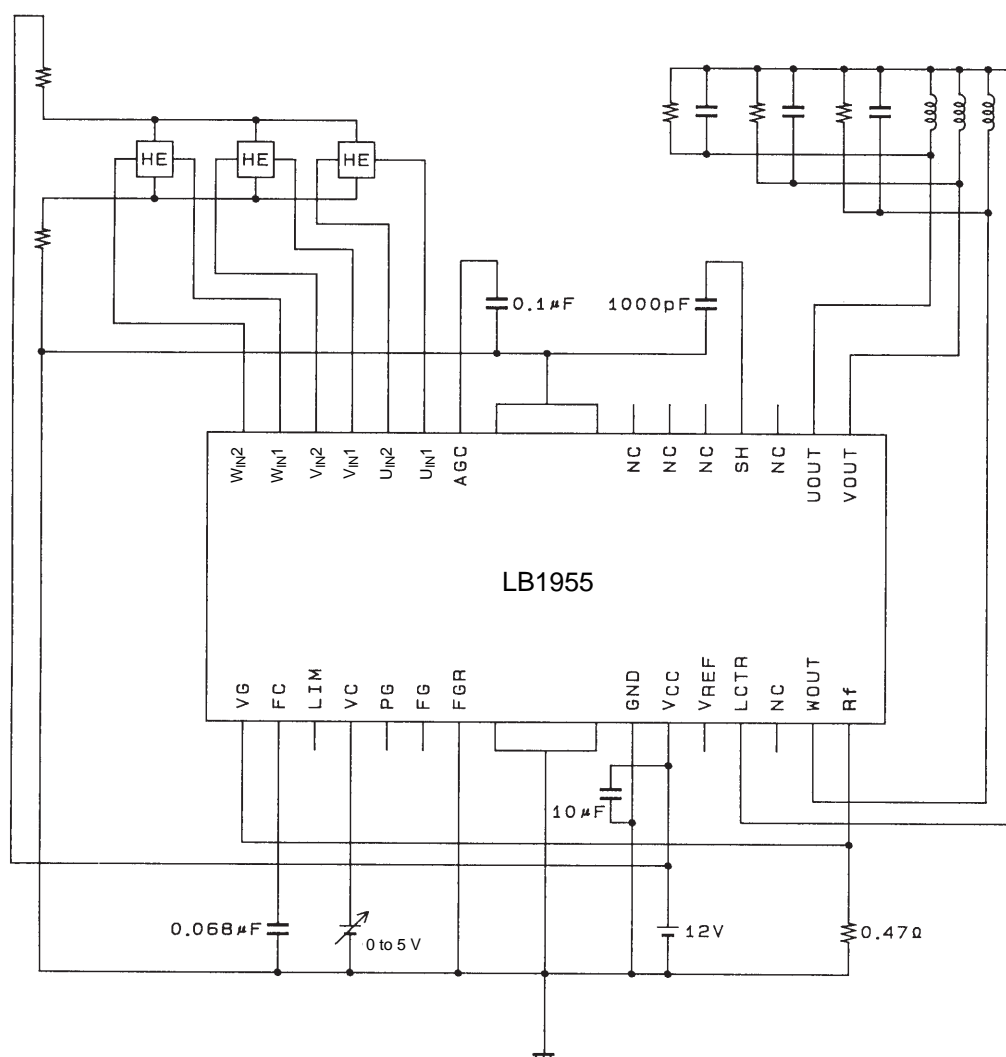
PG (FGR shorted to PG)



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Sample Application Circuit



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