

**LB1997**

Three-Phase Brushless Motor Driver for CD-ROM Spindle Drive

Overview

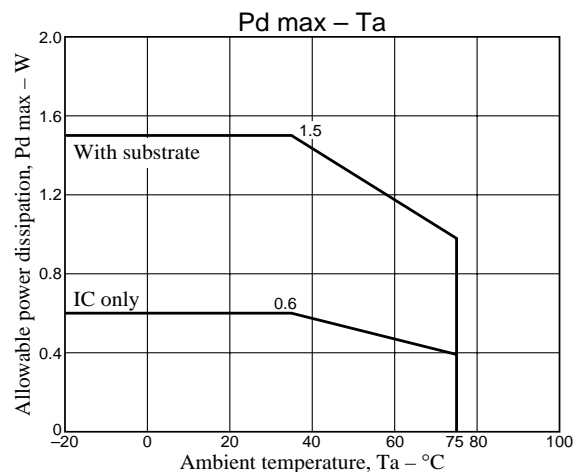
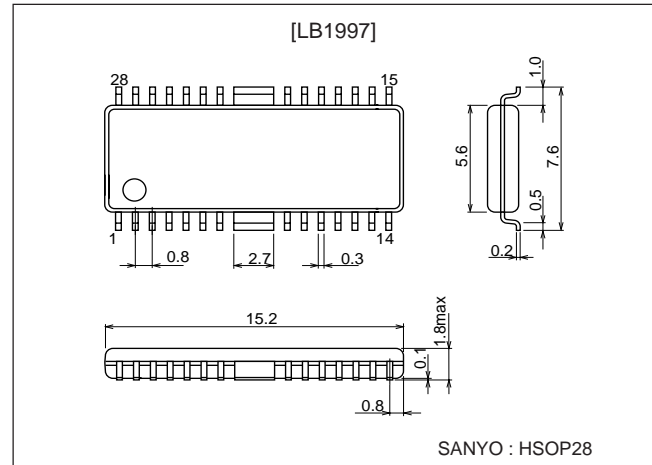
The LB1997 is a three-phase brushless motor driver especially suited for CD-ROM spindle motor drives.

Functions

- Current linear drive
- Control V type amplifier
- Separate power supply for output upper side bias circuit allows low output saturation by boosting this power supply only (useful for 5V power supply types).
- Upper side current detection technique reduces loss voltage of current detection resistor. Voltage effect of this resistor reduces internal current drain of IC.
- Built-in short braking circuit
- Built-in reverse blocking circuit
- Hall FG output
- Built-in S/S function
- Built-in current limiter circuit
- Built-in Hall power supply
- Built-in thermal shutdown circuit
- V type control/single-side control switching pin allows CLV and CAV operation.

Package Dimensions

unit: mm

3222-HSOP28

■ 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.

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V _{CC1} max		7.0	V
	V _{CC2} max		14.4	V
	V _{CC3} max		14.4	V
Applied output voltage	V _O max		14.4	V
Applied input voltage	V _{IN} max		V _{CC1}	V
Output current	I _O max		1.3	A
Allowable power dissipation	Pd max	IC only	0.6	W
		with substrate (114.3 × 76.1 × 1.6 mm ³ , glass epoxy)	1.5	W
Operating temperature	T _{opr}		-20 to +75	°C
Storage temperature	T _{stg}		-55 to +150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V _{CC1}		4 to 6	V
	V _{CC2}	≥ V _{CC1}	4 to 13.6	V
	V _{CC3}		4 to 13.6	V

Sample Application at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
12V type	V _{CC1}	Regulated voltage	4 to 6	V
	V _{CC2} = V _{CC3}	Unregulated voltage	4 to 13.6	V
5V type	V _{CC1} = V _{CC3}	Regulated voltage	4 to 6	V
	V _{CC2}	Boost-up voltage or regulated voltage (Note)	4 to 13.6	V

Note: When boost-up voltage is used at V_{CC2}, output can be set to low-saturation.

LB1997

Electrical Characteristics at Ta = 25°C, V_{CC1} = 5V, V_{CC2} = V_{CC3} = 12V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Power supply current]						
Power supply current	I _{CC1}	V _C = V _{CREF}		8		mA
	I _{CC2}	V _C = V _{CREF}		0		mA
	I _{CC3}	V _C = V _{CREF}		150	250	μA
Output idle current	I _{CC1OQ}	V _{S/S} = 0V			200	μA
	I _{CC2OQ}	V _{S/S} = 0V			30	μA
	I _{CC3OQ}	V _{S/S} = 0V			30	μA
[Output]						
Saturation voltage, upper side 1 lower side 1	V _{OU1}	I _O = -0.5A, V _{CC1} = 5V, V _{CC2} = V _{CC3} = 12V		1.0		V
	V _{OD1}	I _O = 0.5A, V _{CC1} = 5V, V _{CC2} = V _{CC3} = 12V		0.3		V
Saturation voltage, upper side 2 lower side 2	V _{OU2}	I _O = -0.5A, V _{CC1} = V _{CC3} = 5V, V _{CC2} = 12V		0.3		V
	V _{OD2}	I _O = 0.5A, V _{CC1} = V _{CC3} = 5V, V _{CC2} = 12V		0.3		V
Current limiter setting voltage	V _{CL}	R _{RF} = 0.43Ω		0.37		V
[Hall amplifier]						
Common mode input voltage range	V _{HCOM}		1.2		V _{CC} -1.0	V
Input bias current	I _{HIB}			1		μA
Minimum Hall input level	V _{HIN}		60			mV _{P-P}
[S/S pin]						
High level voltage	V _{S/SH}		2.0		V _{CC1}	V
Low level voltage	V _{S/SL}				0.7	V
Input current	I _{S/SI}	V _{S/S} = 5V			200	μA
Leak current	I _{S/SL}	V _{S/S} = 0V	-30			μA
[Control]						
	I _{VC}	V _C = V _{CREF} = 2.5V		1		μA
	I _{VCREf}	V _C = V _{CREF} = 2.5V		1		μA
Voltage gain	GV _{CO}	ΔV _{RF} /ΔV _C		0.25		times
Startup voltage	V _{CTH}	V _{CREF} = 2.5V	2.35		2.65	V
Startup voltage width	ΔV _{CTH}	V _{CREF} = 2.5V	50		150	mV
[Hall power supply]						
Hall power supply voltage	V _H	I _H = 5mA		0.8		V
Allowable current	I _H		20			mA
[Thermal shutdown]						
Operating temperature	T _{TSD}	Design target value	150	180	210	°C
Hysteresis	ΔT _{TSD}	Design target value		15		°C
[Short braking]						
Brake pin at High level	V _{BRH}		4		5	V
Brake pin at Low level	V _{BRL}		0		1	V
[Control switching]						
CC pin at High level	V _{CCH}		4		5	V
CC pin at Low level	V _{CCL}		0		1	V

Note:

- During S/S OFF (standby), the Hall comparator is at High.
- Design target values are not measured.

LB1997

Truth Table

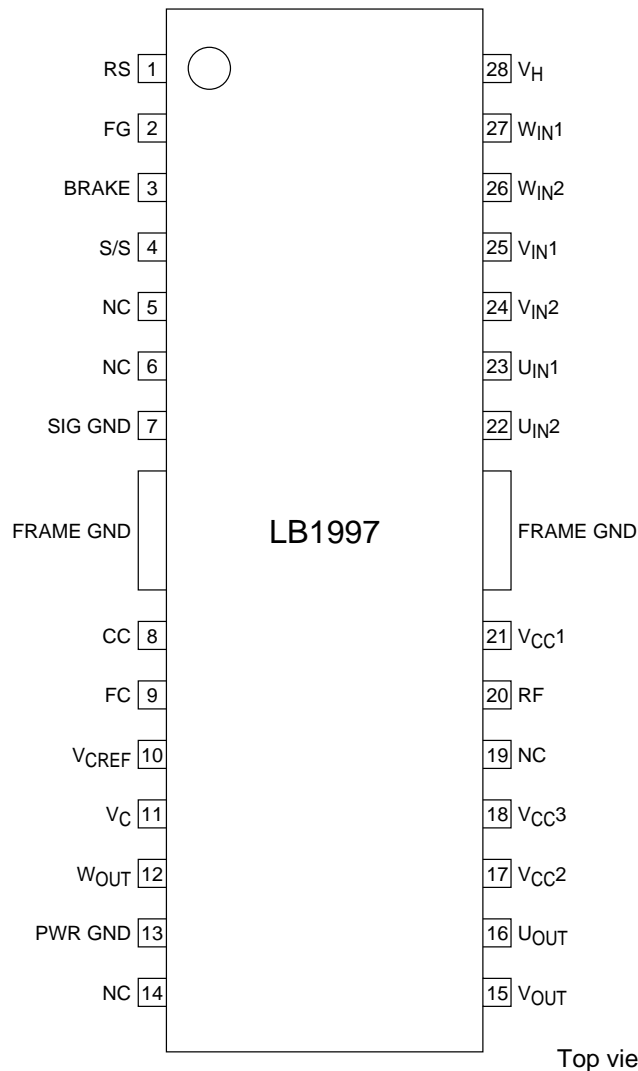
	Source → Sink	Hall input			Control
		U	V	W	V _C
1	Phase W → Phase V	H	H	L	H
	Phase V → Phase W				L
2	Phase W → Phase U	H	L	L	H
	Phase U → Phase W				L
3	Phase V → Phase W	L	L	H	H
	Phase W → Phase V				L
4	Phase U → Phase V	L	H	L	H
	Phase V → Phase U				L
5	Phase V → Phase U	H	L	H	H
	Phase U → Phase V				L
6	Phase U → Phase W	L	H	H	H
	Phase W → Phase U				L

Input:

H: Input 1 is higher in potential than input 2 by at least 0.2V.

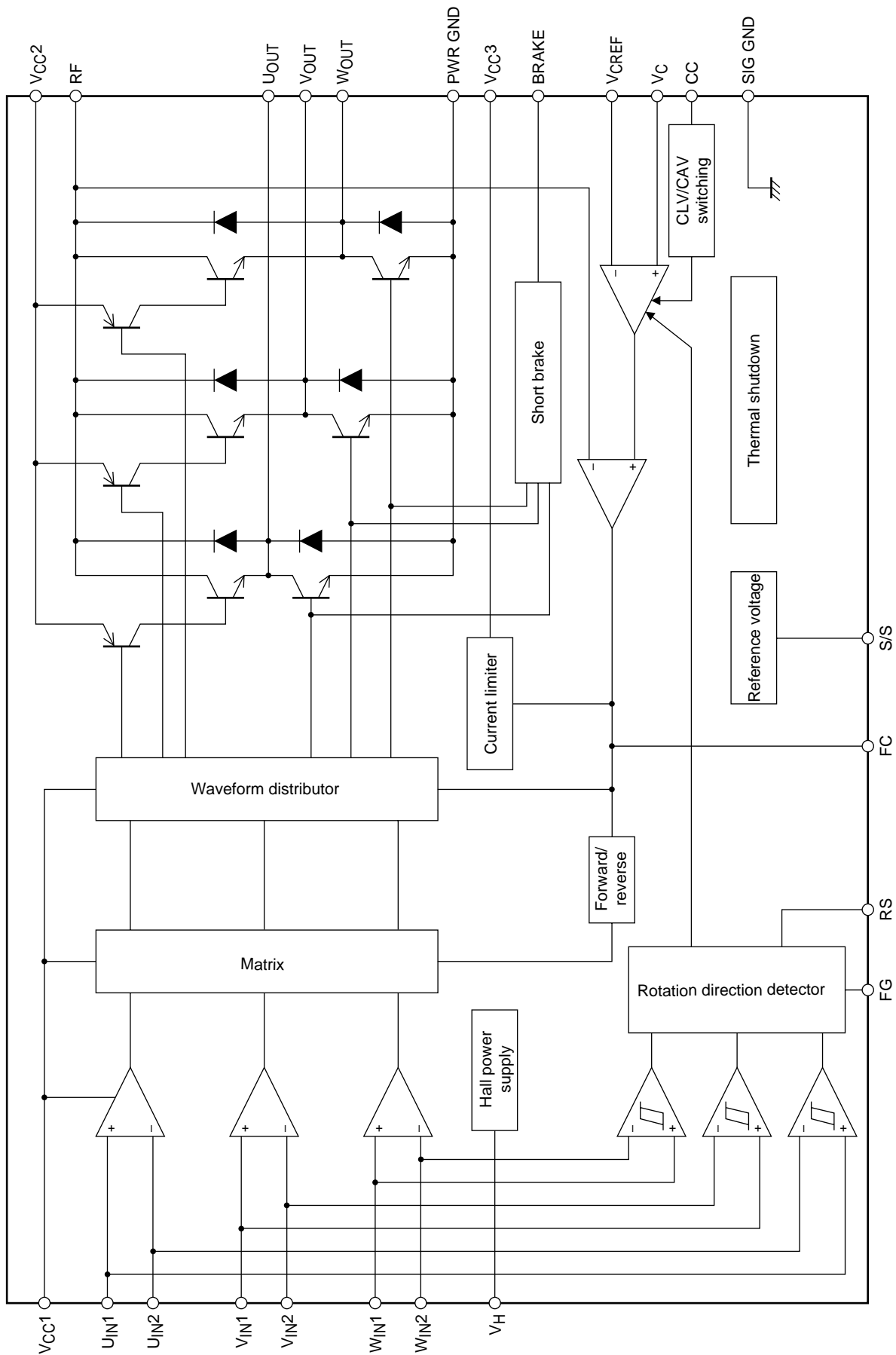
L: Input 1 is lower in potential than input 2 by at least 0.2V.

Pin Assignment



A11182

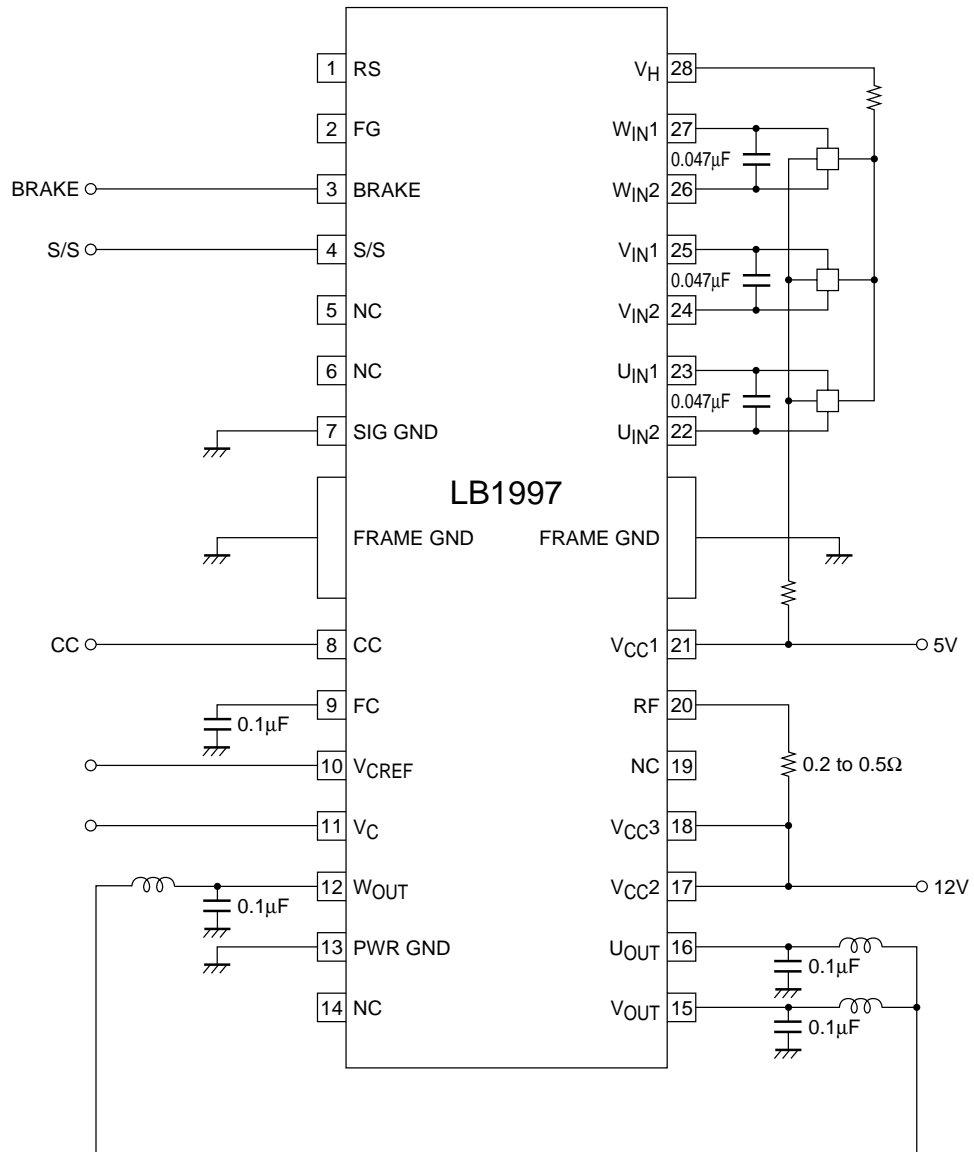
Block Diagram



A11181

LB1997

Sample Application Circuit



A11183

Pin Descriptions

Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
17	V _{CC2}	4V to 13.6V		Source side predrive voltage supply pin
18	V _{CC3}	4V to 13.6V		Constant current control amplifier voltage supply pin
21	V _{CC1}	4V to 6V		Power supply pin for all circuits except output transistors, source predriver, and low current control amplifier
1	RS		<p>A11184</p>	Reverse detector pin Forward rotation: High Reverse rotation: Low
2	FG			1 Hall element waveform Schmitt comparator composite output
23 22	U _{IN1} U _{IN2}	1.2V to V _{CC1} -1V	<p>A11185</p>	U phase Hall element input and reverse detector U phase Schmitt comparator input pin Logic High indicates U _{IN1} > U _{IN2} .
25 24	V _{IN1} V _{IN2}			V phase Hall element input and reverse detector V phase Schmitt comparator input pin Logic High indicates V _{IN1} > V _{IN2} .
27 26	W _{IN1} W _{IN2}			W phase Hall element input and reverse detector W phase Schmitt comparator input pin Logic High indicates W _{IN1} > W _{IN2} .
28	V _H		<p>A11186</p>	Hall element lower side bias voltage supply pin
4	S/S	0V to V _{CC1}	<p>A11187</p>	When this pin is at 0.7V or lower, or when it is open, all circuits are inactive. When driving motor, set this pin to 2V or higher.
7	SIG GND			GND pin for all circuits except output
9	FC		<p>A11188</p>	Control loop frequency compensator pin. Connecting a capacitor between this pin and GND prevents closed loop oscillation in current limiting circuitry.

Continued on next page

LB1997

Continued from preceding page

Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
10	V _{CREF}	2V to 3V		Control reference voltage supply pin. Determines control start voltage.
11	V _C	0V to V _{CC1}		Speed control voltage supply pin V type control technique V _C > V _{CREF} : Forward V _C < V _{CREF} : Slowdown (Reverse-blocking circuit built in to prevent reverse rotation.)
12	W _{OUT}			W phase output
13	PWR GND			Output transistor GND
15	V _{OUT}			V phase output
16	U _{OUT}			U phase output
20	RF			Upper side output PNP transistor collector pin (common for all 3 phases). For current detection, connect resistor between V _{CC3} pin and RF pin. Constant current control and current limiter works by detecting this voltage.
8	CC			V type control/single-side control switching pin CC: High → Single-side control Low/Open → V type control
3	BRAKE			Short brake pin BRAKE: High → Short brake operation Low/Open → Motor drive operation

- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of June, 1999. Specifications and information herein are subject to change without notice.

This datasheet has been download from:

www.datasheetcatalog.com

Datasheets for electronics components.