Ordering number : ENA0371A

SANYO Semiconductors
DATA SHEET

LA5647H — Monolithic Linear IC For Car AV Equipment Multifunction Multi-Voltage Power Supply

Overview

The LA5647H power supply IC provides a set of functions optimal for car audio applications. These functions include regulators, emitter-follower outputs, open-collector outputs, and a reset function.

Features

- 5V/50mA regulator (always on, with reverse current flow prevention function).
- 10V/2000mA regulator (when used with an external 2SB921 PNP transistor) with standby function (on/off control).
- Regulators (four for 8V systems and one 5V system) with on/off functions controlled by a shift resister/latch function. This IC also provides four open-collector output systems and two emitter-follower type output systems.
- Full complement of built-in protection circuits.
  1) Overcurrent protection for each V_O except the open collector outputs.
  2) Thermal protection for each V_O except the V_{DD}5V output.

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC} max		24	V
Allowable power dissipation	Pd max	Ta ≤ 25°C, Independent IC	0.82	W
		Ta ≤ 25°C, Mounted substrate *	2.01	W
Thermal junction to ambient air thermal resistance	θj-a		152.4	°C/W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Mounted substrate : 114.3mm×76.1mm×1.6mm, glass epoxy board.

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Recmmended Operating Condition at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}	V_{DD}5V output, normal operating mode	6 to 18	V
		COM10V output, normal operating mode	10.3 to 18	V
Standby input voltage	V_{ST} OFF	Output off, control voltage	0 to 1.5	V
	V_{ST} ON	Output on, control voltage	3.5 to 5	V
V_{DD}5V output current	I_O1		0 to 50	mA
COM10V output current	I_O2	Within the external transistor ASO		mA
COM8V output current	I_O3		0 to 100	mA
TAPE8V output current	I_O4		0 to 30	mA
RD8V output current	I_O5		0 to 150	mA
FM8V output current	I_O6		0 to 100	mA
A_{CC}5V output current	I_O7		0 to 100	mA
AMP+B output current	I_O9		0 to 100	mA
ANT+B output current	I_O10		0 to 100	mA
P1 (ILL) output current	I_O11		0 to 10	mA
P2 (LCD) output current	I_O12		0 to 10	mA
P3 (CAP MR) output current	I_O13		0 to 10	mA
P4 (RSV) output current	I_O14		0 to 10	mA

Electrical Characteristics at Ta = 25°C, in the specified test circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
No load state [V_{CC} = 13.2V, each output I_O = 0A]						
Current drain 1	I_Q1	V_{STBY} = 0V		200	250	μA
Current drain 2	I_Q2	V_{STBY} = 5V		12	40	mA
V_{DD}5V output [V_{CC} = 13.2V, V_{STBY} = 0V, I_O1 = 50mA]						
Output voltage	V_O1		4.75	5	5.25	V
Dropout voltage	V_{DROP}1	V_{CC} = 4.75V		1.0	1.4	V
Line regulation	ΔV_OLN1	6.7V ≤ V_{CC} ≤ 18V		10	30	mV
Load regulation	ΔV_OLD	0 ≤ I_O1 ≤ 50mA		50	100	mV
Peak output current	I_{OP}1		50			mA
Output shorted current (for reference purposes)	I_OSC1			100		mA
Ripple rejection	P_{REJ}1	f = 120Hz, 7V ≤ V_{CC} ≤ 18V	50	56		dB
Output pin leakage current	I_OLEAK	V_{CC} = 0V, V_O = 6V		0.001	2	μA
Output voltage difference 1	ΔV_ODEF1	Between V_{DD}5V and A_{CC}5V, (V_O1-V_O7) I_O7 = 100mA	0	0.1	0.285	V
Reset block [V_{CC} = 13.2V]						
Reset threshold voltage	V_{RT}	V_{RST} OUT : Lo → Hi	1.21	1.25	1.30	V
Reset threshold hysteresis voltage	V_{RTH}		25	50	80	mV
COM10V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O2 = 2A]						
Output voltage	V_O2	With an external 2SB921 Transistor	9.5	10	10.5	V
Dropout voltage	V_{DROP}2	V_{CC} = 9.5V		0.3	0.6	V
Line regulation	ΔV_OLN2	11.2V ≤ V_{CC} ≤ 18V		30	300	mV
Load regulation	ΔV_OLD2	0 ≤ I_O2 ≤ 2A		200	800	mV
Control input current	I_{CONT}				20	mA
Output off voltage	V_O2 OFF				0.2	V
Ripple rejection (for reference purposes)	R_{REJ}2	C_{CN} = 1μF, f = 120Hz, 11.2V ≤ V_{CC} ≤ 18V		70		dB

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
COM8V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O3 = 100mA]						
Output voltage	V_O3		7.6	8	8.4	V
Dropout voltage	$V_{DROP}3$	V_O2 = 7.6V		1.0	1.4	V
Line regulation	$\Delta V_O LN3$	9.9V ≤ V_{CC} ≤ 18V		50	75	mV
Load regulation	$\Delta V_O LD3$	0 ≤ I_O3 ≤ 100mA		100	150	mV
Peak output current	$I_O P3$		100			mA
Output shorted current (for reference purposes)	$I_O SC3$			230		mA
Output off voltage	V_O3 OFF				0.2	V
TAPE8V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O4 = 30mA]						
Output voltage	V_O4		7.6	8	8.4	V
Dropout voltage	$V_{DROP}4$	V_O2 = 7.6V		1.0	1.4	V
Line regulation	$\Delta V_O LN4$	9.9V ≤ V_{CC} ≤ 18V		50	75	mV
Load regulation	$\Delta V_O LD4$	0 ≤ I_O4 ≤ 30mA		100	150	mV
Peak output current	$I_O P3$		30			mA
Output shorted current (for reference purposes)	$I_O SC4$			60		mA
Output off voltage	V_O4 OFF				0.2	V
RD8V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O5 = 150mA]						
Output voltage	V_O5		7.6	8	8.4	V
Dropout voltage	$V_{DROP}5$	V_O2 = 7.6V		1.0	1.4	V
Line regulation	$\Delta V_O LN5$	9.9V ≤ V_{CC} ≤ 18V		50	75	mV
Load regulation	$\Delta V_O LD5$	0 ≤ I_O5 ≤ 150mA		100	150	mV
Peak output current	$I_O P5$		150			mA
Output shorted current (for reference purposes)	$I_O SC5$			320		mA
Output off voltage	V_O5 OFF				0.2	V
FM8V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O6 = 100mA]						
Output voltage	V_O6		7.6	8	8.4	V
Dropout voltage	$V_{DROP}6$	V_O2 = 7.6V		1.0	1.4	V
Line regulation	$\Delta V_O LN6$	9.9V ≤ V_{CC} ≤ 18V		50	75	mV
Load regulation	$\Delta V_O LD6$	0 ≤ I_O6 ≤ 100mA		100	150	mV
Peak output current	$I_O P6$		100			mA
Output shorted current (for reference purposes)	$I_O SC6$			230		mA
Output off voltage	V_O6 OFF				0.2	V
Output voltage difference 2	$\Delta V_O DEF2$	Between RD8V and FM8V, I_O5 = 150mA			0.3	V
A_{CC}5V output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O7 = 100mA]						
Output voltage	V_O7		4.65	4.9	5.15	V
Dropout voltage	$V_{DROP}7$	V_O2 = 4.65V		1.0	1.4	V
Line regulation	$\Delta V_O LN7$	6.6V ≤ V_{CC} ≤ 18V		50	75	mV
Load regulation	$\Delta V_O LD7$	0 ≤ I_O7 ≤ 100mA		100	150	mV
Peak output current	$I_O P7$		100			mA
Output shorted current (for reference purposes)	$I_O SC7$			220		mA
Output off voltage	V_O7 OFF				0.2	V
AMP+B output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O9 = 100mA]						
Output voltage	V_O9		11.7	12.2		V
Dropout voltage	$V_{DROP}9$			1	1.5	V
Peak output current	$I_O P9$		100			mA
Output shorted current (for reference purposes)	$I_O SC9$			170		mA
Output off voltage	V_O9 OFF				0.2	V

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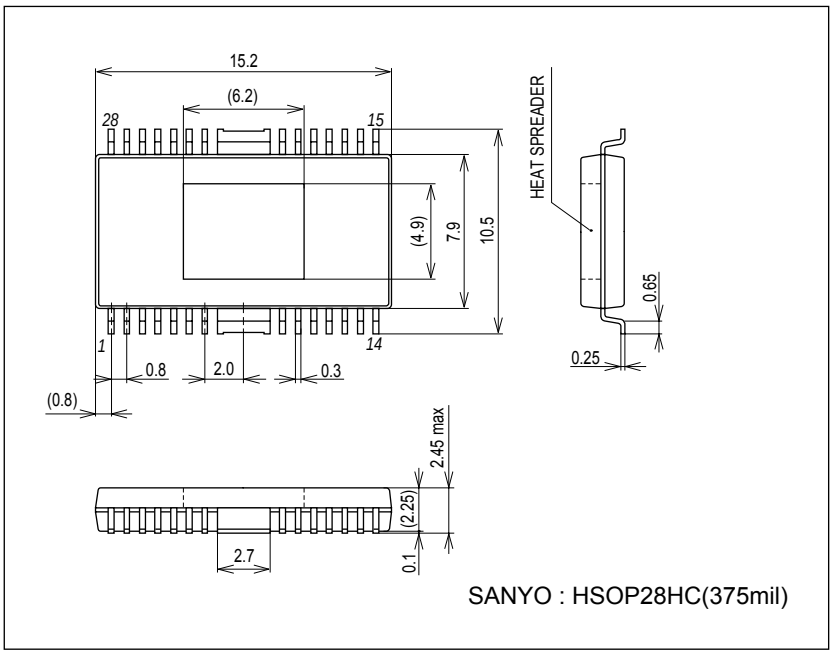
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
ANT+B output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O10 = 100mA]						
Output voltage	V_O10		11.7	12.2		V
Dropout voltage	$V_{DROP}10$			1	1.5	V
Peak output current	I_OP10		100			mA
Output shorted current (for reference purposes)	I_OSC10			170		mA
Output off voltage	V_O10 OFF				0.2	V
P1 (ILL) output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O11 = 10mA]						
Dropout voltage	$V_{DROP}11$			0.4	0.8	V
Sink output current	I_O11		10			mA
P2 (LCD) output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O12 = 10mA]						
Dropout voltage	$V_{DROP}12$			0.4	0.8	V
Sink output current	I_O11		10			mA
P3 (CAP MR) output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O13 = 10mA]						
Dropout voltage	$V_{DROP}13$			0.4	0.8	V
Sink output current	I_O13		10			mA
P4 (RSV) output [V_{CC} = 13.2V, V_{STBY} = 5V, I_O14 = 10mA]						
Dropout voltage	$V_{DROP}14$			0.4	0.8	V
Sink output current	I_O14		10			mA
Overheat protection						
Operating temperature*	TSD	V_O2 (COM10V) operation V_O3 to V_O14 interlocked to V_O2	150	175		°C

Note) * for overheat protection indicates the design target value and not the measured value.

Package Dimensions

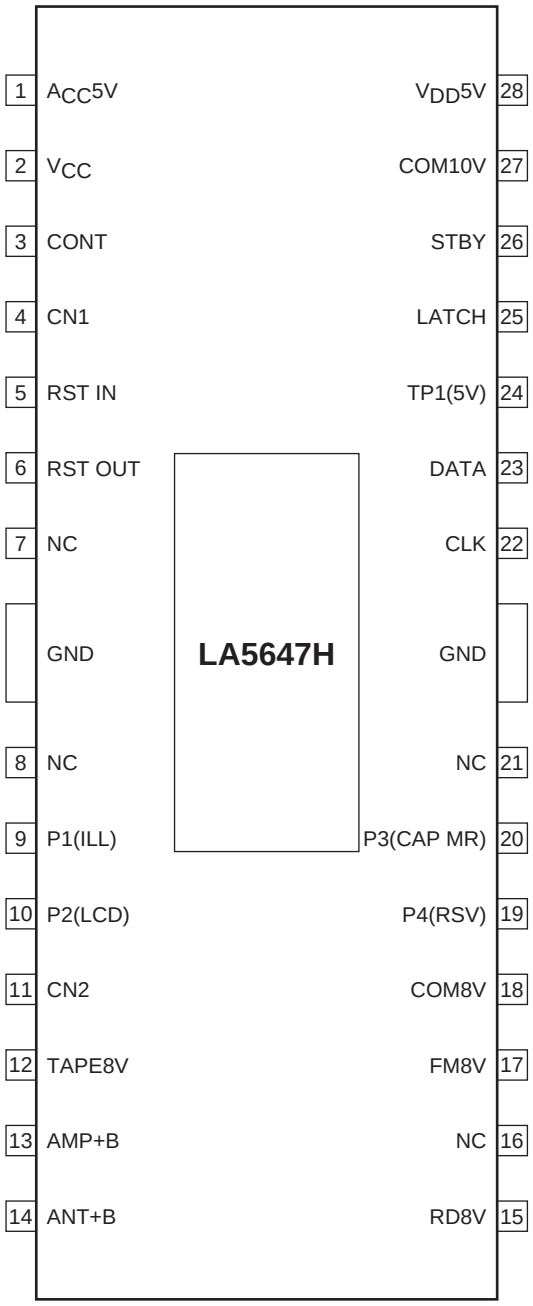
unit : mm (typ)

3234B

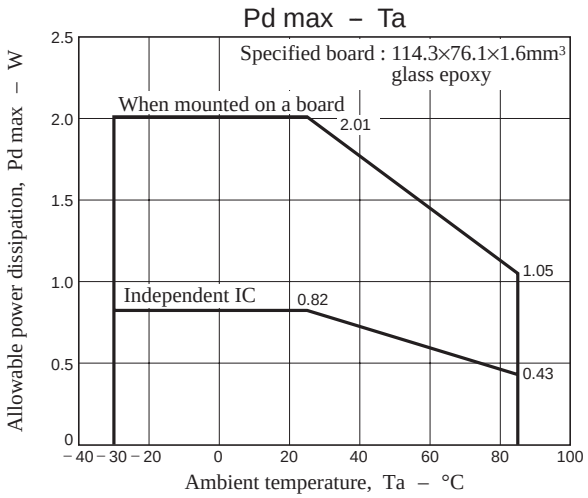


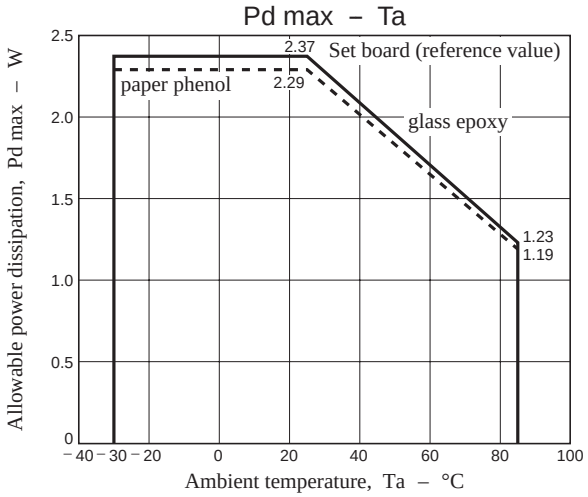
SANYO : HSOP28HC(375mil)

Pin Assignment

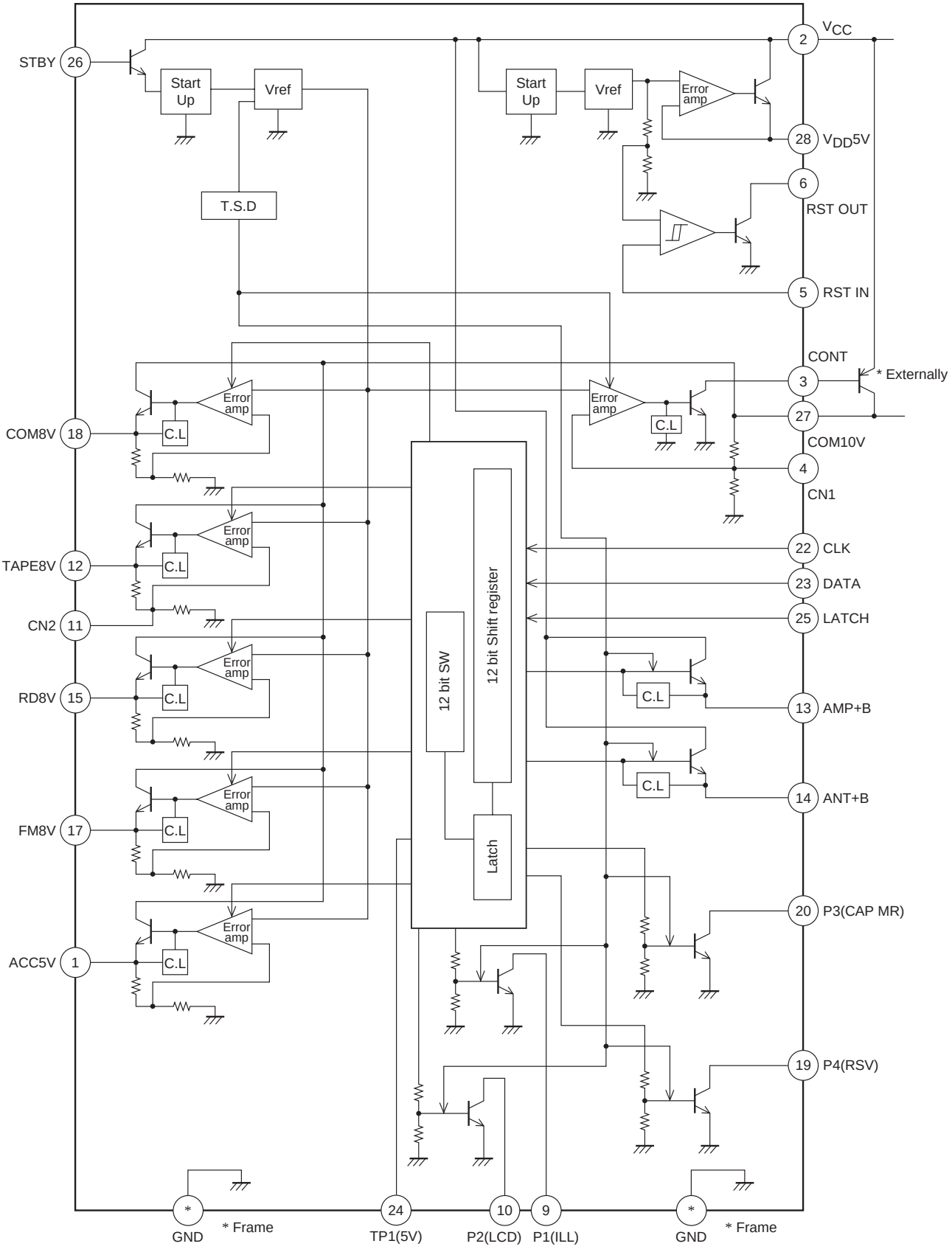


Top view



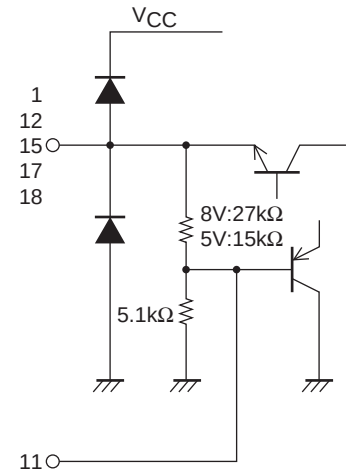
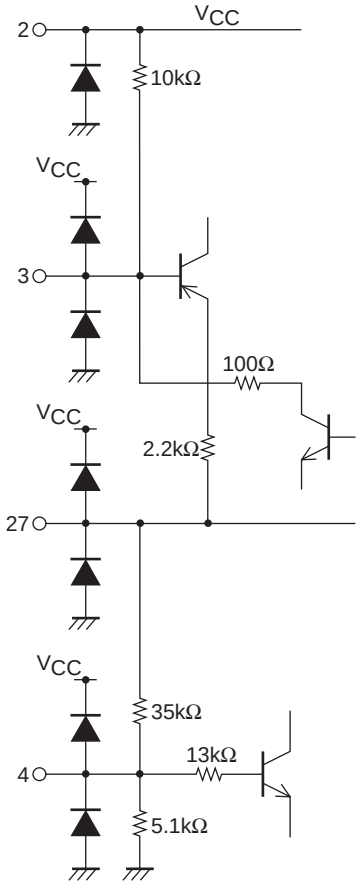
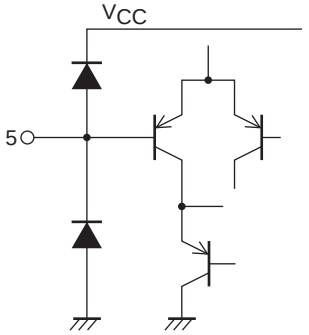


Block Diagram



* External PNPTr is 2SB921 or equivalent under application.

Pin Functions

Pin No.	Functions	Description	Equivalent Circuit
1 11 12 15 17 18	4.9V 100mA (ACC 5V) CN2 8V 30mA (TAPE 8V) 8V 150mA (RD 8V) 8V 100mA (FM 8V) 8V 100mA (COM 8V)	• Stabilized 5V system and 8V system power supply outputs • The on/off state of CD5V is controlled by STBY and other systems by the serial data, respectively. Application examples Pin 1 : ACC5V, digital 5V Pin 11 : Insert a capacitor of about 10μF between this pin and pin 12 to improve the TAPE8V ripple rejection. This pin controls the pin 12 output voltage. Set this pin to about 7V by inserting a resistor between this pin and ground if impulse noise from the Dolby IC occurs in cranking mode. Pin 12 : TAPE8V Pin 15 : 9 pro V_{CC} as 9 RD 8V Pin 17 : FM8V power supply for use with a band switch Pin 18 : COM8V power supply for an electronic volume/tone control circuit. * : Note that total of Pd must not exceed the rating of the IC.	 Only applies to the pin 12 output block
2 3 4 27	V_{CC} CONT CN1 COM10V	Pin 2 : Power supply * : This pin must be at the same voltage level as the emitter of the external transistor. Pin 3 : Bias for the external Transistor. The maximum sink current is 20mA. Pin 4 : Ripple rejection for each of the power supply systems. To increase the rejection capacity, insert a 1μF capacitor between this pin and pin 27. This pin controls the COM10V output voltage. The voltage is set to 10V internally. Pin 27 : The 10V power supply used for CD power, tuner VT, cassette loading, LCD, and ILL illumination. • Used as the power supply for internal 8V and 5V (except V_{DD}5V) systems. • The output voltage can be controlled with the CN1 pin. • The ripple rejection can be improved at the CN1 pin.	
5	RST IN	• Voltage detection input: pin 6 is the corresponding output. • Internal reference voltage : 1.25V, typical. • Used for +B detection, Acc detection, and other purposes by resistor voltage division of the +B level.	

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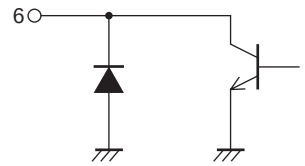
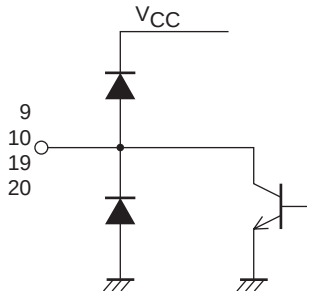
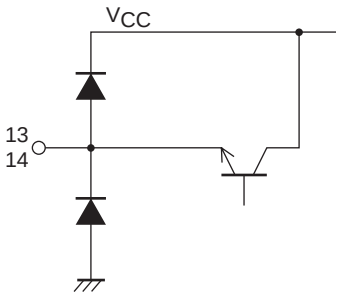
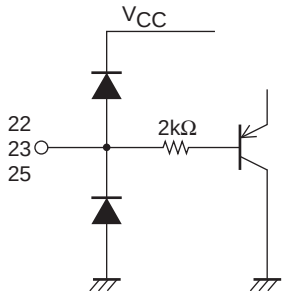
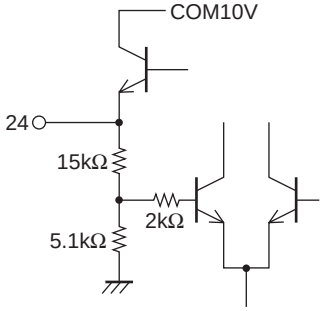
Pin No.	Functions	Description	Equivalent Circuit
6	RST OUT	• Reset signal output to microcontroller and other circuits.	
7 8 16 21	NC NC NC NC		
9 10 19 20	P1 (ILL) P2 (LCD) P4 (CAP MR) P3 (RSV)	• The on/off state of these systems is controlled by the serial data. Pin 9 : ILL illumination on/off control Pin 10 : LCD illumination on/off control Pins 19 and 20 : Used for other applications.	
13 14	V_{CC}100mA (AMP+B) V_{CC}100mA (ANT+B)	• V_{CC}-1V unstabilized outputs that can provide 100mA. • The on/off state of these outputs can be controlled with serial data. • Used with the ANT+B and AMP+B systems.	
22 23 25	CLK DATA LATCH	• The serial data received over this serial interface controls the outputs other than COM10V, CD5V, and V_{DD}5V. It also controls the on/off state of P1 to P4.	
24	TP1 (5V)	• Monitors the power supply used for the internal logic circuits (the CLK, DATA, and LATCH inputs and on/off control).	

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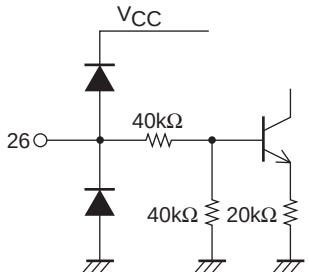
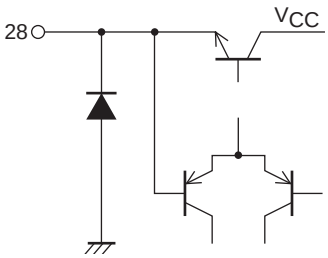
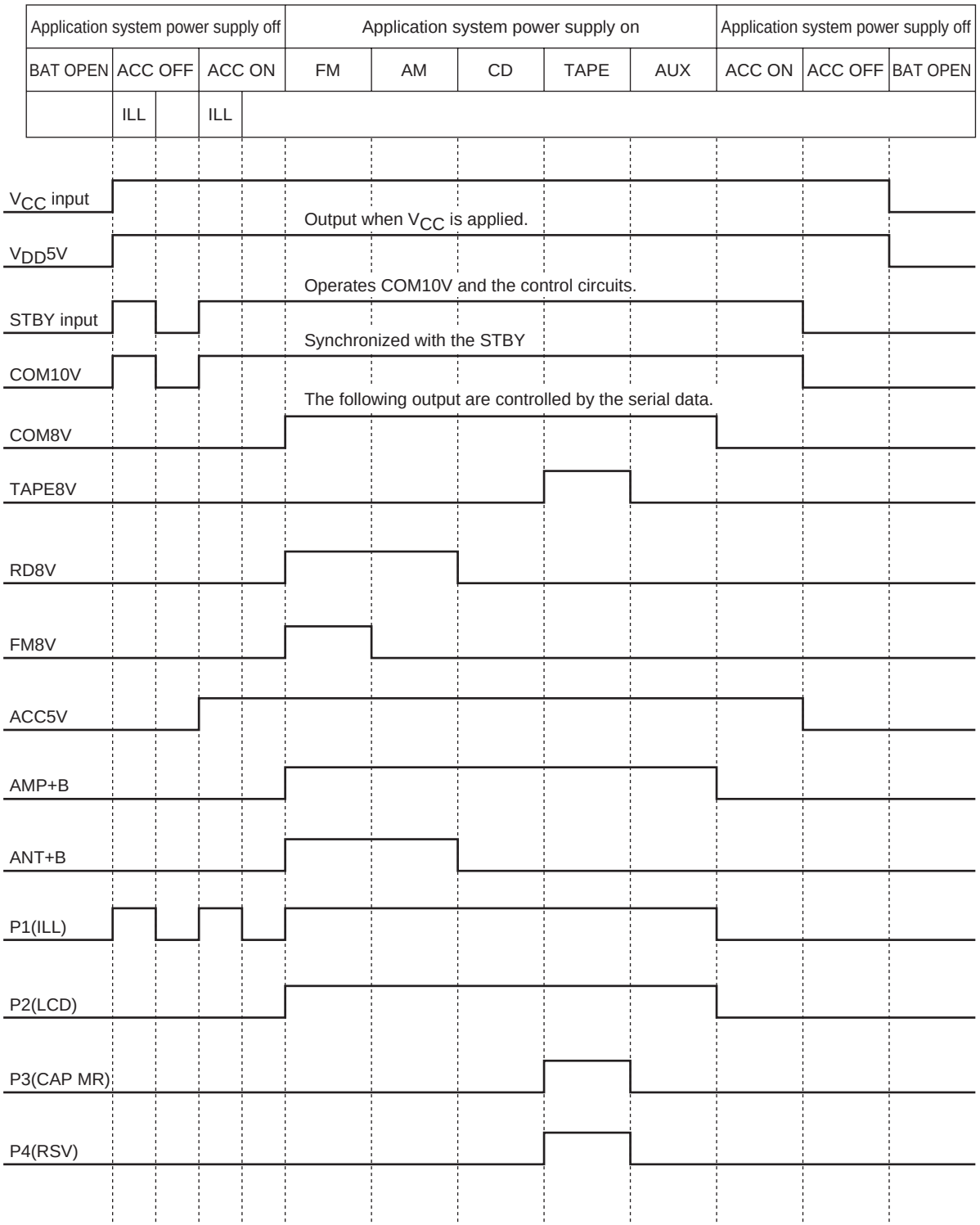
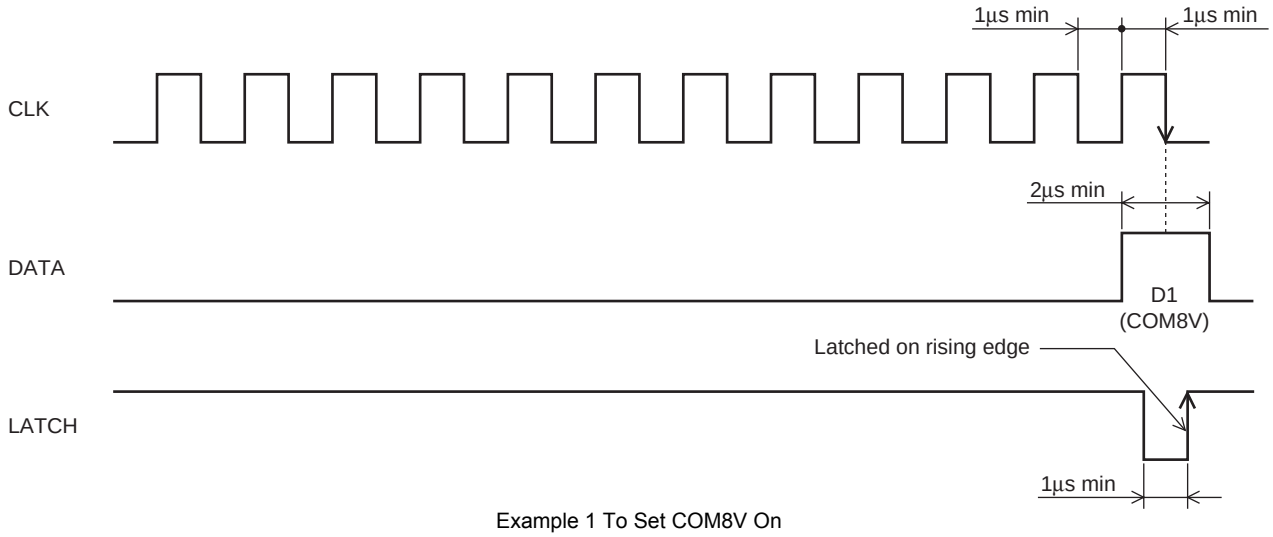
Pin No.	Functions	Description	Equivalent Circuit
26	STBY	• Controls the running/stopped state of this IC. • When low, only V_{DD}5V operates. All other circuits are stopped. • When high, only COM10V and V_{DD}5V operate unconditionally. All other outputs are controlled by the serial data.	
28	V_{DD} 5V	• When +B is applied to the V_{CC}2 pin, 5V is output. • Used as the power supply system for systems, such as the microcontroller, that require memory backup. • IQ = 150 to 180μA • The current flowing into pin 28 when V_{CC} is off, is minimal.	
Frame	GND	Connected to the IC substrate (lowest potential)	

Output Timing Chart

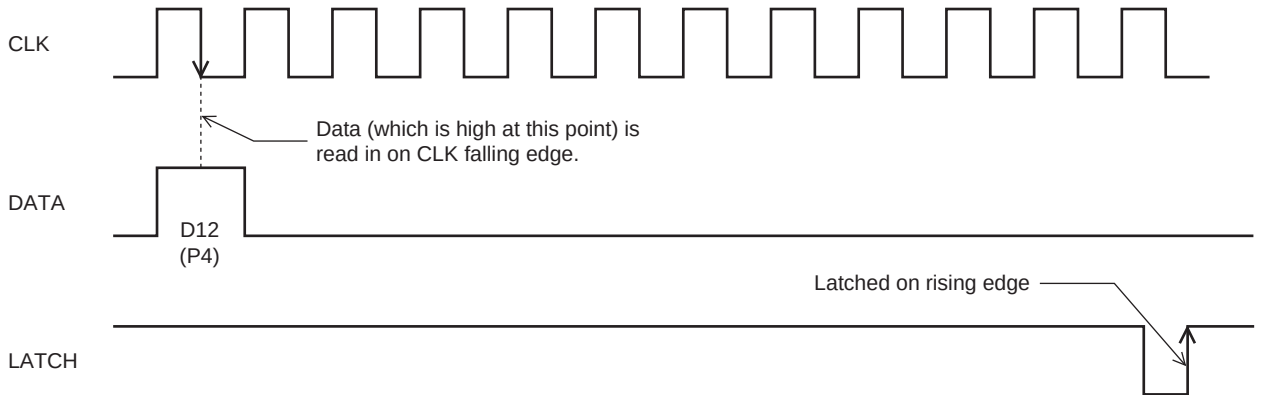


Control Timing and Data Formats

Input the stipulated data to the CLK, DATA, and LATCH pins to control the outputs other than the $V_{DD}5V$ and COM10V.



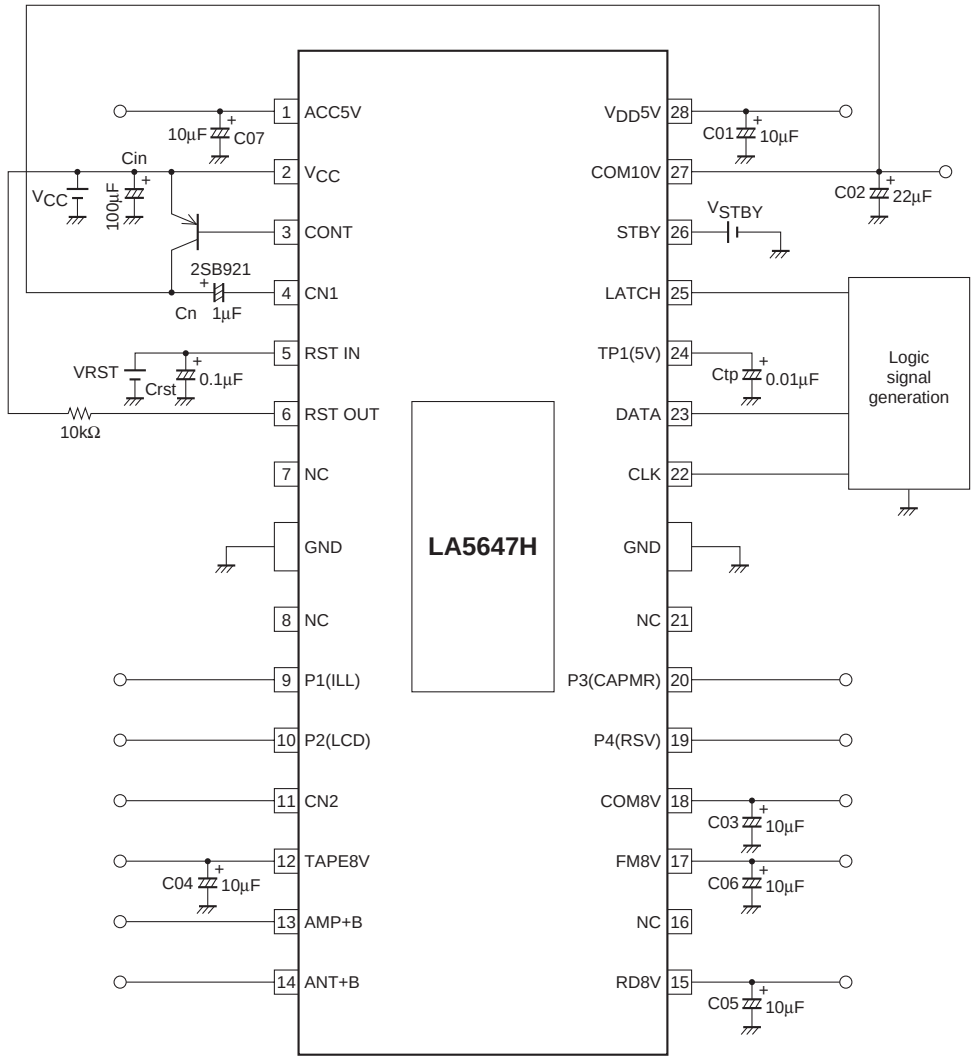
Example 1 To Set COM8V On



Example 2 To Set P4 On

DATA	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
Output	COM8V	TAPE8V	RD8V	FM8V	$A_{CC}5V$	-	AMP+B	ANT+B	P1 (ILL)	P2 (LCD)	P3 (CAPMR)	P4 (RSV)

Specified Test Circuit



This catalog provides information as of July, 2007. Specifications and information herein are subject to change without notice.