



# LA5657H

## System Power Supply IC for Car AV Systems

### Overview

The LA5657H provides 10 V/2.2 A and 5 V/1.4 A external pnp transistor based low-saturation regulators with standby functions, as well as 3.3 V, 5 V, and 8 V constant voltage, open collector, and VCC linked (VCC - 1 V) outputs that can be controlled from serial data (CCB). It also includes three reset detection circuits for the VDD, ACC, and battery systems. The LA5657H is an optimal power supply IC for car audio systems and similar products.

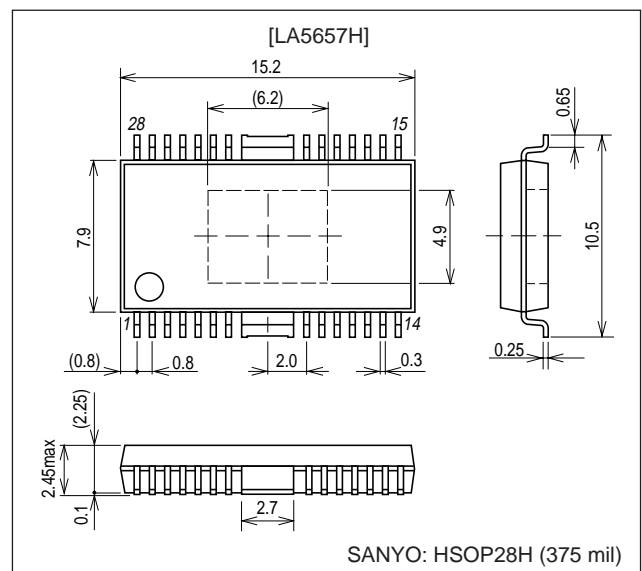
### Features

- Built-in 10 V and 5 V regulators (external pnp transistor required) with standby (on/off) functions
- Extensive set of output systems: two 8 V systems, single 5 V, 3.25 V, and 5 to 9.7 V (set with an external resistor) systems, four open-collector output systems, and two V<sub>CC</sub> linked systems.
- Three reset circuits: A<sub>CC</sub>, V<sub>DD</sub> (with delay circuit), and BATT
- Full complement of protection circuits
  - Overcurrent protection circuits for all output systems except the open collector and reset circuits
  - Thermal protection circuits for all outputs except the reset circuits

### Package Dimensions

unit: mm

#### 3233A-HSOP28H



### Specifications

#### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		24	V
Allowable power dissipation	Pd max	Ta ≤ 25°C, independent IC	0.82	W
		Ta ≤ 25°C, mounted on a 76.1 × 114.3 × 1.6 mm glass epoxy printed circuit board	2.0	W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

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LA5657H

Recommended Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>CC</sub>	COM10V output, normal operation	10.3 to 18	V
		COM5V output, normal operation	5.3 to 18	V
STBY pin input voltage	VST OFF	Output off control voltage	0 to 1	V
	VST ON	Output on control voltage	2.5 to 5	V
COM10V output current	I <sub>O1</sub>		Within the ASO for the external transistor	mA
COM5V output current	I <sub>O2</sub>		Within the ASO for the external transistor	mA
LCDV output current	I <sub>O3</sub>		0 to 30	mA
TAPE8V output current	I <sub>O4</sub>		0 to 30	mA
RD8V output current	I <sub>O5</sub>		0 to 200	mA
DSP5V output current	I <sub>O6</sub>		0 to 100	mA
DSP3.25V output current	I <sub>O7</sub>		0 to 100	mA
AMP+B output current	I <sub>O8</sub>		0 to 100	mA
ANT+B output current	I <sub>O9</sub>		0 to 250	mA
CAP MR output current	I <sub>O10</sub>		0 to 10	mA
P1 output sink current	I <sub>O11</sub>		0 to 10	mA
P2 output sink current	I <sub>O12</sub>		0 to 10	mA
P3 output sink current	I <sub>O13</sub>		0 to 10	mA
ACCRO output sink current	I <sub>O</sub> -ACCR		0 to 1	mA
V <sub>DD</sub> RST output sink current	I <sub>O</sub> -V <sub>DD</sub> R		0 to 1	mA
BATRO output sink current	I <sub>O</sub> -BATR		0 to 5	mA

Electrical Characteristics at Ta = 25°C, V<sub>CC</sub> = 13.2 V, in the specified test circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain 1	I <sub>CC1</sub>	VSTBY = 0 V, BATRO = High, RESET = High, ACCRO = Low		150	170	μA
Current drain 2	I <sub>CC2</sub>	VSTBY = 5 V, Serial data control outputs: all off BATRO, RESET, and ACCRO outputs: all high		19	25	mA
[V <sub>DD</sub> Reset Block *1]						
Reset threshold voltage	VTVDDR		4.05	4.25	4.45	V
Hysteresis	VHVDDR		50	80	130	mV
Low-level output voltage	VOLVDDR	ISINK = 50 μA		0.25	0.4	V
High-level output voltage	VOHVDDR	Resistance between RESET and ground: 1 MΩ	0.8 V <sub>DD</sub>		V <sub>DD</sub>	V
CDLY outflow current	ICDLY	CDLY outflow current	-4.0	-3.4	-2.8	μA
CDLY threshold voltage	VTHCDLY		1.18	1.25	1.32	V
[BAT Reset Block *2]						
Reset threshold voltage	VTBATR		1.21	1.25	1.29	V
Hysteresis	VHBATR		163	233	326	mV
Leakage current	ILKBATR		-2			μA
Low-level output voltage	VOLBATR	ISINK = 50 μA		0.25	0.4	V
High-level output voltage	VOHBATR	Resistance between BATRO and ground: 1 MΩ	0.8 V <sub>DD</sub>		V <sub>DD</sub>	V
[ACC Reset Block *2]						
Reset threshold voltage	VTACCR		1.21	1.25	1.29	V
Hysteresis	VHACCR		10	20	30	mV
Leakage current	ILKACCR		-2			μA
Low-level output voltage	VOLACCR	ISINK = 1 mA		0.35	0.5	V
High-level output voltage	VOHACCR	Resistance between ACCRO and ground: 1 MΩ	0.8 V <sub>DD</sub>		V <sub>DD</sub>	V

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[COM10V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O2} = 2.2\text{ A}$ )]						
Output voltage	$V_{O1}$	External transistor: 2SB921	9.55	10	10.45	V
Dropout voltage	VDROP1	$V_{CC} = 9.55\text{ V}$		0.3	0.6	V
Line regulation	$\Delta\text{VOLN1}$	$11.15\text{ V} \leq V_{CC} \leq 18\text{ V}$		30	300	mV
Load regulation	$\Delta\text{VOLD1}$	$0 \leq I_{O1} \leq 2.2\text{ A}$		200	800	mV
Control input current	ICONT1		20	22	26.4	mA
Output off voltage	$V_{O1}\text{ OFF}$				0.2	V
Ripple rejection (reference value)	RREJ1	$f = 120\text{ Hz}$ , $11.15\text{ V} \leq V_{CC} \leq 18\text{ V}$		70		dB
[COM5V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O2} = 1.4\text{ A}$ )]						
Output voltage	$V_{O2}$	External transistor: 2SB921	4.775	5	5.225	V
Dropout voltage	VDROP2	$V_{CC} = 4.775\text{ V}$		0.3	0.6	V
Line regulation	$\Delta\text{VOLN2}$	$5.925\text{ V} \leq V_{CC} \leq 18\text{ V}$		30	300	mV
Load regulation	$\Delta\text{VOLD2}$	$0 \leq I_{O2} \leq 1.4\text{ A}$		200	800	mV
Control input current	ICONT2		15	16.7	20.2	mA
Output off voltage	$V_{O2}\text{ OFF}$				0.2	V
Ripple rejection (reference value)	RREJ2	$f = 120\text{ Hz}$ , $5.925\text{ V} \leq V_{CC} \leq 18\text{ V}$		70		dB
[LCDV Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O2} = 30\text{ mA}$ , CN pin: open)]						
Output voltage	$V_{O3}$		4.85	5	5.15	V
Dropout voltage	VDROP3	$V_{CC} = 4.85\text{ V}$		0.3	0.6	V
Line regulation	$\Delta\text{VOLN3}$	$5.85\text{ V} \leq V_{CC} \leq 18\text{ V}$		50	75	mV
Load regulation	$\Delta\text{VOLD3}$	$0 \leq I_{O2} \leq 30\text{ mA}$		100	150	mV
Peak output current	IOP3		30			mA
Output short current (reference value)	IOSC3			60		mA
Output off voltage	$V_{O3}\text{ OFF}$				0.2	V
[TAPE8V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O4} = 30\text{ mA}$ )]						
Output voltage	$V_{O4}$		7.64	8	8.36	V
Dropout voltage	VDROP4	$V_{O1} = 7.6\text{ V}$		1.0	1.4	V
Line regulation	$\Delta\text{VOLN4}$	$9.9\text{ V} \leq V_{CC} \leq 18\text{ V}$		50	75	mV
Load regulation	$\Delta\text{VOLD4}$	$0 \leq I_{O4} \leq 30\text{ mA}$		100	150	mV
Peak output current	IOP4		30			mA
Output short current (reference value)	IOSC4			220		mA
Output off voltage	$V_{O4}\text{ OFF}$				0.2	V
[RD8V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O5} = 200\text{ mA}$ )]						
Output voltage	$V_{O5}$		7.64	8	8.36	V
Dropout voltage	VDROP5	$V_{O1} = 7.6\text{ V}$		1.0	1.4	V
Line regulation	$\Delta\text{VOLN5}$	$9.96\text{ V} \leq V_{CC} \leq 18\text{ V}$		50	75	mV
Load regulation	$\Delta\text{VOLD5}$	$0 \leq I_{O5} \leq 200\text{ mA}$		100	150	mV
Peak output current	IOP5		200			mA
Output short current (reference value)	IOSC5			900		mA
Output off voltage	$V_{O5}\text{ OFF}$				0.2	V
[DSP5V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O6} = 100\text{ mA}$ )]						
Output voltage	$V_{O6}$		4.775	5	5.225	V
Dropout voltage	VDROP6	$V_{O1} = 4.775\text{ V}$		1.0	1.4	V
Line regulation	$\Delta\text{VOLN6}$	$6.825\text{ V} \leq V_{CC} \leq 18\text{ V}$		50	75	mV
Load regulation	$\Delta\text{VOLD6}$	$0 \leq I_{O6} \leq 100\text{ mA}$		100	150	mV
Peak output current	IOP6		100			mA
Output short current (reference value)	IOSC6			520		mA
Output off voltage	$V_{O6}\text{ OFF}$				0.2	V

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[DSP3.25V Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O7} = 100\text{ mA}$ )]						
Output voltage	$V_{O7}$		3.104	3.25	3.396	V
Dropout voltage	$V_{DROP7}$	$V_{O2} = 3.104\text{ V}$		1.0	1.4	V
Line regulation	$\Delta V_{OLN7}$	$4.996\text{ V} \leq V_{CC} \leq 18\text{ V}$		50	75	mV
Load regulation	$\Delta V_{OLD7}$	$0 \leq I_{O7} \leq 100\text{ mA}$		100	150	mV
Peak output current	$I_{OP7}$		100			mA
Output short current (reference value)	$I_{OSC7}$			420		mA
Output off voltage	$V_{O7\text{ OFF}}$				0.2	V
[AMP + B Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O8} = 100\text{ mA}$ )]						
Output voltage	$V_{O8}$		11.7	12.2		V
Dropout voltage	$V_{DROP8}$			1	1.5	V
Peak output current	$I_{OP8}$		100			mA
Output short current (reference value)	$I_{OSC8}$			300		mA
Output off voltage	$V_{O8\text{ OFF}}$				0.2	V
[ANT + B Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O9} = 250\text{ mA}$ )]						
Output voltage	$V_{O9}$		11.7	12.2		V
Dropout voltage	$V_{DROP9}$			1	1.5	V
Peak output current	$I_{OP9}$		250			mA
Output short current (reference value)	$I_{OSC9}$			700		mA
Output off voltage	$V_{O9\text{ OFF}}$				0.2	V
[CAP MR Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O10} = 10\text{ mA}$ )]						
Dropout voltage	$V_{DROP10}$			0.4	0.8	V
Output sink current	$I_{O10}$		10			mA
[P1 (ILL) Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O11} = 10\text{ mA}$ )]						
Dropout voltage	$V_{DROP11}$			0.4	0.8	V
Output sink current	$I_{O11}$		10			mA
[P2 (LCD) Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O12} = 10\text{ mA}$ )]						
Dropout voltage	$V_{DROP12}$			0.4	0.8	V
Output sink current	$I_{O12}$		10			mA
[P3 (CAP MR) Output ( $V_{CC} = 13.2\text{ V}$ , $V_{STBY} = 5\text{ V}$ , $I_{O13} = 10\text{ mA}$ )]						
Dropout voltage	$V_{DROP13}$			0.4	0.8	V
Output sink current	$I_{O13}$		10			mA
[Thermal Protection Circuit]						
Operating temperature *3	TSD	$V_{O1}$ and $V_{O2}$ operation $V_{O3}$ to $V_{O13}$ linked to $V_{O1}$ and $V_{O2}$ operation.	150	175		°C

Notes on items \*1 to \*3.

(1)  $V_{DD}$  reset block (\*1)

- The reset detection function detects the level of  $V_{DD5V}$  input to  $V_{DD\text{ IN}}$ .
- This reset function operates correctly when the  $V_{DD\text{ IN}}$  voltage is over 0.5 V, but is undefined when  $V_{DD\text{ IN}}$  is under 0.5 V. The reset voltage must never exceed  $V_{DD\text{ IN}}$ .
- The allowable range for the threshold voltage has a tolerance of  $\pm 4.7\%$ .

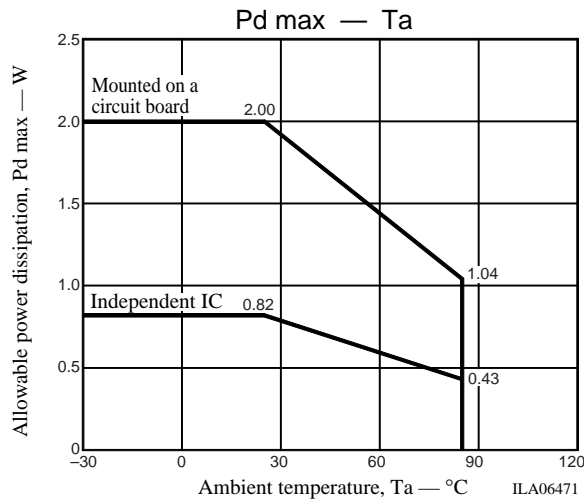
(2) BAT and ACC reset blocks (\*2)

- These reset detection outputs must operate correctly when the  $V_{DD\text{ IN}}$  voltage is over 2 V. The reset voltages must never exceed  $V_{DD\text{ IN}}$ .
- The ACC detection function has no region where detection is unpredictable according to the value of the voltage detected. That is, the low level will be detected correctly when ACC IN is 0 V.
- The allowable range for the threshold voltage has a tolerance of  $\pm 3.2\%$ .

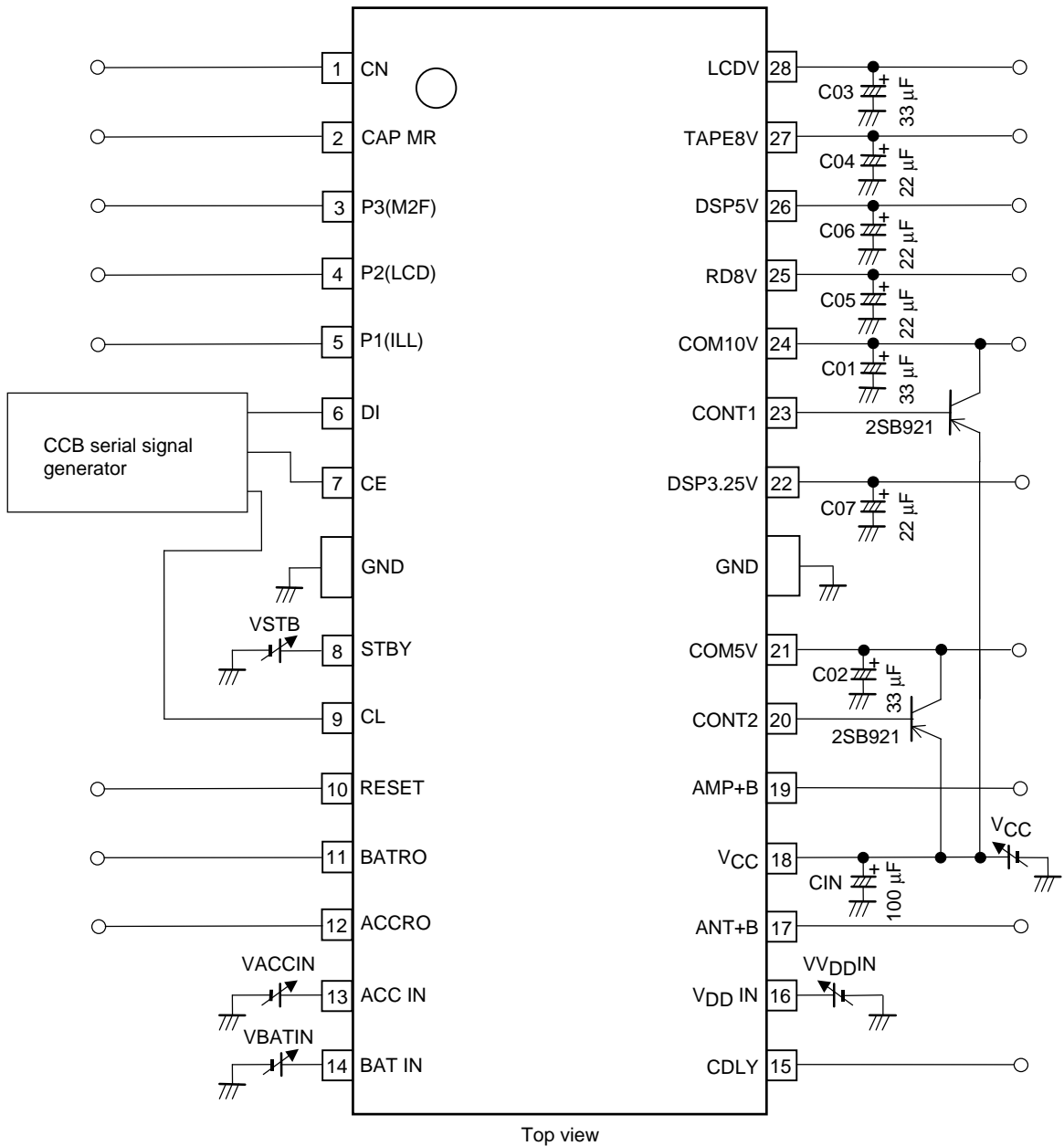
(3) Thermal protection and operating temperature (\*3)

- The values shown are design target values and are not tested.

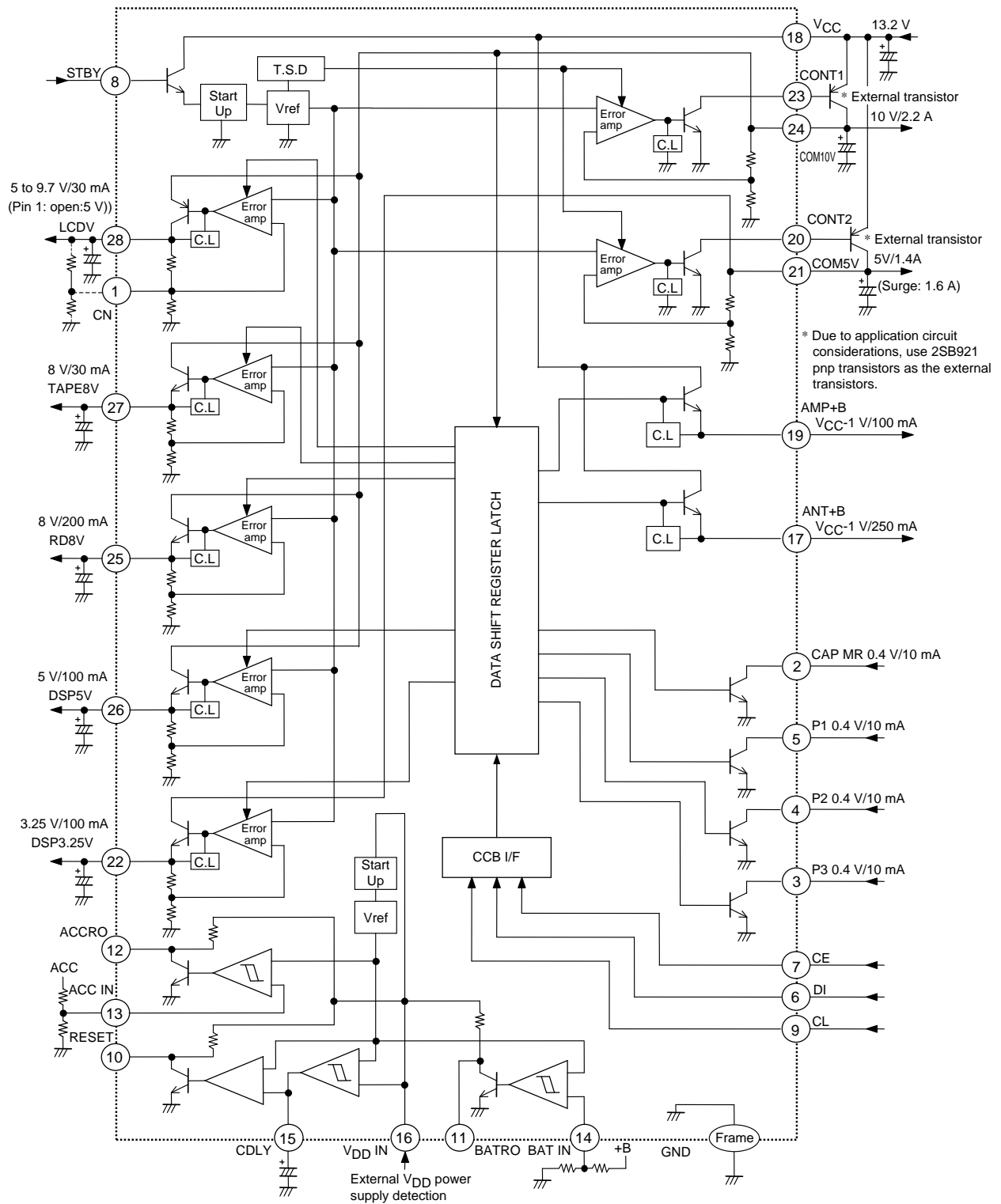
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## Pin Assignment and Test Circuit

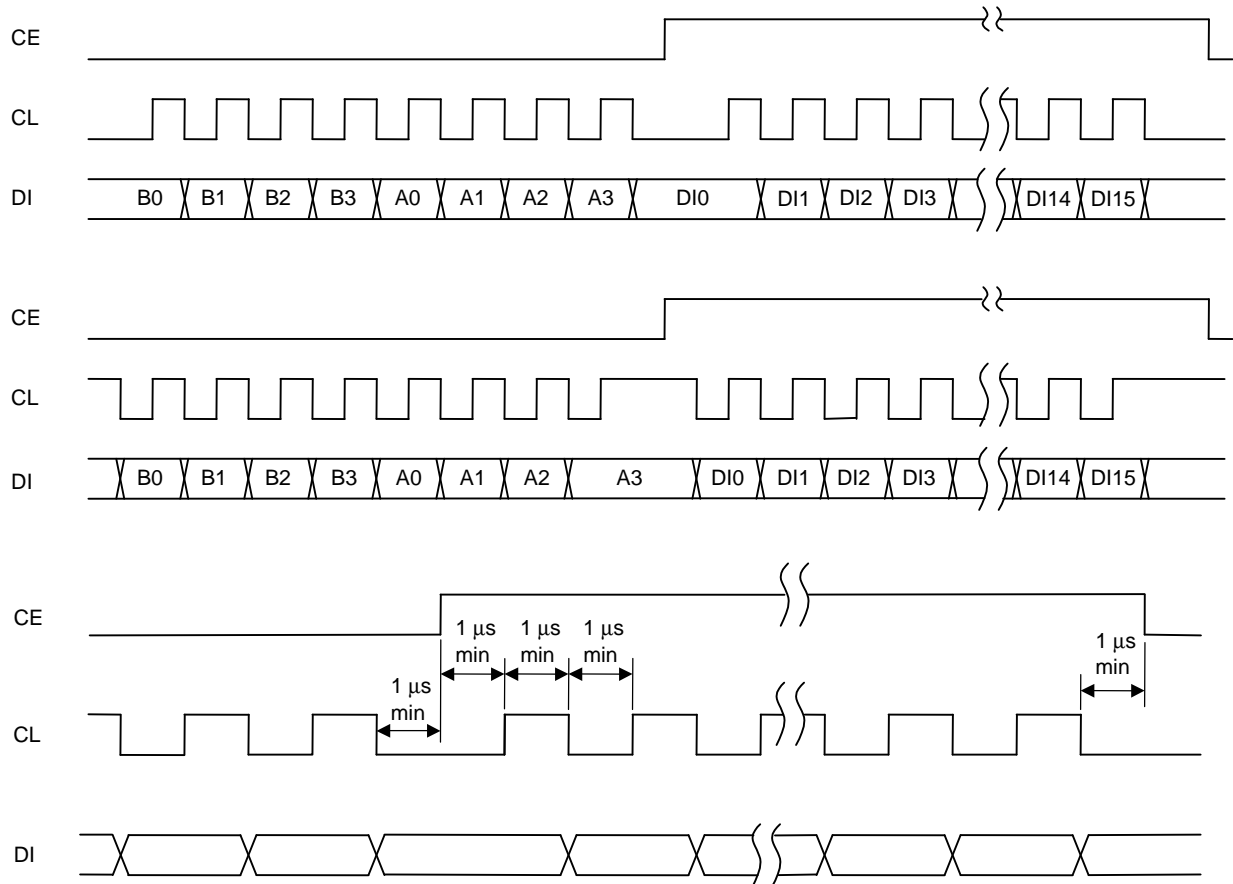


Equivalent Circuit Block Diagram



**Control System Timing and Data Format**

The LA5657H is controlled by inputting the stipulated serial data to the CL, DI, and CE pins. This data consists of a total of 24 bits of which 8 bits are address and 16 bits are data.



• Address code (B0 to A3)

The LA5657H has an 8-bit address code that allows it to be used with the same specifications as other Sanyo serial bus CCB ICs.

Address Code

LSB				MSB				HEX
B0	B1	B2	B3	A0	A1	A2	A3	
1	0	1	0	1	0	1	1	D5

## LA5657H

• On/Off Control Code Assignment

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	Operation
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	LCDV ON
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	TAPE8V ON
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	RD8V ON
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	DSP5V ON
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	DSP3.25V ON
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	AMP+B ON
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	ANT+B ON
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	CAP MR ON
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	P1 ON
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	P2 ON
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	P3 ON

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