Ordering number : ENN5969A

Monolithic Linear IC

LA5633

Satellite Broadcast (BS/CS) Tuner Regulator IC

Overview

The LA5633 is a low-saturation regulator IC designed for use in satellite broadcast tuners (such as tuners for the Japanese BS and CS systems) and provides four controllable outputs.

Applications

- Power supply systems in BS/CS tuners
- Audio Video (AV) equipment that includes any type of satellite broadcast tuner
- Miniature electronic equipment

Functions

- Built-in four regulators of low-saturation output (15.7 V/350 mA, 9 V/250 mA, 12 V/100 mA, 5 V/650 mA)
- Output on/off control (active low)
- On-chip thermal protection and overcurrent protection circuits

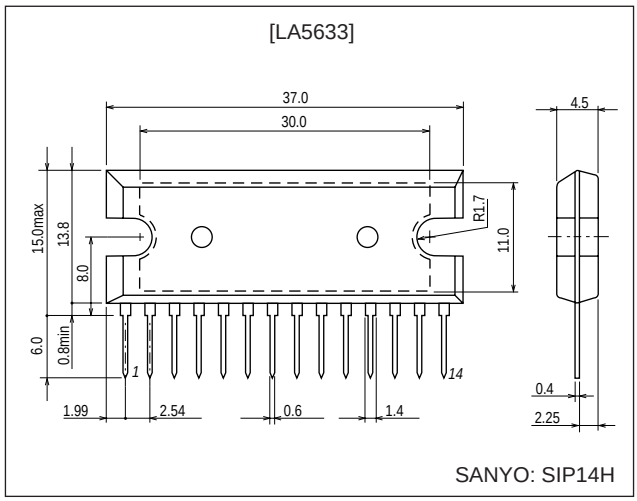
Features

- Provides all four voltages required by BS/CS tuners, and thus can contribute to end product miniaturization.
- V_O1 can be controlled independently, and V_O2, V_O3, and V_O4 are controlled together, thus providing a high degree of flexibility in system design.
- The adoption of a low-saturation regulator circuit reduces internal power dissipation.
- Provides 3 inputs to make both low-power design and thermal design easy.

Package Dimensions

unit: mm

3023A-SIP14H



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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V_{IN} max	$V_{IN}1 \geq V_{IN}2 \geq V_{IN}3$	35	V
Enable pin voltage	V_{EN} max	EN1, EN2	V_{IN} max	V
Allowable power dissipation	Pd max	With an arbitrarily large heat sink	15	W
		With no heat sink	4.3	W
Junction to case thermal resistance	θ j-c		3	°C/W
Junction to atmosphere thermal resistance	θ j-a		29.07	°C/W
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–55 to +150	°C
Junction temperature	Tj max		150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Output current	I_O1	Regulator 1	5 to 350	mA
	I_O2	Regulator 2	1 to 250	mA
	I_O3	Regulator 3	1 to 100	mA
	I_O4	Regulator 4	5 to 650	mA

Operating Characteristics at Ta = 25°C in the stipulated test circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Regulator 1 [$V_{EN}1$ = low, V_O1: on, $V_{IN}1$ = 20 V, I_O1 = 350 mA]						
Output voltage 1	V_O1		14.9	15.7	16.5	V
Dropout voltage	$V_{DROP}1$-1			0.3	0.5	V
	$V_{DROP}1$-2	I_O1 = 175 mA		0.15	0.3	V
Line regulation	$\Delta V_{OLN}1$	17.5 V ≤ $V_{IN}1$ ≤ 23 V		20	100	mV
Load regulation	$\Delta V_{OLD}1$	5 mA ≤ I_O1 ≤ 350 mA		40	200	mV
Peak output current	$I_{OP}1$		350	540		mA
Output short-circuit current	$I_{OSC}1$			150		mA
Output on control voltage	$V_{ENL}1$	V_O1 : ON			1.0	V
Output off control voltage	$V_{ENH}1$	V_O1 : OFF	4.0		$V_{IN}1$	V
Output low-level voltage	V_O1 OFF				0.2	V
Output noise voltage	$V_{NOISE}1$	10 Hz ≤ f ≤ 100 kHz		110		µVrms
Ripple rejection	Rrej1	f = 120 Hz, 18 V ≤ $V_{IN}1$ ≤ 23 V		50		dB
Regulator 2 [$V_{EN}2$ = low, V_O2: on, $V_{IN}2$ = 11 V, I_O2 = 250 mA]						
Output voltage 2	V_O2		8.55	9.0	9.45	V
Dropout voltage	$V_{DROP}2$			0.3	0.5	V
Line regulation	$\Delta V_{OLN}2$	10.45 V ≤ $V_{IN}2$ ≤ 23 V		20	100	mV
Load regulation	$\Delta V_{OLD}2$	1 mA ≤ I_O2 ≤ 250 mA		30	100	mV
Peak output current	$I_{OP}2$		250	270		mA
Output short-circuit current	$I_{OSC}2$			70		mA
Output on control voltage	$V_{ENL}2$	V_O2 : ON			1.0	V
Output off control voltage	$V_{ENH}2$	V_O2 : OFF	4.0		$V_{IN}2$	V
Output low-level voltage	V_O2 OFF				0.2	V
Output noise voltage	$V_{NOISE}2$	10 Hz ≤ f ≤ 100 kHz		110		µVrms
Ripple rejection	Rrej2	f = 120 Hz, 11 V ≤ $V_{IN}2$ ≤ 23 V		50		dB
Regulator 3 [$V_{EN}2$ = low, V_O3 on, $V_{IN}1$ = 20 V, I_O3 = 100 mA]						
Output voltage 3	V_O3		11.4	12.0	12.6	V
Dropout voltage	$V_{DROP}3$			0.3	0.5	V
Line regulation	$\Delta V_{OLN}3$	13.6 V ≤ $V_{IN}1$ ≤ 23 V		20	100	mV
Load regulation	$\Delta V_{OLD}3$	1 mA ≤ I_O3 ≤ 100 mA		20	50	mV
Peak output current	$I_{OP}3$		100	150		mA
Output short-circuit current	$I_{OSC}3$			40		mA
Output on control voltage	$V_{ENL}2$	V_O3 : ON			1.0	V

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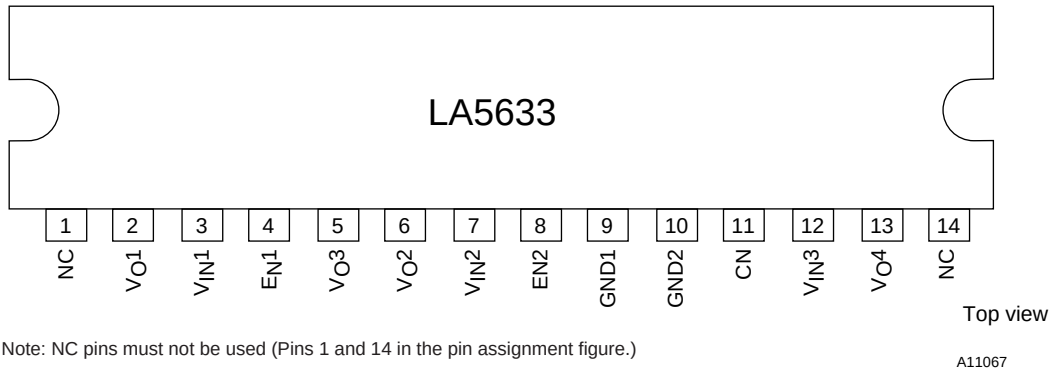
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output off control voltage	$V_{ENH}2$	V_O3 : OFF	4.0		$V_{IN}1$	V
Output low-level voltage	V_O3 OFF				0.2	V
Output noise voltage	$V_{NOISE}3$	10 Hz ≤ f ≤ 100 kHz		70		μVrms
Ripple rejection	Rrej3	f = 120 Hz, 14 V ≤ $V_{IN}1$ ≤ 23 V		55		dB
Regulator 4 [$V_{EN}2$ = low, V_O4: on, $V_{IN}3$ = 7.0 V, I_O4 = 650 mA]						
Output voltage 4	V_O4		4.75	5.0	5.25	V
Dropout voltage	$V_{DROP}4$-1			0.3	0.5	V
	$V_{DROP}4$-2	I_O1 = 325 mA		0.2	0.4	V
Line regulation	$\Delta V_{OLN}4$	6.25 V ≤ $V_{IN}3$ ≤ 23 V		20	100	mV
Load regulation	$\Delta V_{OLD}4$	5 mA ≤ I_O4 ≤ 650 mA		40	200	mV
Peak output current	$I_{OP}4$		650	900		mA
Output short-circuit current	$I_{OSC}4$			250		mA
Output on control voltage	$V_{ENL}2$	V_O4 : ON			1.0	V
Output off control voltage	$V_{ENH}2$	V_O4 : OFF	4.0		$V_{IN}3$	V
Output low-level voltage	V_O4 OFF				0.2	V
Output noise voltage	$V_{NOISE}1$	10 Hz ≤ f ≤ 100 kHz		70		μVrms
Ripple rejection	Rrej4	f = 120 Hz, 7 V ≤ $V_{IN}3$ ≤ 23 V		60		dB
Current drain	I_Q1	I_O1, I_O2, I_O3, I_O4 = 0		11		mA
	I_Q2	I_O1 = 350 mA, I_O2 = 250 mA, I_O3 = 100 mA, I_O4 = 650 mA		65		mA
Output rise times [$V_{IN}1$ = 20 V, $V_{IN}2$ = 11 V, $V_{IN}3$ = 7 V, C_O1 = 220 μF, C_O2 = 220 μF, C_O3 = 220 μF, C_O4 = 3300 μF]						
Regulator 1 rise time	t_O1	$V_{EN}1$ = 5 V → 0 V, $V_{EN}2$ = 0 V, I_O1 = 350 mA, I_O2 to I_O4 = 0 A			22.0	ms
Regulator 2 rise time	t_O2	$V_{EN}1$ = 0 V, $V_{EN}2$ = 5 V → 0 V, I_O2 = 250 mA, I_O1, I_O3, I_O4 = 0 A			27.5	ms
Regulator 3 rise time	t_O3	$V_{EN}1$ = 0 V, $V_{EN}2$ = 5 V → 0 V, I_O3 = 100 mA, I_O1, I_O2, I_O4 = 0 A			44.5	ms
Regulator 4 rise time	t_O4	$V_{EN}1$ = 0 V, $V_{EN}2$ = 5 V → 0 V, I_O4 = 630 mA, I_O1 to I_O3 = 0 A			81.0	ms

Pin Assignment



Note: NC pins must not be used (Pins 1 and 14 in the pin assignment figure.)

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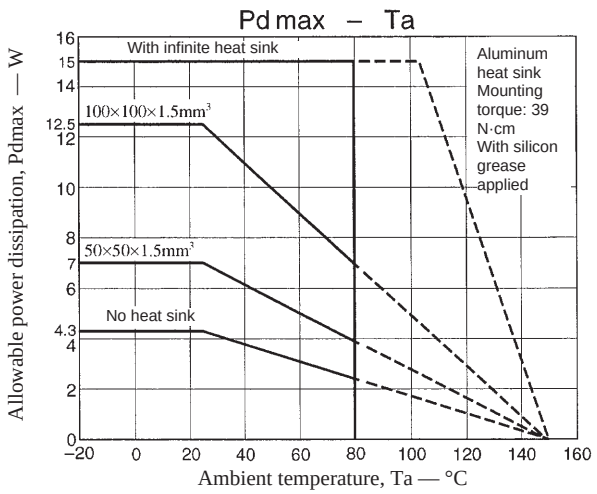
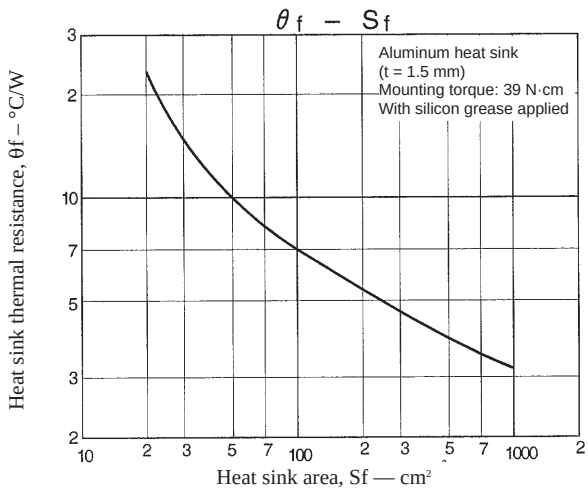
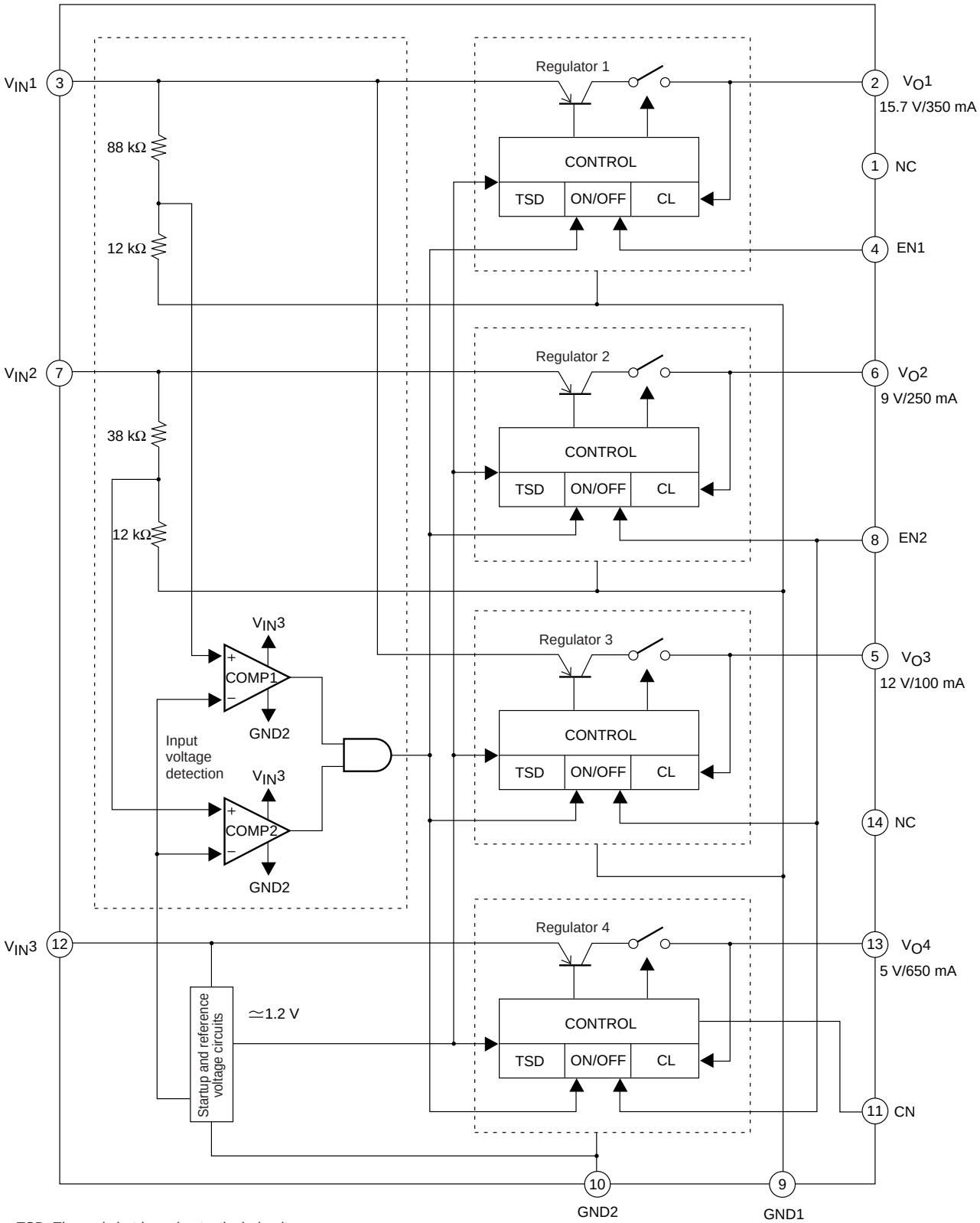




Block Diagram



TSD: Thermal shutdown (protection) circuit
ON/OFF: Output on/off control circuit
CL: Current limiter (overcurrent protection circuit)

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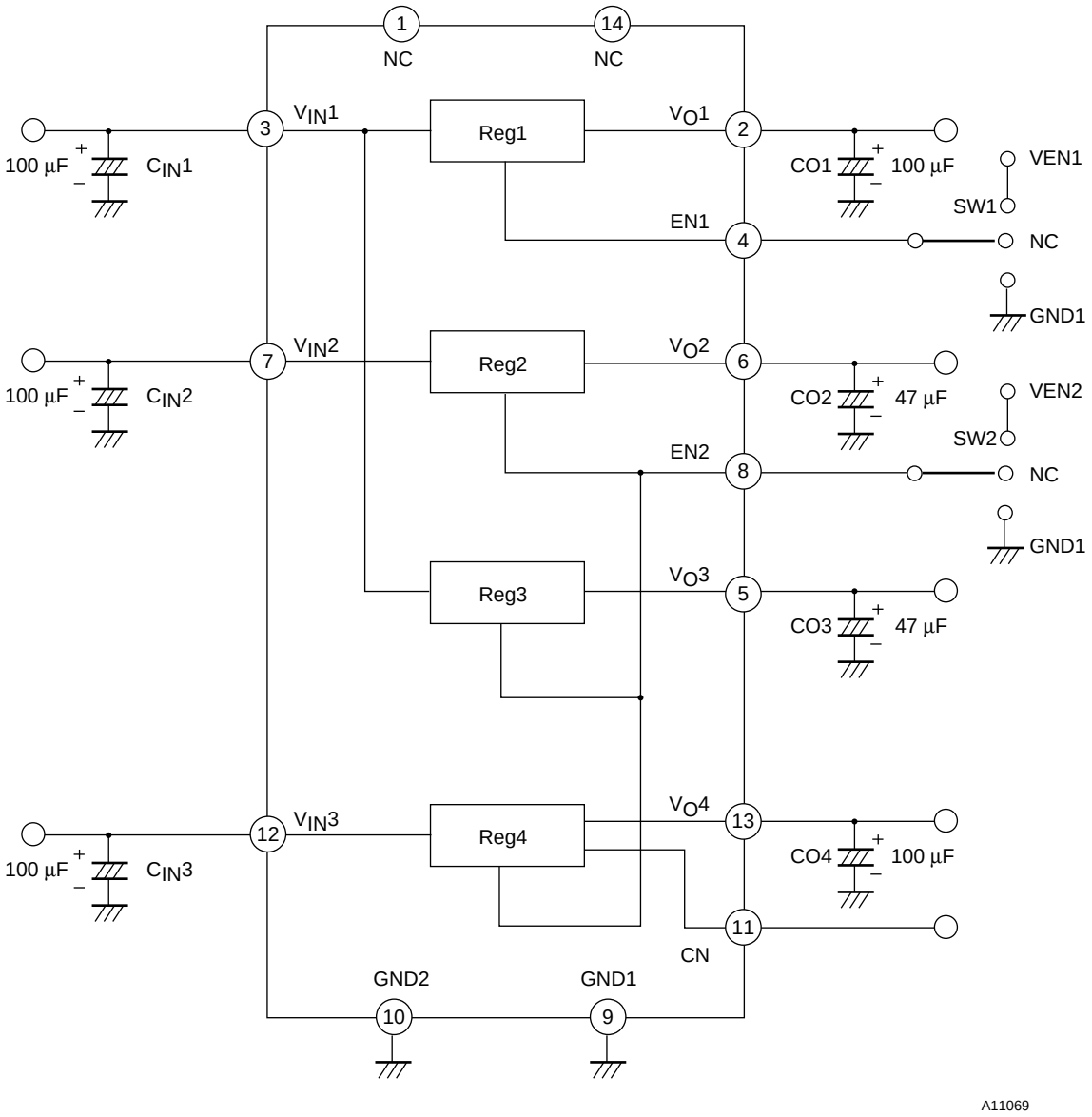
Stipulated Test Circuit



Function Table

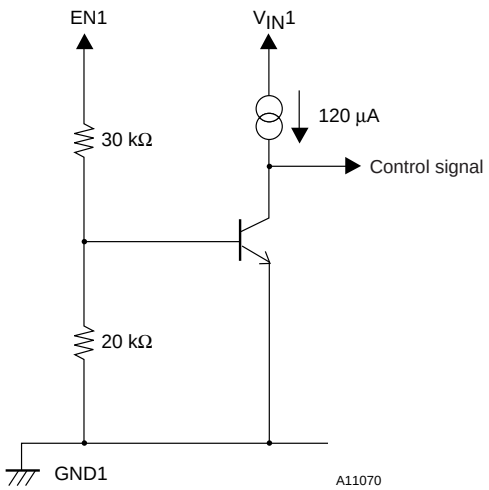
This IC operates as listed in the table under the condition that $V_{IN}1 \geq V_{IN}2 \geq V_{IN}3$.

EN1, EN2	V_O1, $V_O2/V_O3/V_O4$
H	L
L	H
Open	H

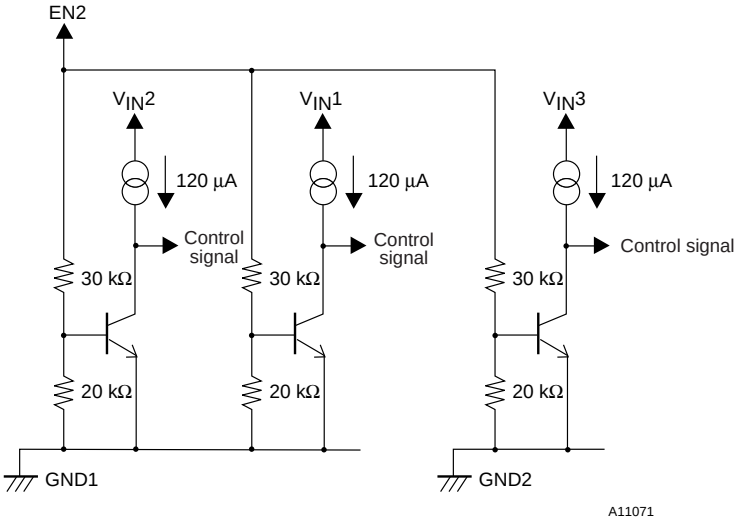
- H and L in the EN column correspond to high and low input voltage levels, respectively.
- H and L in the V_O column correspond to the output on voltage and the output off voltage, respectively.
- The output voltages are controlled independently by the EN lines as follows: EN1 controls VO1, and EN2 controls V_O2, V_O3, and V_O4 in parallel.
- When a given EN is open, the corresponding output will be on.

EN (on/off control) Input Block Equivalent Circuit Block Diagram

V_O1



V_O2, V_O3, V_O4



Usage Notes

- GND1 and GND2 are connected through the IC substrate, and must be connected to the lowest potential in the system and must be connected to identical potentials.
  (The functions and characteristics of this IC are not guaranteed if GND1 and GND2 are connected to different potentials.)
- The rise and fall of the $V_{IN}1$, $V_{IN}2$, and $V_{IN}3$ voltages must be simultaneous, and none of these pins may be either left open or connected to ground.
- If either $V_{IN}1$ or $V_{IN}2$ are open or at a voltage lower than the stipulated voltage, then the V_O1 through V_O4 outputs will be forcibly turned off to protect the IC.
- The output capacitors C_O1 and C_O4 must be at least 100 µF, and C_O2 and C_O3 must be at least 47 µF. Capacitors with low temperature coefficients must be use to prevent oscillation at low temperatures.
- To assure stable operation, the input capacitors $C_{IN}1$ to $C_{IN}3$ and the output capacitors C_O1 to C_O4 must be placed as close to the IC as possible.
- The NC pins (pins 1 and 14) must not be used.
- The output voltage V_O4 can be adjusted by connecting resistors from the CN pin (pin 11) to either V_O4 or to GND2.
  — To lower V_O4: Add resistor RA between CN and V_O4.
  — To raise V_O4: Add resistor RB between CN and GND2.
  Also note that external noise suppression and ripple rejection can be improved by adding an external capacitor at V_O4. However, care is required to assure that the system stability (phase margin) is adequate.
- Note that these power supplies can be influenced by load fluctuations in the other power supplies.

Sample CN Pin Application Circuit