

# HA13168H

## Multiple Voltage Regulator for Car Audio

REJ03F0225-0100

Rev.1.00

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### Description

The HA13168H is a compact multiple voltage regulator for car audio system. The outputs of this IC output consist of regulated 5.7 V output for a microcontroller, regulated 8 V output for CD driver, regulated 9.0 V output for audio control, and regulated 5 V output, VCC-dependent output for external output and VCC-dependent output for remote-ANT.

### Functions

#### General

- ACC power monitor circuit is built-in as to detect low voltage.
- Low saturation output (PNP output) used for audio output.
- A reset signal output for a microcontroller.

#### Protections

- Output current limit circuit to avoid device destruction caused by shorted output, etc.
- High surge input protector against VCC and ACC.
- Built in a thermal shutdown circuit to prevent against the thermal destruction.

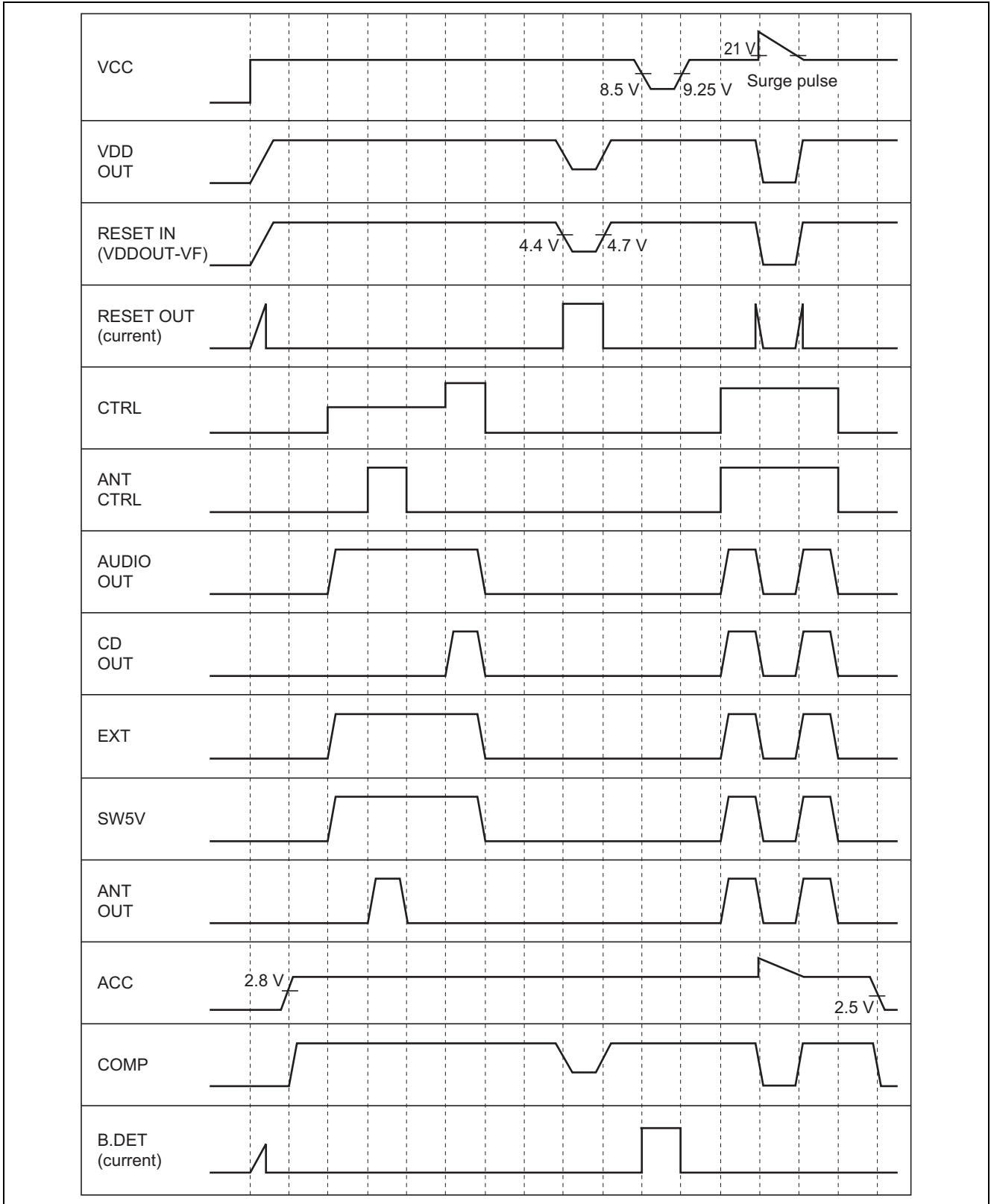
## Pin Description and Equivalent Circuit

Pin No.	Pin Name	Specification	Equivalent Circuit	Function		
				Normal Operation	TSD	Surge Input
1	EXT OUT	VCC-1 V/300 mA min		Output voltage is VCC-1 V when M or H level applied to CTRL pin.	0 V	0 V
2	ANT OUT	VCC-1 V/300 mA min		Output voltage is VCC-1 V when M or H level to CTRL pin and H level to ANT-CTRL.	0 V	0 V
3	ACC IN	—		Connected to ACC.	—	—
4	VDD OUT	5.7 V/100 mA min		Regular 5.7 V.	5.7 V	0 V
5	SW5V OUT	5.0 V/100 mA min		Output voltage is 5 V when M or H level applied to CTRL pin.	0 V	0 V
6	COMP OUT	5.0 V/100 mA min		Output for ACC detector	0 V	0 V
7	ANT CTRL	—		L: ANT output OFF H: ANT output ON	—	—
8	VCC	—		Connected to VCC	—	—

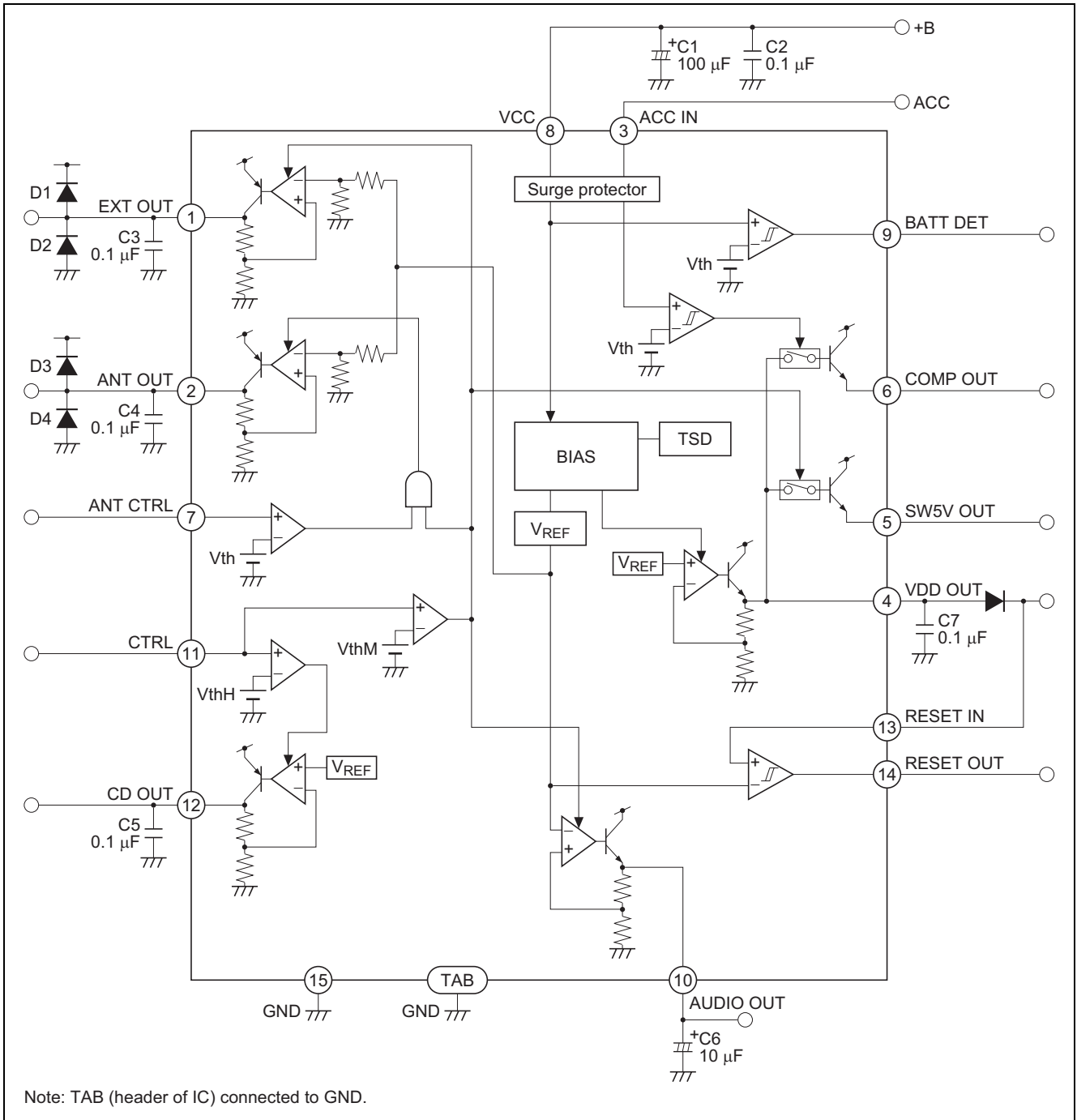
Pin Description and Equivalent Circuit (cont.)

Pin No.	Pin Name	Specification	Equivalent Circuit	Function		
				Normal Operation	TSD	Surge Input
9	BAT DET	—		Low battery detects. Active "L"	Detect	Not detect
10	AUDIO OUT	9.0 V/250 mA min		Output voltage is 9 V when M or H level applied to CTRL pin.	0 V	0 V
11	CTRL	—		L: BIAS OFF M: BIAS ON H: CD ON	—	—
12	CD OUT	8.0 V/1.3 A min		Output voltage is 8 V when H level applied to CTRL pin.	0 V	0 V
13	RESET IN	—		Connected to power supply of microcontroller	—	—
14	RESET OUT	1 mA min		A reset signal output: active "L"	Detect	—
15	GND	—		Connected to GND	—	—

Timing Chart



Block Diagram



## External Parts Lineup

Parts No.	Function	Range of Recommended	Operation with Different Value from the Range of Recommended Value	
			More than the Range	Less than the Range
C1	Bypass capacitor (Chemical capacitor)	Upper 100 $\mu\text{F}$	—	Unstable Lower ripple rejection ratio
C2	To prevent oscillation For stability of IC, this capacitor is inserted near the power supply pin of the IC. We recommend Polyester film capacitor. * <sup>1</sup>	0.1 $\mu\text{F}$	Stability improve	Unstable
C3 C4	To prevent oscillation * <sup>2</sup>	0.1 to 10000 $\mu\text{F}$	Unconfirmed	Unstable
C5 C7	To prevent oscillation * <sup>2</sup>	0.1 to 470 $\mu\text{F}$	Unconfirmed	Unstable
C6	To prevent oscillation	10 to 470 $\mu\text{F}$ (ESR = 0.1 to 2 $\Omega$ )	Unconfirmed	Unstable
D1, D2, D3, D4	Protection against mistake in joining. Terminal protection for short circuit to +B when VCC terminal is open and for short circuit to GND when GND terminal is open. We recommend Schottky barrier diodes.	$I_F \geq 1 \text{ A}$	The ability to protect terminal improve.	The ability to protect terminal lower. And there is some possibility of destruction.

Notes: 1. To improve stability, take notes of the below precautions.

- (1) Use capacitor that is temperature independent.
- (2) Use capacitor that is bias voltage independent.
- (3) No secondary resonance (non-inductive) capacitor.

And, pay attention to the following points so that there can be an efficient bypass of high frequency noise.

- (1) To eliminate PCB pattern inductance mount the capacitor as close as possible to the VCC and GND of IC.
2. For using of the lower limit of recommended value, take notes of the below precautions.
    - (1) Use capacitor that is temperature independent.
    - (2) Use capacitor that is bias voltage independent.
    - (3) No secondary resonance (non-inductive) capacitor.
  3. To eliminate PCB pattern inductance mount the capacitor as close as possible to the VCC and GND of IC about C3, C4, C5, C6 and C7.

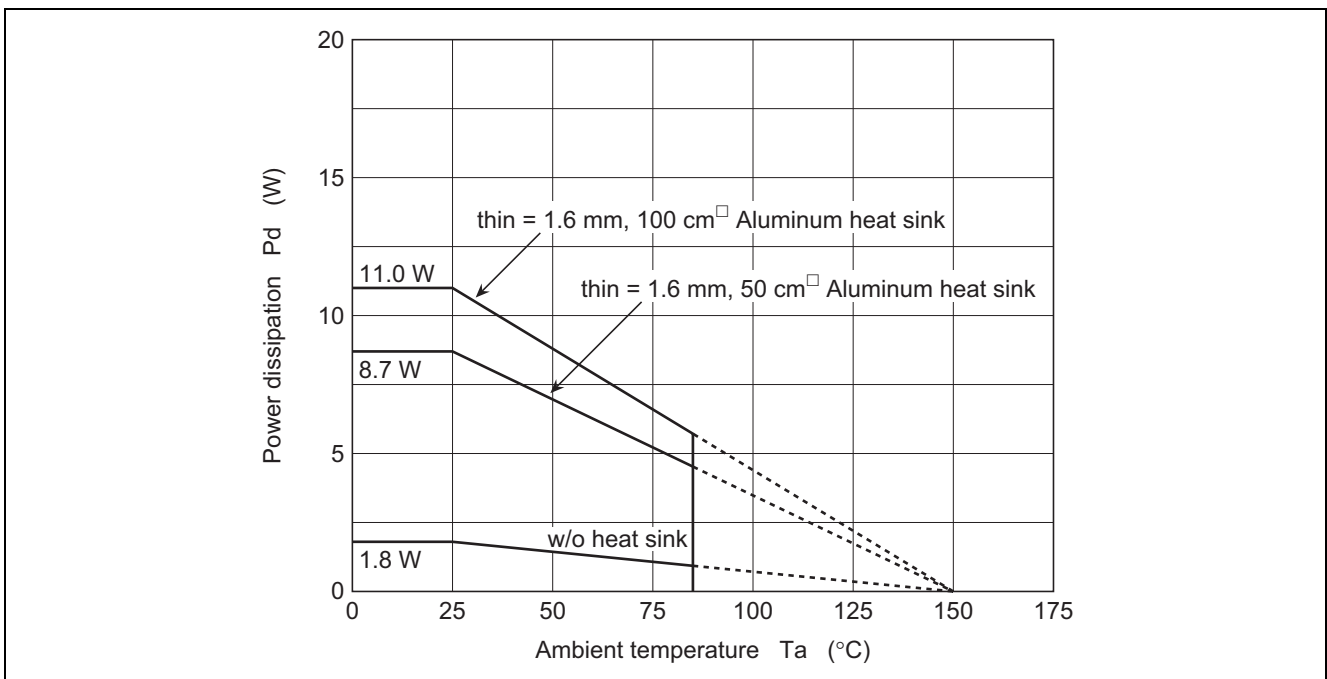
### Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Operating power supply voltage	Vcc	18	V	
DC supply voltage	Vcc(DC)	26	V	1
Peak voltage	Vcc(PEAK)	50	V	2
Power dissipation	Pd	36	W	3
Junction temperature	Tj	150	°C	
Operating temperature	Topr	-40 to +85	°C	
Storage temperature	Tstg	-55 to +125	°C	

Notes: Recommended power supply voltage range 10 to 16 V.

1. Applied time is less than 30 s.
2. Surge pulse as input.
3. Ta = 25°C. : Permissible power dissipation when using a heat sink of infinite area. Refer to the derating curves below.



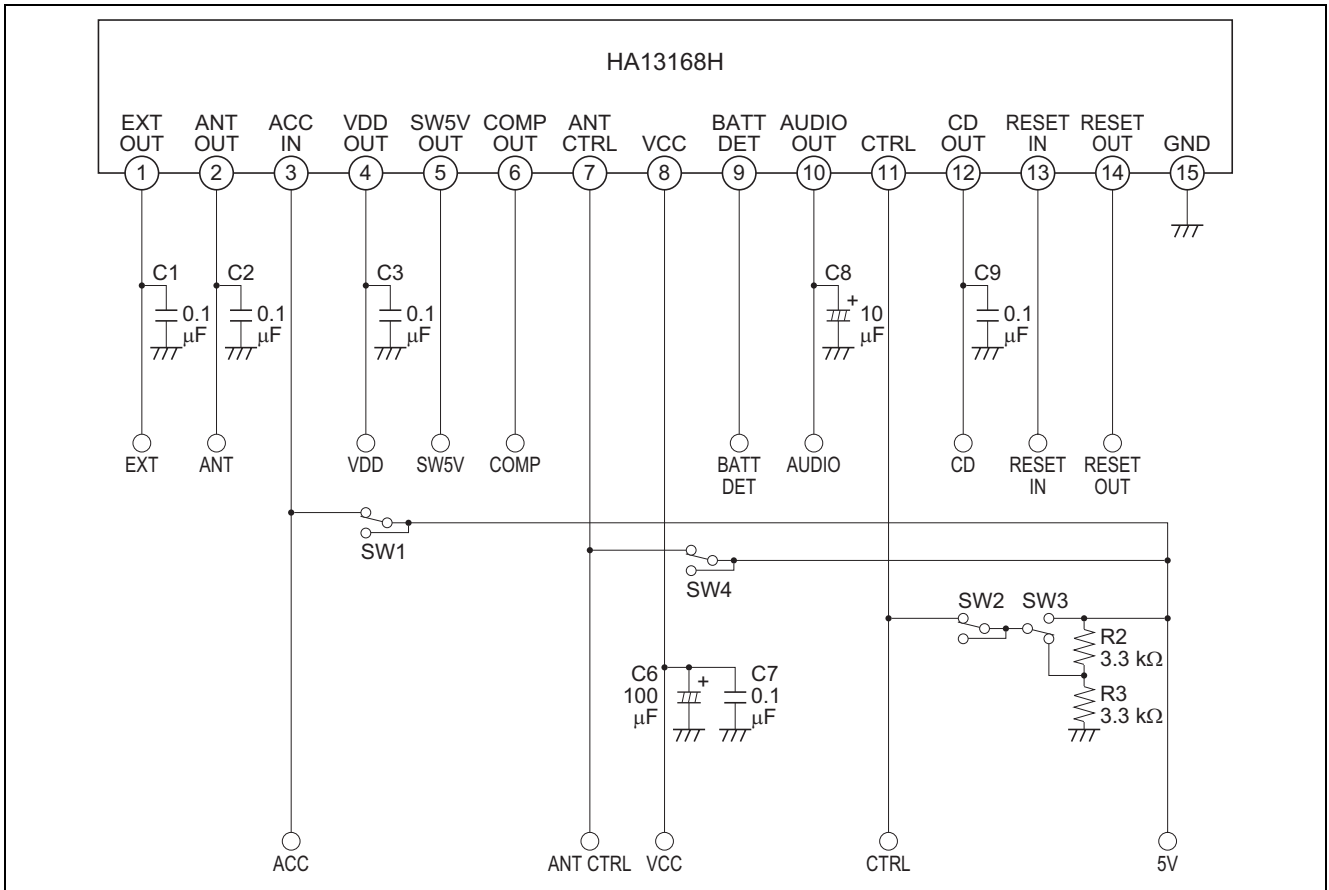
## Electrical Characteristics

(unless otherwise noted,  $V_{CC} = 13.2\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Item	Symbol	Min	Typ	Max	Unit	Test Condition	
Standby current	IST	—	460	700	$\mu\text{A}$	ACC = 0 V, CTRL = 0 V	
CTRL L level (STBY mode)	VCL	0	—	1.0	V		
CTRL M level (CD OFF mode)	VCM	2.0	—	3.0	V		
CTRL H level (CD ON mode)	VCH	4.0	—	—	V		
ANT CTRL L level (ANT OFF mode)	VACL	0	—	2.0	V		
ANT CTRL H level (ANT ON mode)	VACH	3.0	—	—	V		
VDD OUT	Output voltage	Vo1	5.4	5.7	6.0	V	Io1 = 80 mA
	Voltage regulation	$\Delta\text{Vo}11$	—	10	50	mV	$V_{CC} = 10$ to 16 V, Io1 = 80 mA
	Load regulation	$\Delta\text{Vo}12$	—	50	100	mV	Io1 = 0 to 80 mA
	Minimum I/O voltage differential	$\Delta\text{Vo}13$	—	1.0	1.5	V	Io1 = 80 mA
	Output current capacity	Io1	100	250	—	mA	Vo1 $\geq$ 5.4 V
	Ripple rejection ratio	SVR1	50	60	—	dB	f = 100 Hz, Io1 = 80 mA
CD OUT	Output voltage	Vo2	7.6	8.0	8.4	V	Io2 = 1.0 A
	Voltage regulation	$\Delta\text{Vo}21$	—	40	100	mV	$V_{CC} = 10$ to 16V, Io2 = 1.0 A
	Load regulation	$\Delta\text{Vo}22$	—	70	150	mV	Io2 = 10m to 1.0 A
	Minimum I/O voltage differential	$\Delta\text{Vo}23$	—	1.0	1.5	V	Io2 = 1.0 A
	Output current capacity	Io2	1.3	2.0	—	A	Vo2 $\geq$ 7.6 V
	Ripple rejection ratio	SVR2	45	50	—	dB	f = 100 Hz, Io2 = 1.0 A
AUDIO OUT	Output voltage	Vo3	8.5	9.0	9.5	V	Io3 = 160 mA
	Voltage regulation	$\Delta\text{Vo}31$	—	30	90	mV	$V_{CC} = 10$ to 16 V, Io3 = 160 mA
	Load regulation	$\Delta\text{Vo}32$	—	100	200	mV	Io3 = 10 to 160 mA
	Minimum I/O voltage differential	$\Delta\text{Vo}33$	—	0.4	0.9	V	Io3 = 160 mA
	Output current capacity	Io3	250	350	—	mA	Vo3 $\geq$ 8.5 V
	Ripple rejection ratio	SVR3	40	50	—	dB	f = 100 Hz, Io3 = 160 mA
EXT OUT	Differential I/O voltage	$\Delta\text{Vo}41$	—	1.0	1.5	V	Io4 = 300 mA
	Load regulation	$\Delta\text{Vo}42$	—	350	600	mV	Io4 = 10 to 300 mA
	Output current capacity	Io4	300	500	—	mA	Vo4 $\geq$ 11.7 V
ANT OUT	Differential I/O voltage	$\Delta\text{Vo}51$	—	1.0	1.5	V	Io5 = 300 mA
	Load regulation	$\Delta\text{Vo}52$	—	350	600	mV	Io5 = 10 to 300 mA
	Output current capacity	Io5	300	500	—	mA	Vo5 $\geq$ 11.7 V
SW5V OUT	Output voltage	Vo6	4.6	5.0	5.4	V	Io6 = 80 mA, VDD = no load
	Output current capacity	Io6	100	300	—	mA	Vo6 $\geq$ 4.6 V
ACC OUT	Output voltage	Vo7	4.6	5.0	5.4	V	Io7 = 40 mA, VDD = no load
	Output current capacity	Io7	100	300	—	mA	Vo7 $\geq$ 4.6 V
	Rise threshold voltage	VTHH7	2.6	2.8	3.0	V	
	Hysteresis range	$\Delta\text{VTH}7$	0.2	0.3	0.4	V	
BATT. DET	Threshold voltage	VTHH8	8.1	8.5	8.9	V	
	Hysteresis range	$\Delta\text{VTH}8$	0.55	0.75	0.95	V	
	Output current capacity	Io8	200	—	—	$\mu\text{A}$	Vo = 0.3 V
RESET	Threshold voltage	VTHH9	4.2	4.4	4.6	V	
	Hysteresis range	$\Delta\text{VTH}9$	0.15	0.3	0.45	V	
	Output current capacity	Io9	1.0	2.5	—	mA	Vo = 0.5 V
	Reset circuit current	Icc9	—	100	180	$\mu\text{A}$	Reset in = 5.0 V



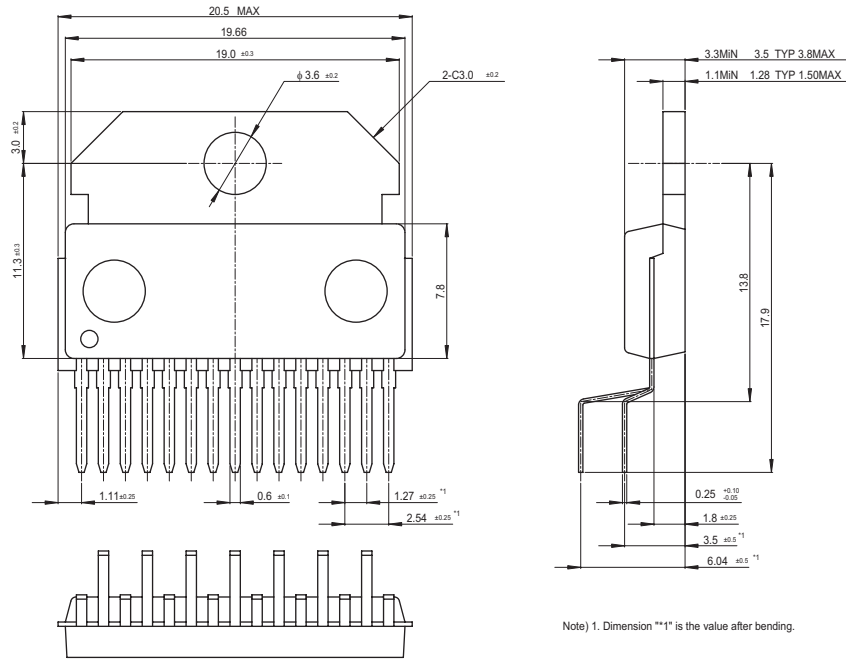
Evaluation Circuit



Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-HSIP15-14.3x19.66-1.27	PRSS0015DA-C	SP-15TGV	3.0g

Unit : mm



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