To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HA13164A

Multiple Voltage Regulator

ADE-207-342 (Z)

Rev.0
Jun. 2001

General Description

The HA13164A 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, regulated 10 V output for illuminations and regulated 5 V output, VCC-dependent output for external output and VCC-dependent output for remort-ANT.

Functions

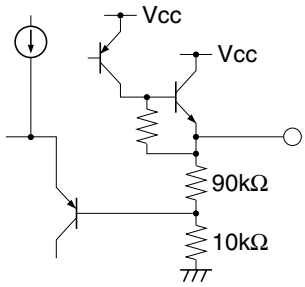
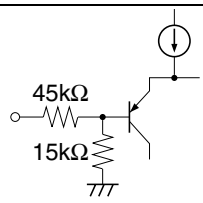
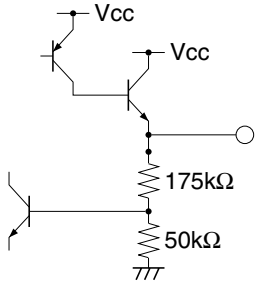
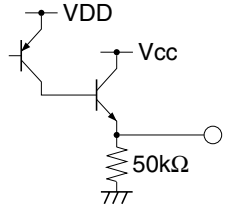
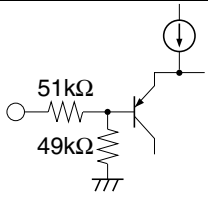
General

- ACC power monitor circuit is built-in as to detect low voltage.
- Low saturation output (PNP output) used for audio output.
- Adjustable voltage for illumination output by changing an external resister.

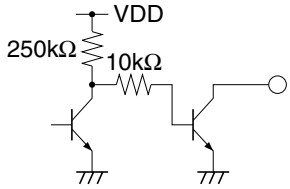
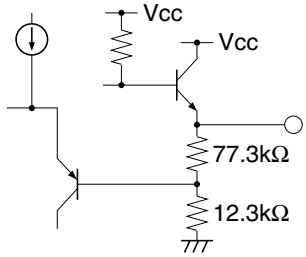
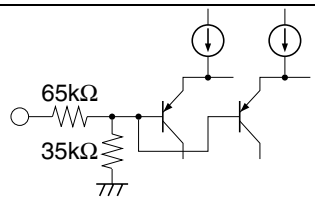
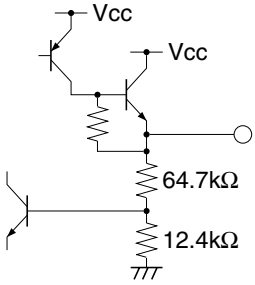
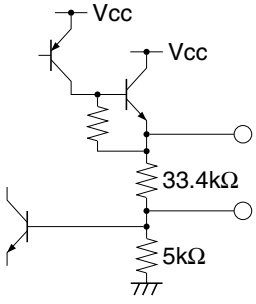
Protections

- 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.

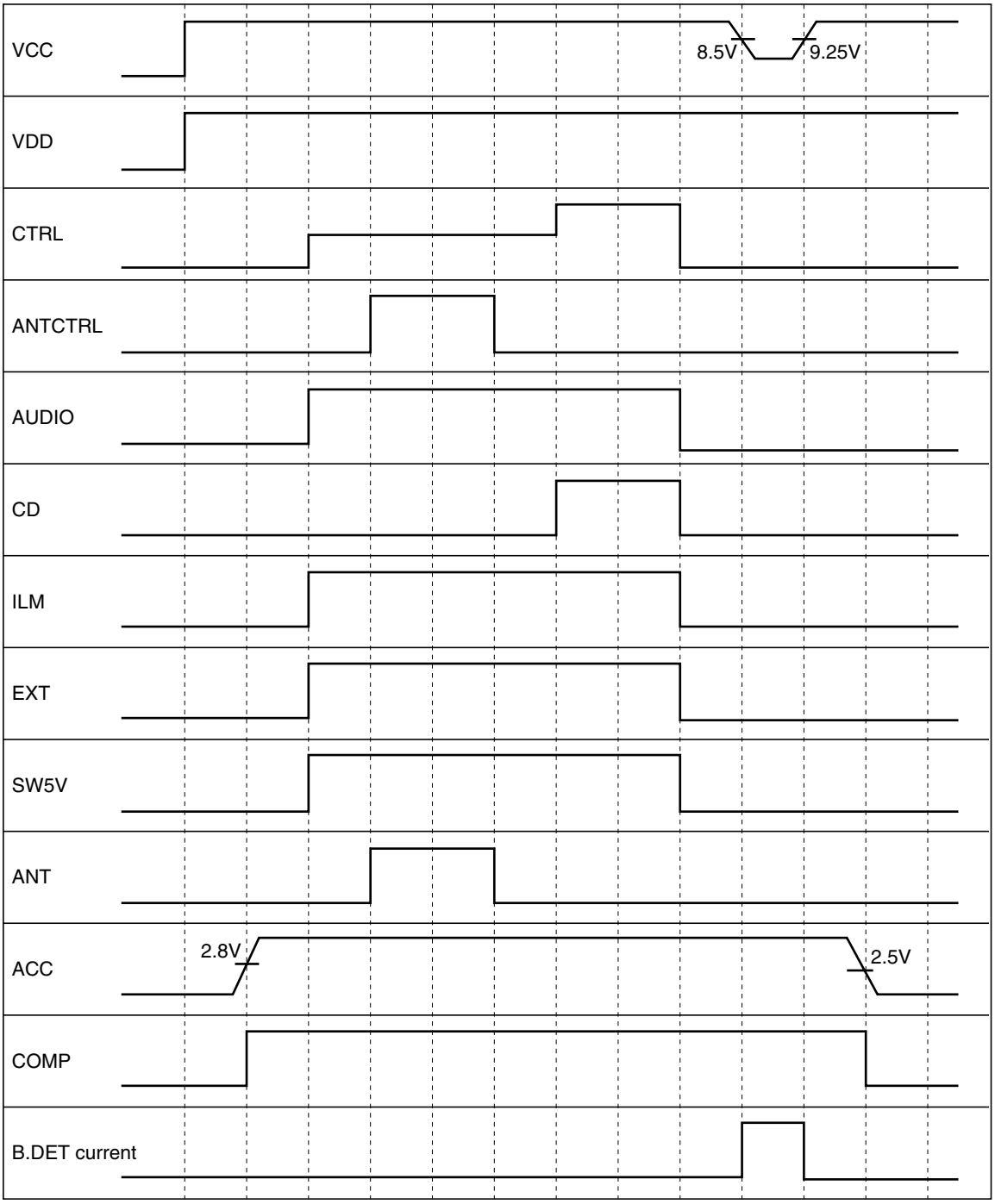
Pin Description and Equivalent Circuit

Pin No.	Pin Name	Specification	Equivalent Circuit	Function: Normal Operation	Function: TSD	Function: Surge Input
1	EXT OUT	VCC-1V/300mA min		Output voltage is VCC-1 V when M or H level applied to CTRL pin.	0V	0V
2	ANT OUT	VCC-1V/300mA min		Output voltage is VCC-1 V when M or H level to CTRL pin and H level to ANT-CTRL.	0V	0V
3	ACCIN	—		Connected to ACC.	—	—
4	VDD OUT	5.7V/100mA min		Regular 5.7V.	5.7V	0V
5	SW5VOUT	5.0V/100mA min		Output voltage is 5V when M or H level applied to CTRL pin.	0V	0V
6	COMPOUT	5.0V/100mA min		Output for ACC detector	0V	0V
7	ANT CTRL	—		L: ANT output OFF H: ANT output ON	—	—

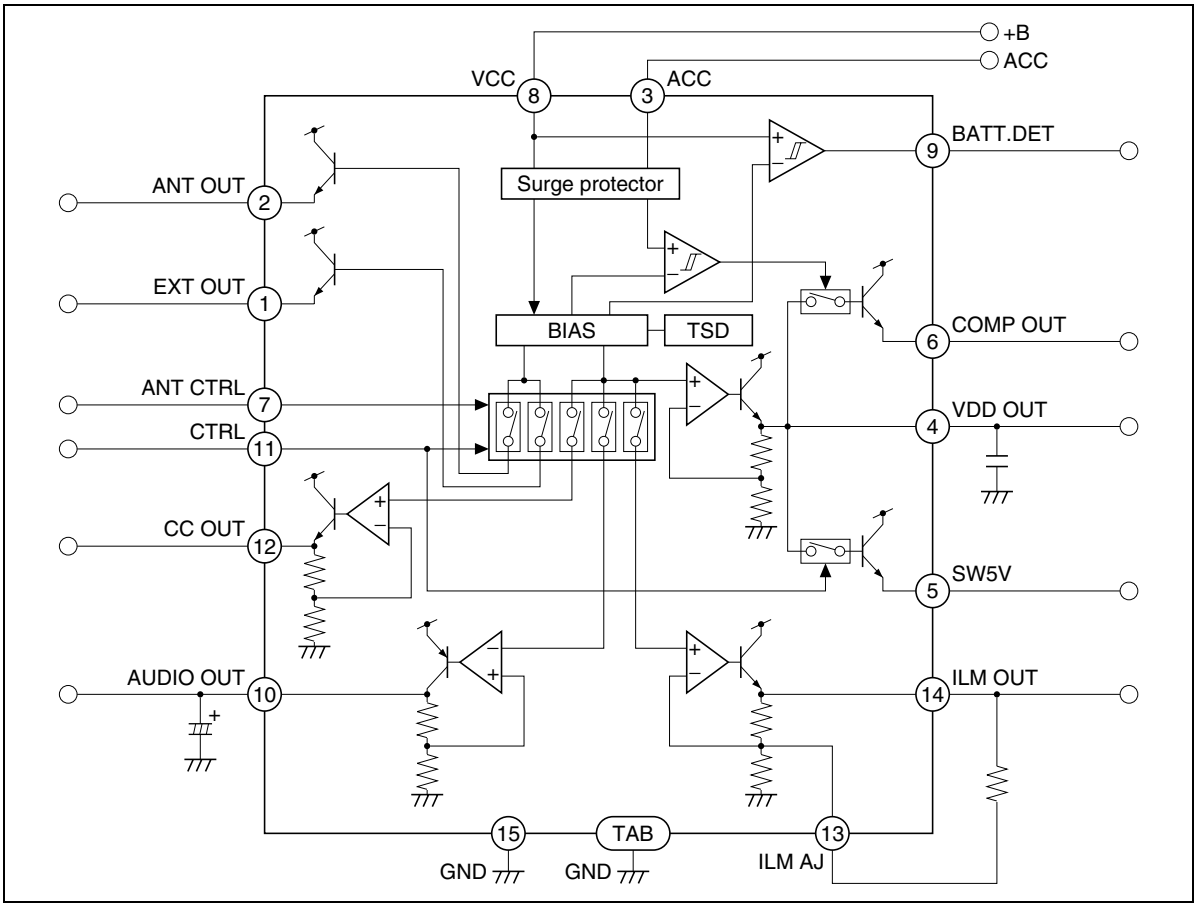
Pin Description and Equivalent Circuit (cont)

Pin No.	Pin Name	Specification	Equivalent Circuit	Function: Normal Operation	Function: TSD	Function: Surge Input
8	VCC	—		Connected to VCC	—	—
9	BATT DET	—		Low battery detect.	Detect	Not detect
10	AUDIOOUT	9.0V/500mA min		Output voltage is 9V when M or H level applied to CTRL pin.	0V	0V
11	CTRL	—		L: BIAS OFF M: BIAS ON H: CD ON	—	—
12	CD OUT	8.0V/1.3A min		Output voltage is 8V when H level applied to CTRL pin.	0V	0V
13	ILM AJ	—		Adjustment pin for ILM output voltage.	—	—
14	ILM OUT	9.85V/500mA min		Output voltage is 10V when M or H level applied to CTRL pin	0V	0V
15	GND	—		Connected to GND	—	—

Timing Chart



Block Diagram



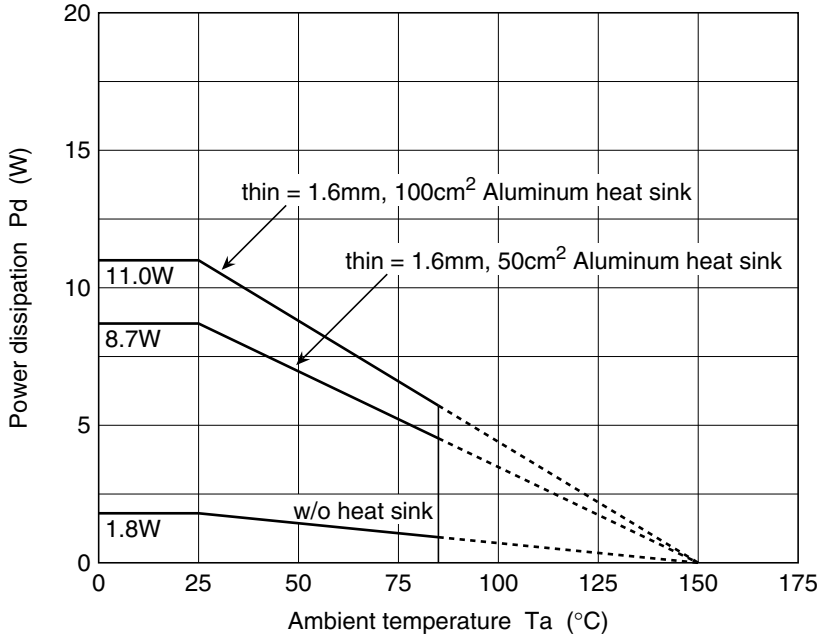
Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Value	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 10V to 16V.

1. Applied time is less than 30 sec.
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, Vcc = 13.2 V, Ta = 25°C)

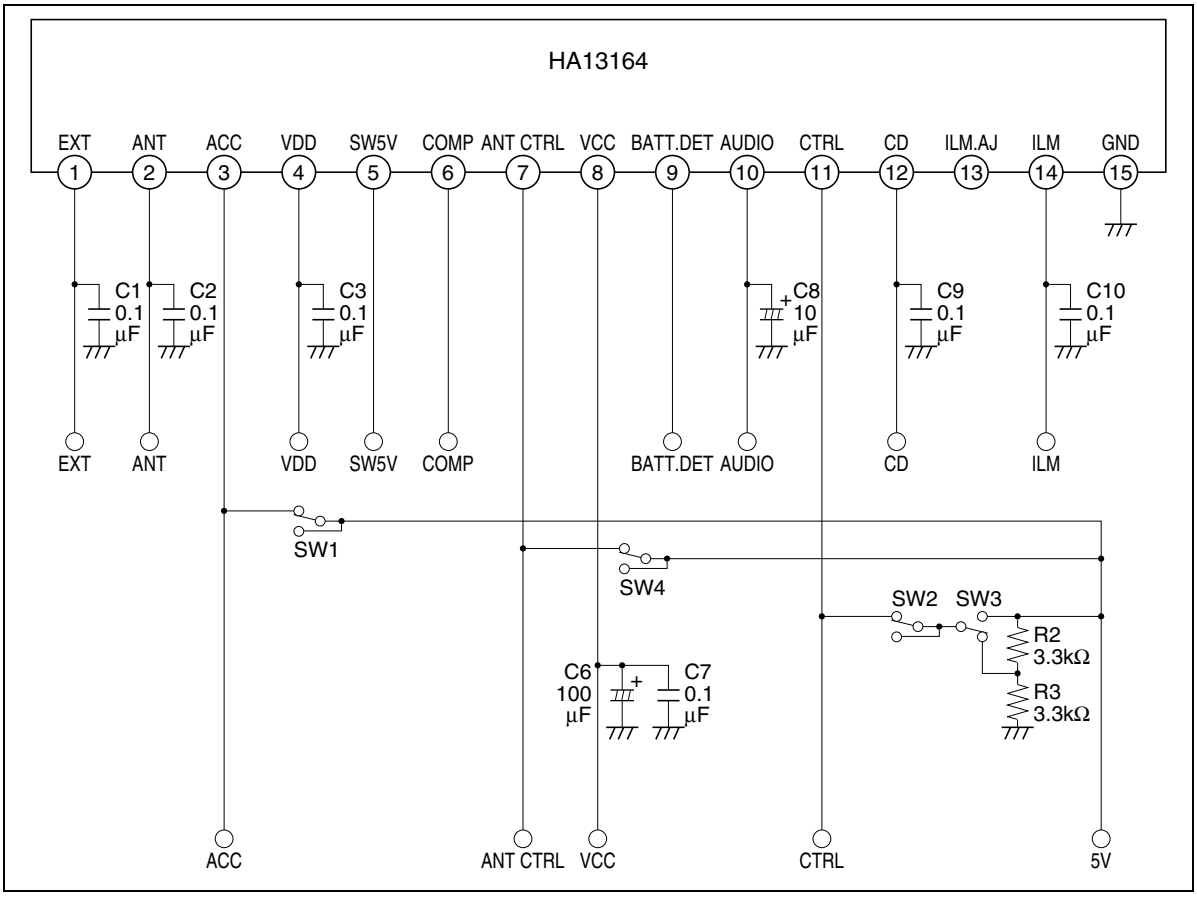
Item		Symbol	Min	Typ	Max	Unit	Test Condition
Standby current		IST	—	460	700	µA	ACC = 0V, CTRL = 0V
CTRL L level (STBY mode)		VCL	0	—	1.0	V	
CTRL M level (CD OFF mode)		VCM	2.0	—	3.0	V	
CTRL H level (CD ON mode)		VCH	4.0	—	—	V	
ANT CTRL L level (ANTOFF mode)		VACL	0	—	2.0	V	
ANT CTRL H level (ANT ON mode)		VACH	3.0	—	—	V	
VDD OUT	Output voltage	Vo1	5.4	5.7	6.0	V	Io1 = 80mA
	Voltage regulation	ΔVo11	—	10	50	mV	Vcc = 10 to 16V, Io1 = 80mA
	Load regulation	ΔVo12	—	50	100	mV	Io1 = 0 to 80mA
	Minimum I/O voltage differential	ΔVo13	—	1.0	1.5	V	Io1 = 80mA
	Output current capacity	Io1	100	250	—	mA	Vo1 ≥ 5.4V
	Ripple rejection ratio	SVR1	50	60	—	dB	f = 100Hz, Io1 = 80mA
CD OUT	Output voltage 2	Vo2	7.6	8.0	8.4	V	Io2 = 1.0A
	Voltage regulation	ΔVo21	—	40	100	mV	Vcc = 10 to 16V, Io2 = 1.0A
	Load regulation	ΔVo22	—	70	150	mV	Io2 = 10m to 1.0A
	Minimum I/O voltage differential	ΔVo23	—	1.0	1.5	V	Io2 = 1.0A
	Output current capacity	Io2	1.3	2.0	—	A	Vo2 ≥ 7.6V
	Ripple rejection ratio	SVR2	40	45	—	dB	f = 100Hz, Io2 = 1.0A
AUDIO OUT	Output voltage 3	Vo3	8.5	9.0	9.5	V	Io3 = 400mA
	Voltage regulation	ΔVo31	—	30	90	mV	Vcc = 10 to 16V, Io3 = 400mA
	Load regulation	ΔVo32	—	100	200	mV	Io3 = 10 to 400mA
	Minimum I/O voltage differential	ΔVo33	—	0.4	0.9	V	Io3 = 400mA
	Output current capacity	Io3	500	850	—	mA	Vo3 ≥ 8.5V
	Ripple rejection ratio	SVR3	45	50	—	dB	f = 100Hz, Io3 = 400mA
ILM OUT	Output voltage 4	Vo4	9.35	9.85	10.35	V	Io4 = 400mA
	Voltage regulation	ΔVo41	—	40	100	mV	Vcc = 12.5 to 16V, Io4 = 400mA
	Load regulation	ΔVo42	—	50	100	mV	Io4 = 10 to 400mA
	Minimum I/O voltage differential	ΔVo43	—	1.0	1.5	V	Io4 = 400mA
	Output current capacity	Io4	500	900	—	mA	Vo4 ≥ 9.35V
	Ripple rejection ratio	SVR4	35	40	—	dB	f = 100Hz, Io4 = 400mA
EXT12 OUT	Differential I/O voltage	ΔVo51	—	1.0	1.5	V	Io5 = 300mA
	Load regulation	ΔVo52	—	350	600	mV	Io5 = 10 to 300mA
	Output current capacity	Io5	300	500	—	mA	Vo5 ≥ 11.7V

Electrical Characteristics (cont)

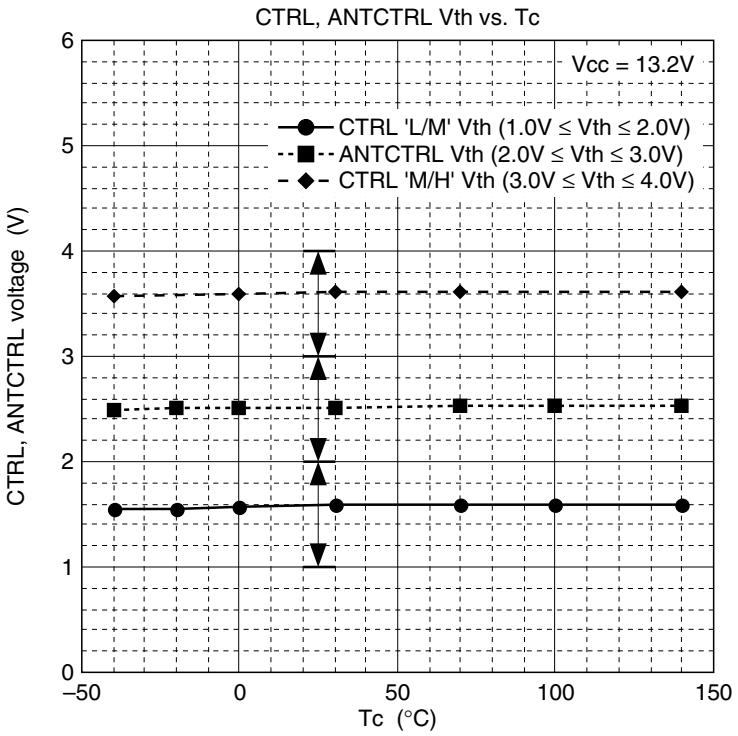
(unless otherwise noted, Vcc = 13.2 V, Ta = 25°C)

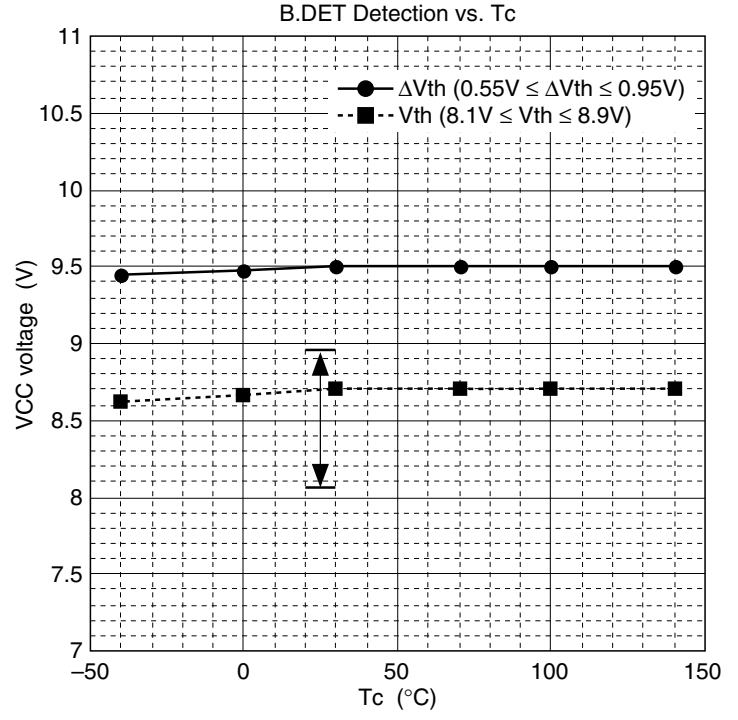
Item		Symbol	Min	Typ	Max	Unit	Test Condition
ANT OUT	Differential I/O voltage	ΔVo61	—	1.0	1.5	V	Io6 = 300mA
	Load regulation	ΔVo62	—	350	600	mV	Io6 = 10 to 300mA
	Output current capacity	Io6	300	500	—	mA	Vo6 ≥ 11.7V
SW5V OUT	Output voltage	Vo7	4.6	5.0	5.4	V	Io7 = 80mA, VDD = no load
	Output current capacity	Io7	100	300	—	mA	Vo7 ≥ 4.6V
ACC OUT	Output voltage	Vo8	4.6	5.0	5.4	V	Io8 = 40mA, VDD = no load
	Output current capacity	Io8	100	300	—	mA	Vo8 ≥ 4.6V
	Rise threshold voltage	VTHH8	2.6	2.8	3.0	V	
	Hysteresis range	ΔVTH8	0.2	0.3	0.4	V	
BATT. DET	Threshold voltage	VTHH9	8.1	8.5	8.9	V	
	Hysteresis range	ΔVTH9	0.55	0.75	0.95	V	
	Output current capacity	Io9	200	—	—	μA	Vo = 0.3V

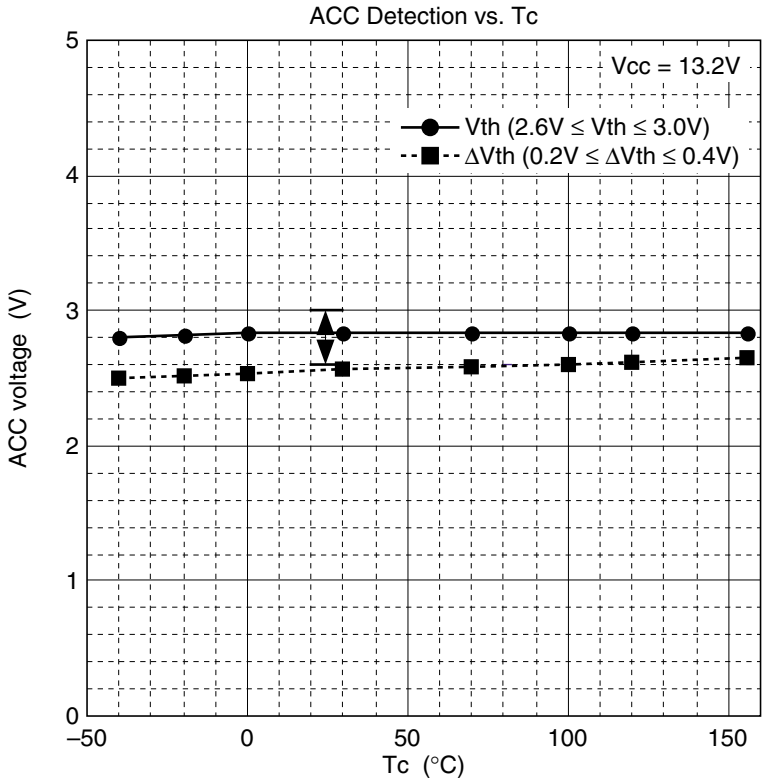
Evaluation Circuit

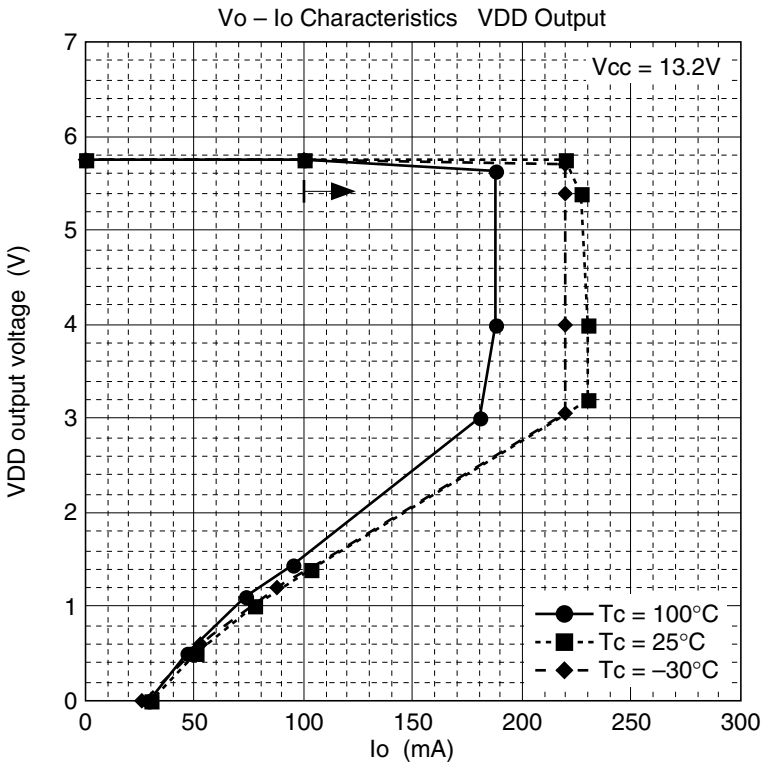


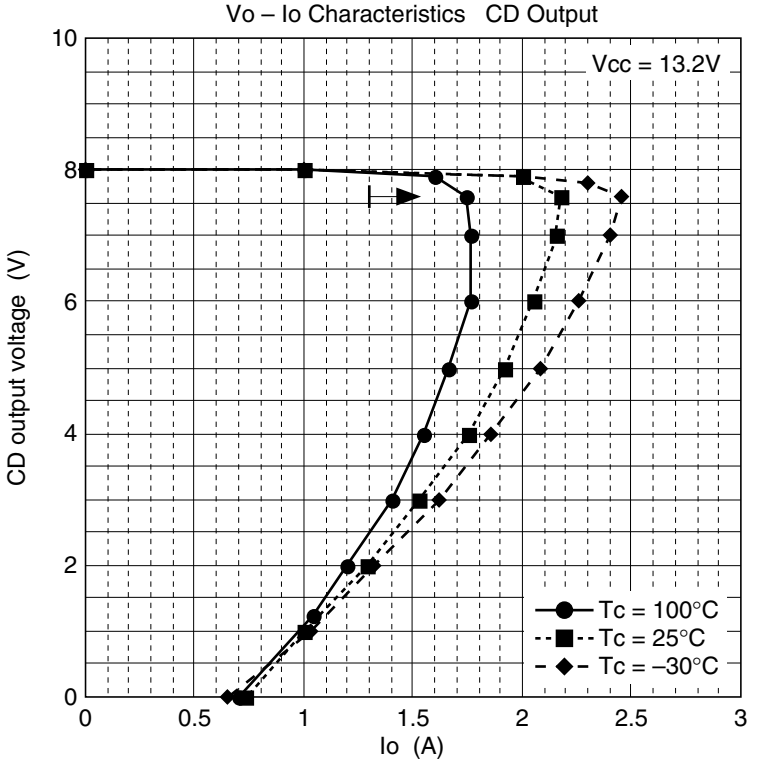
Main Characteristic

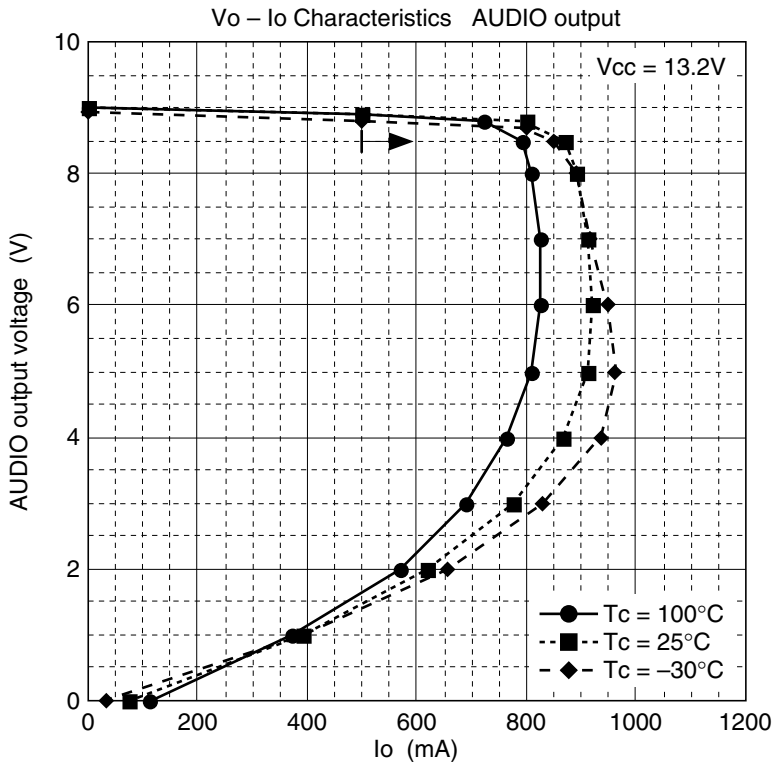


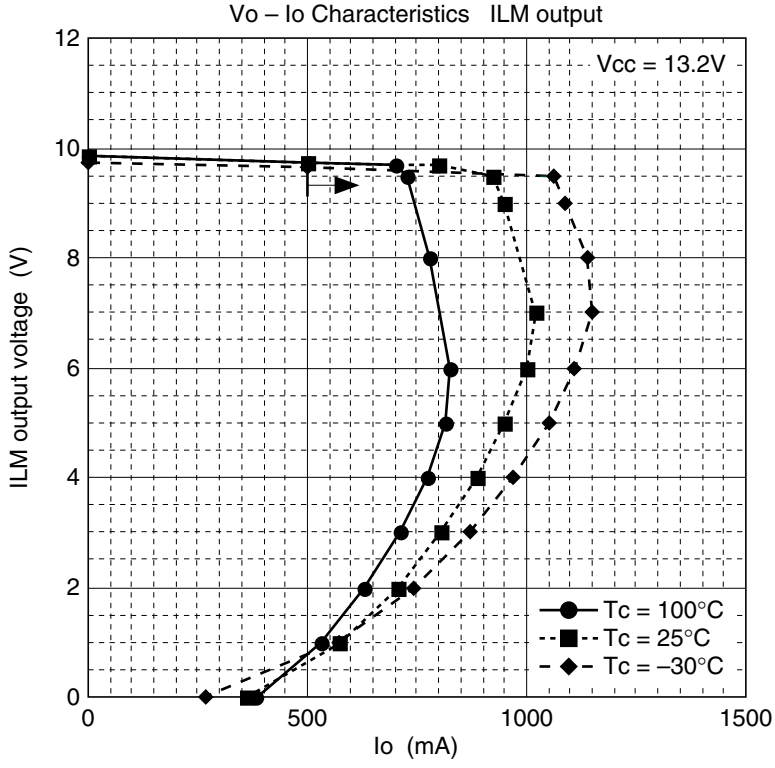



ACC Detection vs. Tc
Vcc = 13.2V
Vth (2.6V ≤ Vth ≤ 3.0V)
ΔVth (0.2V ≤ ΔVth ≤ 0.4V)
ACC voltage (V)
Tc (°C)
0
1
2
3
4
5
–50
0
50
100
150

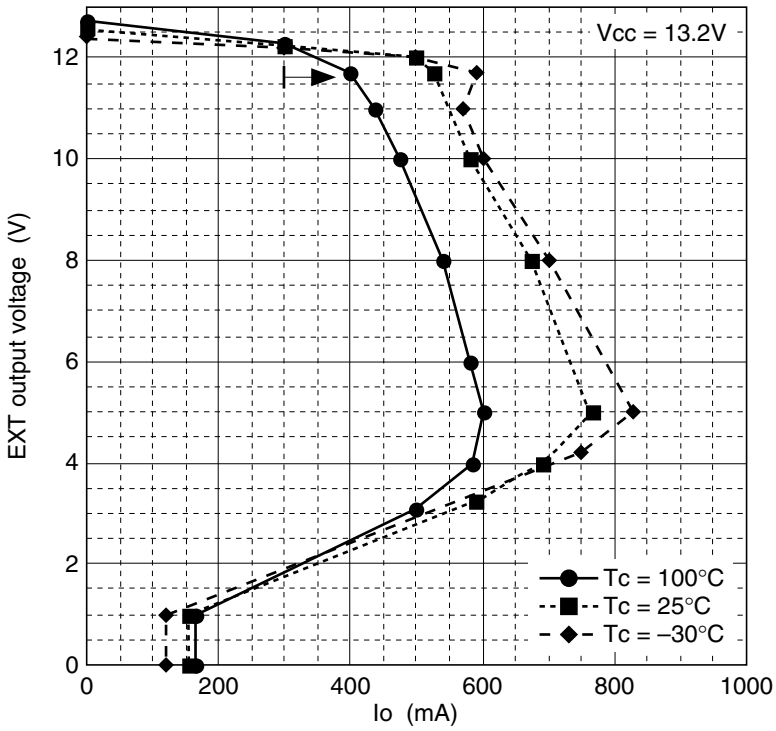

Vo – Io Characteristics VDD Output
Vcc = 13.2V
VDD output voltage (V)
Io (mA)
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
Tc = 100°C
Tc = 25°C
Tc = –30°C


Vo – Io Characteristics CD Output
Vcc = 13.2V
CD output voltage (V)
Io (A)
0
2
4
6
8
10
0
0.5
1
1.5
2
2.5
3
Tc = 100°C
Tc = 25°C
Tc = –30°C

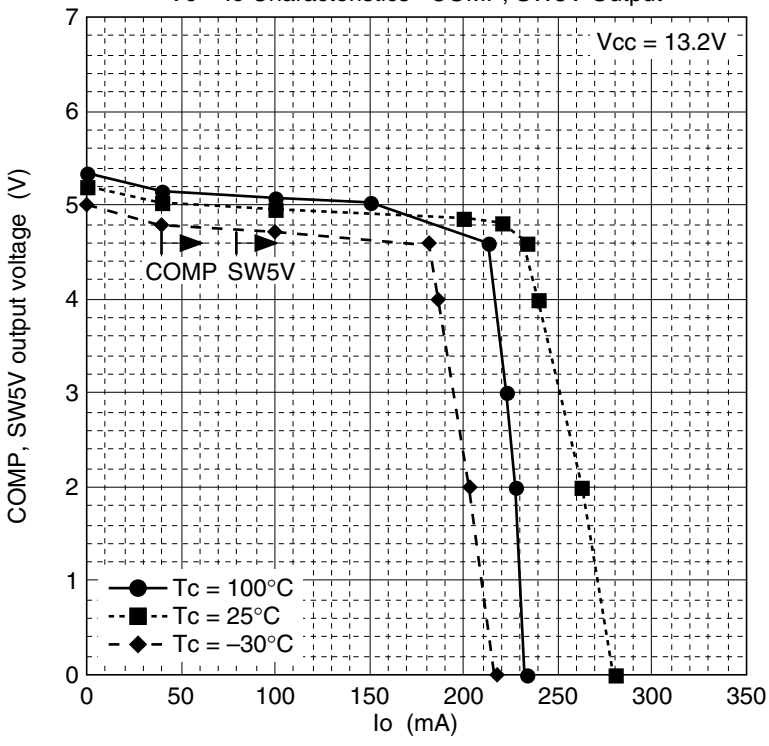

Vo – Io Characteristics AUDIO output
Vcc = 13.2V
AUDIO output voltage (V)
Io (mA)
Tc = 100°C
Tc = 25°C
Tc = –30°C
0
2
4
6
8
10
0
200
400
600
800
1000
1200

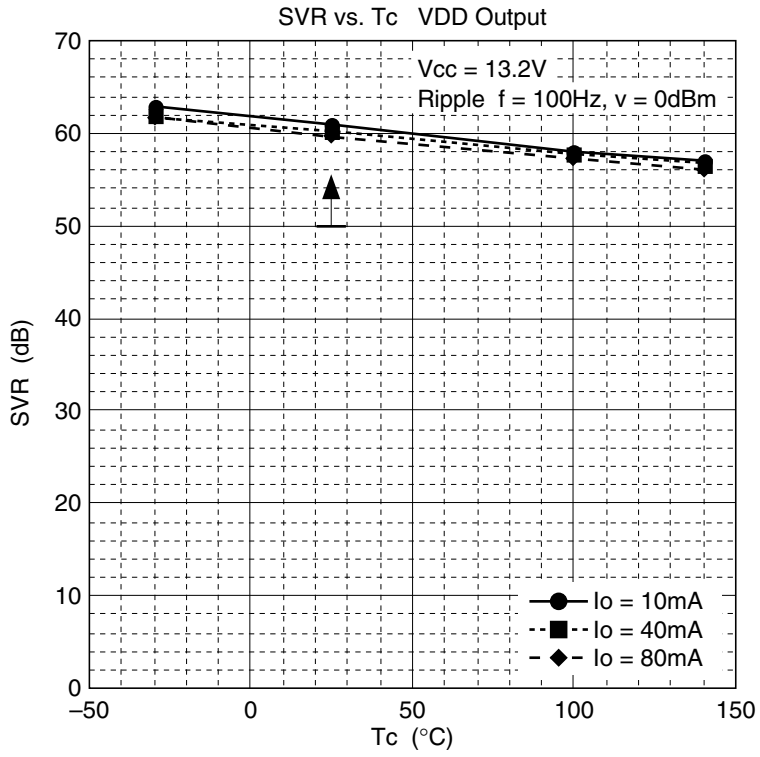

Vo – Io Characteristics ILM output
Vcc = 13.2V
ILM output voltage (V)
Io (mA)
Tc = 100°C
Tc = 25°C
Tc = –30°C
0
2
4
6
8
10
12
0
500
1000
1500

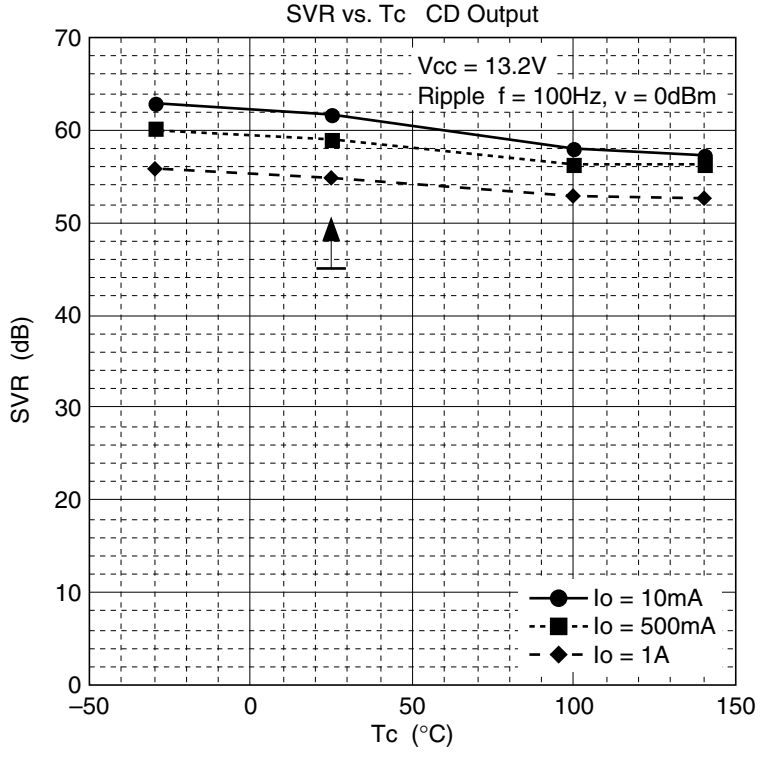
Vo – Io Characteristics EXT, ANT Output

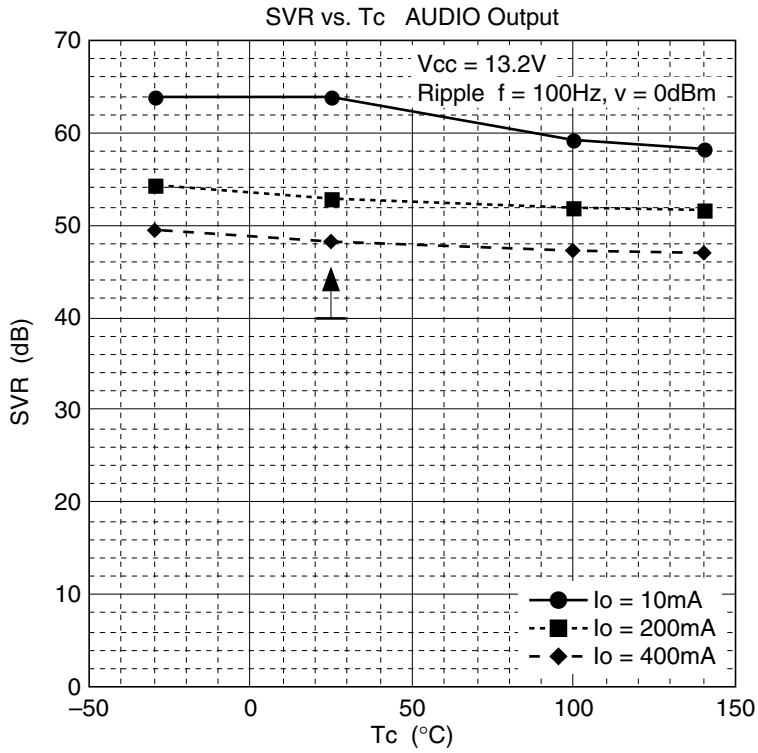


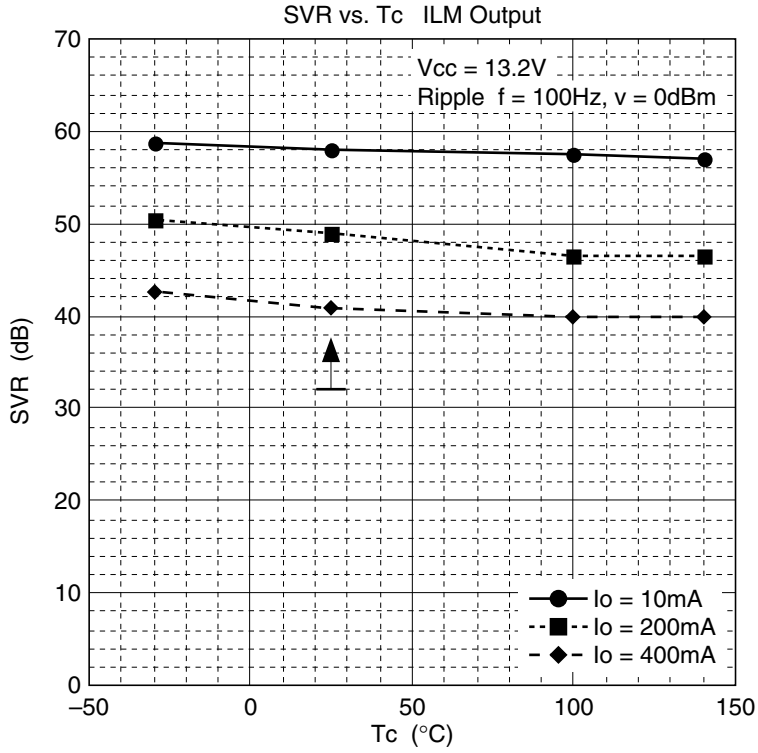
Vo – Io Characteristics COMP, SW5V Output




SVR vs. Tc VDD Output
Vcc = 13.2V
Ripple f = 100Hz, v = 0dBm
Io = 10mA
Io = 40mA
Io = 80mA
SVR (dB)
Tc (°C)
70
60
50
40
30
20
10
0
–50
0
50
100
150

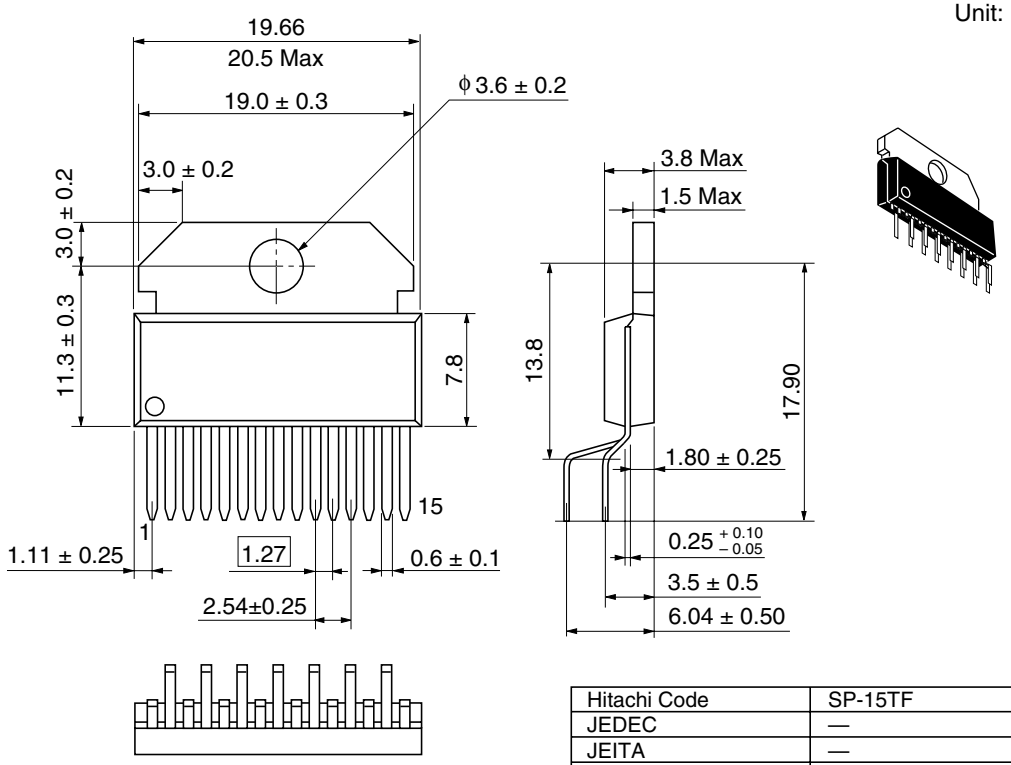

SVR vs. Tc CD Output
Vcc = 13.2V
Ripple f = 100Hz, v = 0dBm
Io = 10mA
Io = 500mA
Io = 1A
SVR (dB)
Tc (°C)
70
60
50
40
30
20
10
0
–50
0
50
100
150


SVR vs. Tc AUDIO Output
Vcc = 13.2V
Ripple f = 100Hz, v = 0dBm
SVR (dB)
Tc (°C)
Io = 10mA
Io = 200mA
Io = 400mA
70
60
50
40
30
20
10
0
–50
0
50
100
150


SVR vs. Tc ILM Output
Vcc = 13.2V
Ripple f = 100Hz, v = 0dBm
SVR (dB)
Tc (°C)
Io = 10mA
Io = 200mA
Io = 400mA
70
60
50
40
30
20
10
0
–50
0
50
100
150

Package Dimensions

Unit: mm



Hitachi Code	SP-15TF
JEDEC	—
JEITA	—
Weight (reference value)	3.10 g

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