

HA11560FP

VCR/VDP RF Modulator

This chip is designed for application as an RF modulator in VCRs and VDPs. A new type RF oscillator provides superior harmonic characteristics.

Functions

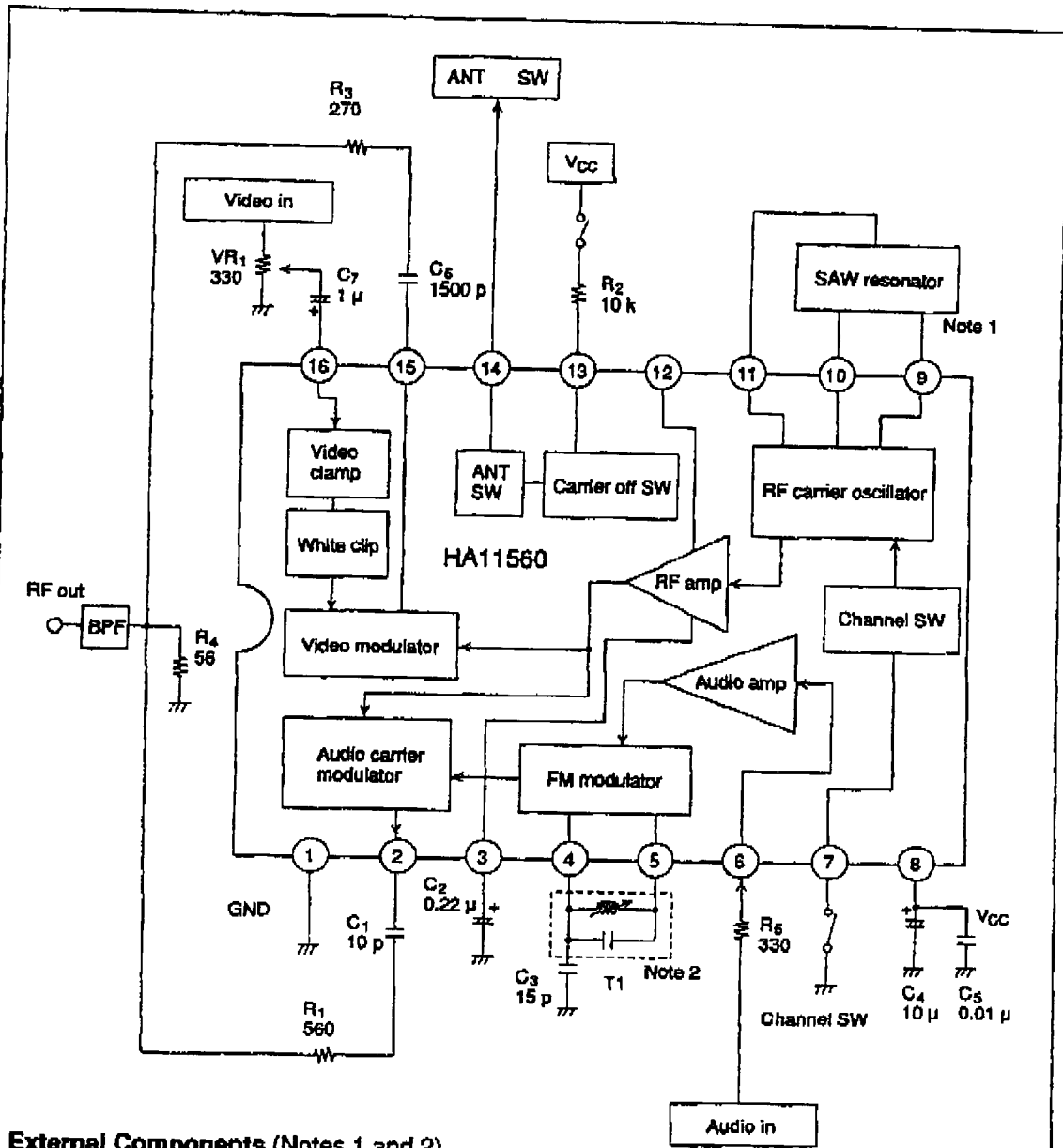
- Video modulator
- RF carrier oscillator
- White clip
- Channel switch
- Audio carrier converter
- ANT switch driver
- Carrier off switch

Features

- Superior harmonic characteristics allow easy pattern design.
- Sharp white chip characteristics with no distortion

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Block Diagram



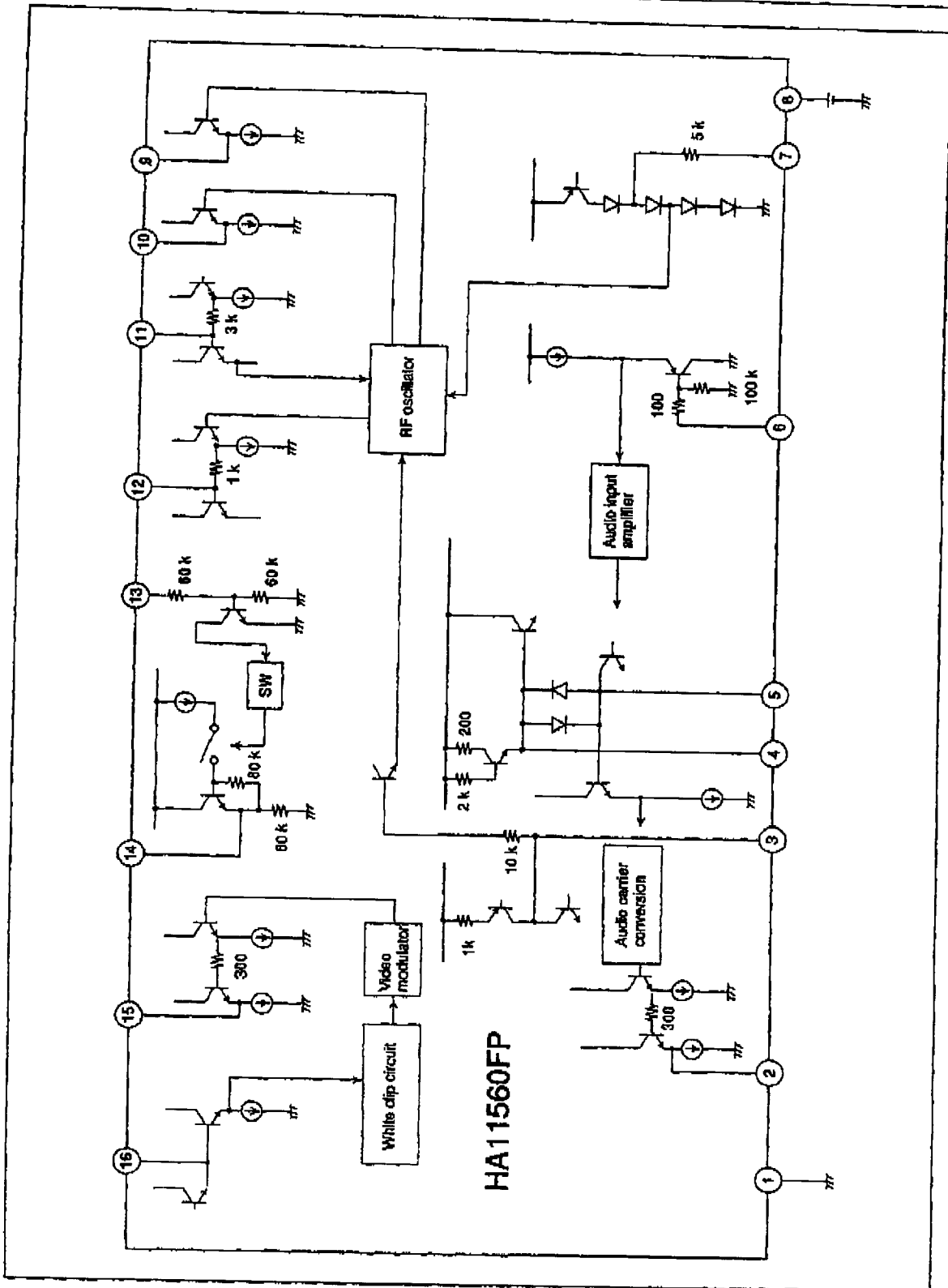
External Components (Notes 1 and 2)

No.	Component	Model	Manufacturer	Remarks
1	SAW resonator	KAR91CS (Japanese specifications)	Kyocera, Inc.	KAR61CT (U. S. specifications)
2	4.5-MHz tank coil	291ACS-4060Z 62-pF tuning capacitor on-chip 369SN-1458Z External tuning capacitor	Toko, Inc.	Use 369SN-1458Z for greater tuning capacitance. Note this also decreases audio modulation factor.

Pin Functions

Pin No.	Symbol	Function	Voltage Pin	Remarks
1	GND	GND	GND	
2	AUDIO RF OUT	Audio RF signal output pin	3.2 V	
3	RF OSCILLATOR BIAS	RF oscillator voltage control pin	(3.2 V)	RF oscillator active state
4	FM MOD COIL	FM modulator tank coil connector pin	4.1 V	Reference voltage pin
5	FM MOD COIL	FM modulator tank coil connector pin	4.1 V	
6	AUDIO IN	Audio signal input pin	0 V	
7	CHANNEL SW	RF oscillation frequency channel switch	2.8 V (when open)	Pin 9 output (when open)
8	V _{CC}	V _{CC}	5V	
9	SAW.R LOW CHANNEL	SAW radiator connector pin (low ch)	3.7 V	
10	SAW.R HIGH CHANNEL	SAW radiator connector pin (high ch)	3.7 V	
11	SAW.R COMMON	SAW radiator connector pin (common)	3.2 V	
12	DP Adj.	Video differential phase adjust pin	2.6 V	
13	CARRIER OFF SW	RF switch driver and RF oscillator switch pin	0 to 5 V	0 V (when open)
14	ANT SW DRIVER	RF switch driver drive pin	0 to 3.6 V	Maximum output current = 30 mA
15	VIDEO RF OUT	Video RF signal output pin	3.1 V	
16	VIDEO IN	Video signal input pin	1.6 V	

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Block Operation Descriptions

The following describes the operation of each block and external circuits.

Video Clamp

The video clamp circuit employs a sync peak value clamp. Input impedance is at a level of approximately 30 kΩ to reduce compression of the sync pulse. Note that sag is generated in the sync pulse when a capacitor of 0.47 μF or lower is used for C₇ at pin 16.

White Clip Circuit

The white clip level is set to 92.5%. A circuit that produces a sharp white clip is used in order to produce high linearity characteristics for the video. Increasing the white clip frequency characteristic by another 5 MHz eliminates video carrier cutoff by the chroma signal and prevents deterioration of audio buzz characteristics.

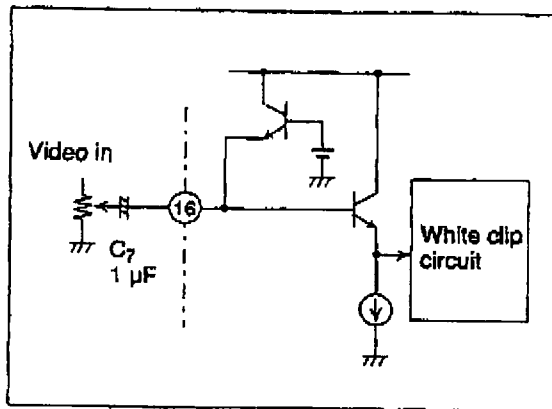


Figure 1 Video Input Circuit

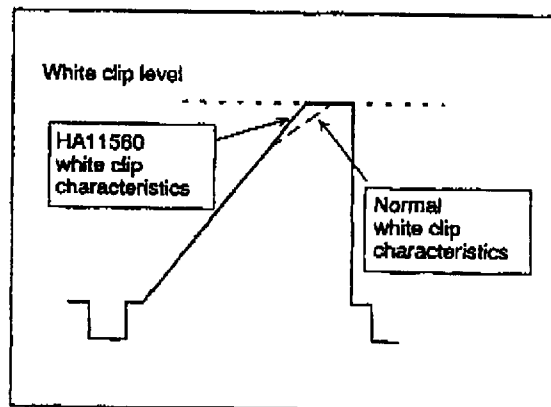


Figure 2 White Clip Characteristics

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RF Oscillator/Channel Switch

A new type RF oscillator is employed to reduce RF harmonics to a level that is dramatically lower than previous available Hitachi products.

Note that using a condenser lower than $0.1 \mu\text{F}$ at pin 3 causes an increase in sync pulse sag.

The input resistance at pin 11, which is the oscillator input pin, is $3 \text{ k}\Omega$. Pins 9 and 10 are oscillator output pins, and are NPN transistor emitter-follower types.

The oscillator frequency is selectable by switching the pin 7 channel switch between SAW radiator low channel and high channel. When the channel switch is open, oscillation output is performed from pin 9, while grounding the switch causes

output from pin 10. The switching voltage of the channel switch is approximately 2.1 V. When the channel switch is grounded, a current of $30 \mu\text{A}$ flows through pin 7, which is sufficient to drive an electronic switch.

Video Differential Phase Adjust Circuit

Pin 12 is for adjustment of the video differential phase characteristics. The differential phase can be adjusted in accordance with external capacitor CX_1 at pin 12. The external constant is determined according to such factors as the board pattern, and adjustment should be made using a capacitance value within the range of 0 through 1000 pF .

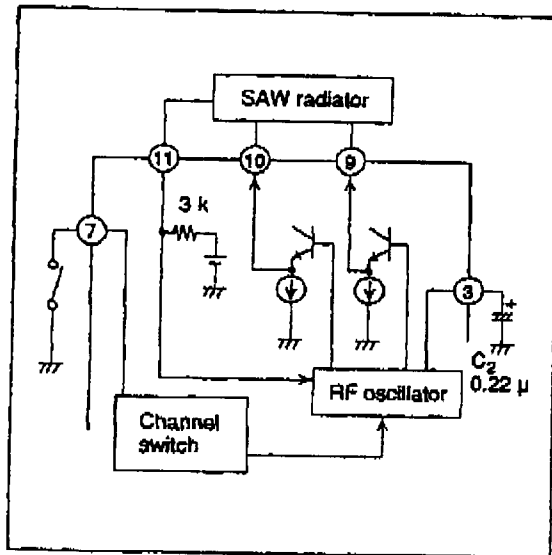


Figure 3 RF Oscillator Interface Circuit

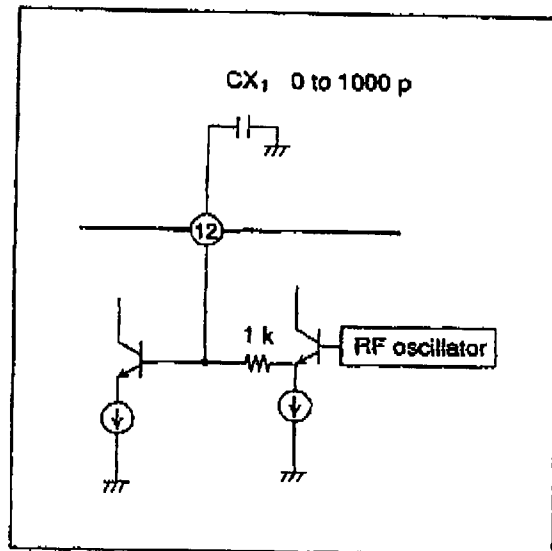


Figure 4 Pin 12 Interface Circuit

Antenna Switch

The antenna switch links the drive circuit that switches the RF switch on and off with the chip's RF oscillator on/off operation.

Opening the switch at pin 13 stops oscillation of the RF oscillator and the antenna switch drive output at pin 14 becomes 0 V. The audio system is operating in this state, which acts to suppress generation of popping noise in the audio as the antenna switches between on and off.

When pin 13 is connected to V_{CC} by a closed switch, the RF oscillator is operational and the antenna switch drive output dc level at pin 14 is high.

Pin 13 should be connected to V_{CC} when the antenna switch is not used. A maximum current of 30 mA can be obtained from the antenna switch driver.

Be sure to connect 10 k Ω for R_2 at pin 13 when the antenna switch is being used. R_2 is used as protective resistance when the antenna switch power supply is switched on before the chip power supply.

Audio Modulator

Pins 4 and 5 make up the reference oscillator for the 4.5-MHz audio modulator. Pin 4 is the oscillator's reference bias source. A 15-pF condenser must be used for C_3 at pin 4 to cut the ac signal. The oscillation frequency is determined by an external tank circuit.

An external coupling condenser is not required when pin 6, which is the audio input pin, is almost equal to ground potential and the audio input signal dc level is ground potential. The ground potential of the input pin results in a circuit configuration that reduces pin 6 voltage fluctuations and suppresses popping noise.

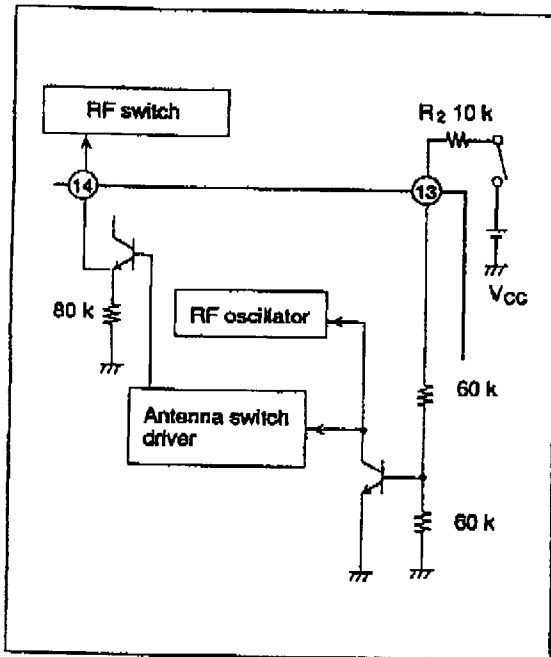


Figure 5 Antenna Switch Interface Circuit

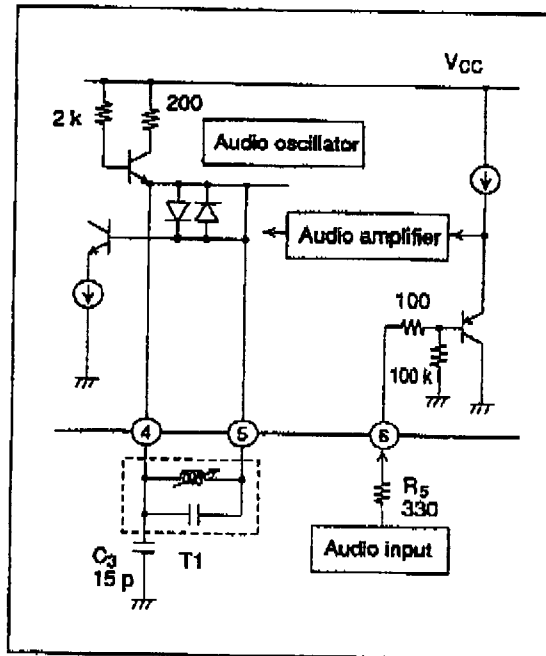


Figure 6 Audio Modulator Interface Circuit

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Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Constant	Unit
Supply voltage	V _{CC}	6.0	V
Power dissipation	P _T	600	mW
Storage temperature	T _{stg}	-55 to +125	°C
Operating temperature	T _{opr}	-20 to +70	°C

Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Application Terminal
Operating supply voltage range	V _{CC}	4.5	5.0	5.5	V		8
Supply current	I _{SS}	9	13	18	mA		8
Video output level	V _O	89.5	91.5	93.5	dB μ	No input	15
Video modulation factor	V _M	73	80	87	%	Video input = 0.65 V _{p-p}	15
Video output channel difference	ΔV_O	-2	0	2	dB		15
Video modulation factor channel difference	ΔV_M	-3	0	3	%		15
Video output S/N	V _{SN}	50	60	—	dB	V _M = 50%	15
Video bandwidth	V _f	-1.0	0	1.0	dB	f _m = 5 MHz Reference f _m = 0.5 MHz	15
White clip level	V _W	89	92.5	96	%		15
Video output sync signal ratio	V _S	2.7	3.0	3.3	—	Measure S when V:S = 7:3 input	15
Differential gain	DG	—	2	5	%	80% modulation at upper part of chroma signal 20 IRE	15
Differential phase	DP	—	2	5	deg		15
Audio output P/S ratio	A _O	5.0	6.5	8.0	dB		2, 15
Audio modulation factor	A _M	20	25	30	\pm kHz/ dev	Input 0.14 V _{p-p}	2
Audio THD	ATHD	—	0.3	1.0	%	Audio modulation = \pm 15 kHz/dev	5
Maximum audio modulation factor	AMM	\pm 100	\pm 175	—	kHz/ dev		2
Audio S/N	ASN	50	60	—	dB	Audio modulation = \pm 15 kHz/dev	5
Audio bandwidth	Af	-1.0	0	1.0	dB	f _m = 60 kHz Reference f _m = 1 kHz	5

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Electrical Characteristics (Ta = 25°C) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Application Terminal
Video input impedance	R _V	10	30	—	kΩ		16
Audio input impedance	R _A	75	100	145	kΩ		6
Spurious response within band	S _{in}	—	-75	-65	dB	Measurement of spurious response between f _V and f _A	2, 15
920-kHz beat	cb	—	-68	-61	dB	0.65 V _{pp} input	2, 15
FA harmonic	nFA	23	28	—	dB	FA harmonic	2
Antenna switch pin voltage	A _{SV}	3.1	3.4	3.7	V	Load current when supply voltage = 5 V	14
Antenna switch residual voltage	A _{SRV}	0	0	0.1	V	When supply voltage = 5 V	14
Carrier-off switch carrier off voltage	C _{OFF}	0	—	0.5	V		13
Carrier-off switch carrier on voltage	C _{ON}	2.5	—	V _{CC}	V	V _{CC} = Pin 8 voltage	13