



**ULA1145**

Preliminary

**CMOS IC**

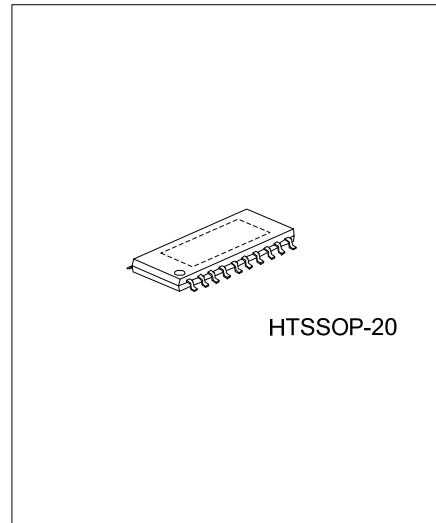
**FM TUNER IF SYSTEM**

■ DESCRIPTION

The UTC **ULA1145** is a high integrated IC for FM tuner IF stage, special in car radio.

■ FEATURES

- \* Built-in IF count buffer circuit and microprocessor-controlled switch circuit for ETR
- \* High S/N
- \* Wide range output
- \* More simplifies design:
  - Built-in SD circuit—regulable sensitivity independently of soft mute characteristics
  - Variable S-meter gradient—output with three pins

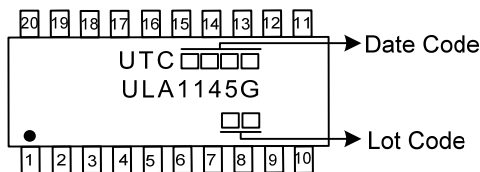


■ ORDERING INFORMATION

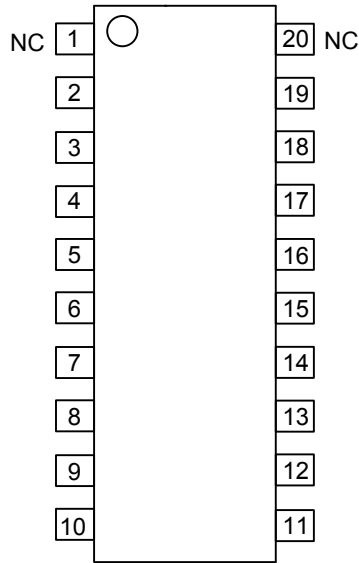
Ordering Number	Package	Packing
ULA1145G-N20-R	HTSSOP-20	Tape Reel

<p>ULA1145G-N20-R</p> <pre>                        ---(1)Packing Type                ---(2)Package Type                ---(3)Green Package           </pre>	<p>(1) R: Tape Reel          (2) N20: HTSSOP-20          (3) G: Halogen Free and Lead Free</p>
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■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1, 20	NC	
2	IF <sub>IN</sub>	IF input
3	IF <sub>BIAS</sub>	IF amp bias
4	IF <sub>GND</sub>	IF amp GND
5	M <sub>sc</sub>	Mute start control
6	M <sub>GC</sub>	Mute gradient control
7	M <sub>AC</sub>	Mute attenuation control
8	AF <sub>OUT</sub>	AF output
9	AFC <sub>OUT</sub>	AFC output
10	IF <sub>OUT</sub>	IF output
11	Q <sub>IN</sub>	Quadrature detection input
12	V <sub>REG</sub>	Voltage regulator output
13	VCC	V <sub>CC</sub>
14	IF <sub>CT</sub>	IF count output, control
15	GND	GND for detection circuit
16	M <sub>DRI</sub>	Mute driver
17	S <sub>OUT</sub>	S-meter output
18	SD <sub>CT</sub>	SD sensitivity control
19	SD <sub>OUT</sub>	SD output

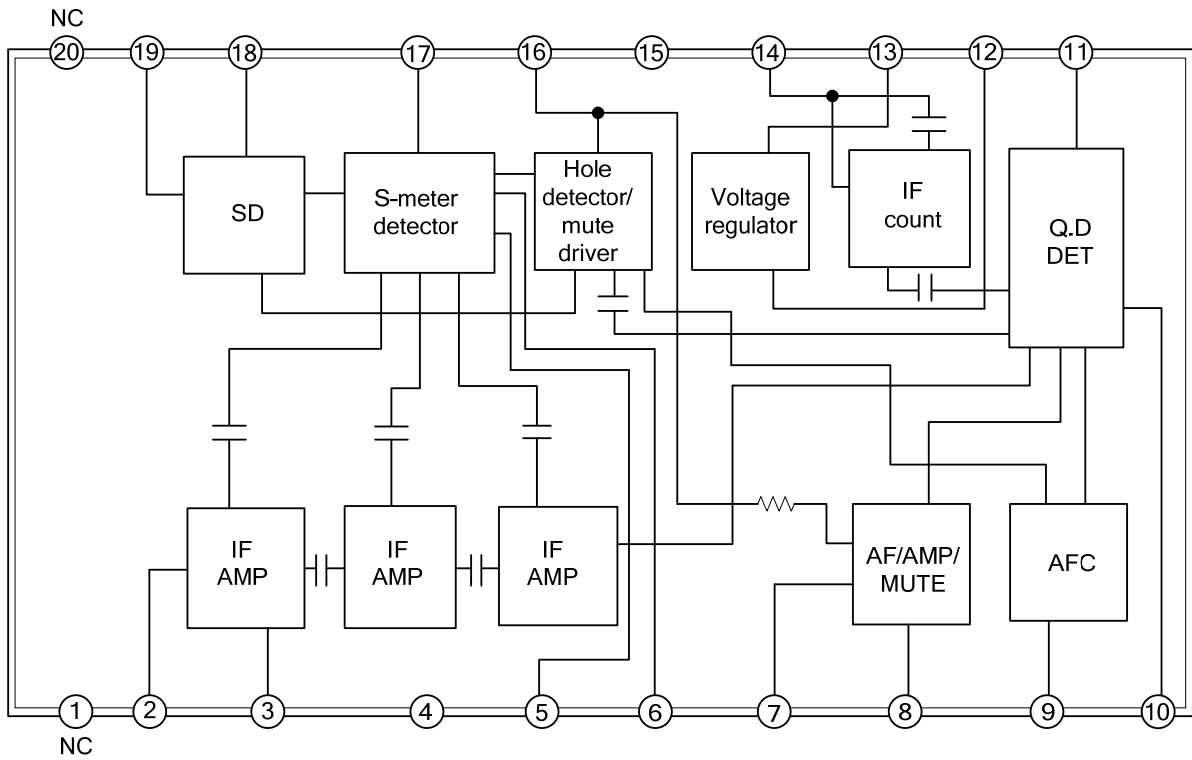
■ PIN FUNCTIONS

PIN NO.	Function	Internal Equivalent Circuit	Notes
2	IF input		
3	Bias pin		
4	GND		IF limiting amp GND
5	Soft mute start point control		For setting the soft mute starting point.
6	Soft muting gradient control pin		Can be used for S-meter output. For setting the mute gradient from the soft mute starting point to the noise finishing point.
7	Mute Att		For setting amount of mute attenuation. The demodulation level changes when the external resistance value is varied.
8	FM-AF output		
9	AFC input		

■ PIN FUNCTIONS(Cont.)

PIN NO.	Function	Internal Equivalent Circuit	Notes
10	IF output		Output to the phase circuit
11	IF input		IF input via the phase shift circuit. The mute circuit malfunctions and demodulation output decreases if the voltage level at this pin drops below 180mV.
12	Vref		4.8V
13	V <sub>CC</sub>		Supply voltage 7.5~14V
14	IF buffer output		
15	GND		
16	Mute driver		Amount of mute attenuation depends on and is controlled by the voltage at this pin.
17	S-meter output		PNP open collector output
18	SD sensitivity setting		Can be used for S-meter output
19	SD output		High active

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T<sub>A</sub>=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	Pin 13	V <sub>CC</sub>	14	V
Maximum Supply Current	Pin 13	I <sub>CC</sub>	45	mA
Allowable Power Dissipation	T <sub>A</sub> =70°C, Mounted On PC Board	P <sub>D</sub>	630	mW
	T <sub>A</sub> =25°C, Mounted On PC Board, Independent IC		630	mW
	T <sub>A</sub> =70°C, Independent IC		360	mW
Operating Temperature		T <sub>OPR</sub>	-20~+70	°C
Storage Temperature		T <sub>STG</sub>	-40~+125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ OPERATING CONDITIONS (T<sub>A</sub>=25°C)

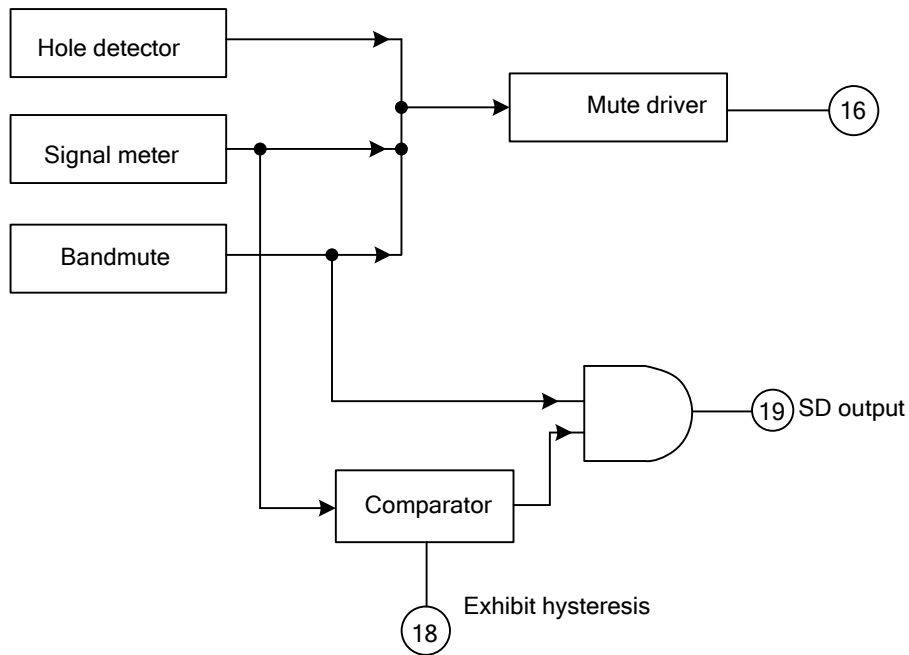
PARAMETER	SYMBOL	RATINGS	UNIT
Recommended Supply Voltage	V <sub>CC</sub>	8	V
Operating Voltage Range	V <sub>CC op</sub>	7.5~14	V

■ ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=25°C, V<sub>CC</sub>=8V, f<sub>in</sub>=10.7MHz)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Quiescent Current	I <sub>CCO</sub>	V <sub>IN</sub> =0dBμ	18	26	36	mA
Current Drain	I <sub>CC</sub>	V <sub>IN</sub> =100dBμ	20	29	40	mA
Demodulation Output	V <sub>O</sub>	V <sub>IN</sub> =100dBμ, 400Hz Tone, 100%	300	400	520	mVrms
Total Harmonic Distortion	THD	V <sub>IN</sub> =100dBμ, 400Hz Tone, 100%, Single Tuning Coil		0.3	0.8	%
Signal-to-Noise Ratio	S/N	V <sub>IN</sub> =100dBμ, 400Hz Tone, 100%	75	85		dB
Input Limiting Voltage	V <sub>IN(lim)</sub>	400Hz Tone, 100%, Soft Mute ON	34	40	46	dBμ
Muting Sensitivity	V <sub>IN(mute)</sub>	V <sub>16</sub> =2V	30	36	42	dBμ
Muting Bandwidth	B <sub>W(mute)</sub>	V <sub>IN</sub> =100dBμ, V <sub>19</sub> ≤0.3V	140	190	280	kHz
Muting Attenuation	mute(1)	V <sub>IN</sub> =100dBμ, V <sub>16</sub> =2V, 400Hz Tone, 100%	10	15	20	dB
	mute(2)	V <sub>IN</sub> =100dBμ, V <sub>16</sub> =4V, 400Hz Tone, 100%	25	29	33	dB
Signal Strength Indication Output	V <sub>17-0</sub>	V <sub>IN</sub> =0dBμ, R <sub>16</sub> =10kΩ, Pin 17	0	0.1	0.6	V
	V <sub>17-50</sub>	V <sub>IN</sub> =50dBμ, R <sub>16</sub> =10kΩ, Pin 17	1.4	2.3	3.2	V
	V <sub>17-70</sub>	V <sub>IN</sub> =70dBμ, R <sub>16</sub> =10kΩ, Pin 17	2.5	4.5	5.5	V
	V <sub>17-100</sub>	V <sub>IN</sub> =100dBμ, R <sub>16</sub> =10kΩ, Pin 17	5.0	5.5	6.0	V
Muting Drive Output	V <sub>16-0</sub>	V <sub>IN</sub> =0dBμ, Pin 16	4.0	4.8	5.5	V
	V <sub>16-100</sub>	V <sub>IN</sub> =100dBμ, Pin 16	0	0	0.3	dB
AM Rejection Ratio	AMR	V <sub>IN</sub> =100dBμ, 1kHz Tone, 30% AM	57	70		dB
Offset Voltage	V <sub>8-12</sub>	V <sub>IN</sub> =0dBμ, Pins 8 to 12	-0.25	0	+0.25	V
	V <sub>9-12</sub>	V <sub>IN</sub> =0dBμ, Pins 9 to 12	-0.5	0	+0.5	V
SD Sensitivity	V <sub>SD</sub>	Pin 19	50	58	66	dBμ
IF Count Output Level	V <sub>IF-ON</sub>	V <sub>IN</sub> =100dBμ, Pin 14, C <sub>L</sub> =10pF	110	180	280	mVrms
	V <sub>IF-OFF</sub>	V <sub>IN</sub> =100dBμ, Pin 14, C <sub>L</sub> =10pF		1	3	mVrms

■ SD OUTPUT CIRCUIT

1.



As shown, the SD output is the logical AND of the band mute and S-meter comparator outputs.

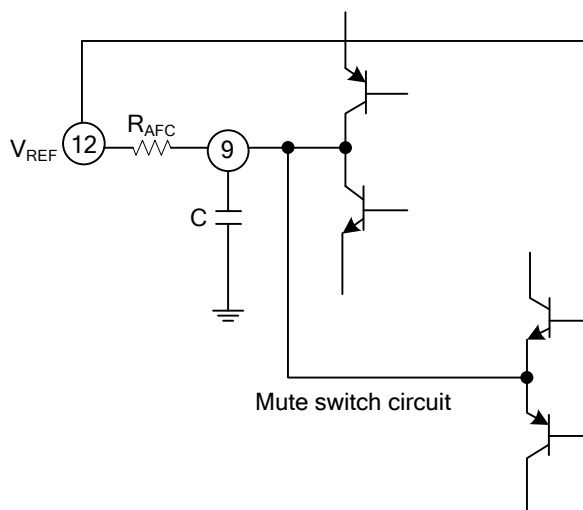
2. Signal search using the SD output circuit

2-1 The transition response characteristics of the SD output circuit depends on the time constants of pins 16, 17, 18 and 9.

As the SD output transition response characteristics are determined by the pin with the largest time constant, erroneous stopping will result when a search time is less than the largest one.

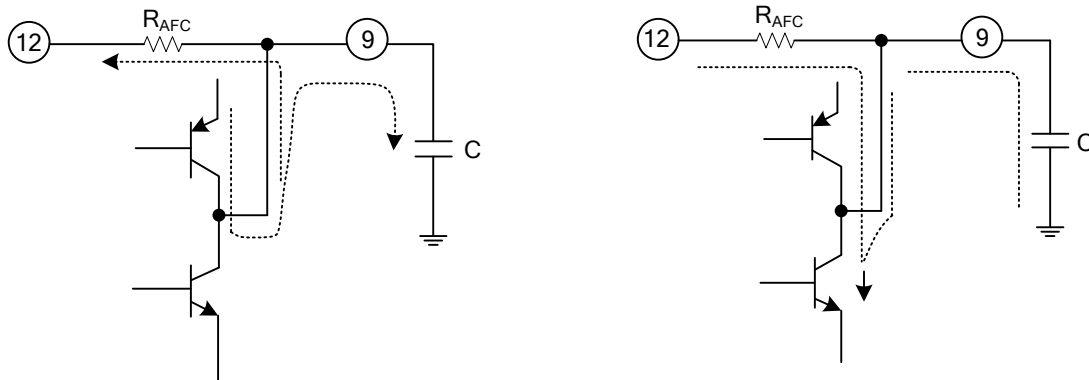
2-2 Band mute range circuit time constant (pin 9)

An equivalent circuit to the band circuit is shown below.

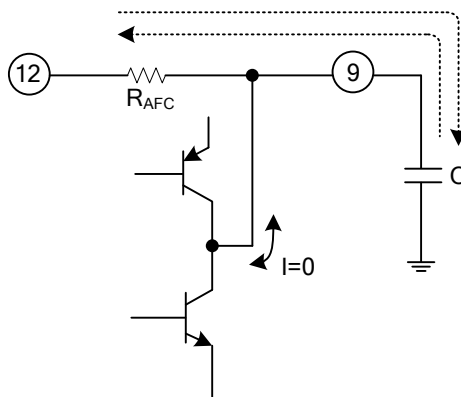


■ SD OUTPUT CIRCUIT(Cont.)

(1) Current path during detuning



(2) Current return path from detuning

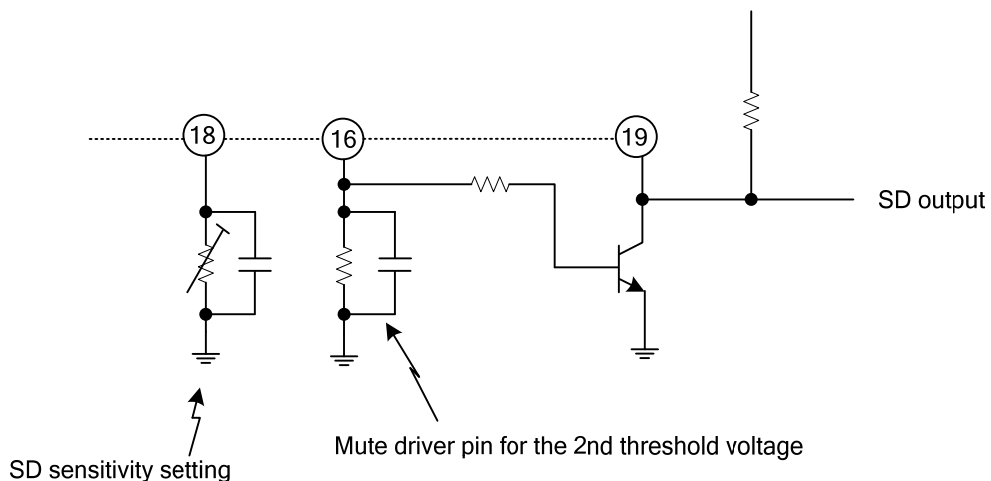


As can be seen from the above circuit diagrams, the time constant during detuning is determined by the internal PNP resistance, the NPN collector resistance and the capacitance of the externally-mounted capacitor. This time constant is determined by the external resistance RAFC and capacitor C.

This time constant,  $\tau = RAFC \times C$ , must be set depending on the required search time.

3. Narrow-band SD output circuit

An IF count circuit is provided for equipment compatibility for the European marketplace. However, if the band is made narrow using only the SD circuit, there is a tendency for the number of erroneous stops caused by an undesired signal to increase. To prevent this, two threshold voltages should be used to control the SD circuit.





■ SOFT MUTE CHARACTERISTICS

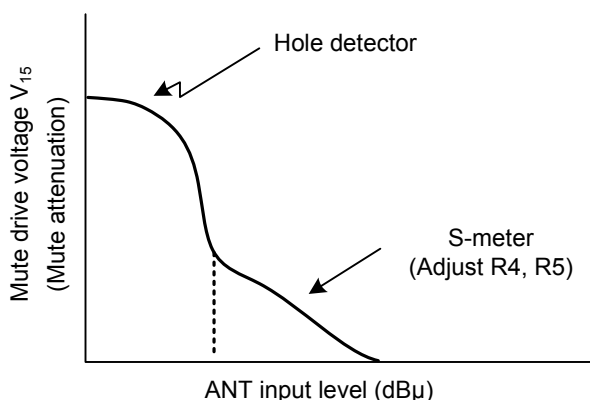
1. Control

The S/N setting (C/N) for weak inputs and the -3dB limiting sensitivity can be controlled by obtaining the proper value for the un-soft muted input/output signal characteristic. However, usable sensitivity cannot be controlled as this is determined by the front end and IF design which are unrelated to soft muting.

2. Soft mute setting

Soft mute operation depends on the S-meter circuit voltage and the hole detection circuit voltage. As shown in the graph on the right, the degree of soft muting correlates with the mute drive voltage, V15. The control signal line of the mute drive voltage switches before and after the 10dBμ ANT divergence point.

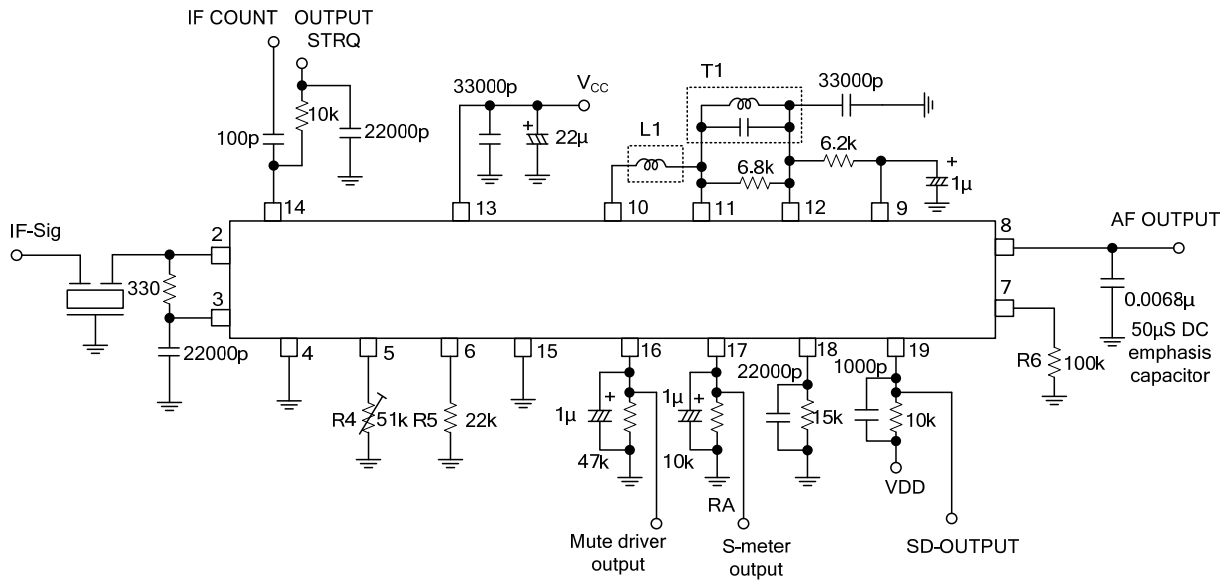
When adjusting the soft mute with a weak signal which does not affect the S-meter, first adjust it using the hole detection input signal. However, as the S-meter output will readjust the soft mute level, also adjust the soft mute using the S-meter output. At this point, the hole detection output adjusts the gain up to the IF input, causing a variance. Also, the S-meter output is varied by the value of R16.



3. Soft mute transition response characteristic

The degree of soft muting automatically varies according to the change in input field strength. Omitting the influence of the front end wideband AGC circuit, the UTC ULA1145's response speed is dependent on the time constant at pins 16 and 17.

■ TYPICAL APPLICATION CIRCUIT



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