TONE DECODER IC

The HT567 are general purpose tone decoders .

ICs are purposed to receive and decode sine signal of wide bandwidth in telelecom systems.

IC can be applied for tone (voice-frequency) decoding, frequency control, broadband FSK demodulations, ultrasonic frequency control, in precision generator, search decoders.

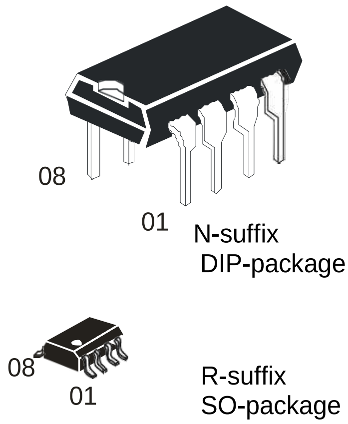


Fig. 1 –Views of ICs in DIP & SO packages

Main features

- Bandwidth, BW, %
  (relatively to central frequency f_C)
  min…………………………………...10;
  max……......................................…......18;
- Bandwidth central frequency, f_C, kHz
  min…………………….………..……100;
  (at U_{CC} = 5 V, R = 2, 8 k∧, C = 3300 pF)
  max…………………………………...500;
  (at U_{CC} = 5 V, R = 2, 8 k∧, C = 800 pF)
  Center frequency adjustable from 0,01Hz to 500 kHz.
- Quiescent consumption current, I_{CC}, mA
  (at U_{CC} = 5 V, R_L = 20 k∧),
  not more ……………………….….….8;
- Operating temperature range 0 to +70°C;
- Immunity to ESD potential 200 V. Limiting value of the potential of static electricity 350 V;
- Logic compatible output with 100mA current sinking capability;
- High rejection of outband signals and noise;
- Thermal resistance «junction-ambient»
  for HT567AN not more 110 °C/W;
  for HT567AR not more 160 °C/W.

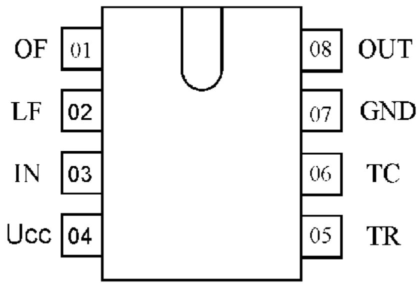


Fig. 2 – Pinout diagramm

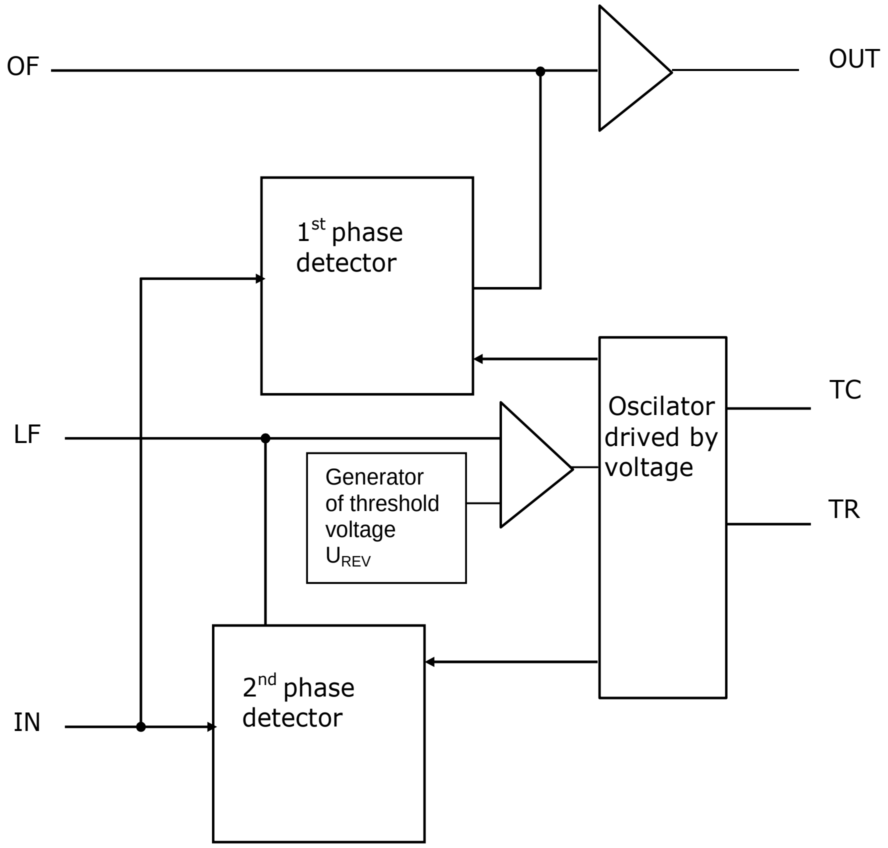


Fig. 3 – Block diagram of IC

Table 1 – Pin description

Pin number	Symbol	Description
01	OF	Filter output
02	LF	Loop filter (Low frequency filter of the synchronous demodulator)
03	IN	Detected frequency input
04	U_{CC}	Supply voltage pin
05	TR	Timing resistor connection pin
06	TC	Timing capacitor connection pin
07	GND	Common pin (Ground)
08	OUT	Output

Table 2 – Absolute maximum ratings

Symbol	Parameter	Norm		Unit
		Min	Max	
U_{CC}	Supply voltage	-	9,5	V
U_{03}	Input voltage (pin 03)	-10	U_{CC}+0,5	V
P_{tot}[1)]	Total power dissipation	-	1100[2)]	mW
Ta	Storage temperature	-50	125	°C

[1)]At IC operation junction temperature has not to excess 115 °C taking into account thermal resistance "junction-ambient". For HT567AN thermal resistance "junction-ambient" - 110 °C/W. For HT567AR thermal resistance "junction-ambient" - 160 °C/W.

Maximum power P_{tot},W, dissipated by IC for T_A, is calculated by formula

$$P_{tot} = (115 - T_A) / R_{TJA}, \qquad (1)$$

115 – maximum permissible operating junction temperature, °C;
T_A – ambient temperature, °C;
R_{TJA} – thermal resistance «junction-ambient» , °C/W.
[2)] Duration of influence of extreme mode has to be not more than 20 ms

Table 3 – Recommended operation modes

Symbol	Parameter	Norm		Unit
		Min	Max	
U_{CC}	Supply voltage	4,75	9	V
U_{08}	Voltage applied to closed output, V (pin 08)	-	15	V
Ta	Operating ambient temperature	0	70	°C

Table 4 – Electric parameters

Parameter, unit, mode of measurement	Symbol	Norm		Ambient temperature, °C
		Min	Max	
Quiescent consumption current, mA at U_{CC} = 5 V, R_L = 20 kΩ	I_{CC}	-	8 9	25±10 0; 70
Dinamic consumption current, mA at U_{CC} = 5 V, R_L = 20 kΩ	I_{OCC}	-	13 14	
Input resistance, kΩ at U_{CC} = 5 V	R_I	15 14	-	
Smallest detectable input voltage, mV (RMS) at U_{CC} = 5 V, I_L = 100 mA, $f_I = f_C$	U_{Imin}	-	25 30	
Largest detectable input voltage (at signal abcence), mV (RMS) at U_{CC} = 5 V, I_L = 100 mA, $f_I = f_C$	U_{Imax}	10 9	-	
Bandwidth, % (relatively to central frequency f_C)	BW	10 9	18 19	
Bandwidth relative deviation, % (relatively to central frequency f_C) at U_{CC} = 5 V	ΔBW_{REL}	-	3,0 3,5	
Coefficient of bandwidth variation with supply voltage , % / V at U_{CC} = (4,75 - 6,75) V	K_{BW}	-	±5 ±5,5	
Highest center frequency, kHz at U_{CC} = 5 V, R = 2,8 kΩ, C = 3300 pF	f_C	100 110	-	
at U_{CC} = 5 V, R = 2,8 kΩ, C = 800 pF		-	500 400	
Center frequency variation with supply voltage, %/V at U_{CC} = (4,75 - 6,75) V at U_{CC} = (4,75 - 9,0) V	δ_{fC}	-	2,0 2,5	
High level output leakage current, μA at U_{CC} = 5 V, U_{08}= 15 V	I_{OLH}	-	25 40	
Output saturation voltage, V at U_{CC} = 5; 9 V, I_{08} [1] = 30 mA, U_{03} = 25 mV	U_{OSAT}	-	0,4 0,6	
at U_{CC} = 5; 9 V, I_{08} = 100 mA, U_{03} = 25 mV		-	1,0 1,5	

[1] I_{08} –08 pin current

Table 5 – Reference parameters

Parameter, unit, mode of measurement	Symbol	Norm		Ambient temperature, °C
		Min	Max	
Largest Simultaneous Outband Signal to Inband Signal Ratio, dB	N_S	1,5 1,0	9 8	25±10 0; 70
Minimum Input Signal to Wideband Noise Ratio, dB at U_{CC} = 5 V, B_n=140 kHz	N_n	-1,5 -1,0	-9 -8	
Cycle repeating frequency, kHz at U_{CC} = 5 V	f_{CYC}	-	f_C/20 f_C/25	
Output fall time, ns at U_{CC} = 5 V	t_f	-	60 80	
Output rise time, ns at U_{CC} = 5 V	t_r	-	300 350	
Coefficient of bandwidth variation with temperature, % / °C at U_{CC} = 5 V	α_{BW}	-	±0,2	0; 70
Coefficient of central frequency variation with temperature, ppm/°C at U_{CC} = (4,75 - 5,75) B	α_{fC}	-100	100	0; 70

Functionality of the microcircuit

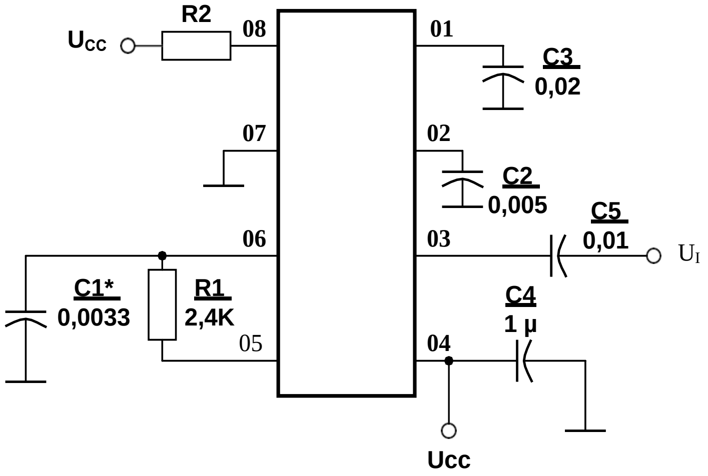
Tone signals decoder IC is purposed for decoding of frequencies in bandwidth BW (relatively the central frequency), %, determined by expression

$$BW = 1070\sqrt{\frac{Ui}{f_C C2}}, \qquad (2)$$

Ui - input voltage (RMS) $Ui \leq 200$ mV;
f_C – bandwidth central frequency of decoder, kHz, is determined by formula

$$f_C \cong \frac{1}{1.1R1C1}, \qquad (3)$$

R1, C1, C2 - extermal passive components.



R2 – load resistor

* for frecuency f_C = 100 kHz only.

Capacitor C1 used to correct oscillator central frequency.
Capacitor C2 used to determine decoder bandwidth.

Fig. 4 – Recommended application diagram

Reference diagramm

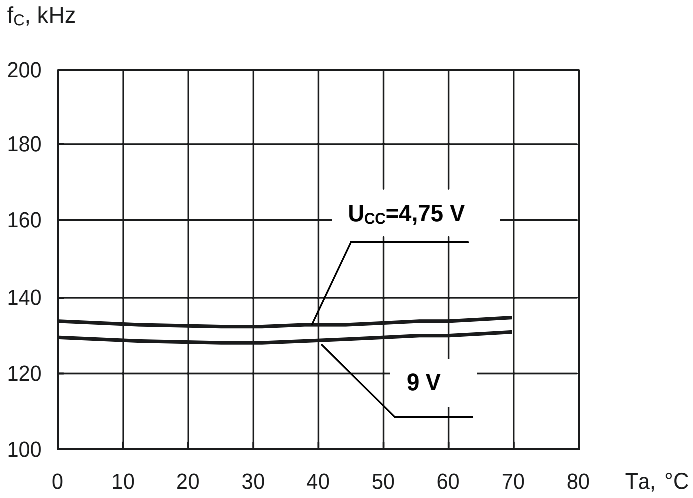


Fig. 5 – Bandwidth central frequency average values versus ambient temperature

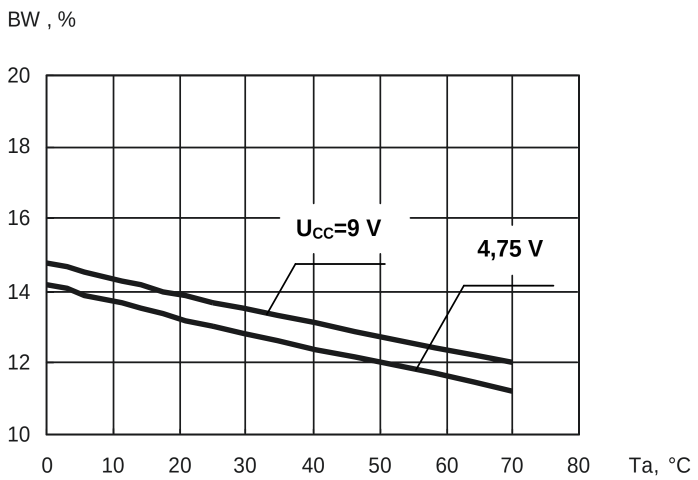


Fig. 6 – Bandwidth average values versus ambient temperature

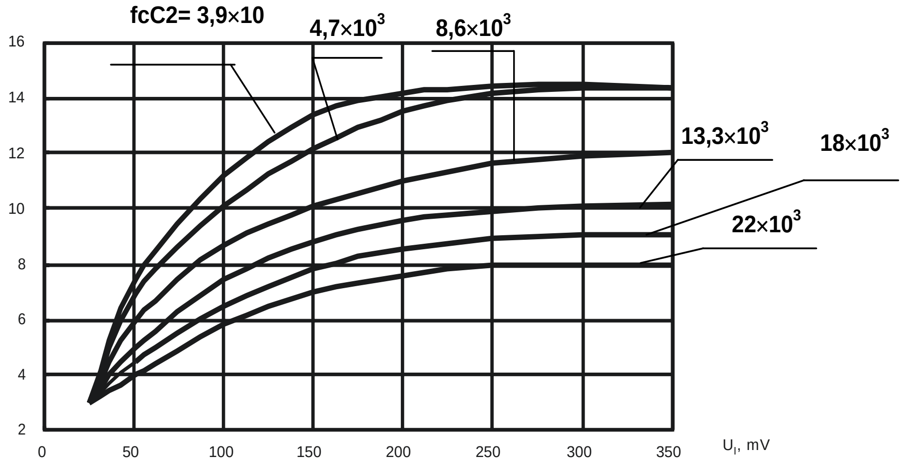


Fig. 7 Bandwidth average values versus input voltage at U_{CC}= 5 V, Ta = (25±10) °C

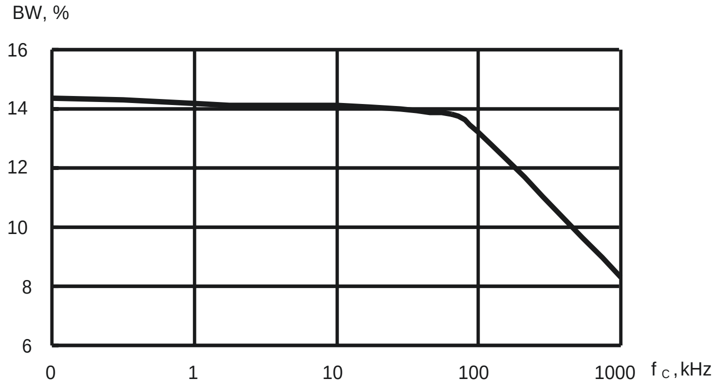


Fig. 8 Bandwidth average values versus central frequency at U_{CC}= 5 V, Ta = (25±10)°C

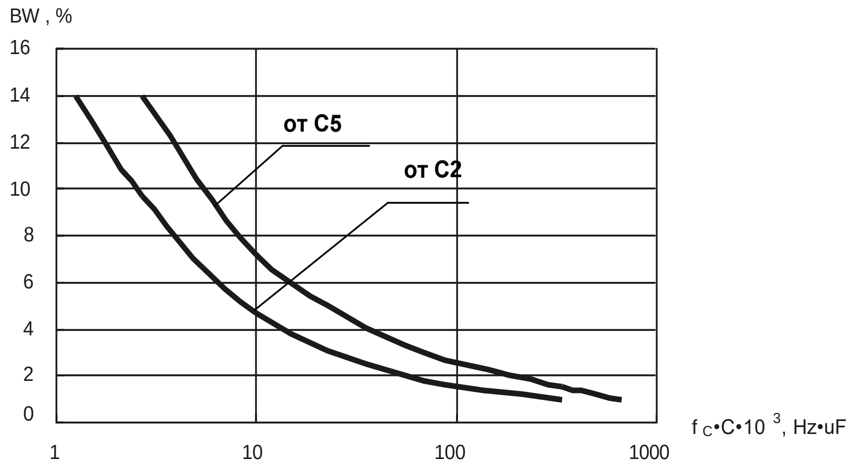


Fig. 9 – Bandwidth average values versus capacity at U_{CC}= 5 V, Ta = (25±10) °C

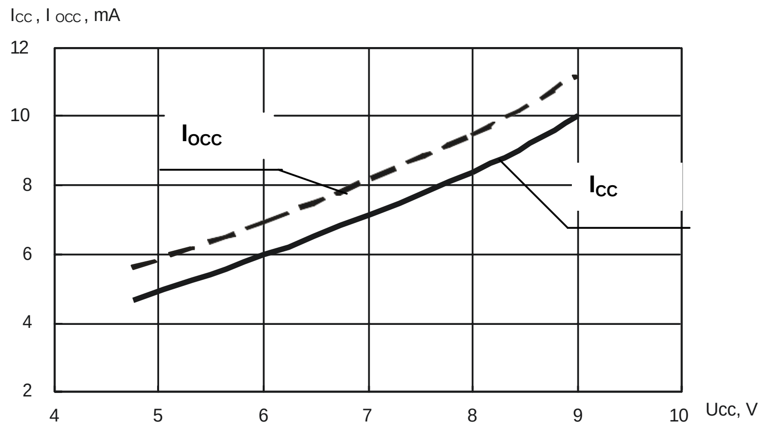


Fig.10 – Quiescent consumption current and dynamic consumption current average values versus supply voltage Ta = (25±10) ^{o}C

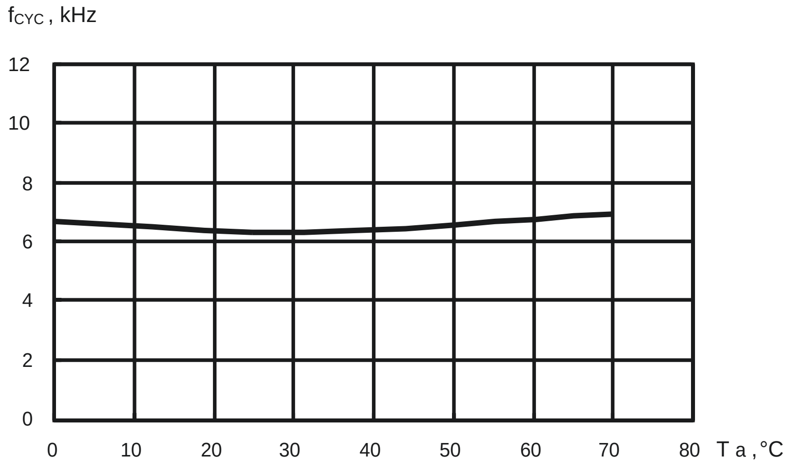


Fig. 11 – Cycle repeating frequency average values versus ambient temperature at U_{CC}= 5 V

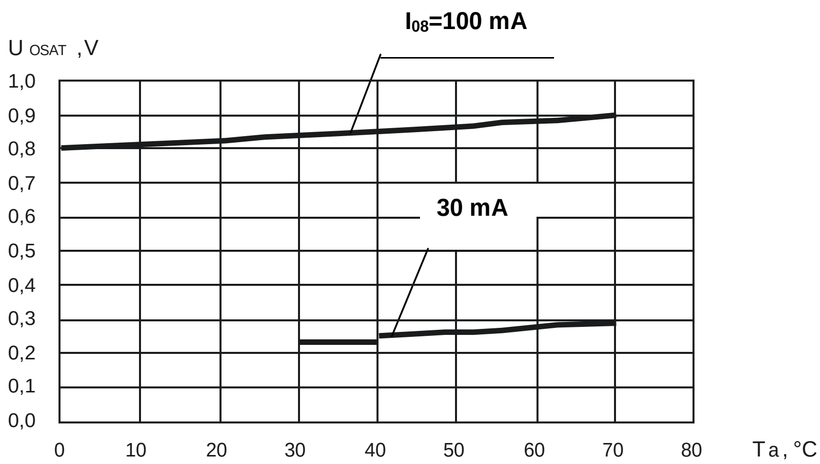
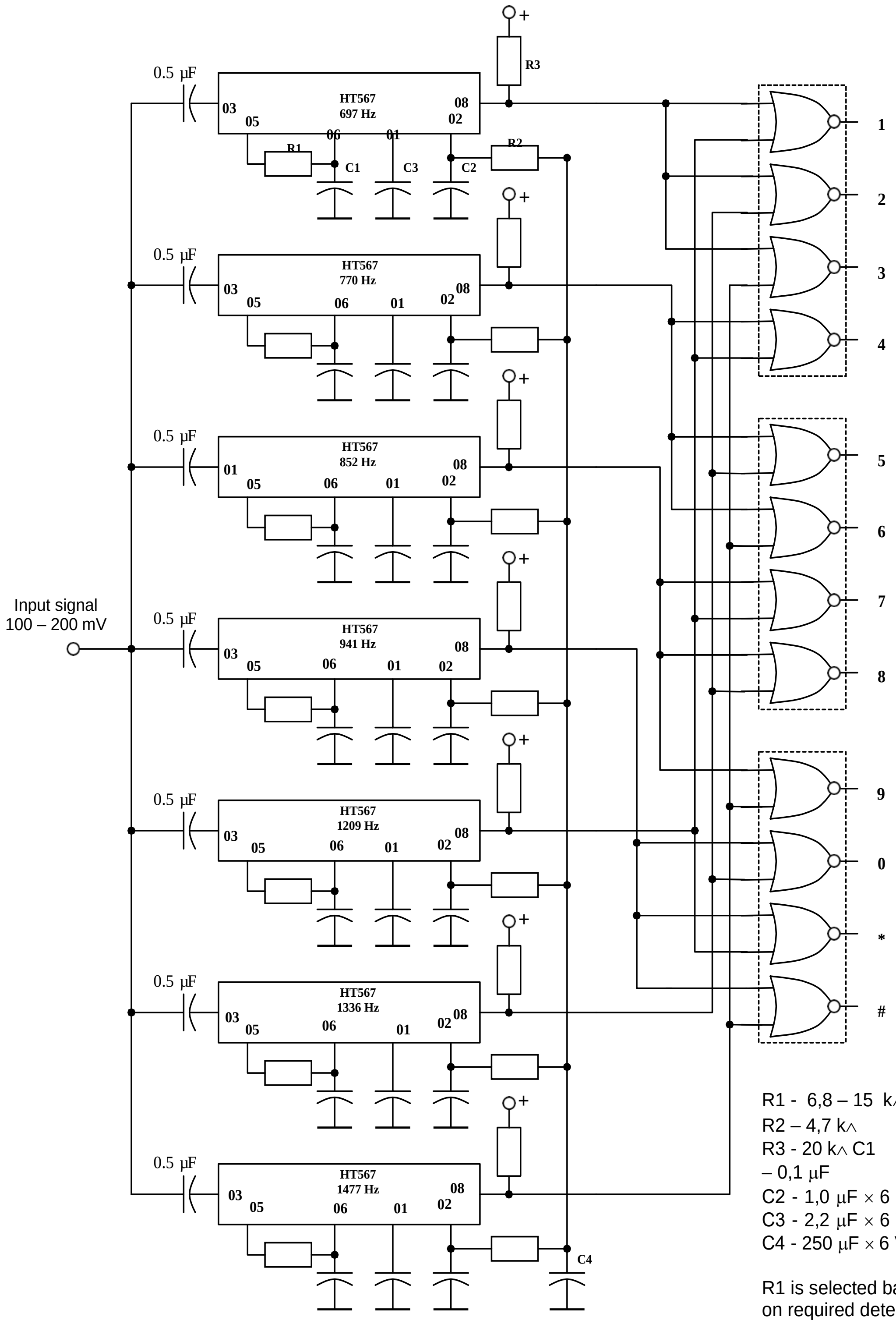


Fig. 12 – Output saturation voltage average values versus ambient temperature at U_{CC}= 5 V

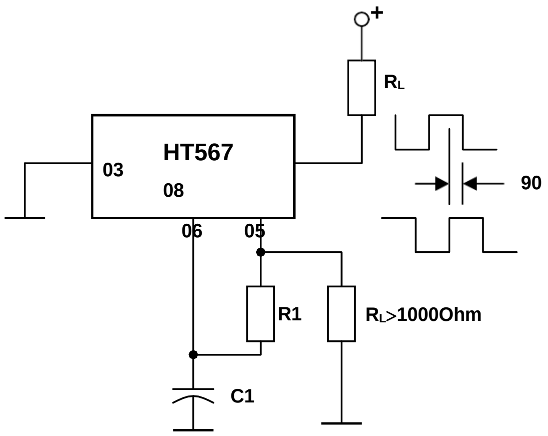
Typical applications diagrams



R1 - 6,8 – 15 k^
R2 – 4,7 k^
R3 - 20 k^ C1
– 0,1 µF
C2 - 1,0 µF × 6 V
C3 - 2,2 µF × 6 V
C4 - 250 µF × 6 V

R1 is selected based on required detecting frequiency

Fig.13 - Push-button phone decoder



Output signal is inverted at 2,8V voltage applied to pin 03 .

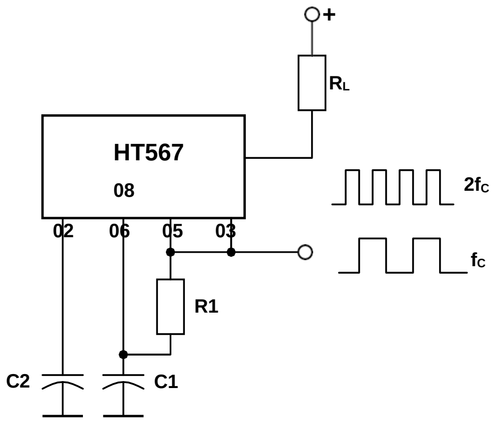


Fig. 14 - Oscillator with Quadrature Output

Fig. 15 - Oscillator with Double Frequency Output

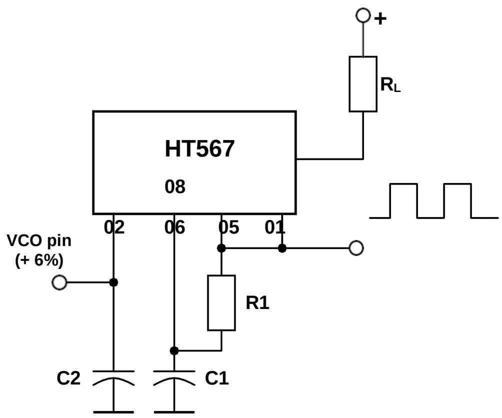
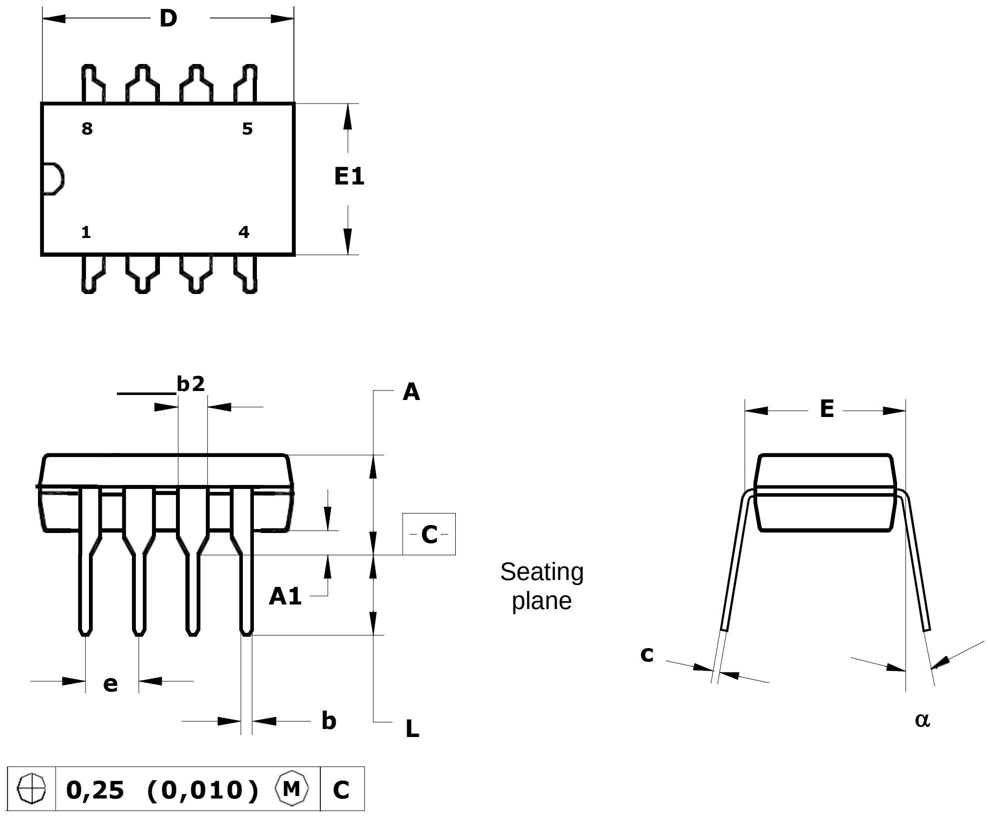


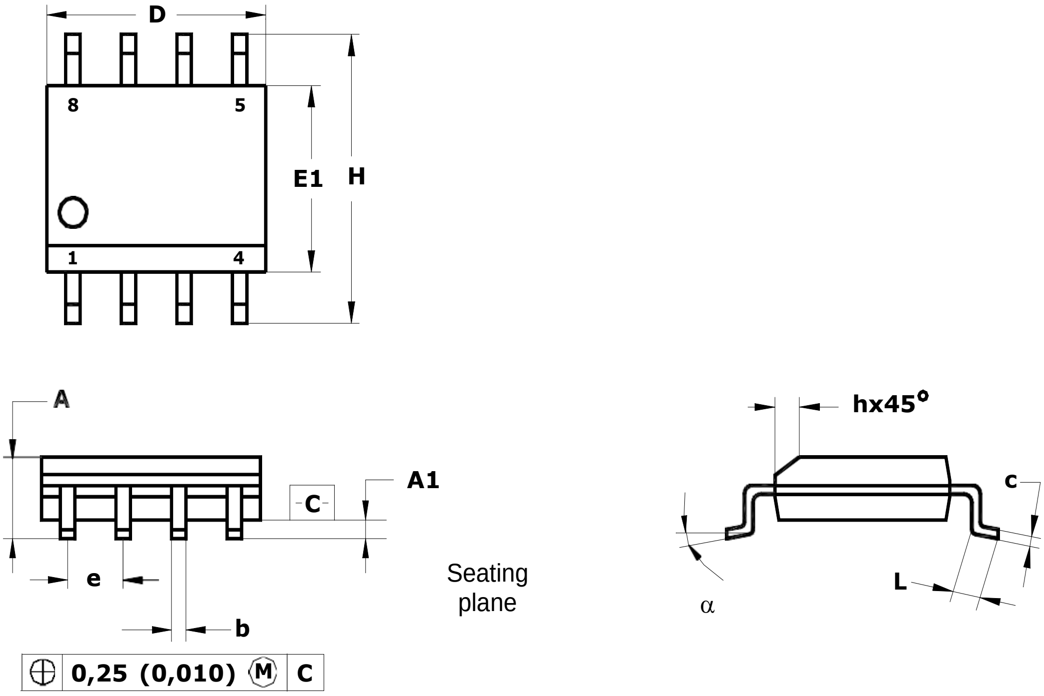
Fig. 16 - Precision oscillator-driver with 100 mA load



Note – The sizes D, E1 do not include size of the spew which should not be more 0,25 (0,010) on the side.

	D	E1	A	b	b2	e	α	L	E	c	A1
mm											
min	9.02	6.07	↓	0.36	1.14		0°	2.93	7.62	0.20	0.38
max	10.16	7.11	5.33	0.56	1.78	2.54	15°	3.81	8.26	0.36	↓
inches											
min	0.355	0.240	↓	0.014	0.045		0°	0.115	0.300	0.008	0.015
max	0.400	0.280	0.210	0.022	0.070	0.1	15°	0.150	0.325	0.014	↓

Fig. 17 – DIP-packade (MS-001BA) dimensions



	D	E1	H	b	e	α	A	A1	c	L	h
mm											
min	4.80	3.80	5.80	0.33		0°	1.35	0.10	0.19	0.41	0.25
max	5.00	4.00	6.20	0.51	1.27	8°	1.75	0.25	0.25	1.27	0.50
inches											
min	0.1890	0.1497	0.2284	0.013		0°	0.0532	0.0040	0.0075	0.016	0.0099
max	0.1968	0.1574	0.2440	0.020	0.100	8°	0.0688	0.0090	0.0098	0.050	0.0196

Fig. 18 – SO- package (MS-012AA) dimensions