

**TELEPHONE PULSE DIALER WITH REDIAL**

The KS5805A/B is a monolithic CMOS integrated circuit and provides all the features required for implementing a pulse dialer with redial.

**FUNCTIONS**

- Mute output logic "0"
- Pulse output logic "0"
- RC oscillation for reference frequency
- Designed to operate directly from the telephone line
- Used CMOS technology for low voltage, low power operation
- Power up clear circuitry
- KS5805A pin 2:  $V_{REF}$
- KS5805B pin 2: Tone out

**FEATURES**

- Uses either a standard 2 of 7 matrix keyboard with negative true common or the inexpensive form A-type keyboard
- Make/Break ratio can be selected
- Redial with • or #
- Continuous MUTE
- Tone signal output or on-chip reference Voltage by bonding option on chip
- 10 pps/20 pps can be selected

**TEST CIRCUIT**

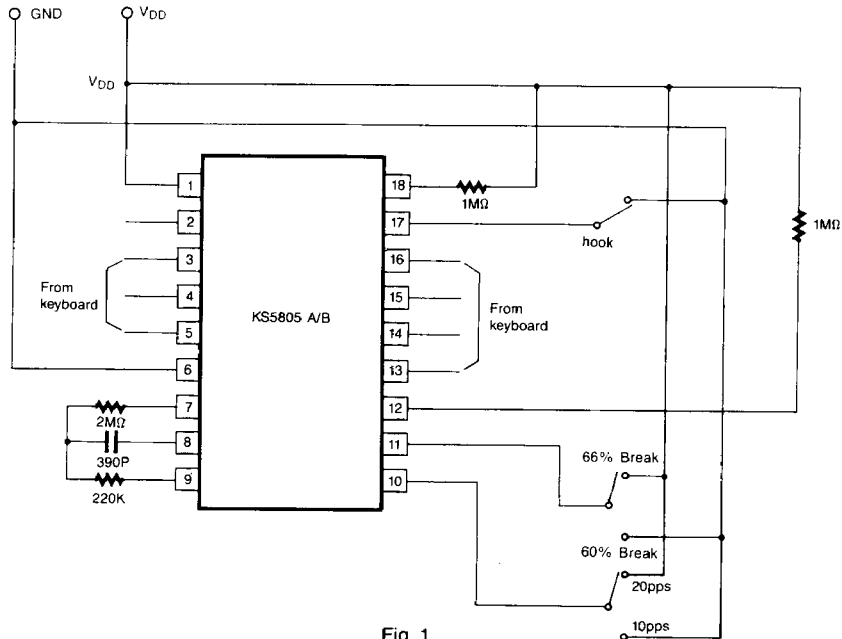
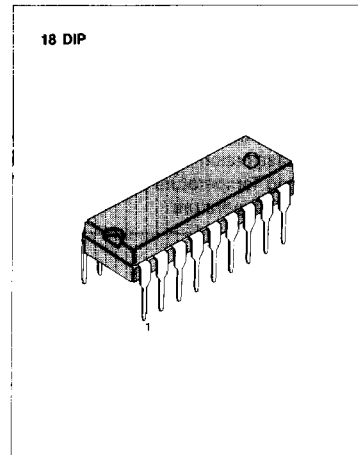


Fig. 1



**ORDERING INFORMATION**

Device	Package	Function	Operating Temperature
KS5805AN	18 DIP	Pin 2 = $V_{ref}$	-30 ~ +60°C
KS5805BN	18 DIP	Pin 2 = Tone Out	

ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ\text{C}$ )

Characteristic	Symbol	Value	Unit
DC Supply Voltage	$V_{DD}$	6.2	V
Voltage on Any Pin	$V_{IN}$	$V_{DD} + 0.3, \text{Gnd} - 0.3$	V
Power Dissipation	$P_D$	500.0	mW
Operating Temperature	$T_{opr}$	$-30 \sim +60$	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-65 \sim +150$	$^\circ\text{C}$

## DC ELECTRICAL CHARACTERISTICS

(T<sub>a</sub> = 25°C unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Notes
Supply Voltage	$V_{DD}$		2.5		6.0	V	
Key Contact Resistance	$R_{KI}$				1	K $\Omega$	1
Keyboard Capacitance	$C_{KI}$				30	pF	
Key Input Voltage	$K_{IH}$	2 of 7 input mode	$0.8V_{DD}$		$V_{DD}$	V	1
	$K_{IL}$		Gnd	$0.2V_{DD}$			
Key Pull-Up Resistance	$K_{IRU}$	$V_{DD} = 6.0\text{V}$		100		K $\Omega$	
Key Pull-Down Resistance	$K_{IRD}$	$V_{IN} = 4.8\text{V}$		4.0		K $\Omega$	
Mute Sink Current	$I_M$	$V_{DD} = 2.5\text{V}$ $V_O = 0.5\text{V}$	500			$\mu\text{A}$	2
Pulse Output Sink Current	$I_P$	$V_{DD} = 2.5\text{V}$ $V_O = 0.5\text{V}$	1.0			mA	3
Tone Output Sink Current	$I_{TL}$	$V_{DD} = 2.5\text{V}$ $V_O = 0.5\text{V}$	250			$\mu\text{A}$	4
Tone Output Source Current	$I_{TH}$	$V_{DD} = 2.5\text{V}$ $V_O = 0.5\text{V}$	250			$\mu\text{A}$	4
Memory Retention Current	$I_{MR}$	All outputs under no load		0.7		$\mu\text{A}$	6
Operating Current	$I_{OP}$	All outputs under no load		100	150	$\mu\text{A}$	
Mute or Pulse Off Leakage	$I_{LKG}$	$V_{DD} = 6.0\text{V}$ $V_O = 6.0\text{V}$		0.001	1.0	$\mu\text{A}$	2.3
$V_{REF}$ Output Source Current	$I_{REF}$	$V_{DD} - V_{REF} = 6.0\text{V}$	1.0	7.0		mA	5

Note 1) Applies to key input pin. ( $R_1$ - $R_4$ ,  $C_1$ - $C_3$ )

2) Applies to MUTE output in.

3) Applies to PULSE output pin.

4) Applies to TONE pin (KS5805B)

5) Applies to  $V_{REF}$  pin (KS5805A)

6) Current necessary for memory to be maintained. All outputs unloaded.

\* Typical values are to be used as a design aid are not subject to production testing.

AC ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )

Characteristic	Symbol	Min	Typ	Max	Unit	Notes
Oscillator Frequency	$F_{OSC}$		4		KHz	1
Key Input Debounce Time	$T_{DB}$		10		ms	3,4
Key Down Time for Valid Entry	$T_{KD}$	40			ms	4,5
Key Down Time During Two-Key Roll Over	$t_{KR}$	5			ms	4
Oscillator Stat-Up Time ( $V_{DD} = 2.5\text{V}$ )	$t_{OS}$		1		ms	
Mute Valid After Last Outpulse	$t_{MO}$		5		ms	3,4
Pulse Output Pulse Rate	$P_R$		10		PPS	2
On-Hook Time Required to Clear Memory	$t_{OH}$	300			ms	4
Pre-Digital Pause	$T_{PDP}$		800		ms	3,4
Inter-Digital Pause	$T_{IDP}$		800		ms	3,4
Frequency Stability $V_{DD} = 2.5 \sim 3.5\text{V}$	$\Delta f$		$\pm 4$		%	
Frequency Stability $V_{DD} = 3.5 \sim 6.0\text{V}$	$\Delta f$		$\pm 4$		%	
Tone Output Frequency	$F_{TONE}$		1		KHz	4,6

Note: 1)  $R_S = 2\text{M}\Omega$ ,  $R = 220\text{K}\Omega$ ,  $C = 390\text{pF}$ .

2) If pin 10 is tied to  $V_{CC}$ , the output pulse rate will be 20pps.

3) If the 20pps option is selected, the time will be 1/2 these shown.

4) These times are directly proportional to the oscillator frequency.

5) Debounce plus oscillator start-up time  $\leq 40\text{ms}$ .

6) If the 20pps option is selected, the tone output frequency will be 2KHz. (KS5805B ONLY)

## PIN CONNECTIONS

Pin 1:  $V_{DD}$

Pin 2:  $V_{ref}$  (KS5805A)/Pacifier tone (KS5805B)

Pin 3: Column 1

Pin 4: Column 2

Pin 5: Column 3

Pin 6: GND

Pin 7: RC Oscillator

Pin 8: RC Oscillator

Pin 9: RC Oscillator

Pin 10: 10/20pps Select

Pin 11: Make/Break Select

Pin 12: Mute Output

Pin 13: ROW 4

Pin 14: ROW 3

Pin 15: ROW 2

Pin 16: ROW 1

Pin 17: On-Hook/Test

Pin 18: Pulse Output

**TIMING CHARACTERISTICS**

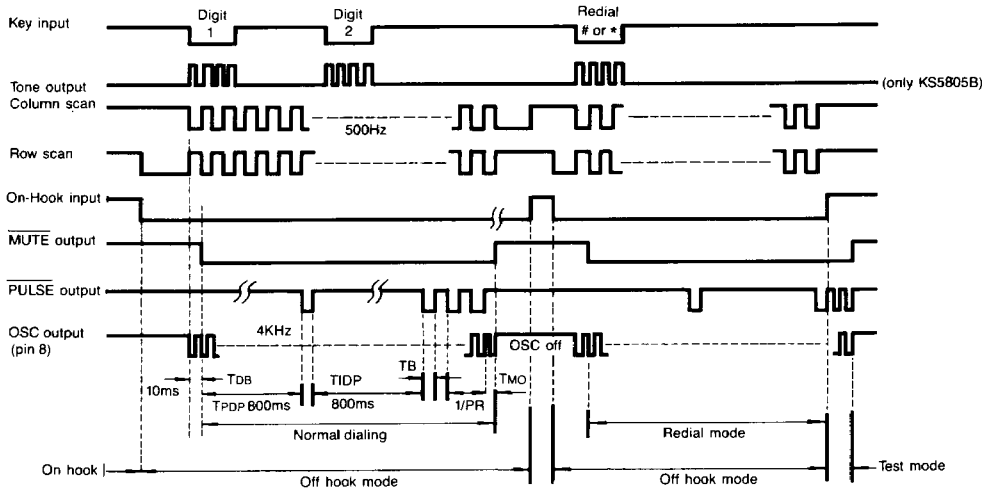


Fig. 2

**PIN DESCRIPTIONS**

**1. V<sub>DD</sub> (Pin 1)**

This is positive supply pin. The voltage on this pin is measured relative to Pin 6 and is supplied from a 150 $\mu$ A current source. This voltage should be regulated to less than 6.0 volts using an external form or regulation.

**2. Tone signal output/V<sub>REF</sub> (Pin 2)**

Tone signal out pin is CMOS complementary output and drives external bipolar transistor. This pin generates a tone signal when a key is depressed. Tone signal frequency is 1KHz when 10pps pulse rate is selected. (the frequency is 2KHz when 20pps pulse rate is selected). Only the pin 2 of KS5805A is V<sub>REF</sub> (on-chip reference voltage).

**TYPICAL I-V CHARACTERISTICS**

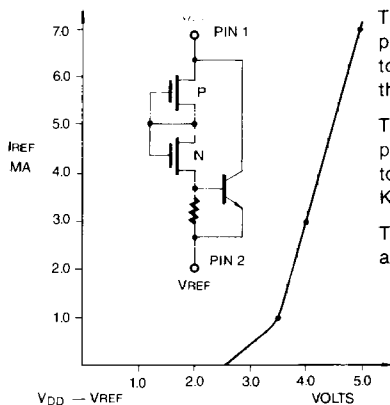


Fig. 3

The V<sub>REF</sub> output provides a reference voltage that tracks internal parameters of the KS5805A. V<sub>REF</sub> provides a negative voltage reference to the V<sub>DD</sub> supply. Its magnitude will be approximately 0.6 volt higher than the minimum operating voltage of each particular KS5805A.

The typical application would be to connect the V<sub>REF</sub> pin to the GND pin (Pin 6). The supply to the V<sub>DD</sub> pin (Pin 1) should then be regulated to 150 $\mu$ A (I<sub>OP</sub> max). With this amount of supply current, operation of the KS5805A is guaranteed.

The internal circuit of the V<sub>REF</sub> function is shown in Figure 3 with its associated I-V characteristic.

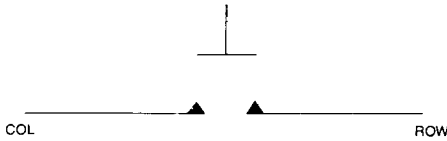
**3. Keyboard inputs (Pin 3, 4, 5, 13, 14, 15, 16,)**

The KS5805A/B incorporates an innovative keyboard scheme that allows either the standard 2-of-7 keyboard with negative common or the inexpensive single contact (form A) keyboard to be used.

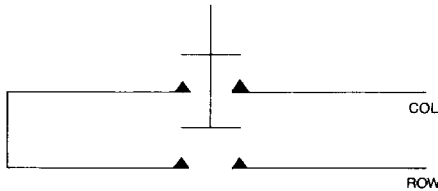
A valid key entry is defined by either a single row being connected to a single column or GND being simultaneously presented to both a single row and column. When in the on-hook mode, the row and column inputs are held high and no keyboard inputs are accepted.

When off-hook, the keyboard is completely static until the initial valid key input is sensed. The oscillator is then enabled and the rows and columns are scanned alternately (pulled high, then low) to verify the varied input. The input must remain valid for 10msec of debounce time to be accepted.

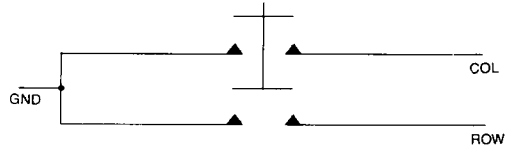
- Form A type keyboard



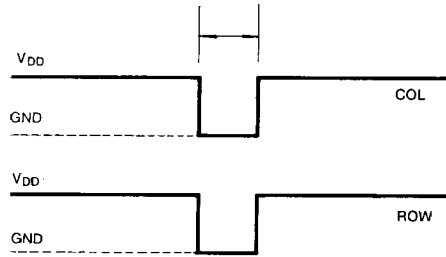
- 2 of 7 keyboard



- 2 of 7 keyboard (negative common)



- Electronic input



KEY BOARD CONFIGURATIONS

**4. GND (Pin 6)**

This is the negative supply pin and is connected to the common part in the general applications.

**5. OSCILLATOR (Pins 7, 8, 9)**

The KS5805A/B contains on-chip inverters to provide oscillator which will operate with a minimum external components.

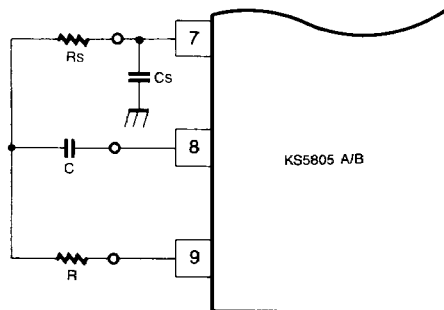
Following figure shows the on-chip configuration with the necessary external components. Optimum stability occurs with the ratio  $K=R_S/R$  equal to 10.

The oscillator period is given by:

$$T = RC (1.386 + (3.5KC_s)/C - (\pm K/(K+1))) \ln (K/(1.5K+0.5))$$

Where  $C_s$  is the stray capacitance on Pin 7.

Accuracy and stability will be enhanced with this capacitance minimized.



### 6. 20/10 pps (Pin 10)

Connecting this pin to GND (pin 6) will select an output pulse rate of 10pps.

Connecting the pin  $V_{DD}$  (pin 1) will select an output pulse rate of 20pps.

### 7. MAKE/BREAK (Pin 11)

The MAKE/BREAK pin controls the MAKE/BREAK ratio of the pulse output. The MAKE/BREAK ratio is controlled by connection  $V_{DD}$  or GND to this pin as shown in the following table.

Input	Make	Break
$V_{DD}$ (Pin 1)	34%	66%
GND (Pin 6)	40%	60%

### 8. MUTE OUTPUT (Pin 12)

The  $\overline{\text{mute}}$  output is an open-drain N-channel transistor designed to drive external bipolar transistor.

This circuitry is usually used to  $\overline{\text{mute}}$  the receiver during outpulsing. As shown in Fig. 2 the KS5805  $\overline{\text{mute}}$  output turns on (pulls to the  $V_{GND}$ -supply) at the beginning of the predigital pause and turns off (goes to an open circuit) following the last break.

The delay from the end of the last break until the  $\overline{\text{mute}}$  output turns off is  $\overline{\text{mute}}$  overlap and is specified as  $t_{MO}$ .

### 9. ON-HOOK/TEST (Pin 17)

The "ON-HOOK" or "Test" input of the KS5805A/B has a 100K $\Omega$  pull-up to the positive supply. A  $V_{CC}$  input or allowing the pin to float sets the circuit in its on-hook or test mode while a  $V_{GND}$  input sets it in the off-hook or normal mode. When off-hook the KS5805A/B will accept key inputs and outputs the digits in normal fashion. Upon completion of the last digit, the oscillator is disabled and the circuit stands by for additional inputs.

Switching the KS5805A/B to on-hook while it is outpulsing causes the remaining digits to be outpulsed at 100x the normal rate (M/B ratio is then 50/50).

This feature provides a means of rapidly testing the device and is also an efficient method by which the circuitry is reset. When the outpulsing in this mode, which can be up to 300msec, is completed, the circuit is deactivated and will require current only necessary to sustain the memory and power-up-clear detect circuitry (refer to the electrical specifications).

Upon retuning off-hook, a negative transition on the mute output will insure the speech network is connected to the line. If the first key entry is either a \* or #, the number sequence stored on-chip will be outpulsed. Any other valid key entries will clear the memory and outpulse the new number sequence.

### 10. PULSE OUTPUT (Pin 18)

The  $\overline{\text{pulse}}$  output is an open drain N-channel transistor designed to drive external bipolar transistor. These transistor would normally be used to  $\overline{\text{pulse}}$  the telephone line by disconnecting and connecting the network. The KS58A/B05 pulse output is an open circuit during make and pulls to the GND supply during break.