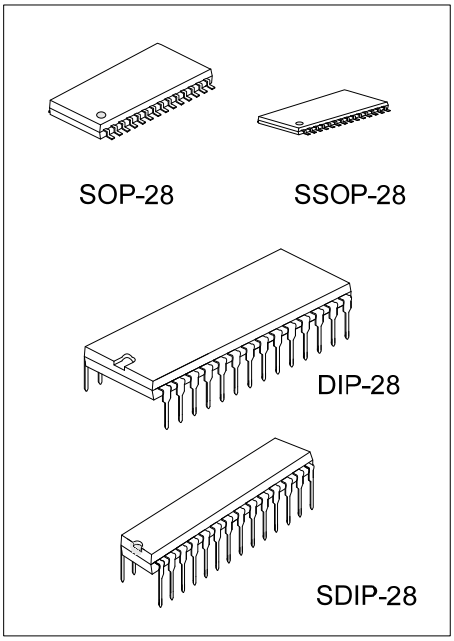
MC34018

LINEAR INTEGRATED CIRCUIT

VOICE SWITCHED SPEAKER-PHONE CIRCUIT



■ DESCRIPTION

The UTC **MC34018** speaker-phone integrated circuit includes all the active circuitry and control functions to implement a high quality hands-free telephone system. The circuit includes a microphone amplifier, a speaker amplifier, level detectors, a background sound level monitoring system in both the transmit and receive channels and an attenuation system which can control the transmit and receive levels as well as the background level.

The applications include household and office speaker-phones, intercom systems, hand free kit for mobile phones, and others.

■ FEATURES

* Chip Select pin for Power conservation (active/standby mode).
* Integrated all necessary active circuitry for a hand-free telephone into one single chip.
* Operating under wide dynamic range through signal compression technology.
* Build-In voltage regulators illuminate external regulators for lining operation.
* Monitoring system for background noise level.
* Background sound level compensation for transmit and receive levels as well as the background level.
* Power audio amplifier for typical 100mW output (into 25Ω) with peak limiting for speaker to minimize distortion.
* Volume control function for external volume control circuit.

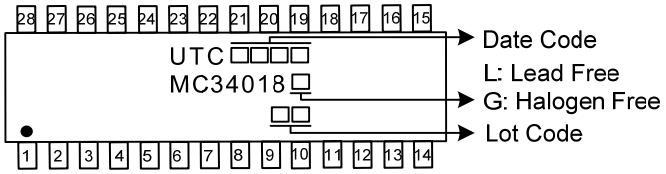
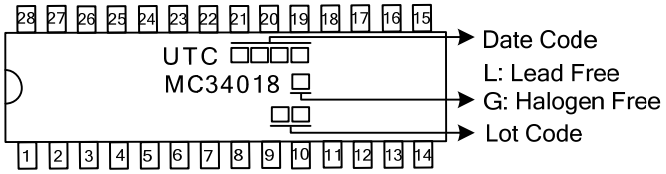
■ ORDERING INFORMATION

Order Number		Package	Packing
Lead Free	Halogen Free		
MC34018L-D28-T	MC34018G-D28-T	DIP-28	Tube
MC34018L-E28-T	MC34018G-E28-T	SDIP-28	Tube
MC34018L-R28-T	MC34018G-R28-T	SSOP-28	Tube
MC34018L-R28-R	MC34018G-R28-R	SSOP-28	Tape Reel
MC34018L-S28-T	MC34018G-S28-T	SOP-28	Tube
MC34018L-S28-R	MC34018G-S28-R	SOP-28	Tape Reel

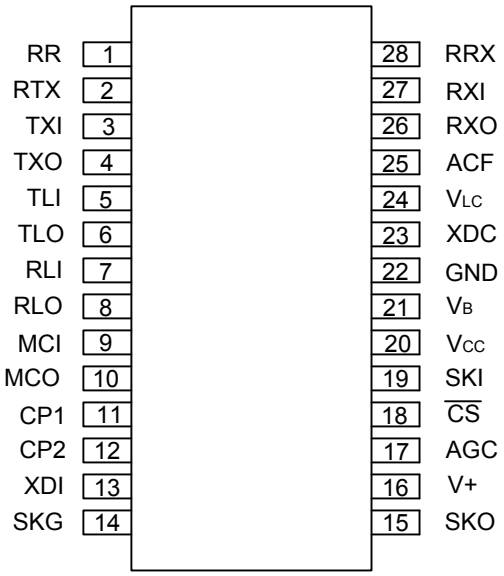
MC34018G-D28-T
(1)Packing Type
(2)Package Type
(3)Green Package

(1) T: Tube, R: Tape Reel
(2) D28: DIP-28, E28: SDIP-28, S28: SOP-28, R28: SSOP-28
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

PACKAGE	MARKING
SOP-28 SSOP-28	
DIP-28 SDIP-28	

■ PIN CONFIGURATION



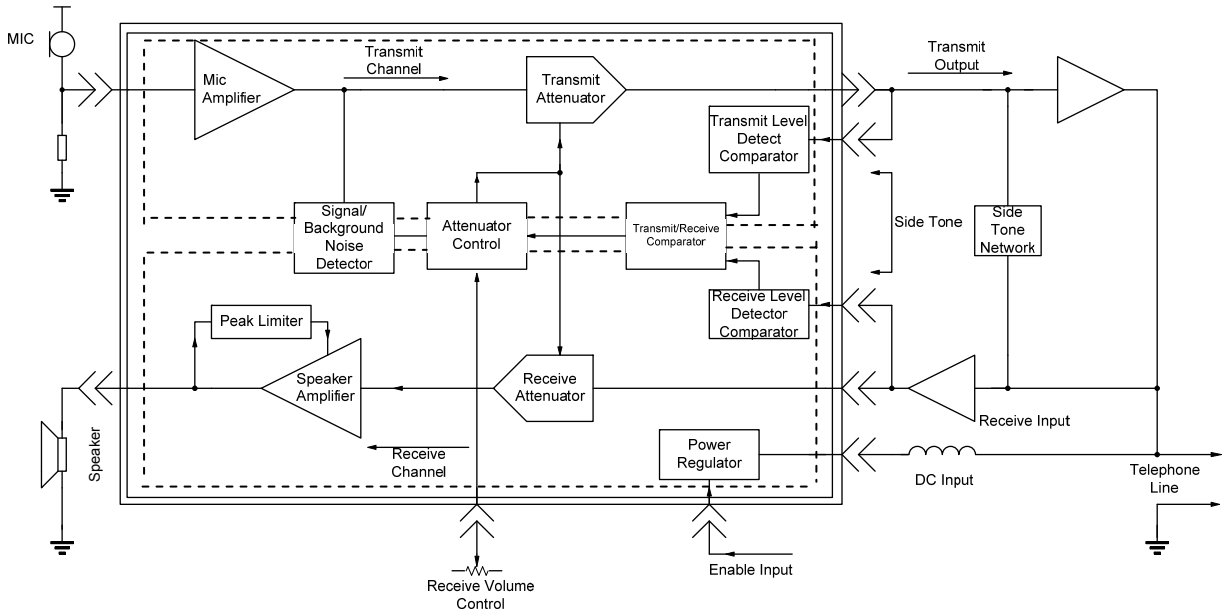
■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	RR	A resistor to ground provides a reference current for the transmit and receive attenuators
2	RTX	A resistor to ground determines the nominal gain of the transmit attenuator, the transmit channel gain is inversely proportional to RTX resistance.
3	TXI	Transmit Attenuator Input, Input resistance is nominally 5.0kΩ.
4	TXO	Transmit Attenuator Output, The TXO output signal drivers the input of transmit level detcetor, as well as the external circuit which drivers the telephone line.
5	TLI	Transmit Level detector Input. An external resistor ac coupled to The TLI pin sets the detection level. Decreasing this resistor increases the sensitivity to transmit channel signals.
6	TLO	Transmit Level detector Output. The external resistor and capacitor set the time the comparator will hold the system in the transmit mode after speech ceases.
7	RLI	Receive Level detector Input. An external resistor ac coupled to The RLI pin sets the detection level. Decreasing this resistor increases the sensitivity to receive channel signals.
8	RLO	Receive Level detector Output. The external resistor and capacitor set the time the comparator will hold the system in the receive mode after speech ceases.
9	MCI	Microphone amplifier input. Input impedance is nominally 10kΩ and the dc bias voltage is approximately equal to VB
10	MCO	Microphone amplifier output. The MIC amp gain is internally set at 34dB (50V/V).
11	CP1	A parallel resistor and capacitor connected between this pin and VCC holds a voltage corresponding to the background noise level. The transmit detector compares the CP1 voltage with the speech signal from CP2.
12	CP2	A capacitor at this pin peak detects the speech signals for comparison with the background noise level held at CP1.
13	XDI	Input to the transmit detector system. The microphone amplifier output is ac coupled to the XDI pin through an external resistor.
14	SKG	High current ground pin for the speaker amplifier output stage. The SKG voltage should be within 10mV of the ground voltage at pin 22.
15	SKO	Speaker amplifier output. The SKO pin will source and sink up to 100mA when ac coupled to the speaker. The speaker amplifier gain is internally set at 34dB (50V/V).
16	V+	Input DC supply voltage. V+ can be powered from Tip and Ring if an ac decoupling inductor is used to prevent loading ac line signals. The required V+ voltage is 6.0V to 11V (7.5V nominal) at 7.0mA.
17	AGC	A capacitor from this pin to VB stabilizes the speaker amplifier gain control loop, and additionally controls the attack and decay time of this circuit. The gain control loop limits the speaker amplifier input to prevent clipping at SKO. The internal resistance at AGC pin is nominally 110kΩ.
18	$\overline{CS}$	Digital chip select input. When at a logic "0" (<0.7V) the VCC regulator is enabled. When at a logic "1" (>1.6V),the chip is in the standby mode drawing 0.5mA.An open $\overline{CS}$ pin is a logic "0".Input impedance is nominally 140k ohms. The input voltage should not exceed 11V.
19	SKI	Input to the speaker amplifier. Input impedance is nominally 20kΩ.
20	VCC	A 5.4V regulated output which powers all circuits except the speaker amplifier output stage. VCC can be used to power external circuitry such as a microprocessor(3.0mA max.) A filter capacitor is required. The UTC MC34018 can be powered by a separate regulated supply by connecting V+ and VCC to a voltage between 4.5V and 6.5V while maintaining $\overline{CS}$ at a logic "1".
21	VB	An output voltage equal to approximately VCC/2 which series as an analog ground for the speakerphone system. Up to 1.5mA of external load current may be sourced from VB. Output impedance is 250 ohms. A filter capacitor is required.
22	GND	Ground pin for the IC(except the speaker amplifier)

■ PIN DESCRIPTION (Cont.)

PIN NO.	PIN NAME	DESCRIPTION
23	XDC	Transmit detector output. A resistor and capacitor at his pin hold the system in the transmit mode during pauses between words or phrases. When the XDC pin voltage decays to ground, the attenuators switch from the transmit mode to idle mode. The internal resistor at XDC is nominally 2.6k ohms(see Fig.1).
24	VLC	Volume control input>connecting this pin to the slider of a variable resistor provides receive mode volume control. The VLC pin voltage should be less than or equal to VB.
25	ACF	Attenuator control filter. A capacitor connected to this pin reduces noise transient as the attenuator control switches level of attenuation.
26	RXO	Receive attenuator Output. Normally this pin is ac coupled to the input of the speaker amplifier.
27	RXI	Receive attenuator Input. Input impedance is nominally is 5.0kΩ.
28	RRX	A resistor to ground determines the nominal gain of the receive attenuator. The receive channel gain is directly proportional to the RRX resistance.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T_A=25°C, Voltage referred to pin 22.)

PARAMETER	SYMBOL	RATINGS	UNIT
V+ terminal Voltage (pin 16)		+12, -1.0	V
$\overline{CS}$ (pin 18)		+12, -1.0	V
Speaker amplifier Ground(pin 14)		+3.0, -1.0	V
V_{LC}(pin 24)		+V_{CC}, -1.0	V
Storage temperature	T_{STG}	-65 ~ +150	°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.

■ RECOMMENDED OPERATION CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
V+ Terminal Voltage (pin 16)		+6.0 ~ +11	V
$\overline{CS}$ (pin 18)		0 ~ +11	V
V_{LC} (pin 24)		0.55V_B ~ V_B	V
Receive Signal(pin 27)		0 ~ 250	mVrms
Microphone Signal(pin 9)		0 ~ 5.0	mVrms
Speaker Amplifier Ground (pin 14)		-10 ~ +10	mVdc
I_{CC} (pin 20)		0 ~ 3.0	mA
Ambient Temperature	T_A	-20 ~ +60	°C

■ TEMPERATURE CHARACTERISTICS (-20 ~+60°C)

PARAMETER	PIN	TYP CHANGE	UNIT
V+ Supply Current (V+ 11V,Pin 18 = 0.7V)	16	-0.2	%/°C
V+ Supply Current(V+ 11V,Pin 18 = 1.6V)	16	-0.4	%/°C
V_{CC} Voltage(V+ = 7.5V)	20	+0.1	%/°C
Attenuator Gain (Max and Min Setting)		±0.003	dB/°C
Delta RXO,TXO Voltage	4,26	±0.24	%/°C
Speaker AMP Gain	15,19	±0.001	dB/°C
Microphone AMP Gain	9,10	±0.4	dB/°C
Microphone Amp Input Resistance	9	+0.4	%/°C
Tx-Rx Switching Threshold (20μA)	5,7	±0.2	nA/°C

■ ELECTRICAL CHARACTERISTICS (Referred to Fig.1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY VOLTAGES						
V_{CC} Voltage	V_{CC}	V+=7.5V	4.9	5.4	5.9	Vdc
Line Regulation	ΔV_{CCLN}	6.5V<V+<11V		65	150	mV
Dropout Voltage	V_D	V+=5.0V		80	300	mV
V_B Voltage	V_B	V+=7.5V	2.5	2.9	3.3	Vdc
V+ Supply Current	I_{V+}	V+=11V, Pin 18=0.7V			9.0	mA
		V+=11V, Pin 18=1.6V			800	μA
Output Resistance	R_{OUT}	I_{CC}=3mA		6.0	20	Ω
Output Resistance	R_{OUT}	I_B=1.7mA		250		Ω
ATTENUATORS						
Receive Attenuator Gain (1.0kHz)	G_{RX}		2.0	6.0	10	dB
Rx Mode, Pin 24= V_B Pin 27 = 250Mvrms	ΔG_{RX}		40	44	48	dB
Range (Rx to Tx Modes) Idle Mode, Pin 27= 250mVrms	G_{RI}		-20	-16	-12	dB

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
RXO Voltage (Rx Mode)		V_{RXO}		1.8	2.3	3.2	mV
Delta RXO Voltage (Switch from Rx to Tx Mode)		ΔV_{RXO}				100	mV
RXO Sink Current (Rx mode)		I_{RXOL}		75			µA
RXO Source Current (Rx mode)		I_{ROXH}		1.0		3.0	mA
RXI Input Resistance		R_{RXI}		3.5	5.0	8.0	kΩ
Volume Control Range		V_{CR}	Rx Attenuator Gain, Rx Mode, $0.6V_B$<Pin 24<V_B	24.5		32.5	dB
ATTENUATORS							
TXO Voltage (Tx mode)		V_{TXO}		1.8	2.3	3.2	Vdc
Delta TXO Voltage (switch from Tc to Rx Mode)		ΔV_{TXO}				100	mV
ACF Voltage (V_{CC}-Pin 25 Voltage)		ΔV_{ACF}	Rx Mode		150		mV
			Tx Mode		6.0		mV
			Idle Mode		75		mV
Transmit Attenuator Gain(1.0kHz)		G_{TX}		4.0	6.0	8.0	dB
Tx Mode, Pin 3 = 250mVrms		ΔG_{TX}		40	44	48	dB
Range, (Tx to Rx Mode) Idle Mode, Pin 3 = 250Mvrms		G_{TXI}		-16.5	-13	-8.5	dB
TXO Sink Current (Tx mode)		I_{SINK}		75			µA
TXO Source Current (Tx mode)		I_{SOURCE}		1.0		3.0	mA
TXO Input Resistance		R_{IN}		3.5	5.0	8.0	kΩ
SPEAKER AMPLIFIER							
Speaker Amp Gain		G_{SPK}	Pin 19 = 20mVrms	33	34	35	dB
SKI Input Resistance		R_{IN}		15	22	37	kΩ
SKO Voltage		$V_{O(SKO)}$	Pin 19 =Cap couple to GND	2.4	3.0	3.6	Vdc
SKO Voltage	High	V_{SKOH}	Pin 19 = 0.1V, -100mA Load at Pin 15	5.5			Vdc
	Low	V_{SKOL}	Pin 19=0.1V +100mA Load at Pin 15			600	mV
MICROPHONE AMPLIFIER							
Microphone Amp Gain		G_{MCI}	Pin 9 = 10mVrms,1KHz	32.5	34	35	dB
Microphone Amp Input Resistance		R_{MCI}		6.5	10	16	kΩ
LOGAMPS							
Leakage Current	RLO	I_{LEAK}	Pin 8 = V_B+1.0V			2.0	µA
	TLO		Pin 6 = V_B+1.0V			2.0	µA
Transmit-Receive Switching Threshold		I_{TH}	Ratio of ITLI to IRLI - at 20µA -to Switch Tx-Rx Comparator)	0.8		1.2	
TRANSMIT DETECTOR							
XDC Voltage	Idle Mode	V_{XDC}			0		Vdc
	Tx Mode				4.0		Vdc
CP2 Current Source		I_{CP2}		5.0	10	13	µA
Distortion							
Rx Mode, RXI to SKO		R_{XD}	Pin 27 = 10mVrms,1KHz		1.5		%
Tx Mode, MCI to TXO		T_{XD}	Pin 9 = 5mVrms,1KHz		2.0		%

Notes: 1. V+=7.5V, CS =0.7V except where noted.
2. Rx mode: Pin7=-100µA,Pin5=+100µA, except where noted.
Tx mode: Pin 5,13=-100µA, pin 7=+100µA, Pin 11=0V.
Idle mode: Pin 5=-100µA, pin 7, 13=+100µA
3. Current into a pin designed as +, current out of a pin designed.
4. Voltage referred to pin 22, T_A=25°C.

■ TEST CIRCUIT

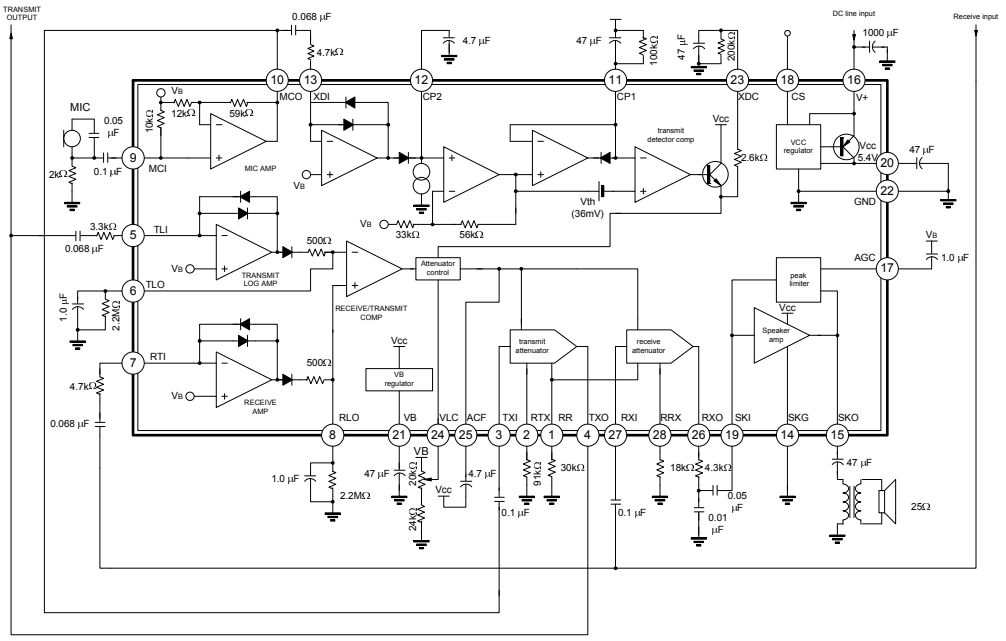


Fig 1 Test circuit

■ BASIC LINE POWERED SPEAKERPHONE

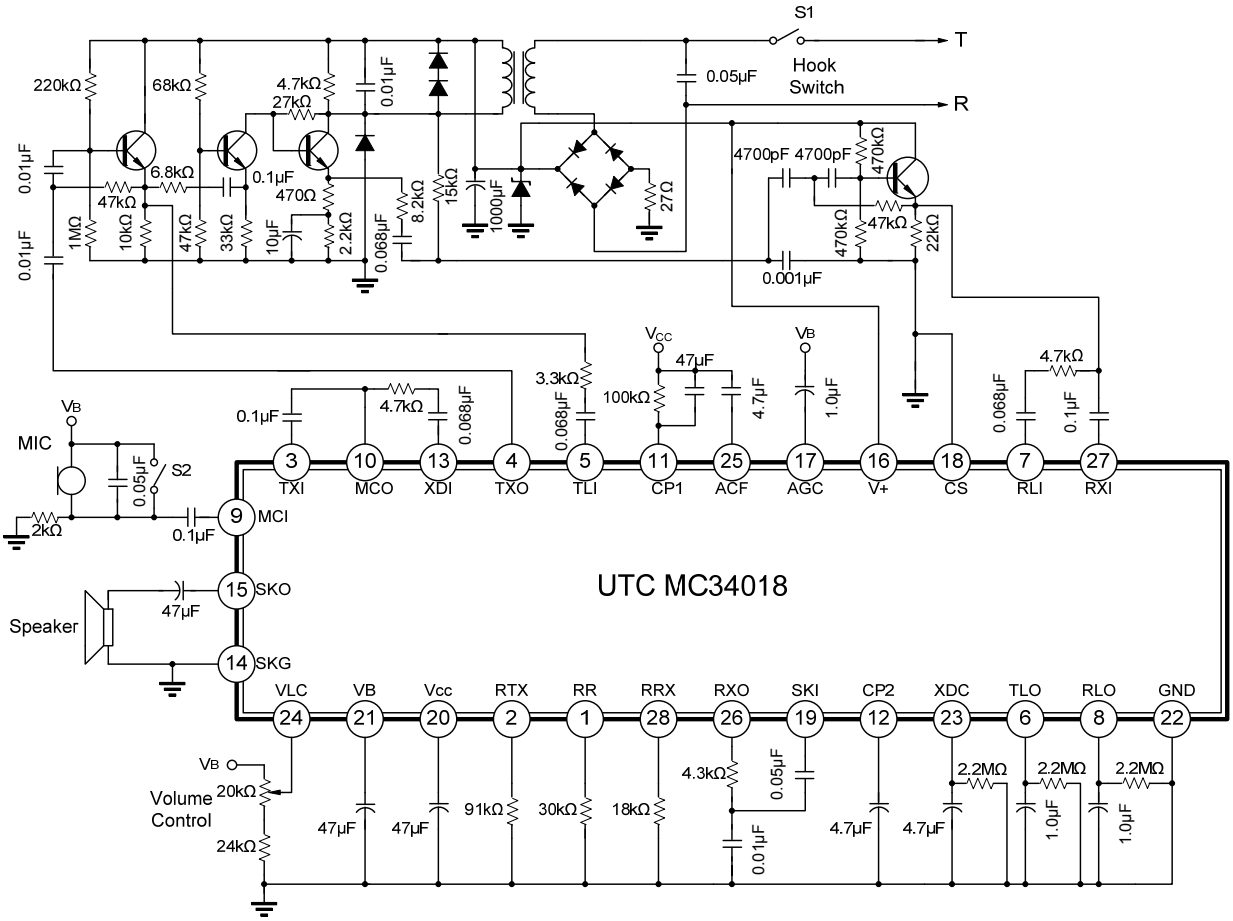


Fig 2