L3211

ADVANCE DATA

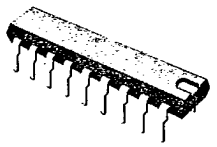
VERY LOW VOLTAGE SPEECH CIRCUIT WITH DTMF INTERFACE

- SPEECH MODE DOWN TO 5mA/1.3V FOR PARALLEL OPERATION
- DTMF MODE DOWN TO 14mA
- A.C. BRIDGE CONFIGURATION ALLOWS ALL IMPEDANCES TO BE CONTROLLED CLOSELY
- DRIVES RECEIVERS OF 150Ω IMPEDANCE FOR REDUCED COST
- ON CHIP DTMF INTERFACE

The L3211 is a monolithic integrated circuit in 18 pin plastic DIP package suitable to replace the hybrid circuit in the telephone set. It works with magnetic capsules in receiving and with electret microphone in sending. With its very low voltage operation the L3211 is particularly suitable to work in parallel with conventional telephone sets.
In addition to speech operation, the L3211 acts as interface for the DTMF for both feeding and signaling functions.

The L3211 basic functions are the following:

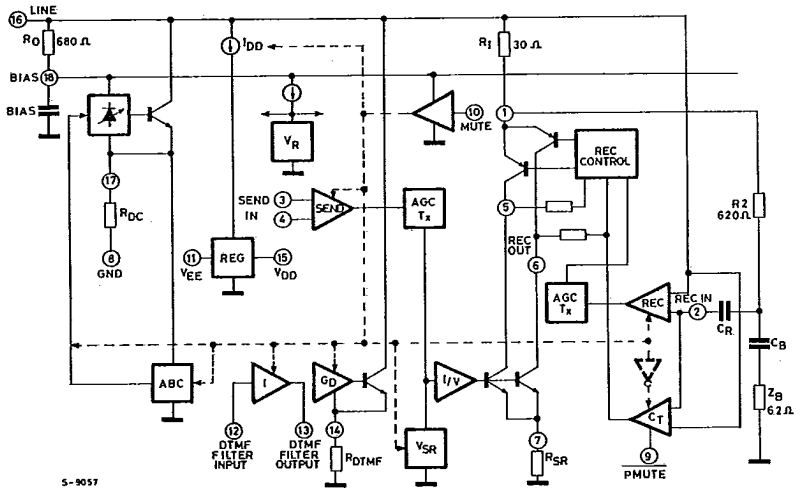
- To present the proper DC path for the line current (particular care has been paid to have very low voltage drop at low line current levels).
- To handle the voice signal, performing the 2/4 wires interface and changing the gain on both sending and receiving amplifiers to compensate for line attenuation by sensing the line current.
- To act as linear interface for the DTMF, supplying a stabilized voltage to the digital chip and delivering to the line the MF tones generated during the signaling.
- To feed with a constant voltage the electret microphone.



DIP-18 Plastic (0.4)

ORDERING NUMBER: L3211

BLOCK DIAGRAM



L3211

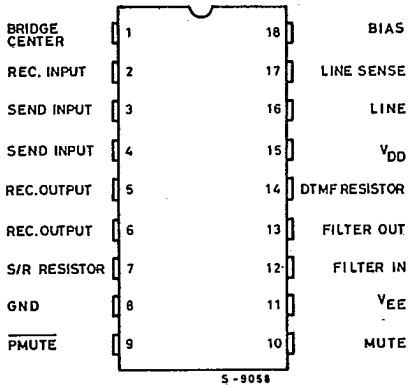
ABSOLUTE MAXIMUM RATINGS

V_L	Line Voltege (3ms pulse duration)	20	V
I_L	Line Current	150	mA
P_{tot}	Total Power dissipation at $T_{amb} = 70°C$	1	W
T_{op}	Operating temperature	-20 to +55	°C
T_{stg}, T_j	Storage and Junction temperature	-60 to +150	°C

THERMAL DATA

$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	80	°C/W

CONNECTION DIAGRAM
(Top view)



Electret Bias (V_{EE})
The electret is biased through a voltage generator at Pin 11.

DC Regulator
This stage provides the path for the DC line current (DC characteristics) through the external resistor R_{DC} to pin 17.

AGC (AGC T_X, AGC R_X)
The Automatic Gain Control is internally fixed for both T_X, and R_X sections. The AGC function is built with low distortion stages.

V_{DD}
A regulated voltage is available at Pin 15 for the bias of the DTMF generator. This stage has the following characteristics:

- When the line voltage drops lower then V_{DD}, the V_{DD} output follows the line voltage.
- The load is fed through a saturated NPN transistor. During pulse dialing when the I_C is disconnected from the line, the capacitor across the V_{DD} output is discharged only by the base-emitter leakage of the NPN transistor. This allows this capacitor to be used for "Keep Alive Memory" in pulse dialing application.

BLOCK DESCRIPTION (continued)

Sending/Receiving Stages
A differential input stage is available in sending. The sending/receiving gains are internally fixed. Nevertheless, sending gain can be adjusted by varying the electret bias and receiving gain can be adjusted by rearranging the external balancing network R_1, R_2, Z_B.

Confidence Level
A confidence level gain stage is built in parallel with the input receiving stage. During DTMF mode the C.L. gain stage is turned on and the input receiving stage is turned off. This permits a fixed amount of DTMF signal when receiving.

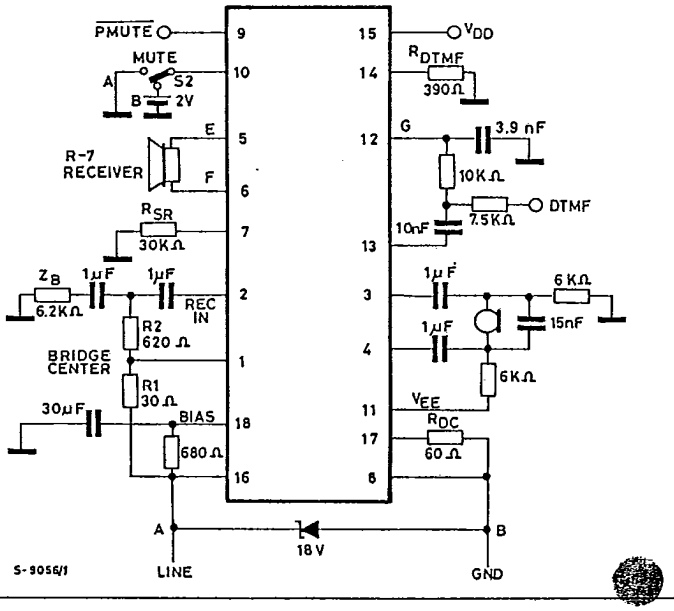
DTMF Amplifier and Filter
The DTMF transconductance output amplifier is available between pins 14 and 16. An external resistor at Pin 14 controls the amount of DTMF gain. A buffer stage for filtering an incoming DTMF gain. A buffer stage for filtering an incoming DTMF tone is provided between pin 12 and 13.

Mute
The functions performed by the mute (active high, pin 10) are:

- Mute of the sending path
- Reduction of the sending/receiving consumption.
- Increase of the source current at the regulated output V_{DD}.
- Increase of the line voltage.
- Switching of the ABC into the high current mode.
- Mute of the first stage in receiving.
- Turn on of the confidence level stage.
- Bias of the DTMF amplifier stage and filter.

$\overline{\text{Pmute}}$
When $\overline{\text{Pmute}}$ (Pin 9) is low the confidence level signal in receiving is muted.

Fig. 1 - Application and test circuit



L3211

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, f = 200 to 3400Hz, S2 in position (a) on the test circuit, unless otherwise specified).

Parameter		Test Conditions	Min	Typ	Max	Unit	Fig.
SPEECH OPERATION for I_L = 20mA to 125mA							
V_L	Line Voltage	I_L = 20mA I_L = 125mA			5.1 12	V V	
G_S	Sending Gain	f = 1KHz I_L = 42mA V_{MI} = 3mV I_L = 96mA	39 35		41 37	dB dB	2 2
	Sending Distortion	f = 1KHz V_{SO} = 700mV I_L = 20mA			2	%	2
	Sending Noise	V_{MI} = 0V		-70		dBmp	2
	Micro Input Impedance	V_{MI} = 3V	40			KΩ	
G_R	Receiving gain	V_{RI} = 0.3V I_L = 42mA f = 1KHz I_L = 96mA	-11 -15		-9 -13	dB dB	3 3
	Receiving Distortion	f = 1KHz V_{RO} = 440mV I_L = 20mA			2	%	3
	Receiving Noise	V_{RI} = 0		100		μV	3
	Receiving out impedance	V_{RO} = 50mV		30		Ω	
	Sidetone	f = 1KHz		36		dB	2
Z_{ML}	Line matching impedance	V_{RI} = 0.3V f = 1KHz		600		Ω	3
	Return Loss	V_{RI} = 0.3V f = 1KHz	-14			dB	3
V_{EE}	Electret Bias		2.4			V	
I_{EE}	Electret Supply Current		0.5			mA	
V_{DD}	DTMF Supply Voltage		2.4			V	
I_{DD}	DTMF Stand-by Supply Current		0.5			mA	
SPEECH OPERATION for I_L = 5mA to 20mA							
V_L	Line Voltage	I_L = 5mA			1.3	V	
V_{SO}	Sending dyn. input voltage	I_L = 5mA		100		mV_{rms}	
I_{RO}	Receiving dyn. output current	I_L = 5mA		0.8		mA	
V_{EE}	Electret bias	I_L = 5mA		0.7		V	

0202 A-01

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test Conditions	Min	Typ	Max	Unit	Fig.
DTMF INTERFACE AND OPERATION I_L = 20mA to 125mA							
V_{DD}	DTMF Supply Voltage	S2 in (b)	2.4			V	
I_{DD}	DTMF Supply Current	S2 in (b)	2.5			mA	
V_{PI}	Sinusoidal Input pair level (Pin 12)	V_{DD} = 2.5V		3.4		V_{PP}	5
DTMF	Amplifier Gain	$f_{MF\ in}$ = 1KHz $V_{MF\ in}$ = 80mV	-3.3	-2.3	-1.3	dB	4
DTMF	Transient Voltage				V_L+5	V	
R_I	Input impedance	$V_{MF\ in}$ = 80mV	60			KΩ	
	Signal Tone Dist.	I_L = 14mA		2		%	
	Starting Delay Time				5	ms	
V_{IL}	Mute Input Low				1.0	V	
V_{IH}	Mute Input High		2.0			V	
V_{CL}	Conf. level gain $(20 \log_{10} \frac{V_{RO}}{V_{SO}})$		-24		-30	dB	
	Sending Gain Mute	V_{MI} = 3mV S2 in (b)		-60		dB	2
I_{LEAK} V_{DD}	Leakage	V_{DD} = 2.5V		2		nA	
DTMF INTERFACE AND OPERATION 14mA to 20mA							
I_b	Boost Current (Pin 12)			100		μA	
V_{SO}	Sinusoidal Output Levels	High Low		-9 -11		dBm dBm	
PULSE DIALING OPERATION							
I_{PL}	Input Low Current $\overline{Pmute}$				50	μA	
I_{LEAK}	Input High Current $\overline{Pmute}$				-10	μA	
	Confidence Level	Pmute Low		-40		dB	3

TEST CIRCUITS

Fig. 2

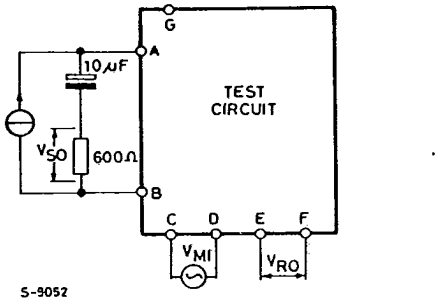


Fig. 3

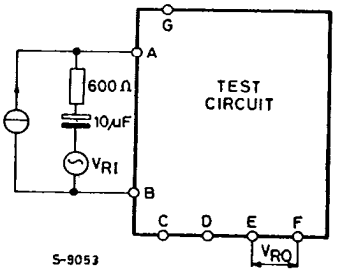


Fig. 4

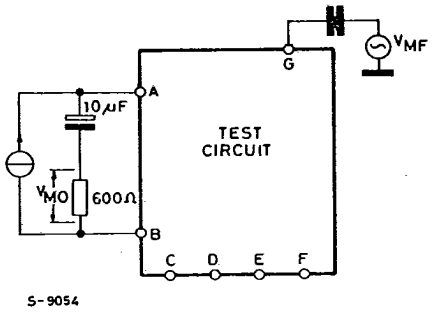
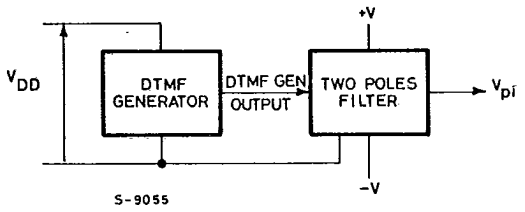


Fig. 5



0204 A-03