Austria Mikro Systeme International AG

Versatile Single Chip Telephone with 14 Number Repertory Dialler

Key Features

- ❑ Line/speech circuit, LD/MF repertory dialler and tone ringer on one 28 pin CMOS chip
- ❑ NET 4 compatible
- ❑ Operating range from 13 to 100 mA (down to 5 mA with reduced performance)
- ❑ Soft clipping to avoid harsh distortion
- ❑ Volume control of receive signal (except AS2531D)
- ❑ Line loss compensation selectable by pin option
- ❑ Low noise (max. - 72 dBmp)
- ❑ Real or complex impedance programmable
- ❑ LD/MF switchable dialling
- ❑ 31 digit last number redial
- ❑ 14 memories, 4 direct/10 indirect or 10 direct
- ❑ Sliding cursor protocol with comparison
- ❑ Pause key for auto pause (2, 3, or 6 sec.) or wait function
- ❑ 2 flash keys, 100 ms and 280 ms or 600 ms
- ❑ On chip MF filter (CEPT CS 203 compatible)
- ❑ Ring frequency discrimination
- ❑ 3-tone melody generator

General Description

The AS2531 is a CMOS integrated circuit that contains all the functions needed to form a high performance electronic telephone.

The device incorporates LD/MF repertory dialling, melody generation, ring frequency discrimination and a high quality line/speech circuit.

A RAM is on chip for a 31 digit last number redial and 14 memories each containing up to 21 digits/data. The sliding cursor procedure makes the LNR function easy to use under various PABX systems.

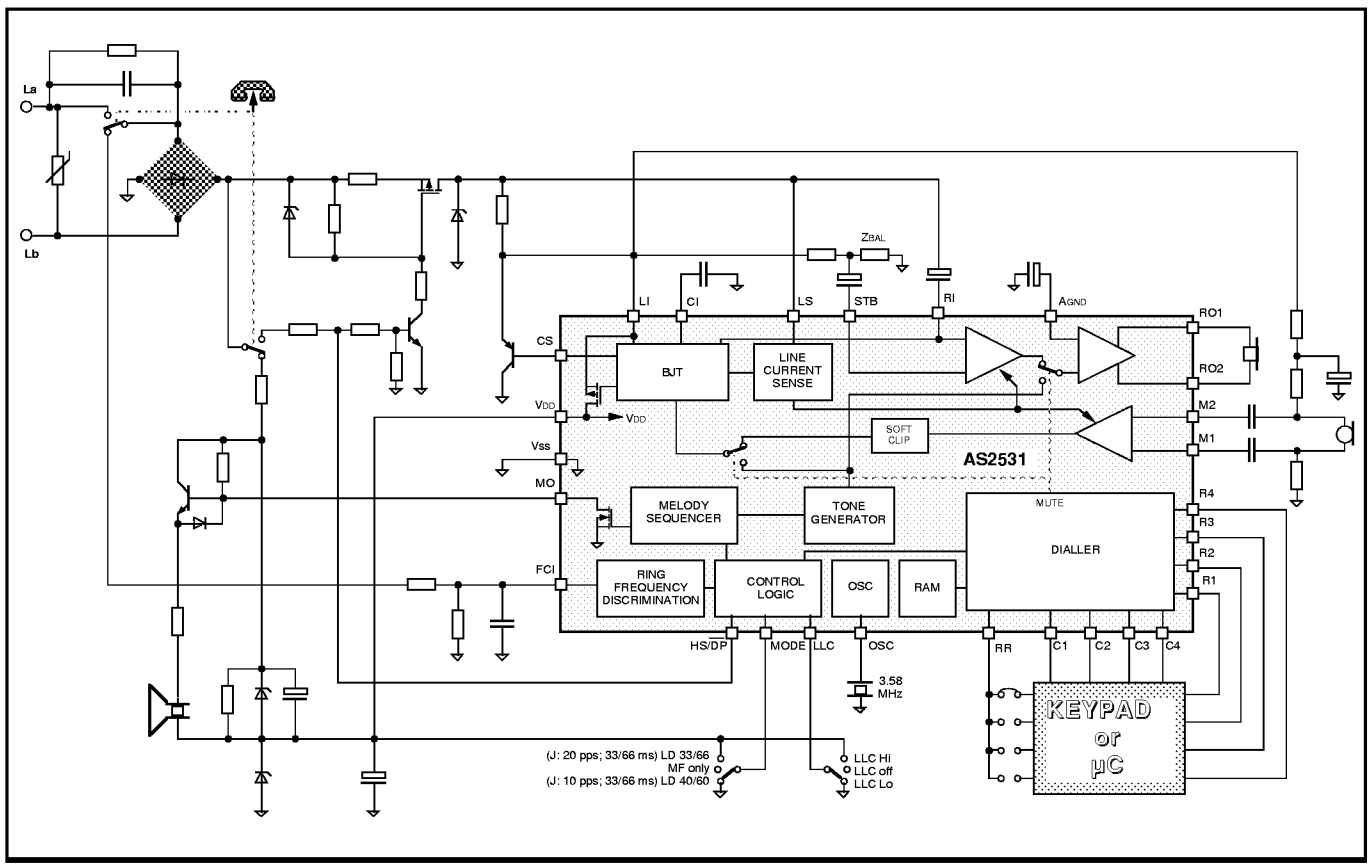
The AS2531 (except AS2531D) incorporates a volume control for the earpiece. The volume can be controlled by the VOL key (+ 4 dB) or by the +/– keys (+6 dB/-4 dB in 5 steps).

The versatility of the circuit is provided by on chip programmability and a few external components. This allows easy adaptation to different PTT requirements.

Package

Available in 28 pin DIP, SOIC and PLCC.

Block Diagramme



Pin Description

Pin #	Symbol	Function
23 24	M1 M2	**Microphone Inputs** Differential inputs for the microphone (electret).
3 2	RO1 RO2	**Receive Outputs** These are the outputs for driving a dynamic earpiece with an impedance of 150 to 300 Ω.
5	A_{GND}	**Analogue Ground** This is the analogue ground for the amplifiers.
28	RI	**Receive Input** This is the input for the receive signal.
6	STB	**Side Tone Balance Input** This is the input for side tone cancellation.
1	LS	**Line Current Sense Input** This is the input for sensing the line current.
27	LI	**Line Input** This input is used for power extraction and line current sensing.
25	CS	**Current Shunt Control Output** This N-channel open drain output controls the external high power shunt transistor for the modulation of the line voltage and for shorting the line during make period of pulse dialling.
4	V_{DD}	**Positive Voltage Supply** This is the supply pin for the circuit.
26	V_{SS}	**Negative Power Supply**
8	MO	**Melody Output** PDM output of the melody generator for tone ringing. At high impedance when not active.
21	FCI	**Frequency Comparator Input** This is a Schmitt trigger input for ring frequency discrimination. Disabled during off-hook.
10	$\overline{HS/DP}$	**Hook Switch Input and Dial Pulse Output** This is an I/O that is pulled high by the hook switch when off-hook and an open drain pulls it low during break periods of pulse dialling and flash.
11	OSC	**Oscillator Input** Pin for ceramic resonator (3.58 MHz). Recommended: Murata CSA 3.58MG312AM.
9	LLC	**Line Loss Compensation** Select pin for line loss compensation. LLC = Open: None LLC = V_{DD}: 45 - 75 mA LLC = V_{SS}: 20 - 50 mA.
12	RR	**Repetition Rate** Select pin for repetition rate of melody for the tone ringer.

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Pin Description cont´d

Pin #	Symbol	Function
22	MODE	**Signalling Mode Select Input** Mode pin: High — LD default mode, 10 pps, M/B 33/66 ms (**J**: 20 pps, M/B 33/66 ms) Mode pin: Open — MF only Mode pin: Low — LD default mode, 10 pps, M/B 40/60 ms (**J**: 10 pps, M/B 33/66 ms)
20 19 18 17	R1 R2 R3 R4	**Keyboard Rows** (see key arrangement in figure 1 and 2)
16 15 14 13	C1 C2 C3 C4	**Keyboard Columns** (see key arrangement in figure 1 and 2)
7	CI	**Complex Impedance Input** Input pin for the capacitor in the complex impedance

Keyboard Connections 1

10 direct memories (either **VOL** or **+/–** keys)

Key closure, $R_{ON\ MAX.}$ = 1 kohm; key open, $R_{OFF\ MIN.}$ = 1 Mohm

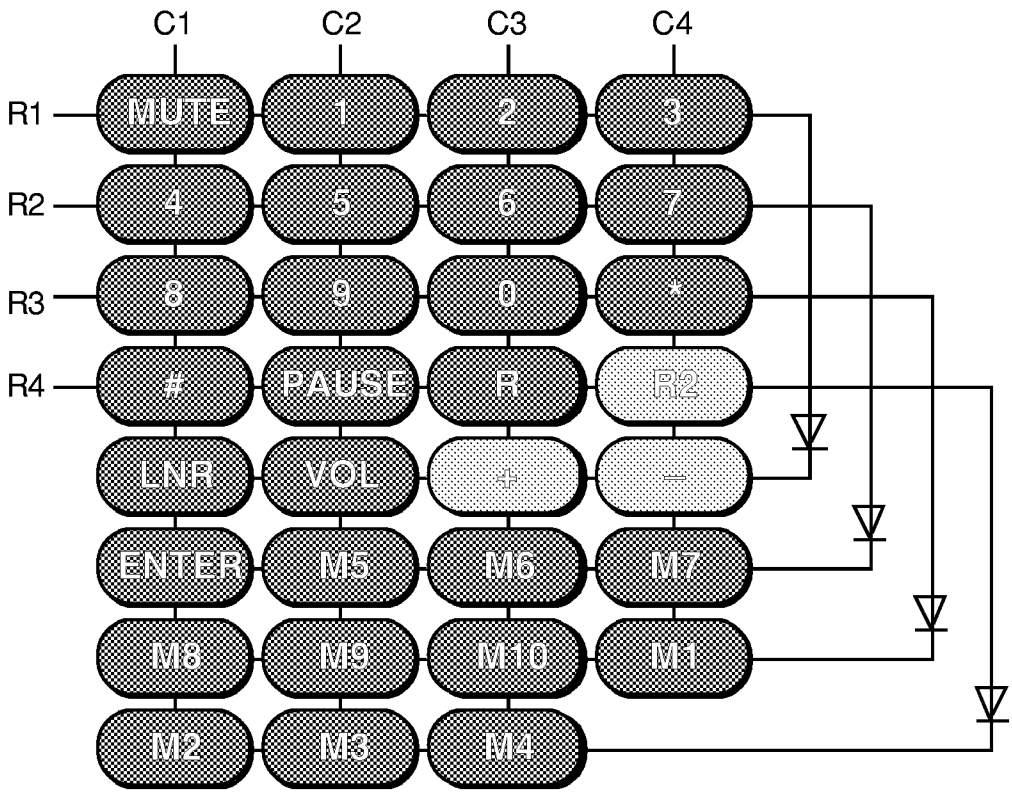


Figure 1

Keyboard Connections 2

4 direct and 10 indirect memories (either **VOL** or **+/–** keys)

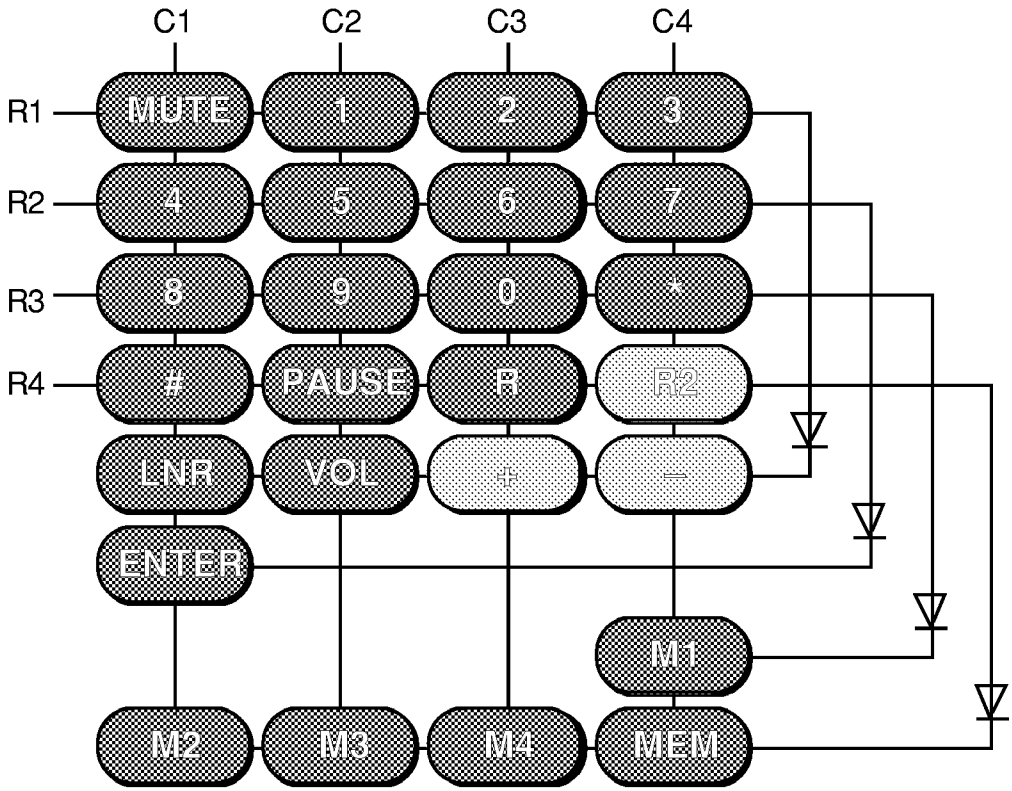


Figure 2

Power On Reset

The on chip power on reset circuit monitors the supply voltage (V_{DD}) during off-hook. When V_{DD} rises above approx. 1.2V, a power on reset occurs which clears the RAM.

DC Conditions

The normal operating range is from 13 mA to 100 mA. Operating range with reduced performance is from 5 mA to 13 mA (parallel operation). In the operating range all functions are operational.

At line currents below 13 mA the AS2531 provides an additional slope below 4.5V in order to allow parallel operation (see figure 14).

The dc characteristic (excluding diode bridge) is determined by the voltage at LI and the resistor R1 at line currents above 13 mA as follows:

$$V_{LS} = V_{LI} + I_{LINE} \cdot R1$$

The voltage at LI 4.5V.

During pulse dialling the speech circuit and other part of the device not operating is in a power down mode to save current. The CS pin is pulled to V_{SS} in order to turn the external shunt transistor on to keep a low voltage drop at the LS pin during make periods.

AC Impedance

The ac impedance of the circuit is set by mask options and an external capacitor. The impedance can be real or complex.

Return loss andside tone cancellation can be determined independant of each other (see figure 3).

Speech Circuit

The speech circuit consists of a transmit and a receive path with dual soft clipping, mute, line loss compensation and sidetone cancellation.

Transmit

The gain of the transmit path is 35 dB for 600 Ω and 37 dB for 1000 Ω from M1/M2 to LS (see test circuit figure 5). The microphone input is differential with an input impedance of 25 kΩ.

The soft clip circuit limits the output voltage at LI to $2V_{PEAK}$ (see figure 10 and 11). The attack time is 30 µs/6 dB and

the decay time is 20 ms/6 dB. When mute is active, during dialling or after pressing the **MUTE** key, the gain is reduced by > 60 dB.

Receive

The gain of the receive path is 2 dB for 600 Ω and 0 dB for 1000 Ω (test circuit figure 5) with differential outputs, RO1/RO2. The receive input is the differential signal of RI and STB. When mute is active during dialling the gain is reduced by > 60 dB. During DTMF dialling a MF comfort tone is applied to the receiver. The comfort tone is the DTMF signal with a level that is -30 dB relative to the line signal.

The receive gain can be changed by pressing the volume keys (except AS2531D). The **VOL** key gives a +4 dB boost and has a toggle function, i.e. repressing the key resets the gain to default. As an alternative the **+/–** keys can be used. The **+** key increases the gain by 6 dB in 3 steps and the **–** key decreases the gain by 4 dB in 2 steps. The gain is reset by next off-hook.

Sidetone

A good sidetone cancellation is achieved by using the following equation:

$$\frac{Z_{BAL}}{Z_{LINE}} = \frac{R5}{R1}$$

The sidetone cancellation signal is applied to the STB input.

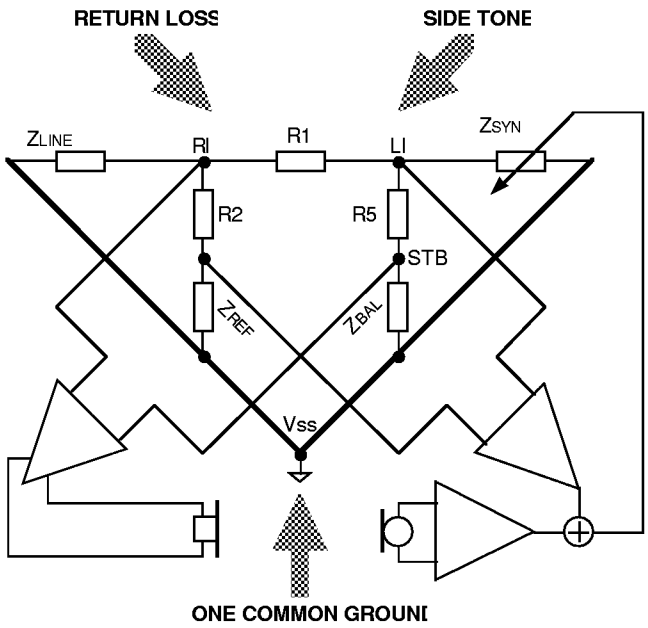


Figure 3
Dual balance bridge (return loss and sidetone) with one common ground

Line Loss Compensation

The line loss compensation is a pin option. When it is activated, the transmit and receive gains are decreased by 6 dB at line currents from 20 to 50 mA when LLC = low and 45 to 75 mA when LLC = high (@ R1 = 30 Ω). The line loss compensation is disabled when LLC = open (see figure 6, 7, 8 and 9).

Dialling Functions

Valid Keys

The key scanning is enabled when HS/DPN is pulled high and V_{DD} is above V_{REF}. A valid key is detected from the keyboard by connecting the appropriate row to the column (R_{ON} 1 kohm). This can be done using an n x m keyboard matrix with single contacts. Four diodes are used to extend the number of rows (see keyboard arrangement 1 and 2). It is also possible to connect a µcontroller to the rows and columns.

Mute Key

The **MUTE** key is enabled in speech mode only. Depressing the **MUTE** key mutes the microphone amplifier. Repressing the **MUTE** key deactivates the mute (toggle function). Any key entry overwrites a mute activated by the **MUTE** key and mute will be deactivated.

When privacy mute is activated, a reminder tone is applied to the earpiece.

Dial Mode Selection

The default mode (LD or MF) can be selected by the mode pin. When default LD mode is selected, a temporary change to MF can be invoked by pressing the * key (**F**: MF tone generated on the first * key). The circuit will revert to LD by pressing the **R** (or **R2**) key or by next on-hook.

When MF mode is selected by the mode pin, the circuit can not be changed temporary to LD but will remain in MF.

Last Number Redial

LNR is a facility that allows resignalling of the last manually dialled number without keying in all the digits again. The LNR is repeatable.

The current contents of the RAM are overwritten by new entries.

A manually entered number is automatically stored in the LNR RAM. The capacity of the RAM is 31 digits. If a number greater than 31 digits is entered, the LNR facility will be inhibited (until new entries < 32 digits) and further entries will be buffered in FIFO.

Pauses can be inserted by pressing the **PAUSE** key. Post dialled digits, i.e. digits manually entered after LNR has been invoked, are not stored in RAM but buffered in FIFO.

Recall Function
A recall (**R** key or **R2** key) activation will invoke a flash (timed loop break), however, on **C/D/E/G** a flash is never executed in LD mode.

If recall is the first entry in a digit string, it will be stored in LNR RAM when digit(s) are entered after the recall.

If the recall key is depressed after a digit string has been entered or dialled out, the recall will not be stored but buffered in the FIFO together with subsequently entered digit.

If pressing the recall key is not followed by digit entries, the LNR RAM remains intact.

A post flash pause of 3 sec. (**C/D/E/G/J/U**) or 274 ms (**A/B/F**) will automatically be executed.

Memory Keys
The keys **M1** to **M10** are direct memory access keys and the **MEM** key is used for abbreviated dialling.

In the on chip RAM,14 numbers can be stored. Each number can contain up to 21 digits (including pauses).

During programming multiple pauses can be inserted by pressing the **PAUSE** or the **LNR** key. Each pause is 3 seconds (C: 6 sec, F: 2 sec) when inserted within the first 5 digits otherwise a wait function that will halt dialling until the **PAUSE** or the **LNR** key is depressed.

Memory dialling is cascadable. However, the content of one memory must be dialled out before a new can be invoked.

Sliding Cursor Procedure
To accommodate easy and uncomplicated redialling (LNR) behind a PABX, a sliding cursor protocol is implemented. If new entries match the previous RAM contents, pressing the **LNR** key will dial out the remaining digits.

If there is an error in matching, the LNR will be inhibited until next on-hook, and the RAM will contain the new number.

Tone Generator
The tone generator incorporates the DTMF tones and 3 basic frequencies for the tone ringer.

DTMF
The DTMF generator provides 7 frequencies, namely:

Low group	
Digit 1-2-3	697 Hz
Digit 4-5-6	770 Hz
Digit 7-8-9	852 Hz
Digit * -0-#	941 Hz
High group	
Digit 1-4-7- *	1209 Hz
Digit 2-5-8-0	1336 Hz
Digit 3-6-9-#	1477 Hz

The MF output level is -6/-8 dBm or -9/-11 dBm depending on version. The preemphasis is 2.6 dB.

The MF tones are according to CEPT recommendations.

Tone Ringer (Melody)
The three basic frequencies of the melodies are:

F1 = 800 Hz, F2 = 1067 Hz, and F3 = 1333 Hz (± 5%).

The repetition rate can be set by pin options as follows:

Pin RR	Repetition rate
R1	1 time (50 ms pause)
R2	4 times
R3	7 times
R4	10 times
open	disabled

Repetition rate means that a sequence of 6 frequencies is repeated 1, 4, 7 or 10 times within 1 second.

The sequence of the frequencies is controlled by the sequence register as follows:

Sequence F1 F2 F3 F1 F2 F3 ...

Ring Frequency Discrimination
The ring frequency discriminator assures that only signals with a frequency between 13Hz and 70 Hz (AS2531D/G: 20 Hz to 60 Hz) are regarded as valid ring signals.

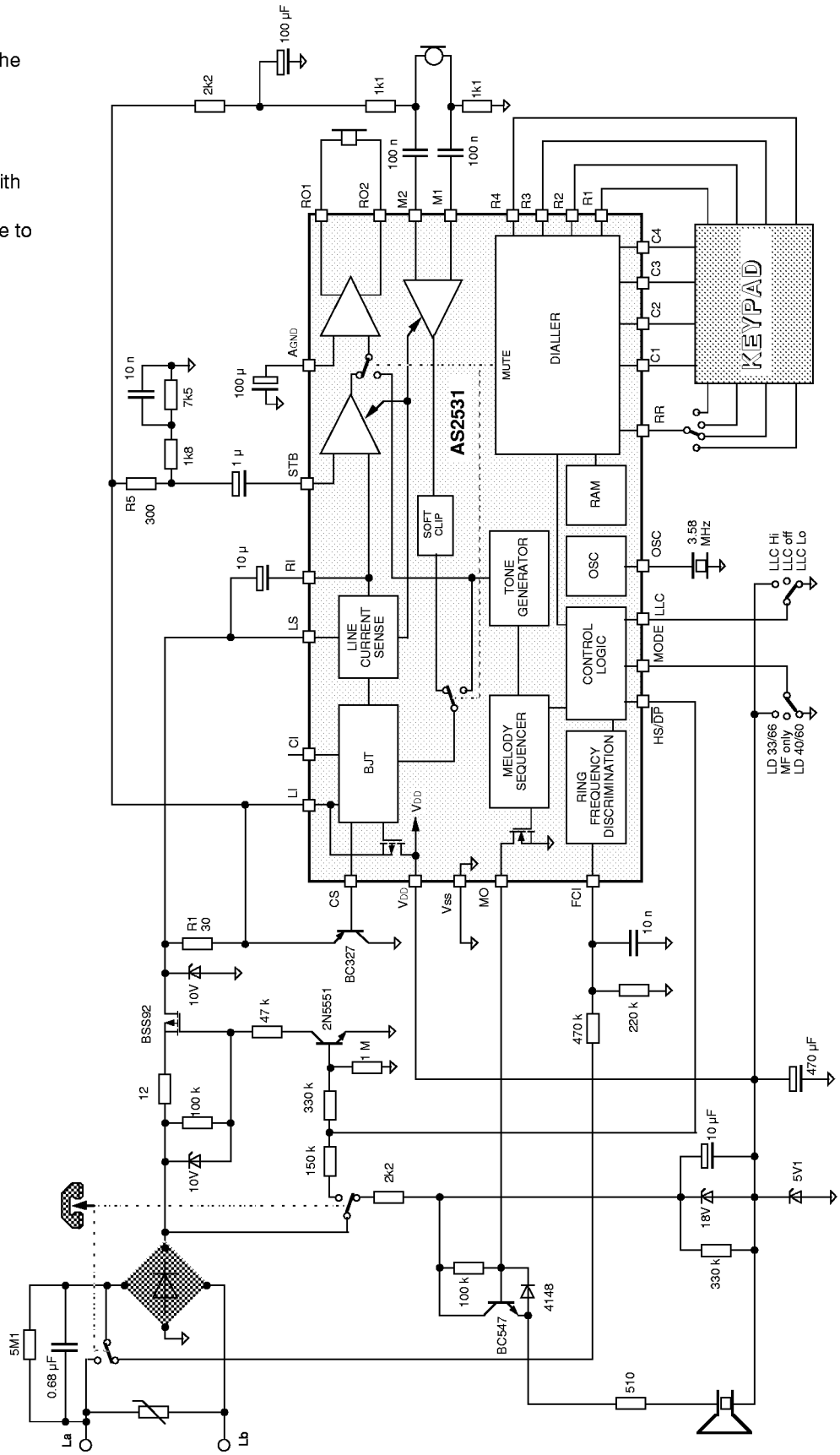
When a valid ring signal is present for 73 ms continuously, the melody generator is activated and remains active as long as the ring signal is present.

Once the melody generator has been started, the ring signal is continuously monitored and the melody generator is instantly turned on or off according to the momentary presence of a valid or unvalid ring signal respectively (until next POR or off-hook).

Typical Application

Only the components necessary for presenting the complete functions of the AS2531 are included.

The external components might change to comply with various national PTT regulations and to interface to different transducers.



Operating Procedures

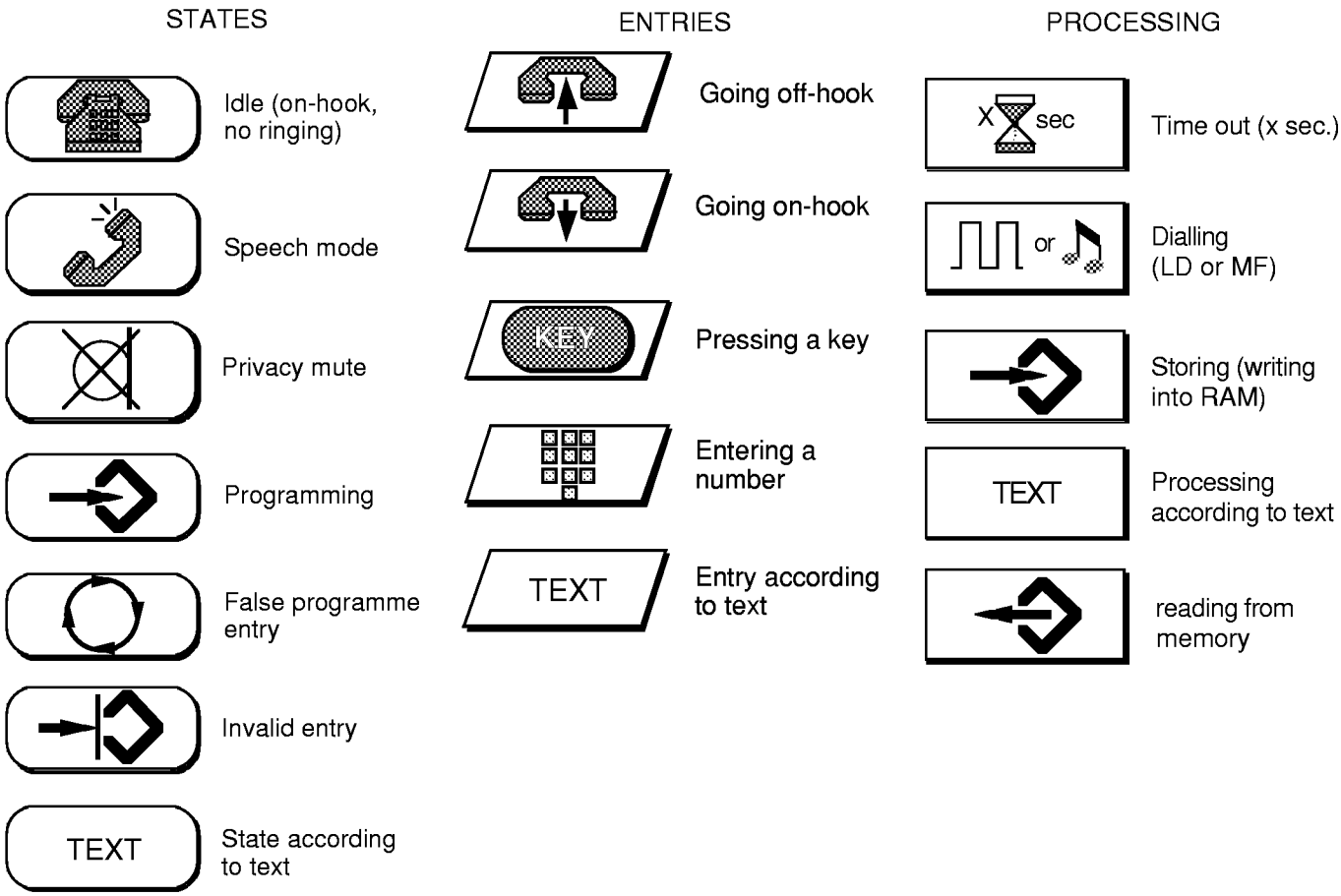
Procedure Principles

The procedures for utilizing the features of the AS2531 are optimized out of consideration for the human factor in order to:

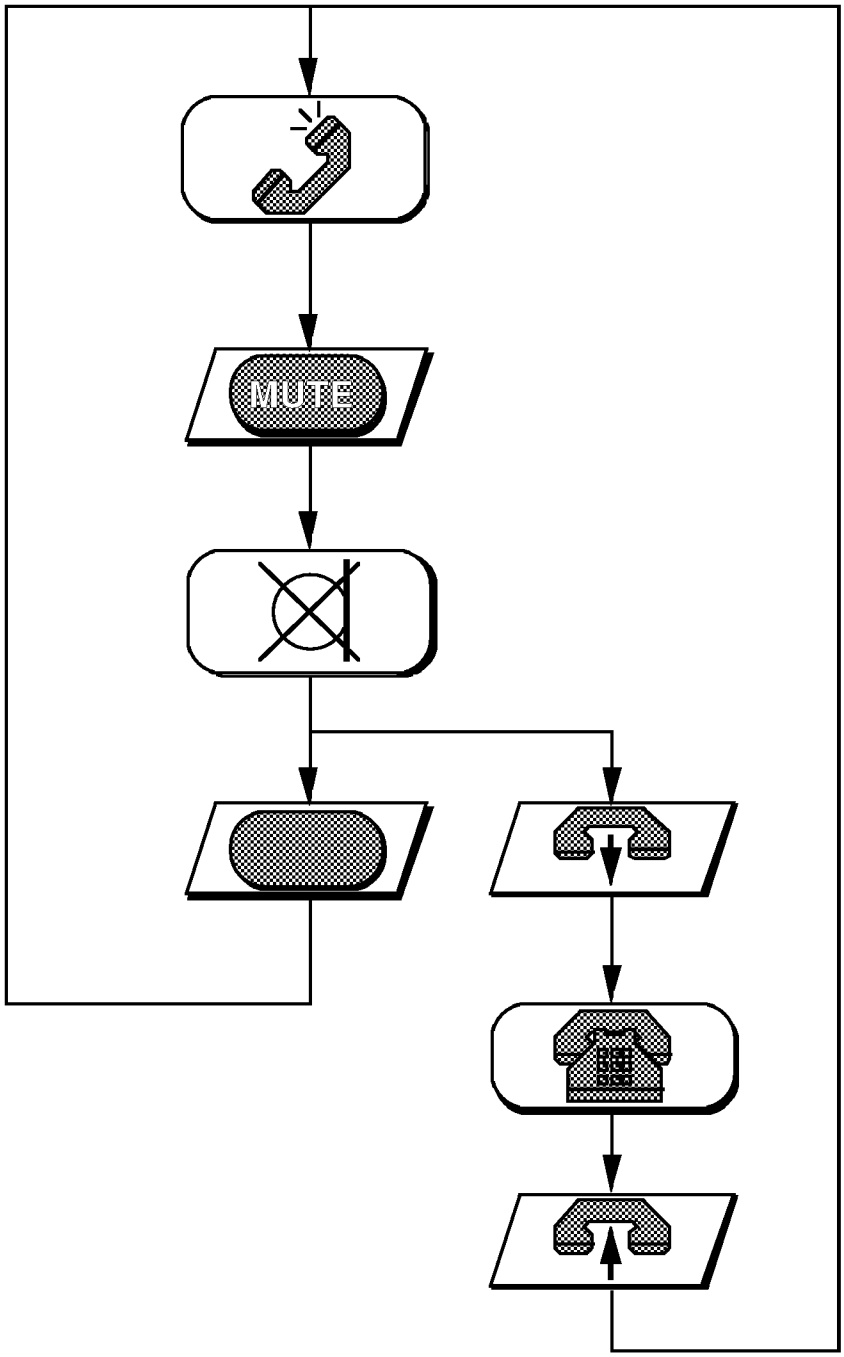
- meet the user´s expectations
- be easy to learn and relearn
- not invoke any automatic functions which the user doesn´t expect
- protect the user from committing critial errors, e.g. dialling wrong numbers, deleting stored numbers, etc.
- be consistent, simple and usable.

The following pages describe the operating procedures for the provided features. Pressing an unvalid key or key combination during programming will cause the device to abort the programme state. Pressing any key combination or sequence which is not described or defined may cause the device to enter a state or mode that does not comply with the expectation of the user. In such cases, any undesired state can be terminated at any time by going on-hook / off-hook which will generate a functional reset.

Symbols

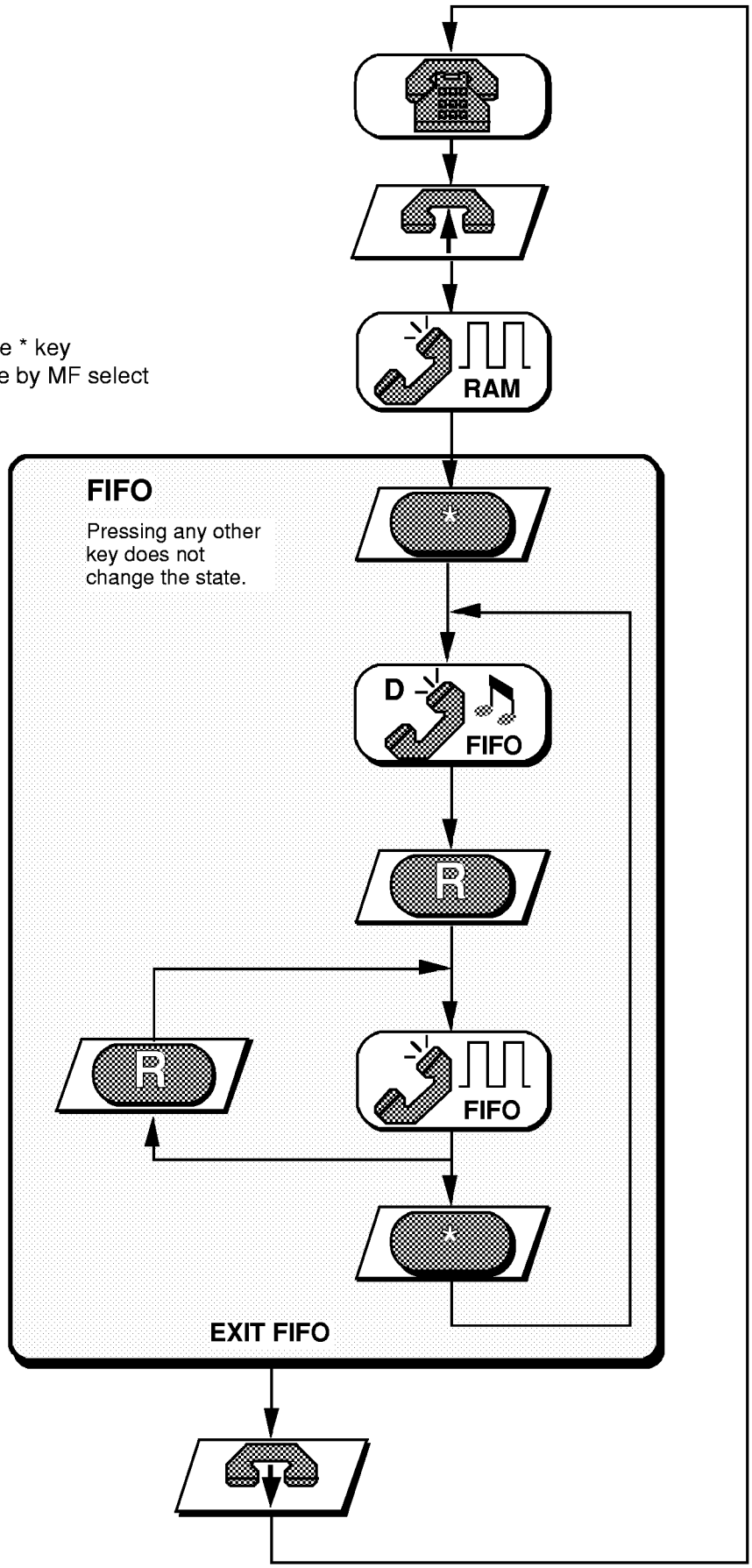


Privacy Mute

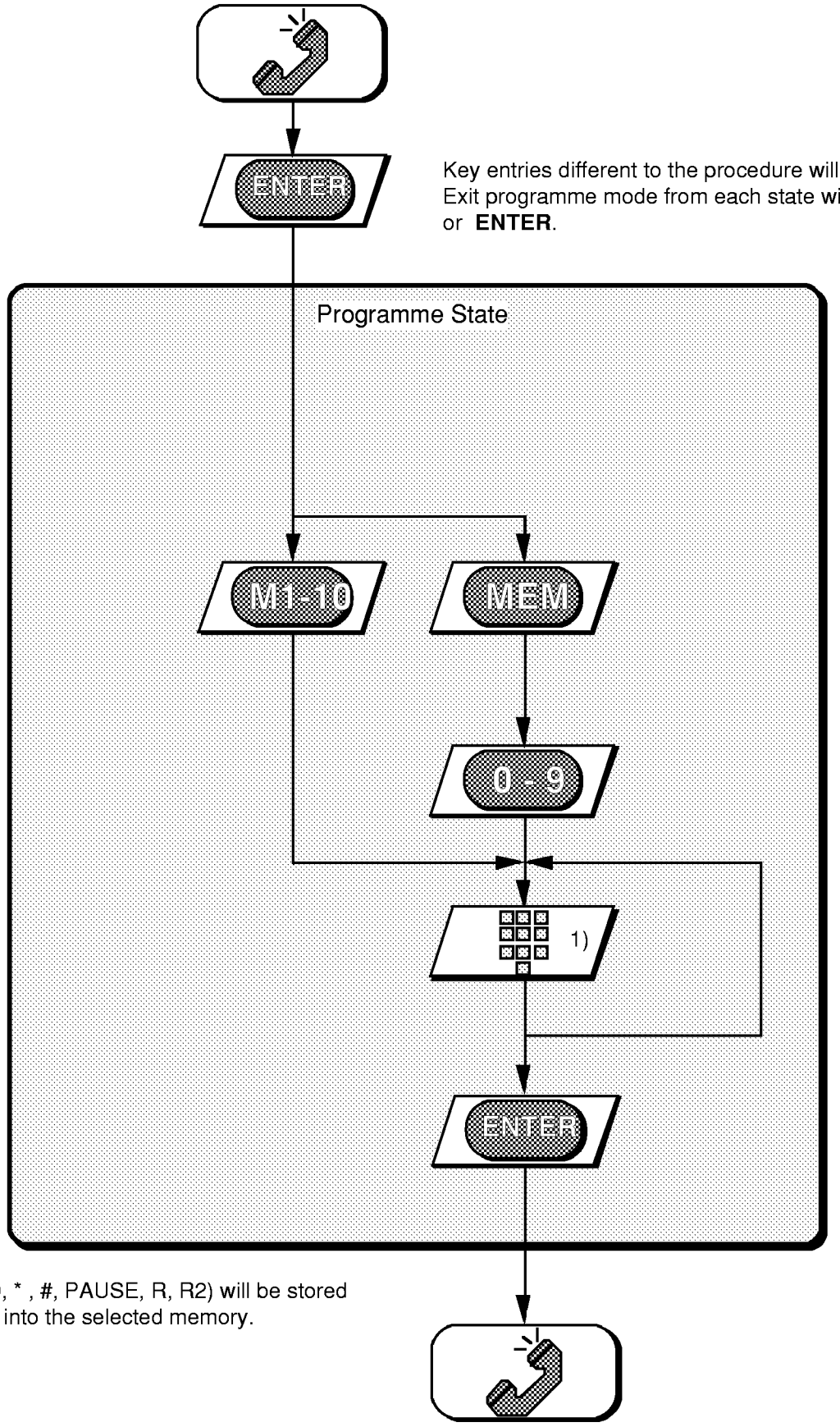


Temporary MF

AS2531F: pressing the * key
also transmits the tone by MF select

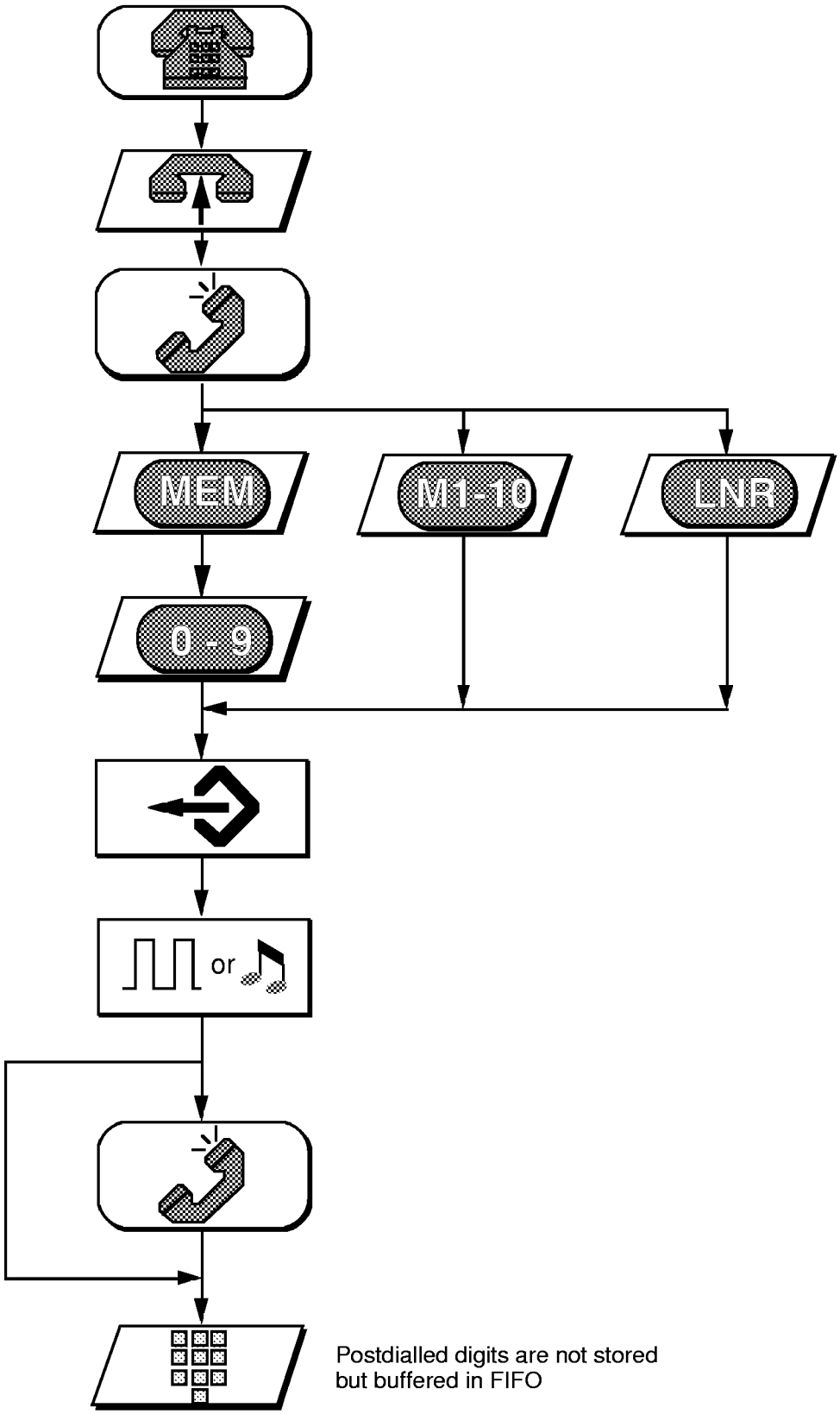


Storing Numbers



1) Entries (0 - 9, * , #, PAUSE, R, R2) will be stored immediately into the selected memory.

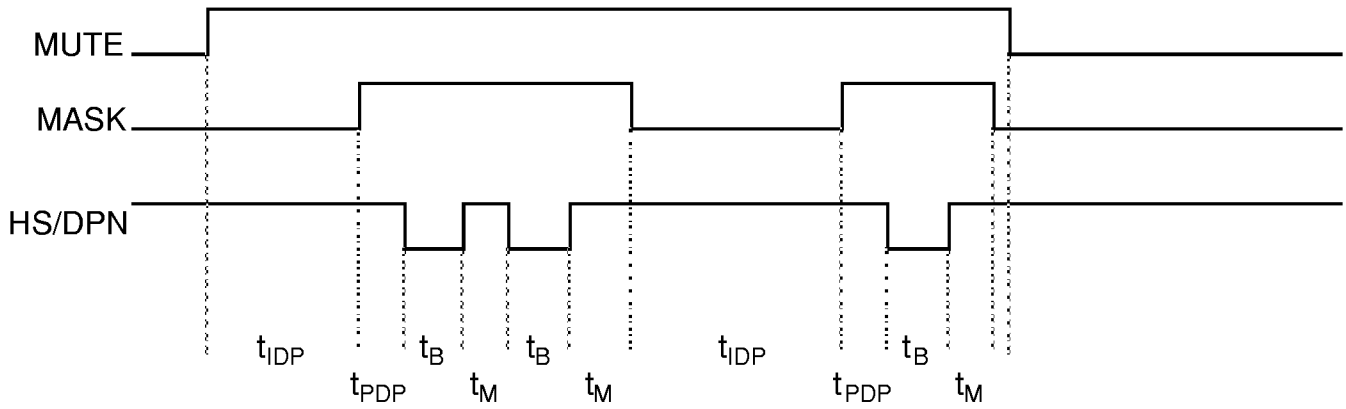
Automatic Dialling



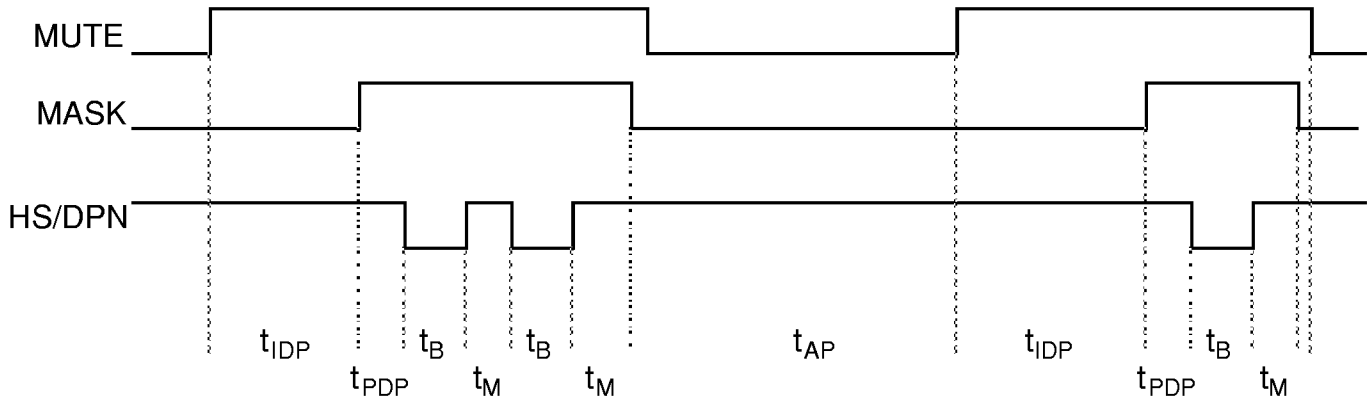
Postdialled digits are not stored
but buffered in FIFO

Timing Diagrammes

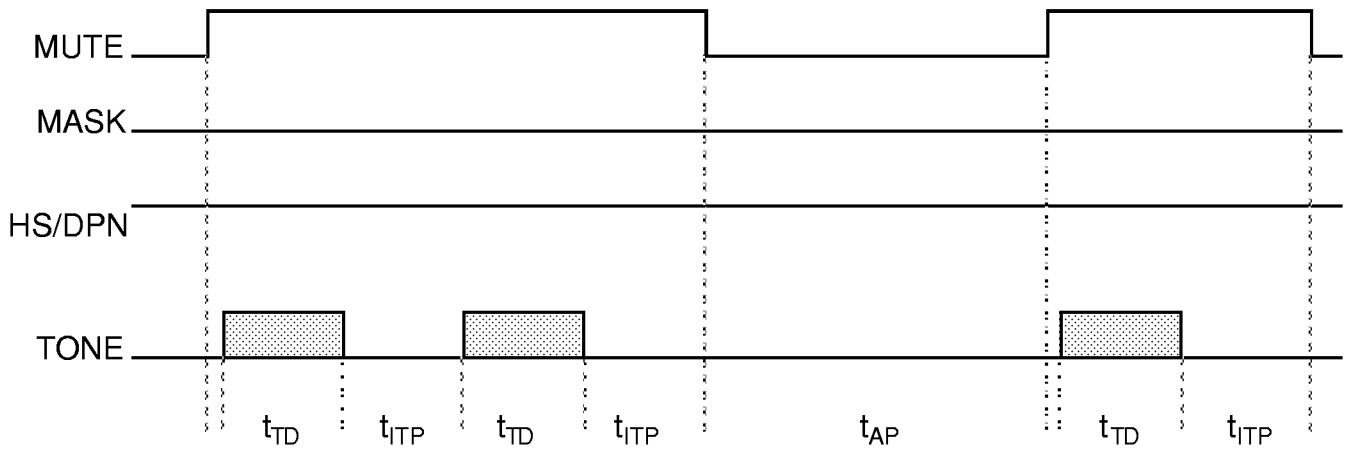
LD Dialling



LD Dialling With Access Pause



MF Dialling



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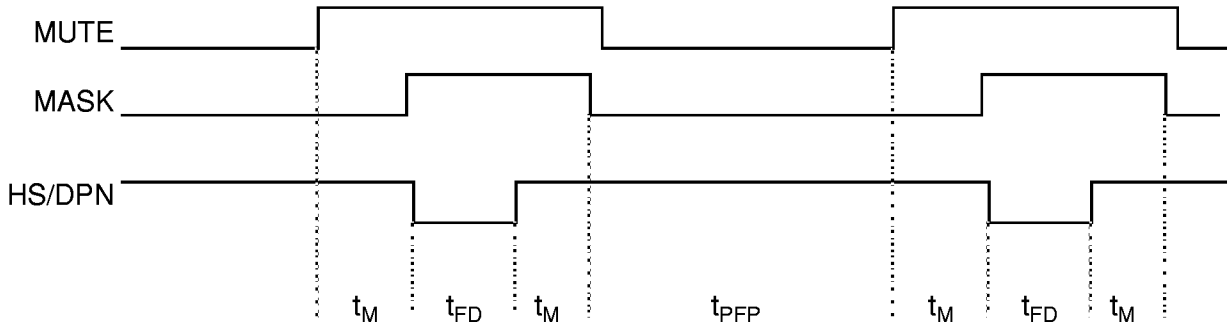
Flash



Electrical Characteristics

Absolute Maximum Ratings

Positive Supply Voltage	$-0.3V \le V_{DD} \le 7V$
Input Current	± 25 mA
Input Voltage (LS)	$-0.3V \le V_{IN} \le 10V$
Input Voltage (LI, CS)	$-0.3V \le V_{IN} \le 8V$
Input Voltage (STB, RI)	$-2V \le V_{IN} \le V_{DD} + 0.3V$
Input Voltage (MO)	$-0.3V \le V_{IN} \le 35V$
Digital Input Voltage	$-0.3V \le V_{IN} \le V_{DD} + 0.3V$
Electrostatic Discharge	+/- 800V
Storage Temperature	-65°C to +125°C

Recommended Operating Conditions

Supply Voltage * (Speech Mode)	$4V \le V_{DD} \le 5V$
Oscillator Frequency (Resonator: Murata CSA 3.58M G312AM)	3.58 MHz
Operating Temperature	- 25°C to +70°C

* This voltage is generated internally

DC Characteristics (I_{LINE} = 15 mA unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{DD}	Operating Current	Speech mode		3	5	mA
		MF dialling		4		mA
		LD dialling, V_{DD} = 2.5V		200		µA
		Ring mode, V_{DD} = 2.5V		300		µA
I_{DD0}	Retention Current	Idle mode, V_{DD} = 2V T_{AMB} = 25°C		0.05		µA
V_{LI}	Line Voltage (default)	13 mA ≤ I_{LINE} ≤100 mA		4.5		V
I_{OL}	Output Current, Sink CS, HS/DP, MO	V_{OL} = 0.4V		1.5		mA

AC Characteristics (I_{LINE} = 15 mA; f = 800 Hz unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Tx	**Transmit**	**Test Circuit Fig. 5**				
A_{TX}	Gain (M1/M2)	**A/B/E/F/J** (600 Ω)	34	35	36	dB
		C/D/G/U (1000 Ω)		37		dB
$\Delta A_{TX/F}$	Variation with Frequency	f = 500 Hz to 3.4 kHz		±0.8		dB
THD	Distortion	$V_{LI} \leq 0.5V_{RMS}$			2	%
V_{AGC}	Soft Clip Level	V_{LI} =		2		V_{PEAK}
A_{SCO}	Soft Clip Overdrive			20		dB
t_{ATTACK}	Attack Time			30		µs/6 dB
t_{DECAY}	Decay Time			20		ms/6dB
Z_{IN}	Input Impedance (M1/M2)			20		kΩ
A_{MUTE}	Mute Attenuation	Mute activated	60			dB
V_{NO}	Noise Output Voltage	T_{AMB} = 25°C			-72	dBmp
$V_{IN\ Max}$	Input Voltage Range	Differential		±1		V_{PEAK}
	(M1/M2)	Single Ended		±0.5		V_{PEAK}
BJT	**Output Driver**					
$V_{IN\ MAX}$	Input Voltage Range (LI)			±2		V_{PEAK}
V_{TX}	Dynamic Range			±2		V_{PEAK}
RL	Return Loss; **A/B/E/F/J**	Z_{RL}= 600Ω; T_{AMB} = 25°C	18			dB
RL	Return Loss; **C/D/G/U**	Z_{RL}= 1000Ω; T_{AMB} = 25°C	18			dB
$\Delta Z_{AC/TEMP}$	Variation with Temperature			0.5		Ω/°C
Rx	**Receive**	**Test Circuit Fig. 5**				
A_{RX}	Receive Gain (RO1/RO2)	**A/B/E/F/J** (600Ω)	1	2	3	dB
		C/G/U (1000Ω)		0		dB
		D (1000Ω)		6		dB
$\Delta A_{RX/F}$	Variation with Frequency	f = 500 Hz to 3.4 kHz		±0.8		dB
THD	Distortion	$V_{RI} \leq 0.5V_{RMS}$			2	%
V_{AGC}	Soft Clip Level	V_{RI} =		1		V_{PEAK}
A_{SCO}	Soft Clip Overdrive			10		dB
t_{ATTACT}	Attact Time	V_{RI} > 0.8V		30		µs/6 dB
t_{DECAY}	Decay Time			20		ms/6dB
V_{NO}	Noise Output Voltage				-72	dBmp
$V_{FC.}$	Unwanted F. Components	50 Hz…20 kHz			-60	dBm
Z_{IN}	Input Impedance (RI)			8		kΩ
$V_{IN\ RI}$	Input Voltage Range (RI)			±2		V_{PEAK}

AC Characteristics (cont´d) (I_{LINE} = 15 mA; f = 800 Hz unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
ST	**Sidetone**	**Test Circuit Fig. 5**				
A_{ST}	Sidetone Cancellation	$V_{RI} \leq 0.5V_{RMS}$	26			dB
$V_{IN\ ST}$	Input Voltage Range (STB)			±2		V_{PEAK}
Z_{IN}	Input Impedance (STB)			80		kΩ
	Keyboard					
t_D	Key Debounce Time			15		ms
	HS Input					
t_{HS-L}	Low to High Debounce	Going off-hook		15		ms
t_{HS-H}	High to Low Debounce	Line breaks/on-hook		240		ms
	Dialling					
ΔF	Frequency deviation	Note 5			1.2	%
V_{MF}	MF Tone Level (Low group)	**B/D/G/U**	- 12.5	- 11	- 9.5	dB
		A/C/E/F/J	- 9.5	- 8	- 6.5	dB
ΔV_{L-H}	Preemphasis Low to High	**A/B/C/E/F/J/U**	1.8	2.6	3.0	dB.
ΔV_{L-H}	Preemphasis Low to High	**D/G**	1.8	2.6	3.2	dB
V_{FC}	Unwanted Frequency	50…300 Hz			-43	dBm
	Components	4.3…28 kHz			note 6	
		above 28 kHz			-70	dBm
t_{TD}	Tone Duration	Note 1	80	82.3	85	ms
t_{ITP}	Inter Tone Pause	**A/B/C/D/F/G/J/U**;Note1	80	82.3	85	ms
t_{ITP}	Inter Tone Pause	**E**; Note 1	160	165	170	ms
t_{TR}	Tone Rise Time	Note 2			5	ms
t_{TF}	Tone Fall Time	Note 2			5	ms
t_{DR}	LD Dial Rate	±5%		10		pps
	(Note 7)	±5%, pin option on **J**		20		pps
$t_{M/B}$	Make/Break Period	±5%, not on **J**		40.8/61.2		ms
		±5%		33/66		ms
t_{PDP}	Pre-Digit Pause			35		ms
t_{IDP}	Inter Digit Pause	Note 7	800	840	880	ms
t_{MO}	Mute Overhang			t_M		
t_{FD}	Flash Duration 1		100		102	ms
	Flash Duration 2	**B/C/D/E/F/G**	270		300	ms
	Flash Duration 2	**A/J/U**	600		650	ms
t_{PFP}	Post Flash Pause	**C/D/E/G/J/U**	2.9	3.0	3.1	sec
		A/B/F		274		ms

AC Characteristics Cont´d

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{AP}	Access Pause	**E/D/G/J/U**	2.9	3.0	3.1	sec
t_{AP}	Access Pause	**C**	5.8	6	6.2	sec
t_{AP}	Access Pause	**A/B/F**	2.0	2.05	2.12	sec
	Tone Ringer					
V_{MO}	Melody Output			PDM		
t_{MD}	Melody Delay				10	ms
F1	Frequency 1		770	800	830	Hz
F2	Frequency 2		1025	1067	1110	Hz
F3	Frequency 3		1280	1333	1385	Hz
t_{DT}	Detection Time	Initial	70		80	ms
t_{TO}	Detection Time-out			note 4		ms
f_{MIN}	Min. Detection Frequency	**D/G**	19	20	21	Hz
f_{MIN}	Min. Detection Frequency	**A/B/C/E/F/J/U**	12	13	14	Hz
f_{MAX}	Max. Detection Frequency	**D/G**	58	59	60	Hz
f_{MAX}	Max. Detection Frequency	**A/B/C/E/F/J/U**	68	70	75	Hz
	Reminder Tone					
V_{RT}	Level (RO1/RO2)	Relative to LS		-30		dBr
t_{RTD}	Duration			82.3		ms
t_{RTI}	Interval	**C/D/E/G/J/U**		3		sec
	Interval	**A/B/F**		274		ms
	Comfort Tone (DTMF)					
V_{CT}	Level (RO1/RO2)	Relative to LS		-30		dBr

Note 1: The values are valid during automatic dialling and are minimum values during manual dialling, i.e. the tones will continue as long as the key is depressed.
Note 2: The rise time is the time from 10% of final value till the tone amplitude has reached 90 % of its final value.
Note 3: Relative to high group.
Note 4: The FCI circuit is reset by POR and HS/DP pulled high (off-hook). After a reset the FCI circuit is in a standby state. A positive edge on FCI will start a 73 ms timer and the frequency discrimination is initiated. Whenever a period of the ring signal is missing, the timer is reset. When a valid ring signal is present for 73 ms, the melody generator is started and is directly controlled by the ring signal. This condition will remain until a new reset.
Note 5: This does not include the frequency deviation of the ceramic resonator.
Note 6: -37 dBm at 4.3 kHz and decreasing 12 dB/octave till 28 kHz.
Note 7: When dial rate 20 pps is selected on the J version, all LD timings will be twice the speed of 10 pps.

Test Circuit

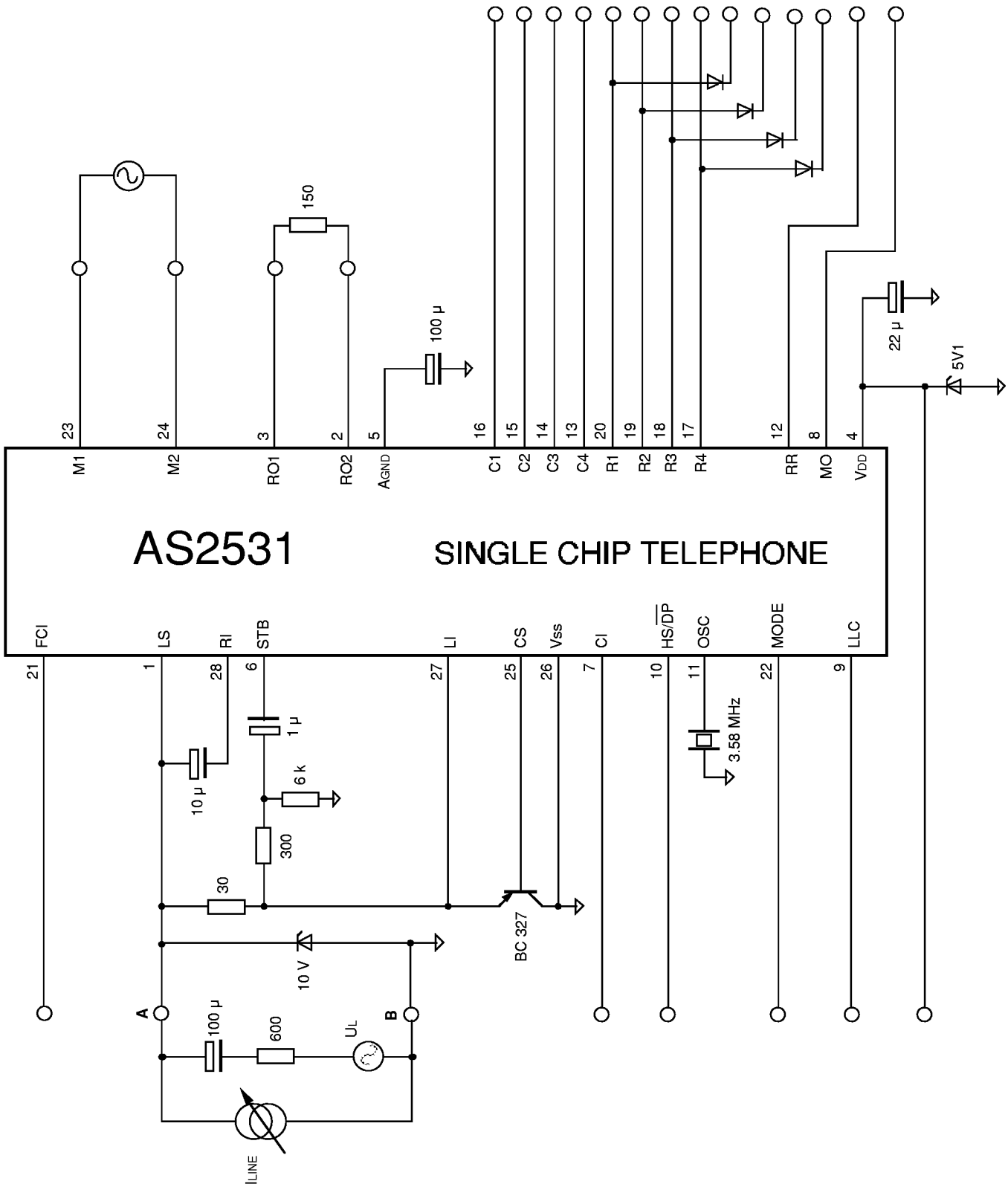


Figure 5

Typical Characteristics of Line Loss Compensation

Fig. 6

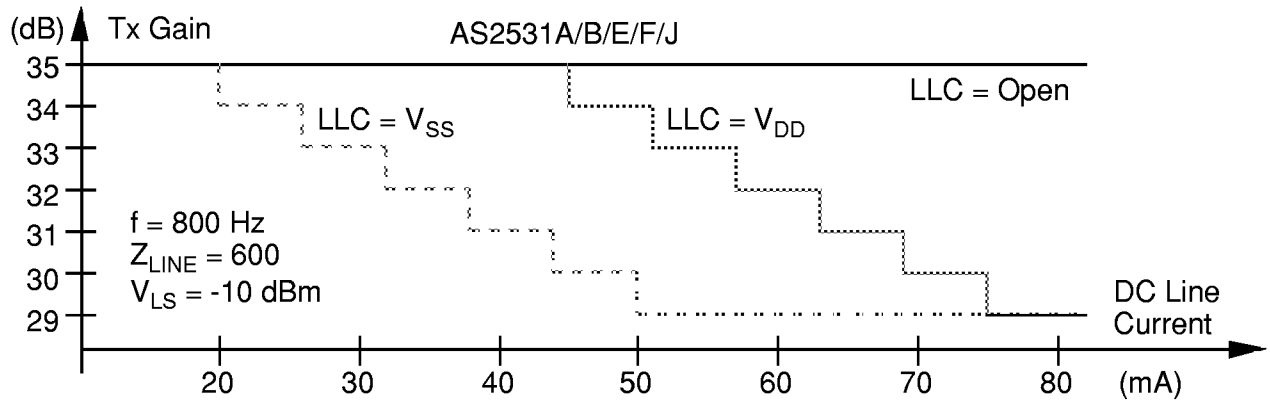


Fig. 7

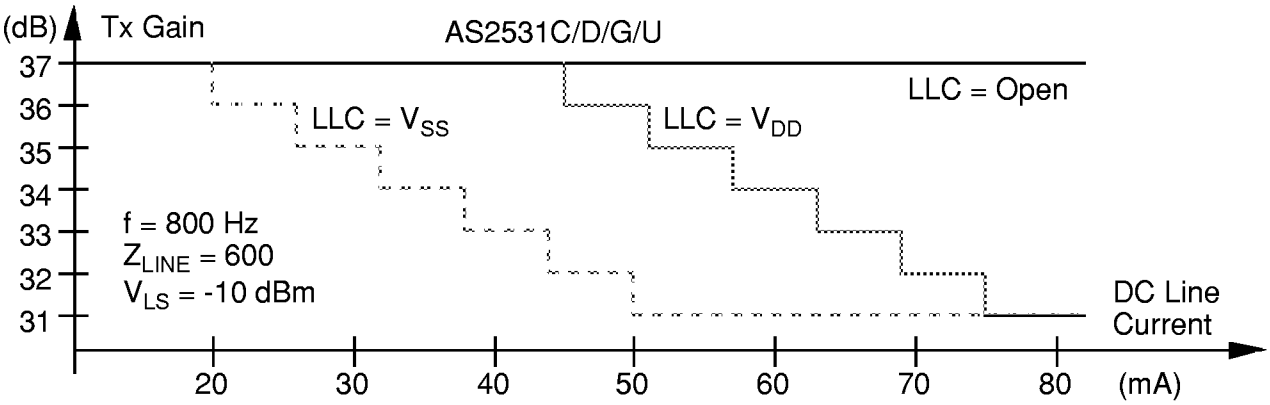


Fig. 8

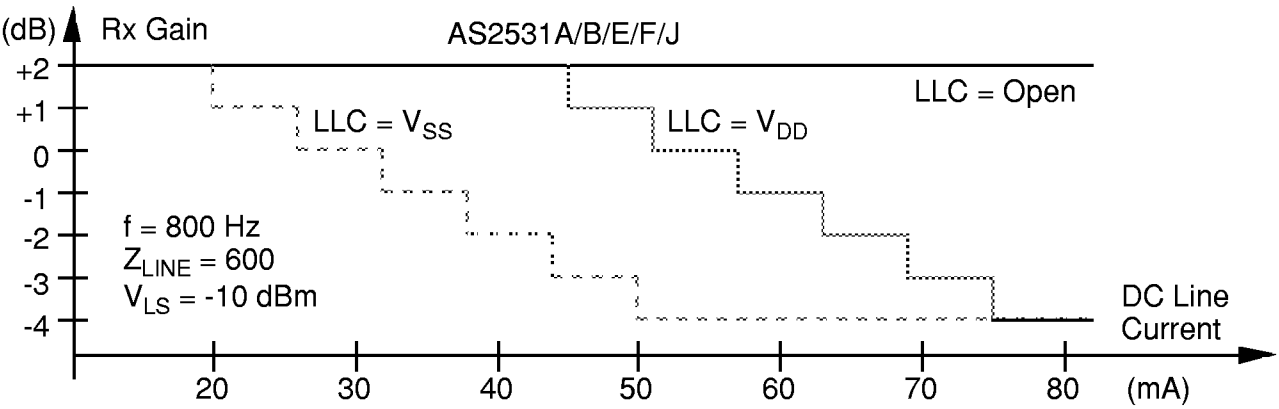
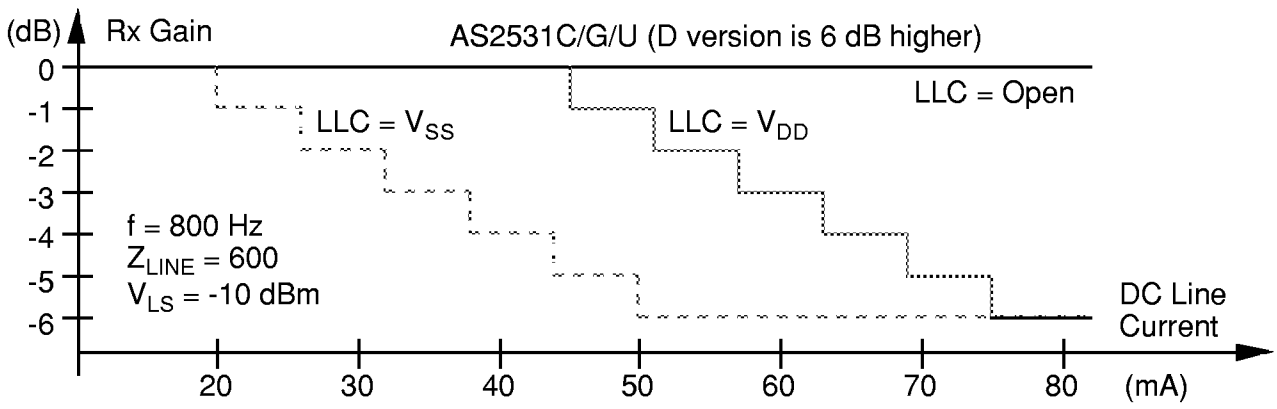


Fig. 9



Characteristic Curves (Typical)

Fig. 10 Transmit Soft Clipping and Distortion (600 Ω)

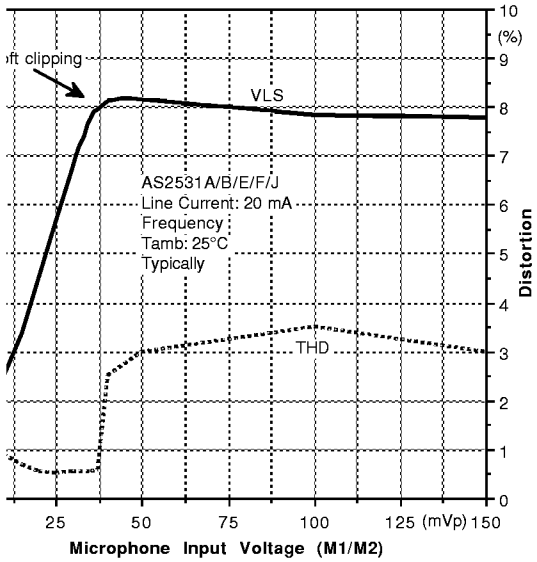


Fig. 11 Transmit Soft Clipping and Distortion (1000 Ω)

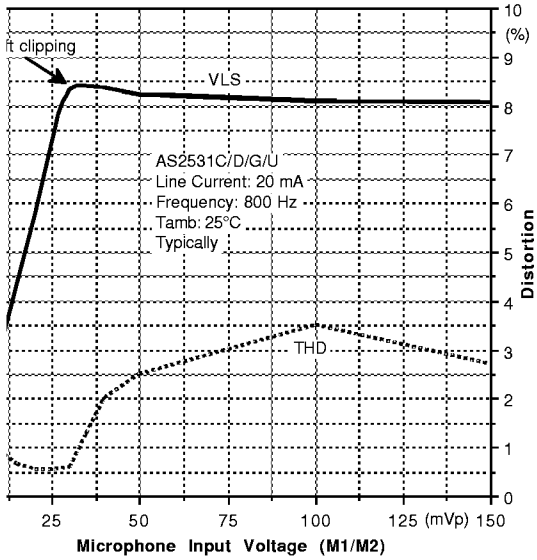


Fig. 12 Receive Soft Clipping and Distortion (600 Ω)

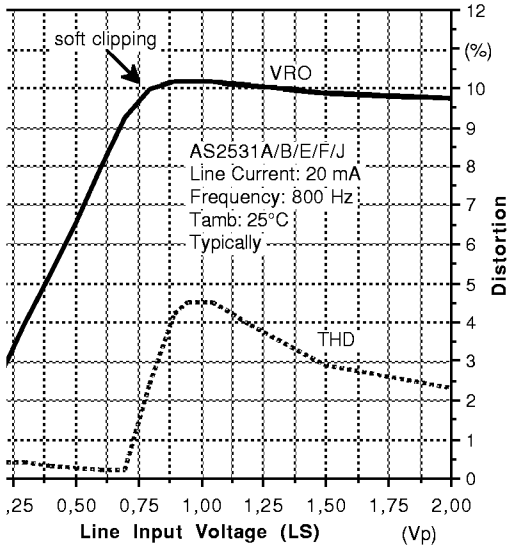


Fig. 13 Receive Soft Clipping and Distortion (1000 Ω)

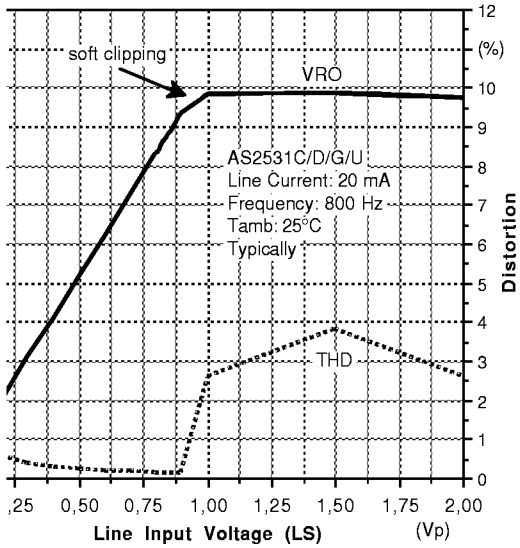
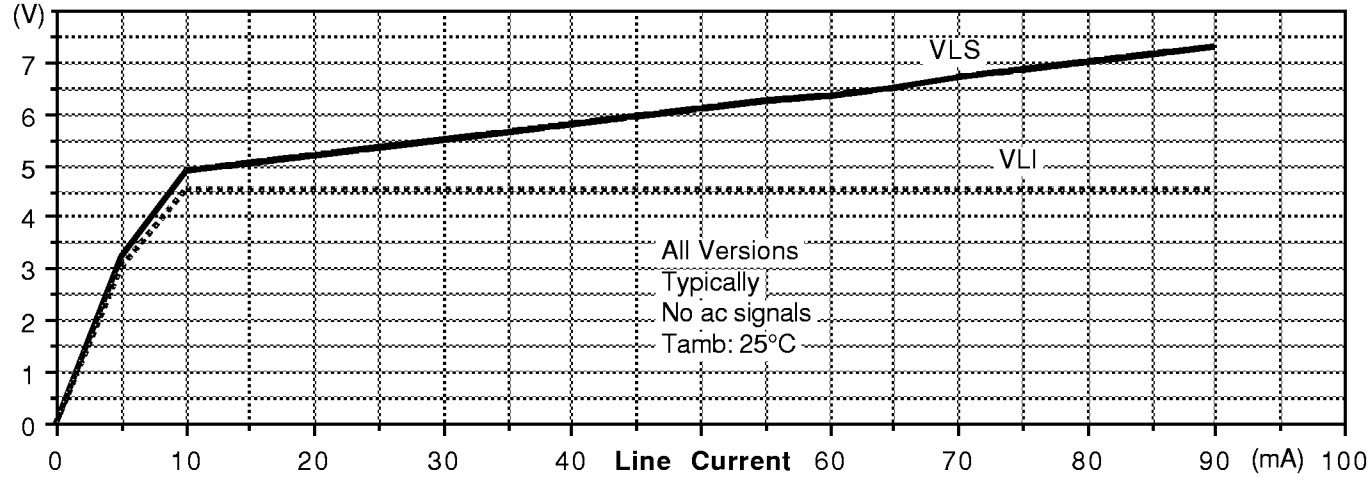
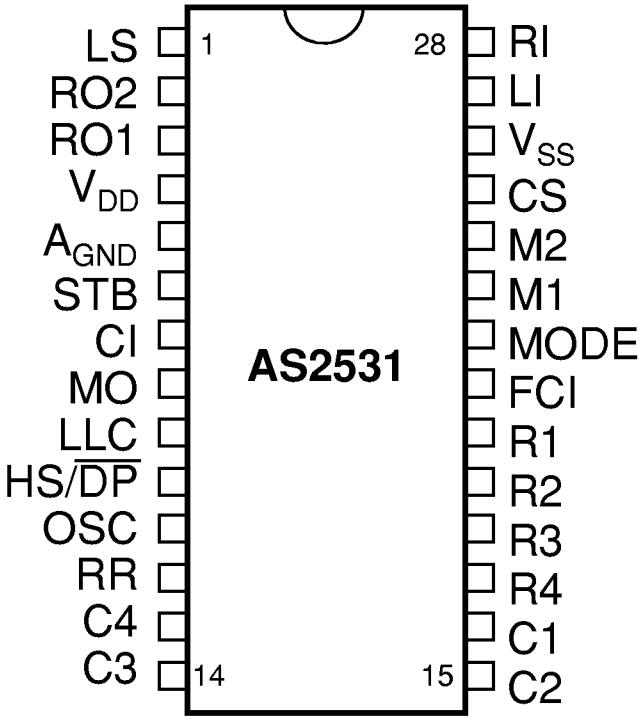


Fig. 14 DC Mask



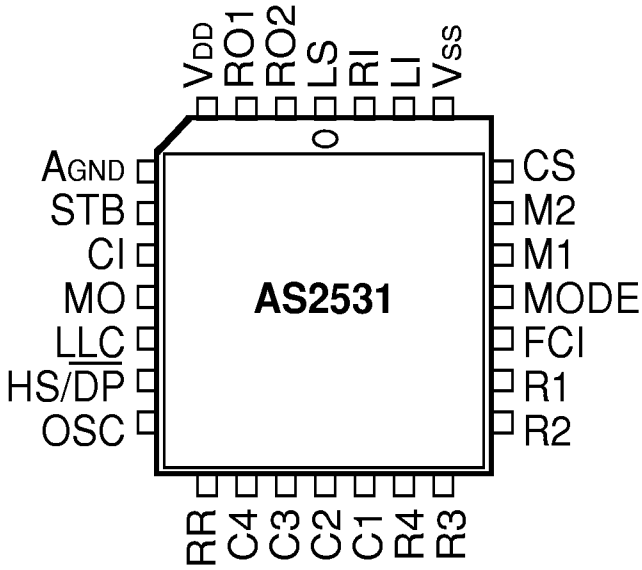
Pin Configurations

28 Pin DIP



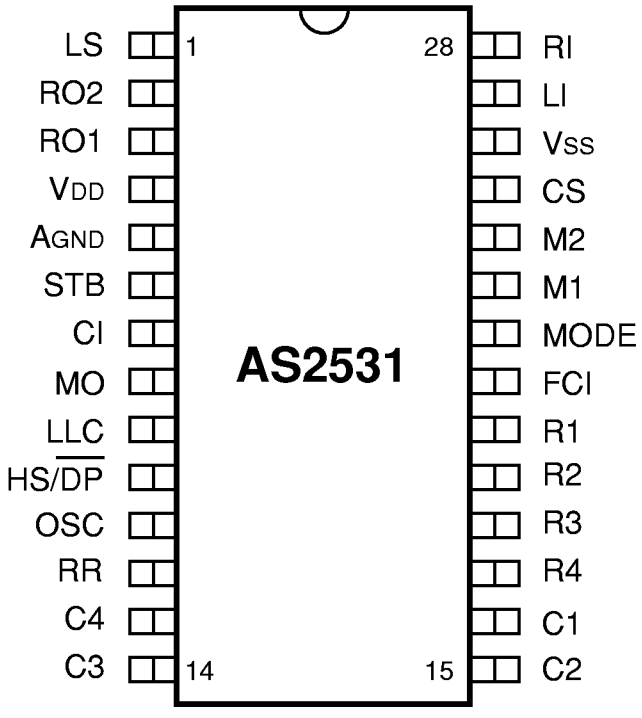
Suffix P

28 Pin PLCC



Suffix N

28 Pin SOIC



Suffix T

Package Suffix

AS2531X P	28 pin DIP
AS2531X T	28 pin SOIC
AS2531X N	28 pin PLCC

X = version (see table next page)

Ordering Information:

Versions	ZRL (ohm)	DTMF Level	FCI (Hz)	ITP (ms)	R2 (ms)	Flash in LD Mode	Flash Pause	Access Pause	Remarks
AS2531A	600	-6/-8 dBm	13-70	82	600	yes	274ms	2 sec	
AS2531B	600	-9/-11dBm	13-70	82	280	yes	274ms	2 sec	
AS2531C	1000	-6/-8 dBm	13-70	82	280	no	3 sec	6 sec	
AS2531D	1000	-9/-11dBm	20-60	82	280	no	3 sec	3 sec	Rx gain +6 dB, no VOL
AS2531E	600	-6/-8 dBm	13-70	165	280	no	3 sec	3 sec	
AS2531F	600	-6/-8 dBm	13-70	82	280	yes	274ms	2 sec	MF select (*) with tone
AS2531G	1000	-9/-11dBm	20-60	82	280	no	3 sec	3 sec	
AS2531J	600	-6/-8 dBm	13-70	82	600	yes	3 sec	3 sec	Mode pin: 10/20 pps
AS2531U	1000	-9/-11dBm	13-70	82	600	yes	3 sec	3 sec	

Example: AS2531G N (G version in PLCC)

Application:

For application support contact your local sales offices.