Universal Telephone IC – All Functions Integrated

Description

Atmel Wireless & Microcontrollers' low-voltage telephone circuit U3759B-N performs the speech and line interface functions and the tone ringer required in an electronic telephone set. Operation below 15 mA is possible with reduced performance.

Electrostatic sensitive device.
Observe precautions for handling.

Features

Speech Circuit

- Adjustable DC characteristic
- Symmetrical input of microphone amplifier
- Receiving amplifier for dynamic or piezo-electric earpieces
- Automatic line-loss compensation

Tone Ringer

- 2-tone ringer
- Adjustable volume
- RC oscillator
- Adjustable threshold

Benefits

- Low number of external components
- High quality through one IC solution

Ordering Information

Extended Type Number	Package	Remarks
U3759B-NFN	SSO28	Tube
U3759B-NFNG3	SSO28	Taped and reeled

Block Diagram / Applications

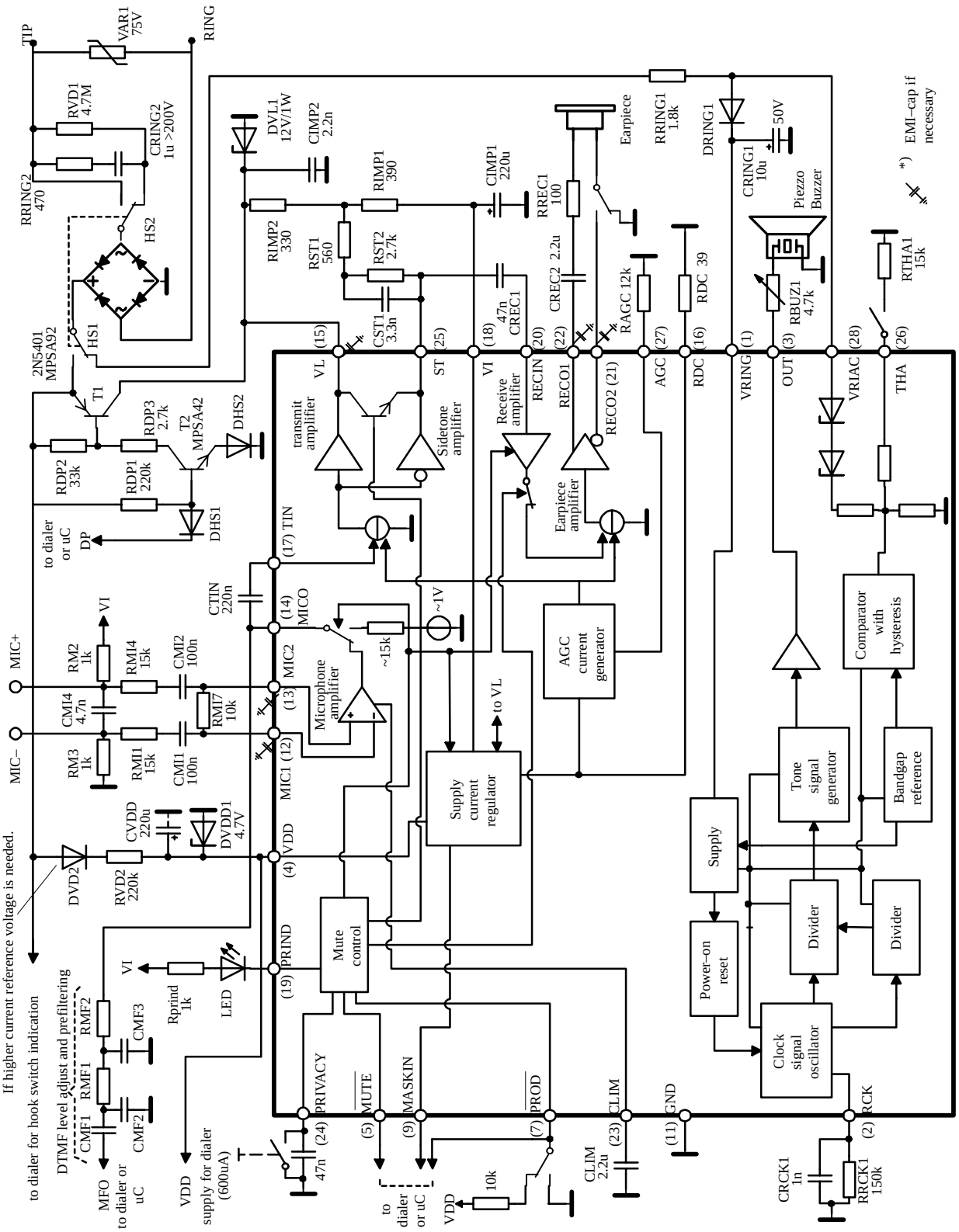


Figure 19. Block diagram / applications

Pin Description

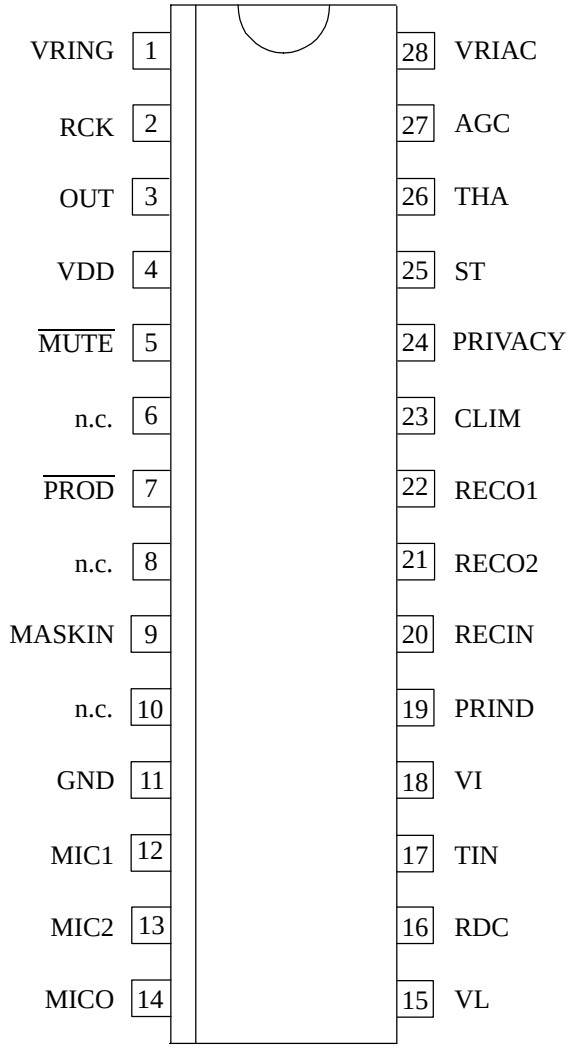
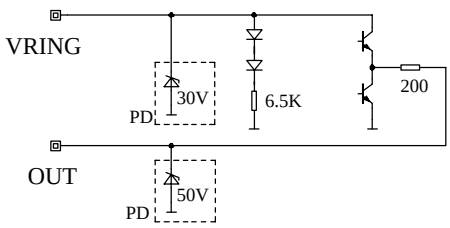
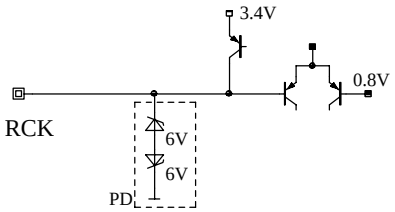
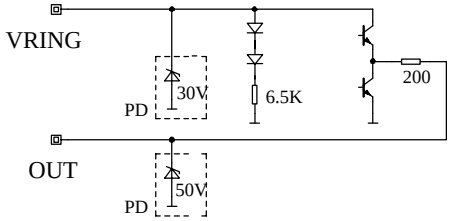
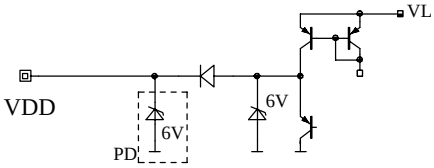
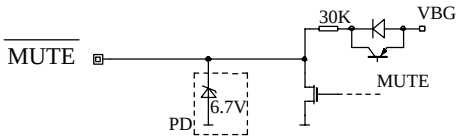
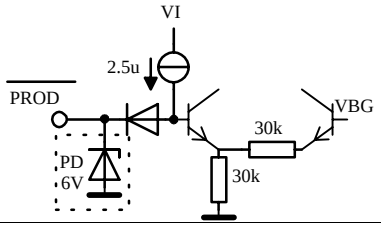
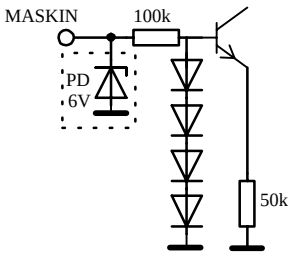
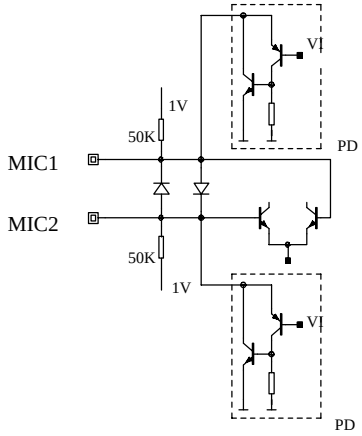
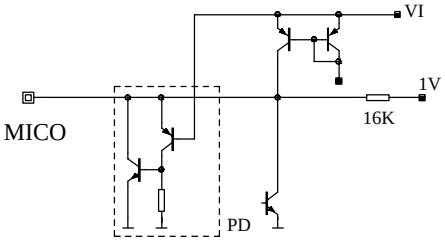
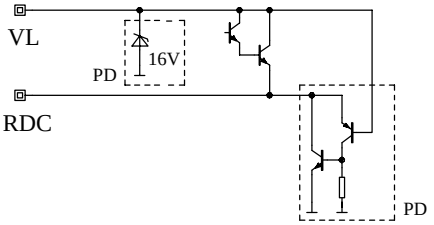
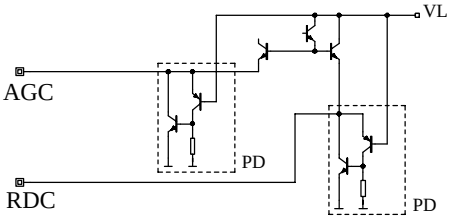
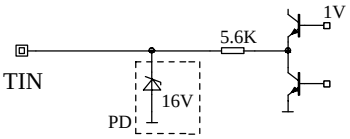
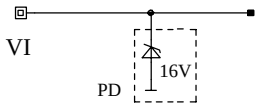
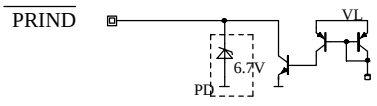
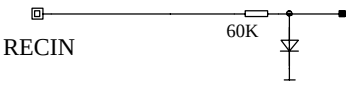
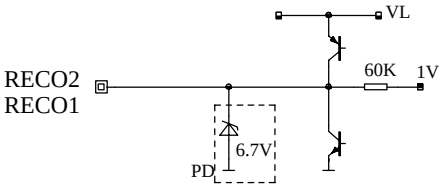
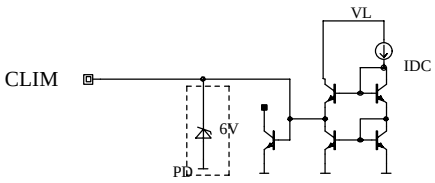
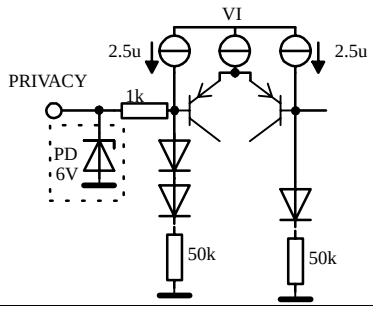
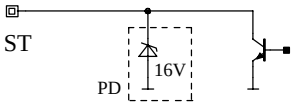
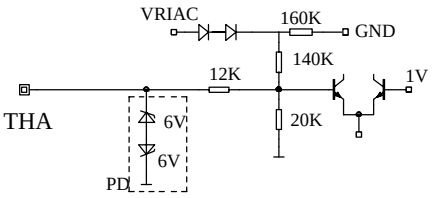
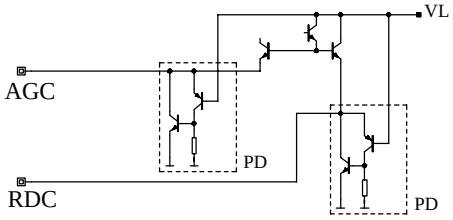
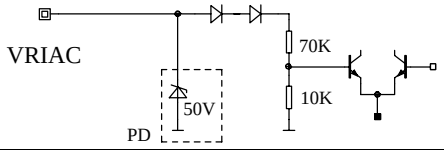


Figure 20. Pinning SSO28

Pin	Symbol	Function	Configuration
1	VRING	DC supply voltage for the tone ringer is limited to 30 V with integrated Z-diode.	

Pin	Symbol	Function	Configuration
2	RCK	RC clock oscillator for ringer	
3	OUT	Buzzer output	
4	VDD	Supply output for dialer part $I_{DD\ max}$ = 750 µA out of VDD for external functions	
5	$\overline{\text{MUTE}}$	Active Low: $\overline{\text{MUTE}}$ < 150 mV Forcing $\overline{\text{MUTE}}$ to GND mutes the microphone and decreases the earpiece signal by typically 29 dB; no pull up circuit allowed. Dialer/µC port must be open drain.	
6	n.c.	Not connected	
7	$\overline{\text{PROD}}$	During Low level (< 100 mV) handset mute is active.	
8	n.c.	Not connected	
9	MASKIN	Short mute during pulse dialing, active high During MASK an internal npn-transistor shortens VL against VI.	
10	n.c.	Not connected	
11	GND		

Pin	Symbol	Function	Configuration
12 13	MIC 1 MIC 2	Inverting input of microphone amplifier Non-inverting input of microphone amplifier	
14	MICO	Transmit pre-amp output which is normally capacitively coupled to Pin TIN Coupling point for DTMF signal from dialer/ µC Input for prefiltering and level adjustment circuit of incoming dialer signal (see application circuit)	
15	VL	Positive supply voltage input to the device. The current through this pin is modulated by the transmit signal.	
16	RDC	An external resistor (1 W) is required from this pin to GND to control the DC input impedance of the circuit. It has a nominal value of 39 Ω for low-voltage operation. Values up to 100 Ω may be used to increase the available transmit output voltage swing at the expense of low-voltage operation.	
17	TIN	Input to the line output driver amplifier. Transmit AGC applied to this stage.	
18	V_I	This internal voltage bias line must be connected to VL via an external resistor which dominates the AC input impedance of the circuit and should be 680 Ω for an 600-Ω input impedance or 1.2 kΩ for a 900-Ω input impedance.	
19	PRIND	PRIVACY indication pin Open collector with minimum 1 mA drive current to GND when PRIVACY = active	

Pin	Symbol	Function	Configuration
20	RECIN	Receive amplifier input. The receiving amplification is regulated by an AGC.	
21 22	RECO2 RECO1	Output of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.	
23	CLIM	Time constant of anticlipping in transmit path. CLIM ≥ 2.2 µF CLIM = GND: anticlipping inactive	
24	PRI- VACY	Toggle input for handset mute Negative trigger pulse activates handset mute and privacy indication output (PRIND).	
25	ST	The output of the sidetone cancellation signal, which requires a balanced impedance of 8 to 10 times the subscribers line impedance to be connected to Pin VL.	
26	THA	Ringer threshold adjustment	
27	AGC	The range of transmit and receive gain variations between short and long loops may be adjusted by connecting a resistor R_{AGC} from this pin to (GND). This pin can be left open to set AGC out of action.	
28	VRIAC	Ringing supply	

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Line current	I_L	140	mA
DC line voltage	V_L	14	V
DC voltage at Pins 1 to 11 and 33 to 44	V_{DC}	5.5	V
Junction temperature	T_j	125	°C
Ambient temperature	T_{amb}	–25 to +75	°C
Storage temperature	T_{stg}	–55 to +150	°C
Total power dissipation, T_{amb} = 60°C SSO28	P_{tot}	0.9	W

ESD withstand voltage 1 kV according to ESD standard S5.1 (HBM)

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction ambient SSO28	R_{thJA}	70	K/W

Electrical Characteristics: Speech Circuit

Reference point Pin GND, f = 1000 Hz, 0 dBm = 775 mV_{rms}, R_{DC} = 39 Ω / 1 W, T_{amb} = 25°C, unless otherwise specified, refer to “Basic Test Circuit”. CLIM = GND

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Line voltage	I_L = 8 mA	V_L		1.4		V
	I_L = 20 mA		3.6	3.85	4.1	V
	I_L = 73 mA		5.9	6.55	7.2	V
	I_L = 100 mA		6.9		8.2	V
Transmit and sidetone						
Input resistance	R_i	R_i	45	80	120	kΩ
Gain	I_L = 20 mA, S5 = open	G_s	46.8	47.8	48.8	dB
Gain change with current	I_L = 20 to 60 mA R_{AGC} = infinite	ΔG_S	–0.5		0.5	dB
Gain deviation	T_{amb} = –10 to +60°C I_L = 20 mA	ΔG_S	–0.5		0.5	dB
Line-loss compensation	R_{AGC} = 12 kΩ, I_L = 73 mA	ΔG_s	–7	–6	–4.8	dB
Distortion at line V_L = 0.775 V_{rms}	I_L = 20 mA, S5 = open	d_t			2	%
Max. output voltage at line d ≦ 5%	I_L = 20 mA, V_{mic} = 10 mV, CLIM = 2.2 µF, S_1 = open	V_{Lmax}		1.2		dBm
Attack time transmit anticlipping	CLIM = 2.2 µF	t_{att}		3.5		ms
Noise at line weighted psophometrically	I_L > 20 mA, G_S = 48dB	n_o			– 72	dBmp
Sidetone reduction	I_L ≧ 20 mA	G_{STA}	10	15	20	dB

Electrical Characteristics: Speech Circuit (continued)

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Receiving amplifier						
Gain	$I_L \geq 20$ mA	G_R	3		5	dB
Gain change with current	I_L = 20 to 60 mA R_{AGC} = infinite	ΔG_R	–0.5		0.5	dB
Gain deviation	T_{amb} = –10 to +60°C I_L = 20 mA	ΔG_R	–0.3		0.7	dB
Line-loss compensation	I_L = 73 mA	ΔG_R	–7	–6	–4.7	dB
Receiving noise at earphone weighted psophometrially	I_L = 73 mA	n_i		–77.5	–71	dBm
Gain change when muted	$I_L \geqq 20$ mA	G_{RM}	24	29	34	dB
Output voltage push-pull	$I_L \geqq 20$ mA, Z_{ear} = 68 nF, 100 Ω in series, d ≤ 2%	V_{RECO}	0.8	0.9		V_{rms}
Ear protection differential	I_L = 40 mA, V_{gen} = 4 V_{rms}, Z_{ear} = 68 nF + 100 Ω	V_{ear}	1.3	1.6	2.5	V_{rms}
Supply voltage						
Output voltage Note: Output must be limited externally to max. 5.5 V	$I_L \geqq 20$ mA dialing mode	V_{DD}	2.0		6.3	V
Available current for peripherals	$I_L \geqq 20$ mA dialing mode	I_{DD}	750			µA
Transmit						
Maximum output voltage swing at line	I_L = 20 mA, V_{MIC} = 50 mV_{rms}	$V_{L\,max}$		3.4	4	Vpp
Mute suppression transmit with privacy function	I_L = 20 mA	G_{SPRIV}	60			dB

Electrical Characteristics Tone Ringer

f_{RCK} = 4 kHz, V_{RING} = 20 V, T_{amb} = 25°C, reference point GND, unless otherwise specified

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current, outputs open	V_{RIAC} = 20 V	I_{RING}	2.1		3.8	mA
Switch-on threshold	V_{RIAC}, THA = open	V_{RON}	8	9	10	V
Switch-off threshold	V_{RIAC}	V_{ROFF}	5.0	5.6	6.5	V
Ringing frequency	R = 150 kΩ, C = 1 nF $V_{RIAC} > V_{RON}$	f_{1H} f_{1L}	937 752	1010 808	1083 868	Hz Hz
Range of external components for R/ C oscillator		C R	1000 50		2200 330	pF kΩ
Audio sequence frequency		f_2	11.5	12.5	14.0	Hz
Output voltage swing	V_{Ring} = 25 V, C_{out} = 68 nF	V_{out}	21	23		V_{pp}
Turn-off delay	See figure 15	t_{off}		65	100	ms

Remark: Max. current into internal Zener Diode at Pin VRING = 20 mA

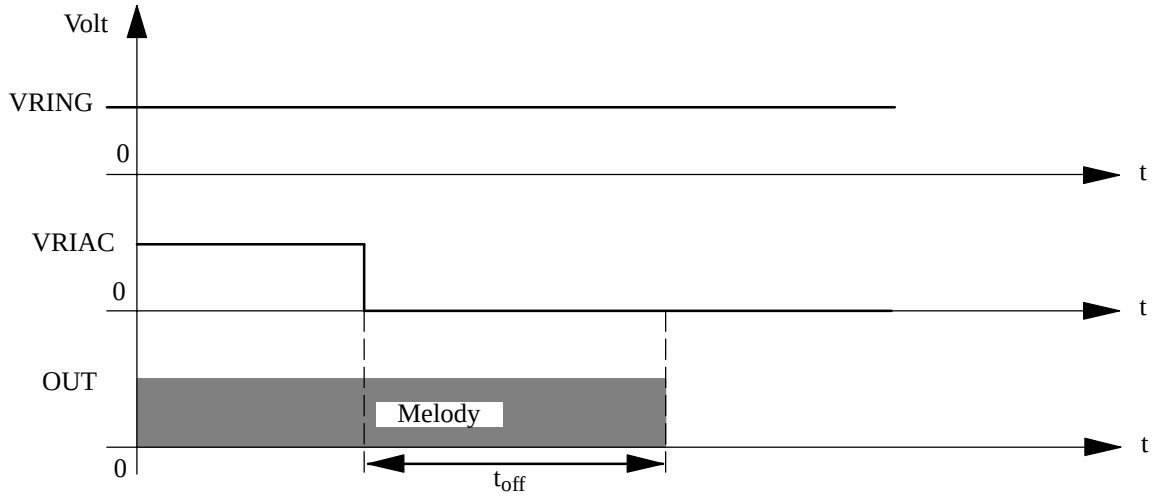


Figure 21. Turn-off delay time

Note

The oscillator frequency is defined by R and C at Pin RCK.

$$f_{Osc} \approx \frac{1}{1.594 \times C \times [R + 3809\ \Omega]}$$

The audio sequence frequency f_2 and the ratio of low frequency f_{1L} and high frequency f_{1H} are derived from oscillator frequency by internal deviders. So f_2, f_{1H} and f_{1L} are given by:

$$f_2 = \frac{f_{Osc}}{320} \;;\; f_{1H} = \frac{f_{Osc}}{4} \;;\; f_{1L} = \frac{f_{Osc}}{5}$$

For more information of adjusting ringer melody see document “Application and Adjustment Hints ”

Basic Test Circuit

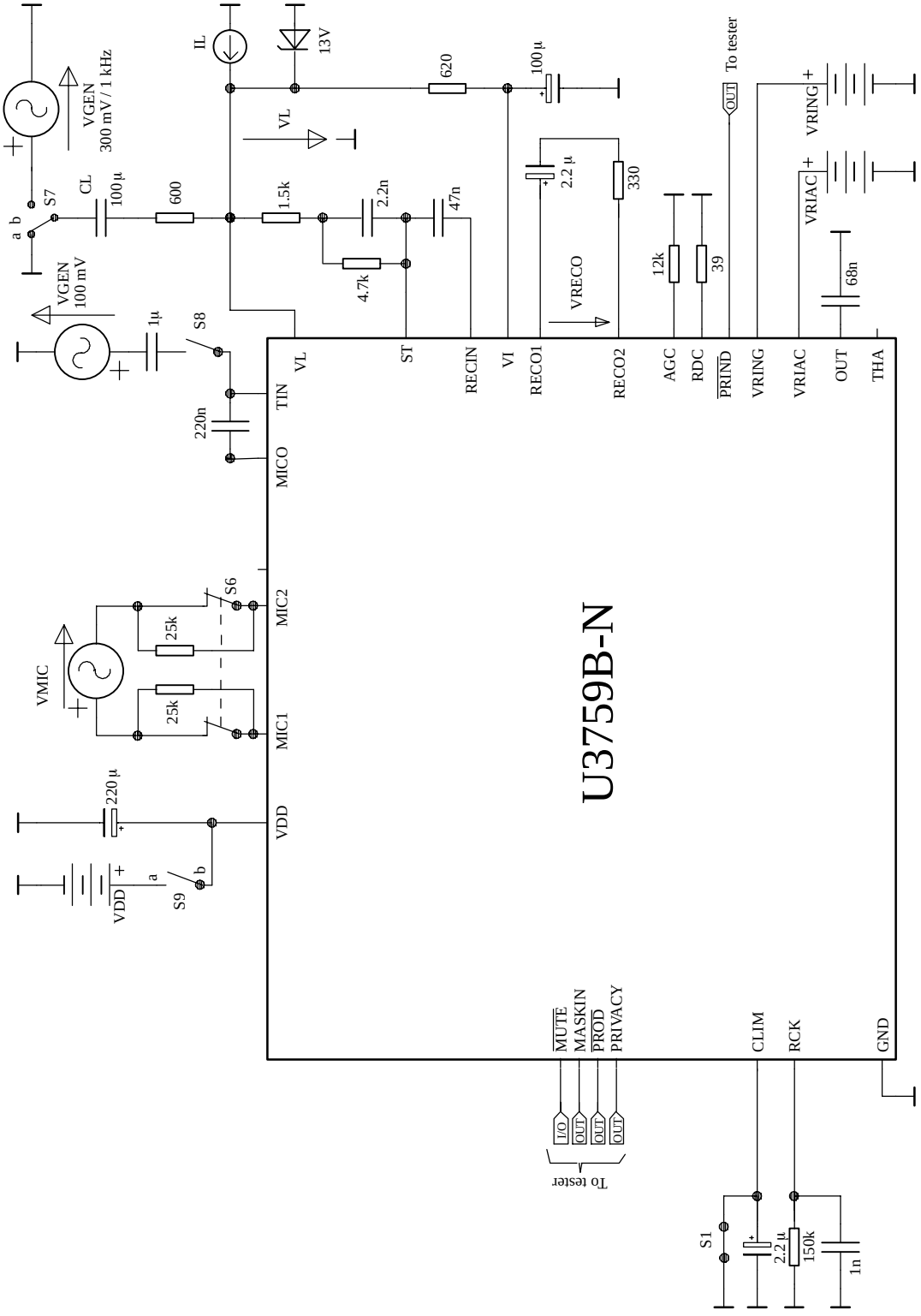


Figure 22. Basic test circuit

Equations for Electrical Characteristic Parameters of the Speech Circuit

The equations refer to the basic test circuit. If not otherwise specified, the switches in the basic test circuit are inactive.

Transmit gain

$$GS = 20 \times \log\left(\frac{V_L}{V_{MIC}}\right)$$

V_{MIC} = 3 mV/1 kHz, S5 = open

Receiving gain

$$GR = 20 \times \log\left(\frac{V_{RECO}}{V_L}\right)$$

RX-mode: V_{gen} = 300 mV/1 kHz, S7b

Line-loss compensation transmit

$\Delta GS = GS(\text{at } I_L = 73 \text{ mA}) – GS(\text{at } I_L = 20 \text{ mA})$

TX-mode: V_{MIC} = 3 mV/1 kHz, S5 = open

Sidetone reduction

$$GSTA = 20 \times \log\left(\frac{V_L}{V_{RECO}}\right)(\text{in TX–mode}) + GR$$

TX-mode: V_{MIC} = 3 mV/1 kHz, S5 = open

Line-loss compensation receive

$\Delta GR = GR(\text{at } I_L = 73 \text{ mA}) – GR(\text{at } I_L = 20 \text{ mA})$

RX-mode: V_{gen} = 300 mV/1 kHz, S7b

Input impedance of microphone amplifier

$$Ri = \frac{50 \text{ k}}{\left(\frac{V_{L(S6 = \text{closed})}}{V_{L(S6 = \text{open})}} – 1\right)}$$

TX-mode: V_{MIC} = 3 mV/1 kHz, S5 = open

Gain change when muted

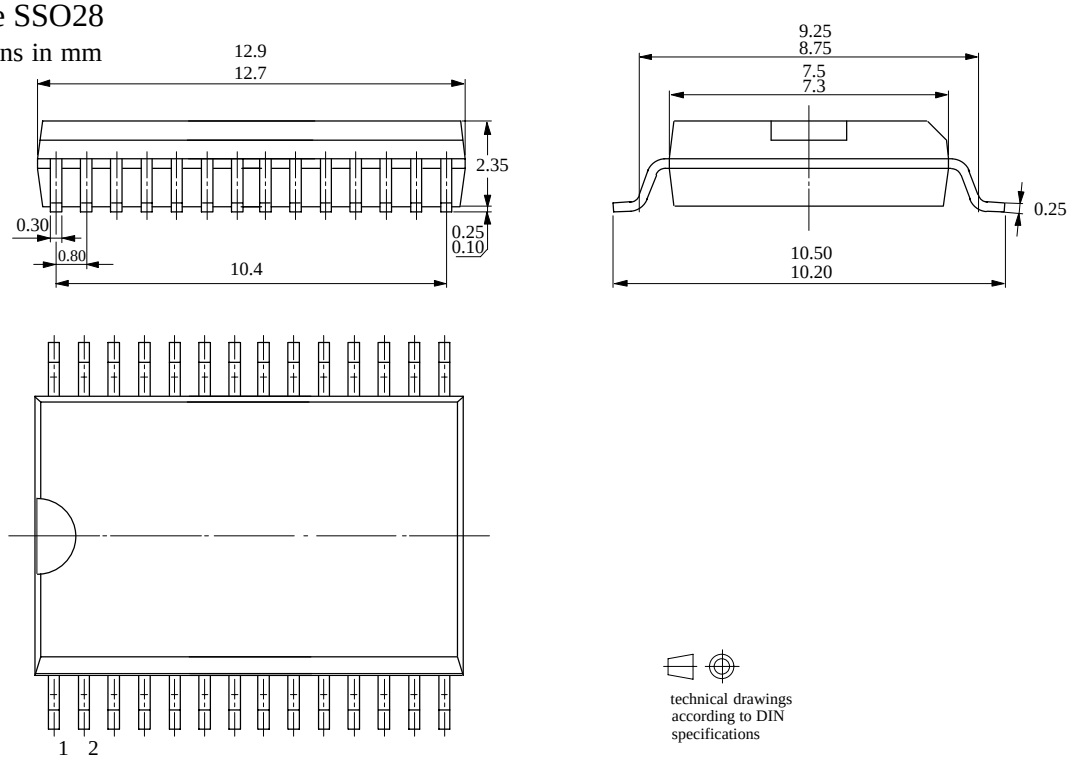
$$GRM = 20 \times \log \frac{V_{RECO}}{V_L} (\text{Mute} = \text{inactive}) – 20 \times \log \frac{V_{RECO}}{V_L} (\text{Mute} = \text{active})$$

V_{gen} = 100 mV/1 kHz, S5 = open, S8 = open

Packaging Information

Package SSO28

Dimensions in mm



technical drawings
according to DIN
specifications

Ozone Depleting Substances Policy Statement

It is the policy of **Atmel Germany GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Atmel Germany GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Atmel Germany GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Data sheets can also be retrieved from the Internet: http://www.atmel–wm.com

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