Low Voltage Standard Telephone Circuit

Description

TELEFUNKEN microelectronic's low voltage telephone circuit, U3760MB performs all the speech and line interface functions required in an electronic telephone set, the tone ringer, the pulse and DTMF dialing with redial.

Features

Speech Circuit

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

Dialer

- DTMF / pulse switchable
- Pulse dialing 66/33 or 60/40 for 10 ppS and 20 ppS or DTMF dialing selectable by pins
- Key tone
- Selectable flashing duration by key pad
- Pause function
- Last number redial up to 32 digits
- Standard low-cost crystal 3.58 MHz or ceramic resonator

Tone Ringer

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

Benefits

- Low number of external components
- High quality through one IC solution
- One IC for all standards

Block Diagram / Applications

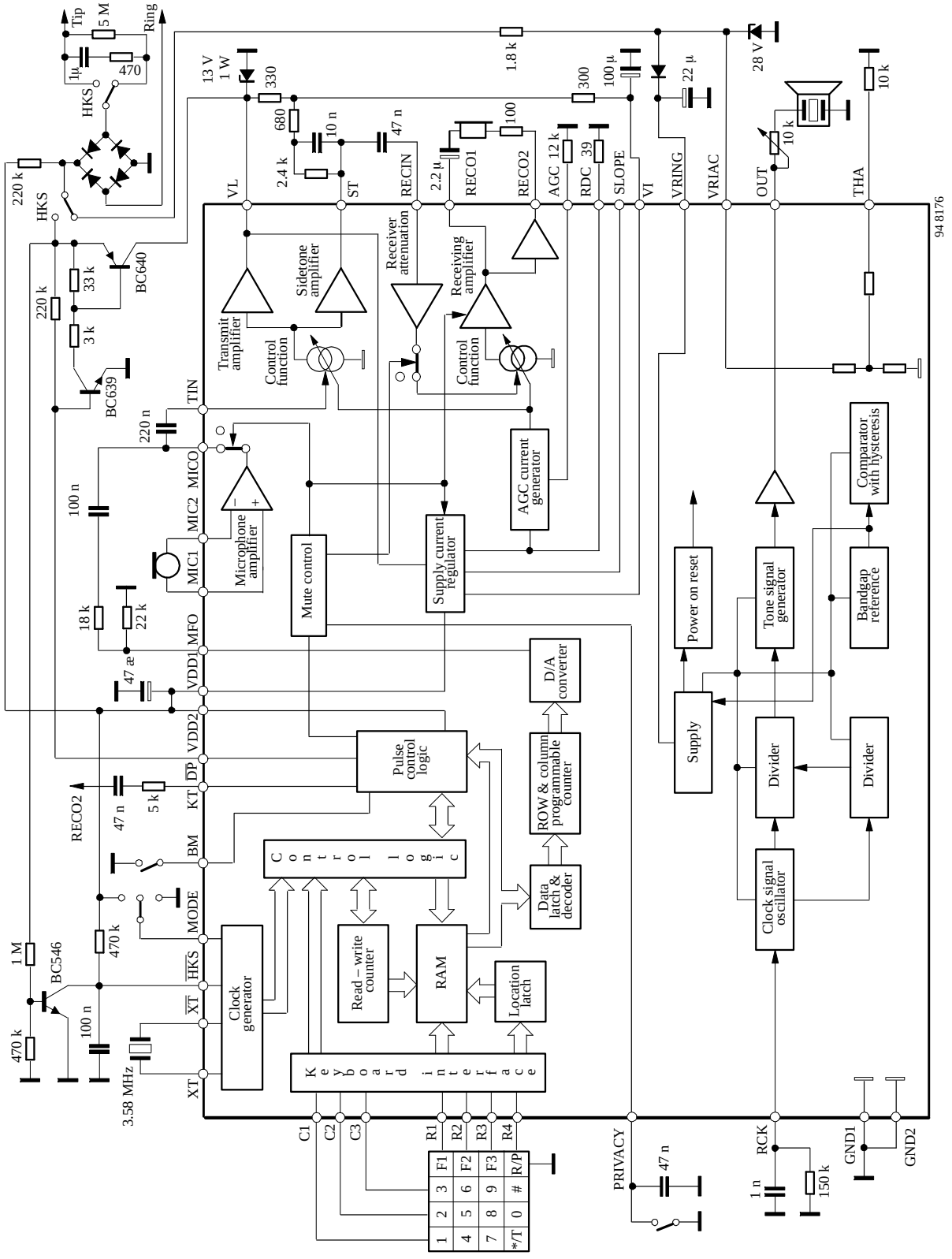
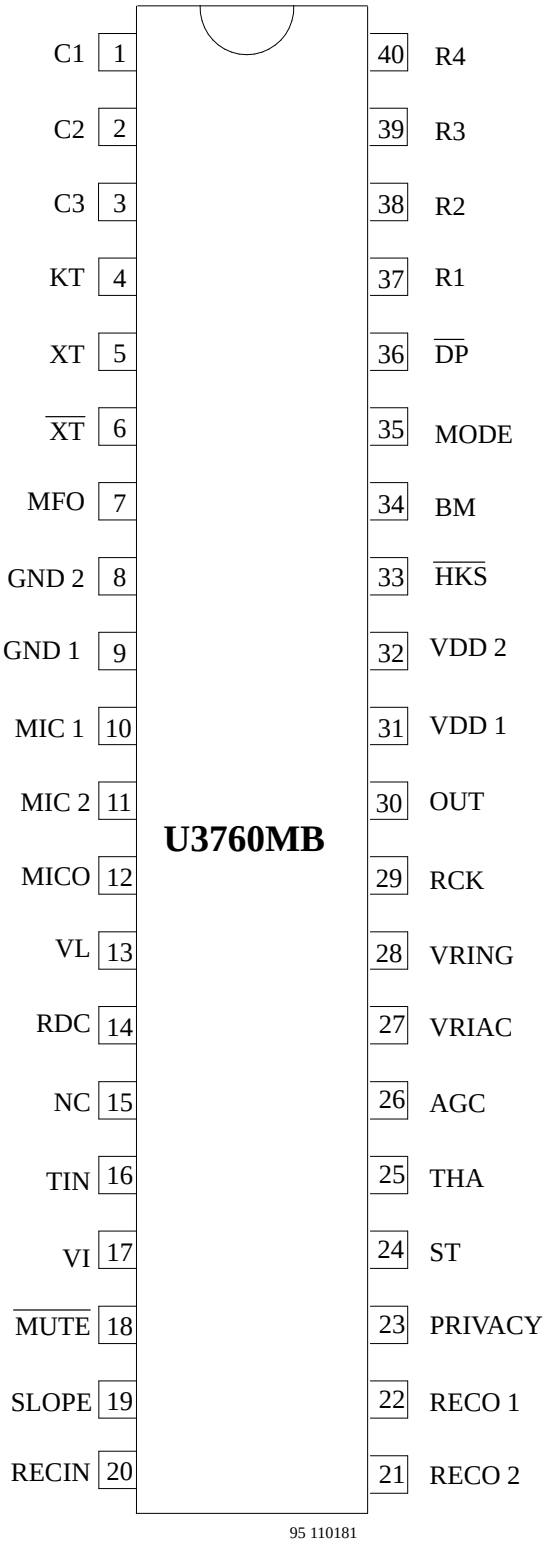
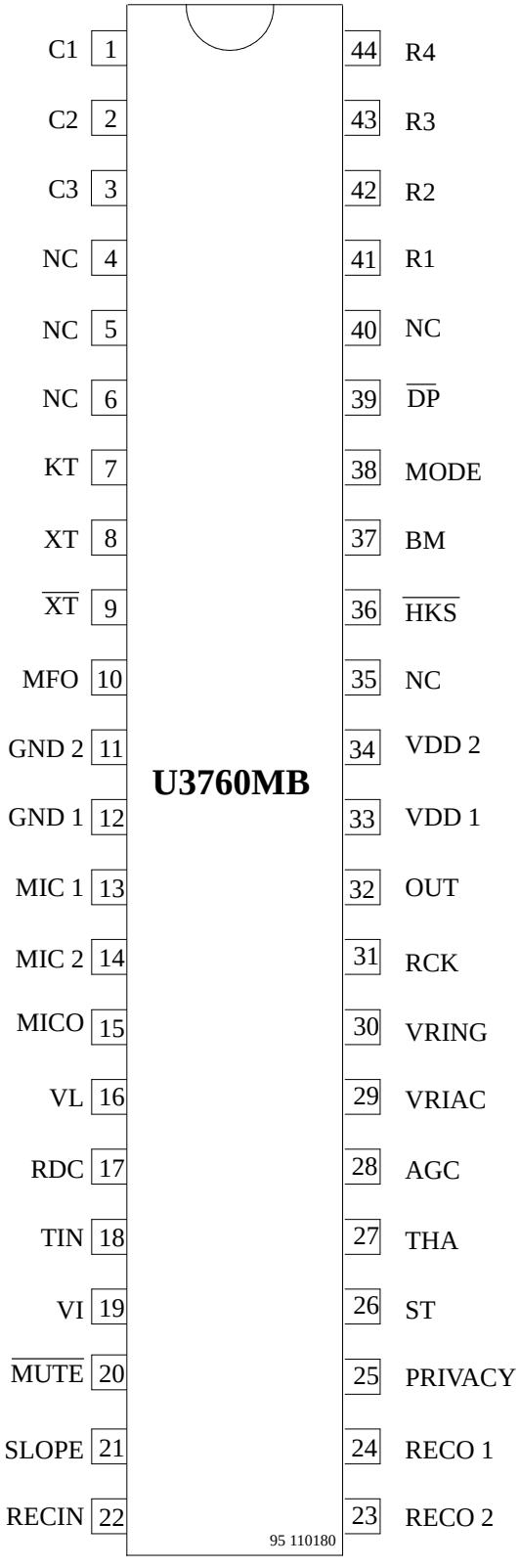


Figure 1.

SDIP 40



SSO 44



Pin Description

SDIP 40	SSO 44	Symbol	Function
1	1	C1	The keyboard input
2	2	C2	
3	3	C3	
15	4, 5, 6, 35	NC	Not connected
4	7	KT	Key tone signal output. It is generated for all keys in pulse dialing mode (except Flash + Redial) with a frequency of about 1240 Hz and duration about 50 ms
5	8	XT	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator
6	9	XT	
7	10	MFO	Output of DTMF
9	12	GND 1	Ground 1 connected with ground 2
8	11	GND 2	
10	13	MIC 1	Inverting input of microphone amplifier
11	14	MIC 2	Non-inverting input of microphone amplifier
12	15	MICO	Transmit pre-amp output DTMF output which is normally capacitively coupled to Pin TIN.
13	16	VL	Positive supply voltage input to the device. The current through this pin is modulated by the transmit signal.
14	17	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.
16	18	TIN	Input to the line output driver amplifier. Transmit a.g.c. applied to this stage.
17	19	V_I	This internal voltage bias line must be connected to VL via an external resistor, R_B, which dominates the ac input impedance of the circuit and should be 620 Ω for an 600 Ω input impedance or 910 Ω for a 900 Ω input impedance.
18	20	MUTE	Pin for testing
19	21	SLOPE	Control input for increasing slope of dc characteristic; if necessary pin can be connected to RDC pin via a resistor of any value.
20	22	RECIN	Receive amplifier input. The receiving amplification is regulated by an a.g.c.
22	24	RECO1	Output of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.
21	23	RECO2	Output of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.
23	25	PRIVACY	Input for handset mute
24	26	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.
25	27	THA	Ringer threshold adjustment
26	28	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 a.g.c. out of action.
27	29	VRIAC	Ringing supply
28	30	VRING	DC supply voltage for the tone ringer is limited to 31 V with integrated Z-diode.
29	31	RCK	RC clock oscillator for ringer
30	32	OUT	Buzzer output

SDIP 40	SSO 44	Symbol	Function
31	33	VDD 1	Supply voltage for dialer part. Stabilized to 2.7 V during dialing. Unregulated voltage in speech mode, internally limited to 4.2 V.
32	34	VDD 2	Supply of dialer section
33	36	HKS	Hook switch input. $\overline{HKS}$ = 1: On-hook state. Chip in sleep mode, no operation. $\overline{HKS}$ = 0: Off-hook state. Chip enable for normel operation. $\overline{HKS}$ pin is pulled to VDD by internal resistor.
34	37	BM	If BM = floating pulse dialing with 2:3 B/M ratio If BM is connected to ground pulse dialing with a B/M ratio of 1:2
35	38	MODE	Pulling mode pin to V_{DD} places the dialer in tone mode. Pulling mode pin to GND places the dialer in pulse mode (20 ppS). If the mode pin is left floating, the dialer is in pulse mode (10 ppS)
36	39	DP	N-channel open drain pulse dialing output. Flash key will cause $\overline{DP}$ to be active in either DTMF mode or pulse mode.
37	41	R1	The keyboard input
38	42	R2	
39	43	R3	
40	44	R4	

Keyboard Operation

C1	C2	C3		
1	2	3	F1	R1
4	5	6	F2	R2
7	8	9	F3	R3
⁎/T	0	#	R/P	R4

- ⁎/T: ⁎ and pulse to tone key
- R/P: Redial and pause function key
- F1, F2, F3: Flash keys

Normal Dialing

OFF HOOK , D1 , D2 , ..., Dn

1. D1, D2, ..., Dn will be dialed out.
2. Dialing length is unlimited, but redial is inhibited if length oversteps 32 digits.

Redialing

OFF HOOK , D1 , D2 , ..., Dn BUSY, Come ON HOOK , OFF HOOK , R/P

The R/P key can execute the redial function only as the first key-in after off-hook; otherwise, it executes the pause function.

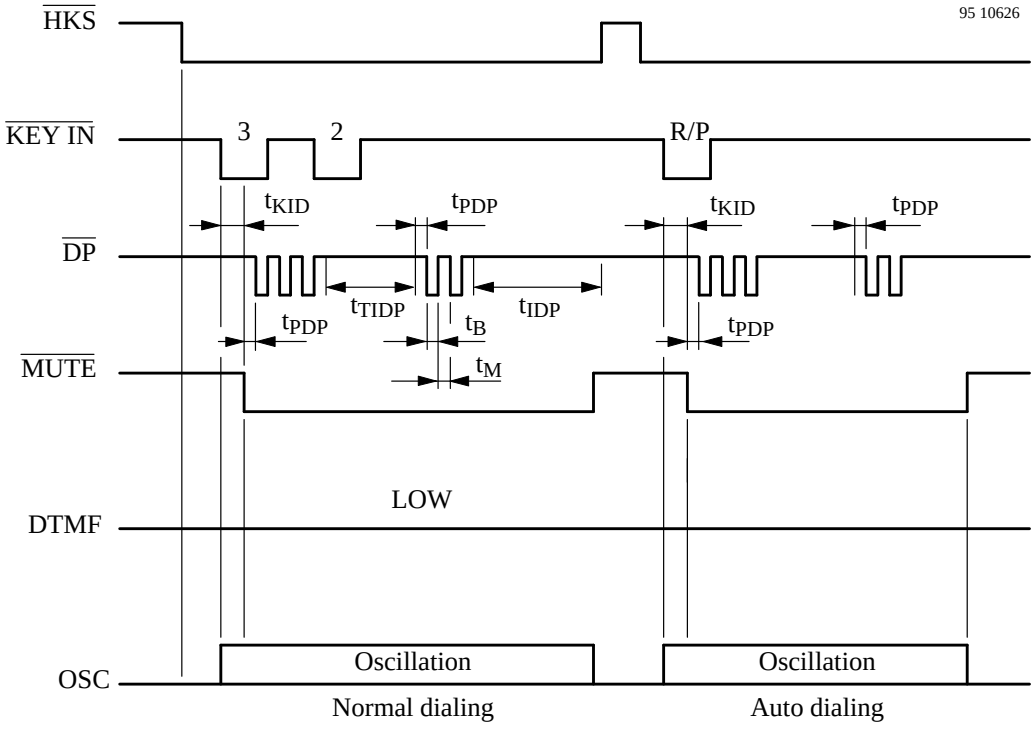


Figure 2. Pulse mode

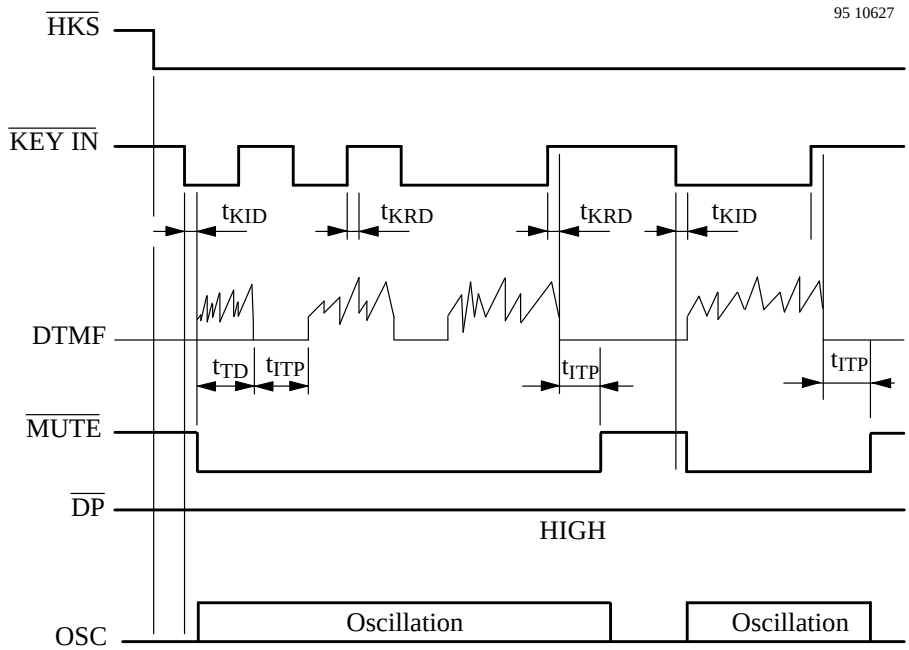


Figure 3. DTMF mode normal dialing

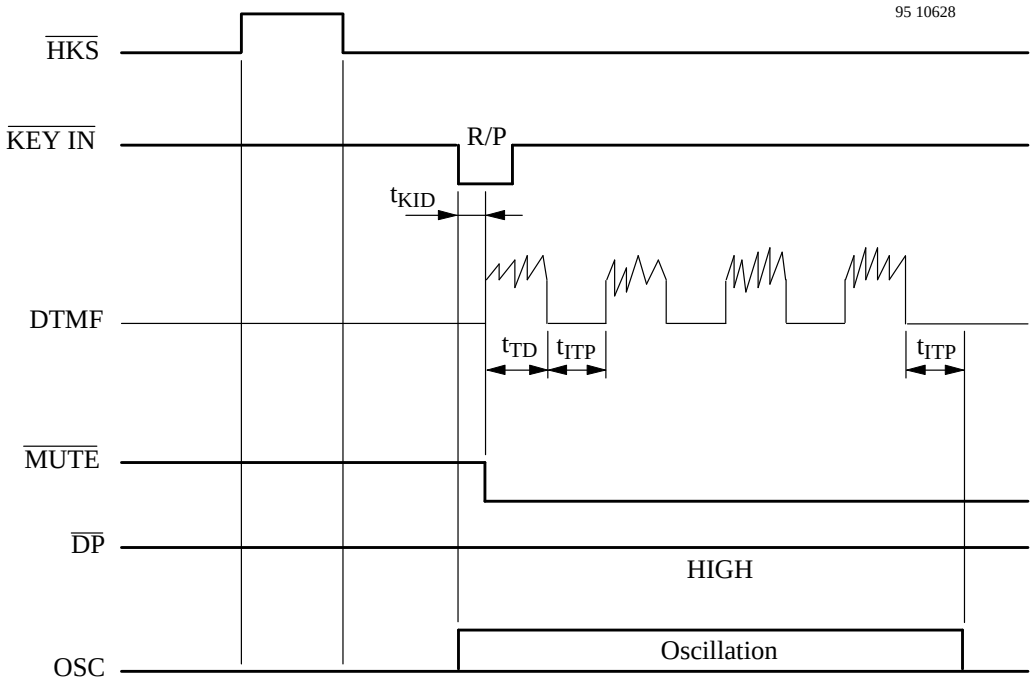


Figure 4. DTMF auto dialing

Access Pause

OFF HOOK , D1 , D2 , R/P , D3 , ..., Dn'

1. The pause function can be stored in memory.
2. The pause function is executed in normal dialing and redialing.

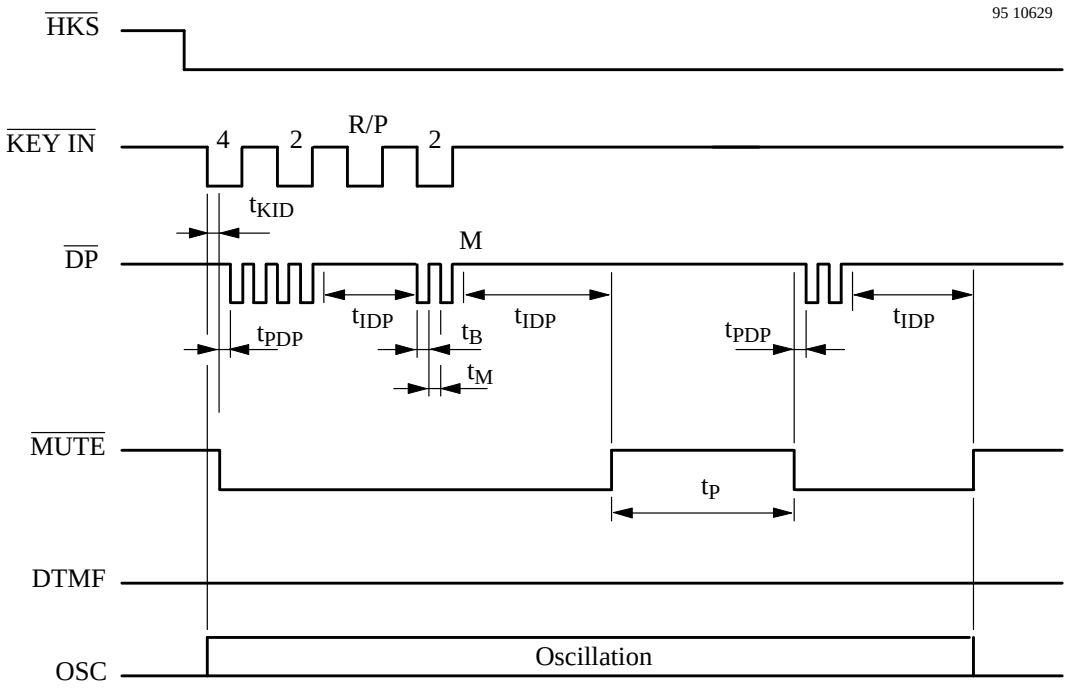


Figure 5. Pause function

Pulse-to-Tone (⁎/T)

OFF HOOK	,	D1	,	D2	, ...,	Dn	,	⁎/T	,	D1’	,	D2’	, ...,	Dn’

1. If the mode switch is set to pulse mode, then the output signal will be:

   D1, D2, ..., Dn, Pause (3.6 s), D1’, D2’ ,..., Dn’

   (Pulse) (Tone)

2. If the mode switch is set to tone mode, then the output signal will be:

   D1, D2, ..., Dn, * , D1’, D2’, ..., Dn’

   (Tone) (Tone) (Tone)

3. The dialer remains in tone mode when the digits have been dialed out and can be reset to pulse mode only by going on-hook.

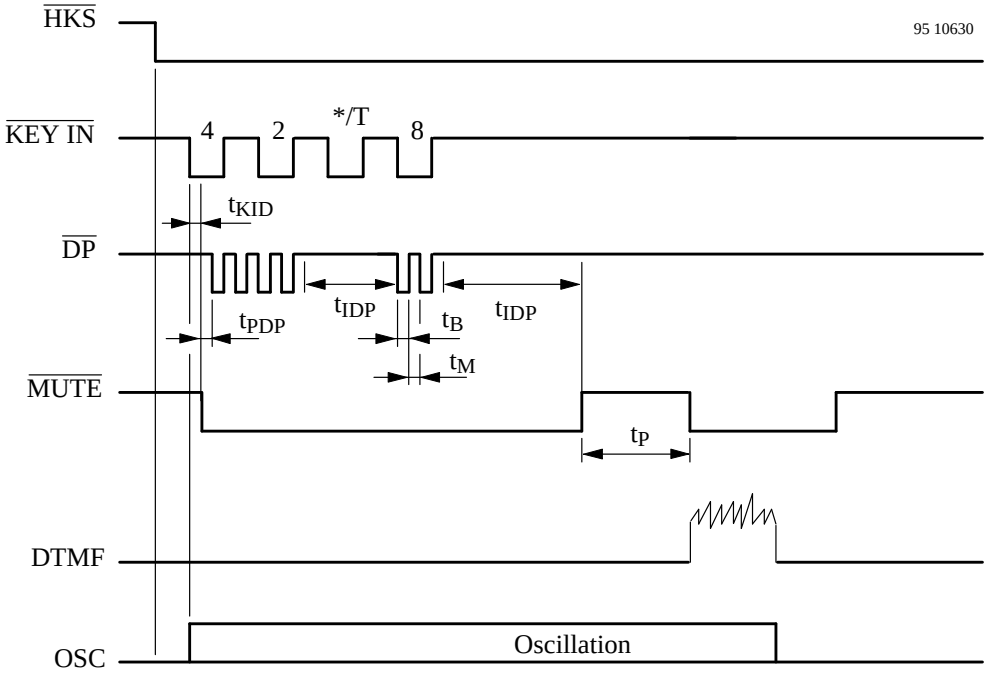


Figure 6. Pulse-to-tone operation

Flash

OFF HOOK	,	F

1. The flash key can not be stored as a digit in memory. The flash key has first priority among the keyboard functions.
2. The system will return to the initial state after the flash pause time is finished.

OFF HOOK	,	F	,	D1	,	D2	,	D3	, ...,	Dn

LNB = D1, D2, D3, ..., Dn

OFF HOOK	,	D1	,	D2	,	F	,	D3	, ...,	Dn

LNB = D3, ..., Dn

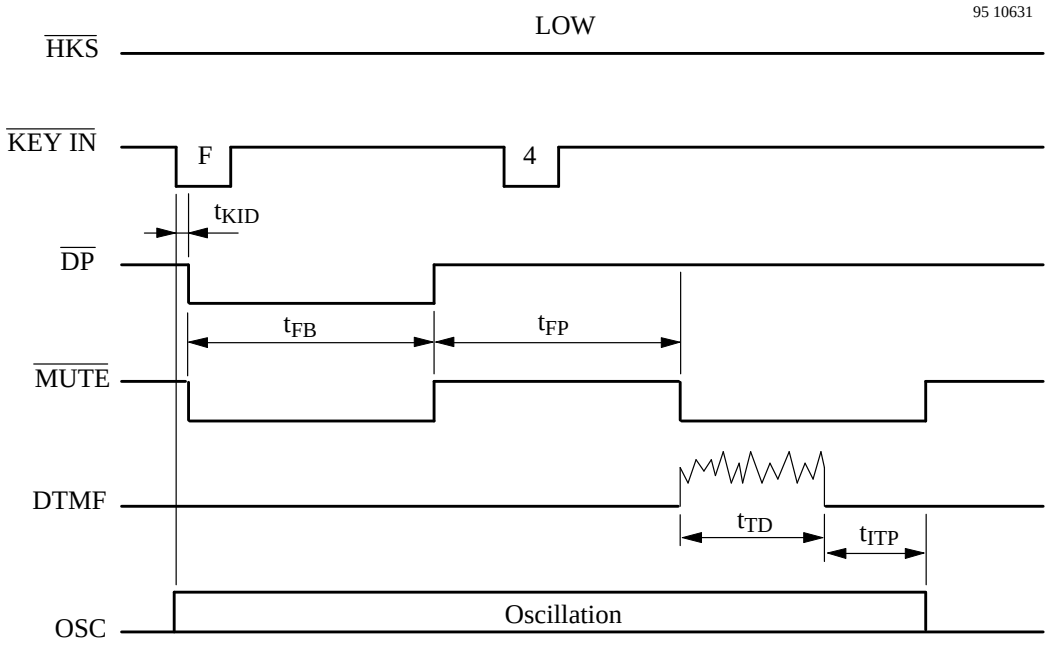


Figure 7. Flash operation

t_{KID} = key active in debounce
t_{KRD} = key release debounce
t_{PDP} = pre digit pause
t_{IDP} = Interdigit pause
t_{TD} = DTMF output duration
t_{ITP} = intertone pause
t_{FB} = Flash break time
t_{FP} = Flash pause time
t_P = pause time

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Line current	I_L	140	mA
DC line voltage	V_L	14	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 SSO44 SDIP40	P_{tot}	 0.9 1.3	W
Junction ambient SSO44 SDIP40	R_{thJA}	 70 50	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

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Line voltage	I_L = 8 mA I_L = 20 mA I_L = 30 mA I_L = 73 mA	V_L	1.4 2.8 3.1 5.0	1.7	2.0 3.4 3.9 6.0	V V V V
Transmit and sidetone						
Input resistance	R_i	R_i	45	80	120	kΩ
Gain	I_L = 30 mA	G_s	46.8	47.8	48.8	dB
Line loss compensation	R_{AGC} = 0 Ω, I_L = 73 mA	ΔG_s	–4.8	–6	–7	dB
Noise at line weighted psophometrically	I_L > 30 mA, G_S = 48dB	n_o			– 72	dBmp
Sidetone reduction	$I_L \geqq$ 20 mA	G_{STA}	10	15	20	dB
DTMF-amplifier						
Volume range d ≧ 5%	Single tone	V_0	1			V_{RMS}
Receiving amplifier						
Gain	IL ≥ 20 mA	G_R	3		5	dB
Line loss compensation	I_L = 73 mA	ΔG_R	–4.7	–6	–7	dB
Receiving noise at ear-phone weighted psophome-trially	I_L = 73 mA	n_i		–80	–71	dBm
Gain change when muted	$I_L \geqq$ 20 mA	G_{RM}	40	45	50	dB
Output voltage push pull	$I_L \geqq$ 20 mA	V_0	0.8	0.9		V_{RMS}
Supply voltage (for internal use only)						
Output voltage	$I_L \geqq$ 20 mA dialing mode speech mode dialing mode	VDD 1	 1.8 2.4		 6.1 3.1	 V V

DC Characteristics of Dialer

V_{DD2} = 2.7 V, f_{OSC} = 3.58 MHz, all outputs unloaded

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Memory rentention current	$\overline{HKS}$ = 1, V_{DD2} = 1.0 V	I_{MR}			0.2	µA
Pre-emphases	Column/Row		1	2	3	dB
DTMF distortion	R_L = 5 kΩ	d		–30	–23	dB
DTMF output dc level	R_L = 5 kΩ	V_{TDC}	1.1		2.0	V
DP output sink current	V_{PO} = 0.5 V	I_{PL}	0.5			mA
Keyboard input drive current	V_I = 0 V	I_{KD}	30			µA
Keyboard input sink current	V_I = 2.7 V	I_{KS}	200	400		µA
Keyboard resistance					5	kΩ
Key tone output current				± 1		mA
Key tone frequency	t = 50 ms			1240		Hz

AC Characteristics of Dialer

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Keypad active in debounce		t_{KID}		20		ms
Key release debounce		t_{KRD}		20		ms
Pre-digit pause	B/M pin = floating 10 ppS B/M pin = low 20 ppS	t_{PDP} t_{PDP}		40 33.3		ms ms
Interdigit Pause (auto dialing)	B/M pin = floating 10 ppS B/M pin = low 20 ppS	t_{IDP} t_{IDP}		800 500		ms ms
Make/break ratio	B/M pin = floating 10 ppS B/M pin = low 20 ppS	M/B		40:60 33:67		% %
DTMF output duration	Auto dialing	t_{TD}		87		ms
Intertone pause	Auto dialing	t_{ITP}		87		ms
Flash break time F1 F2 F3	 R_1 grounded R_2 grounded R_3 grounded	t_{FB}		 94 250 600		 ms ms ms
Flash pause time	F1 F2 F3	t_{FP}		 3.6		s s s
Pause time		t_P		3.6		

Electrical Characteristics Tone Ringer

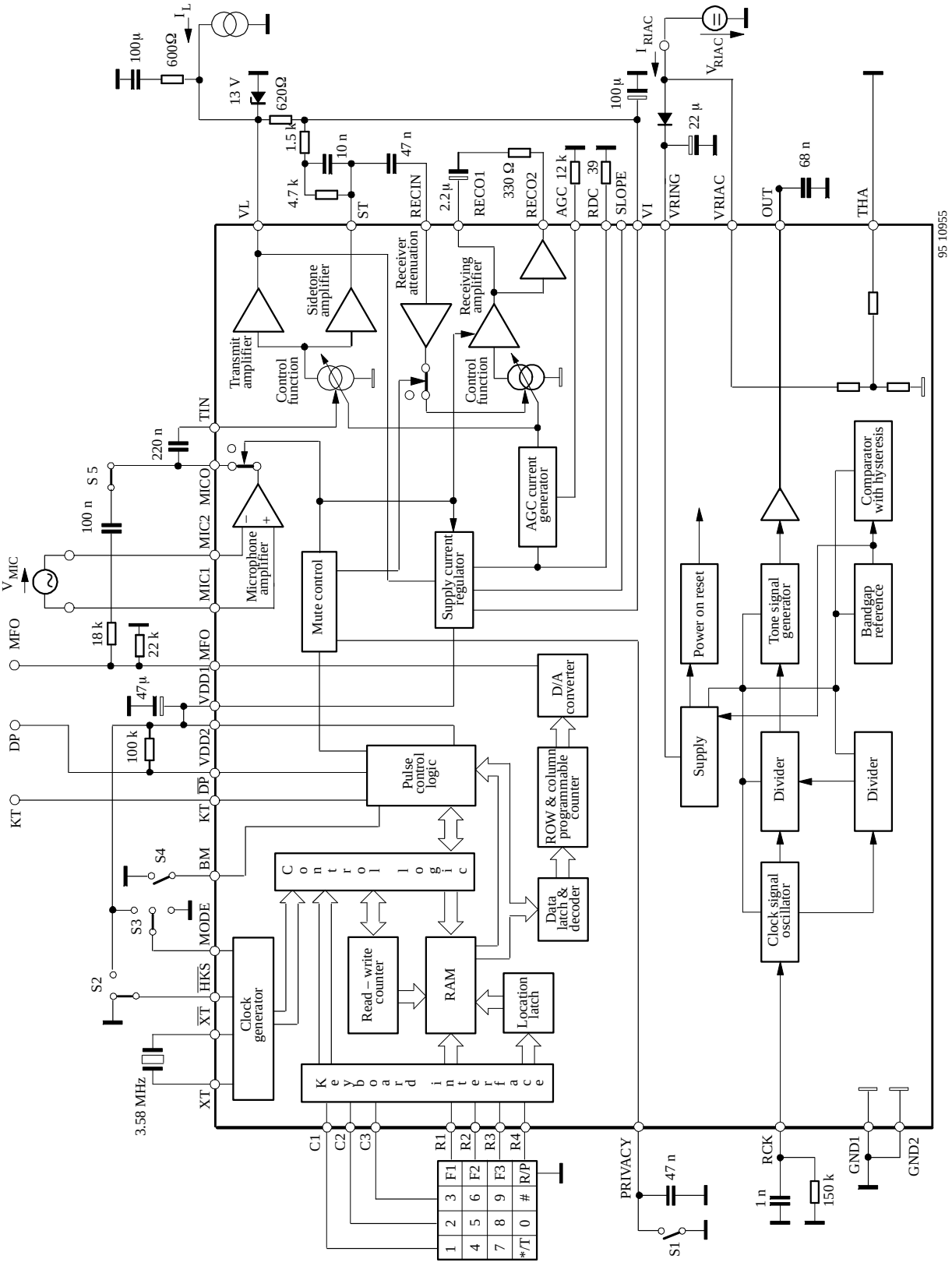
V_{RIAC} = 20 V, f = 4 kHz, T_{amb} = 25°C, Reference point GND, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current, outputs open	V_{RIAC}	I_S	2.1		3.8	mA
Switch-on threshold	V_{RIAC}	V_{RON}		28		V
Switch-off threshold	V_{RIAC}	V_{ROFF}		6.5		V
Ringing frequency	R = 150 kΩ, C = 1 nF	f_{1H} f_{1L}	937 752	1010 808	1083 868	Hz
Audio sequence frequency		f_2	11.5	12.5	14.0	HZ

Ordering Information

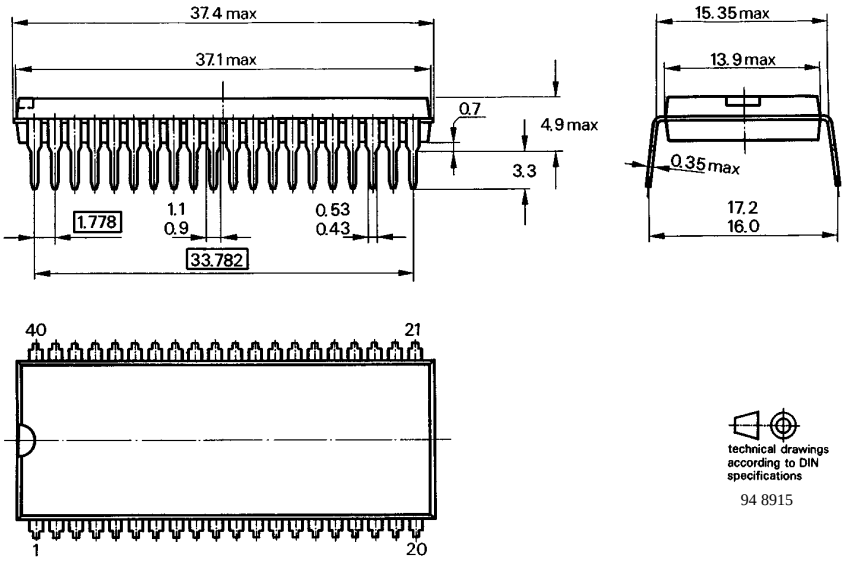
Type	Package
U3760MB-ASD	SDIP 40
U3760MB-AFN	SSO 44

Basic Test Circuit

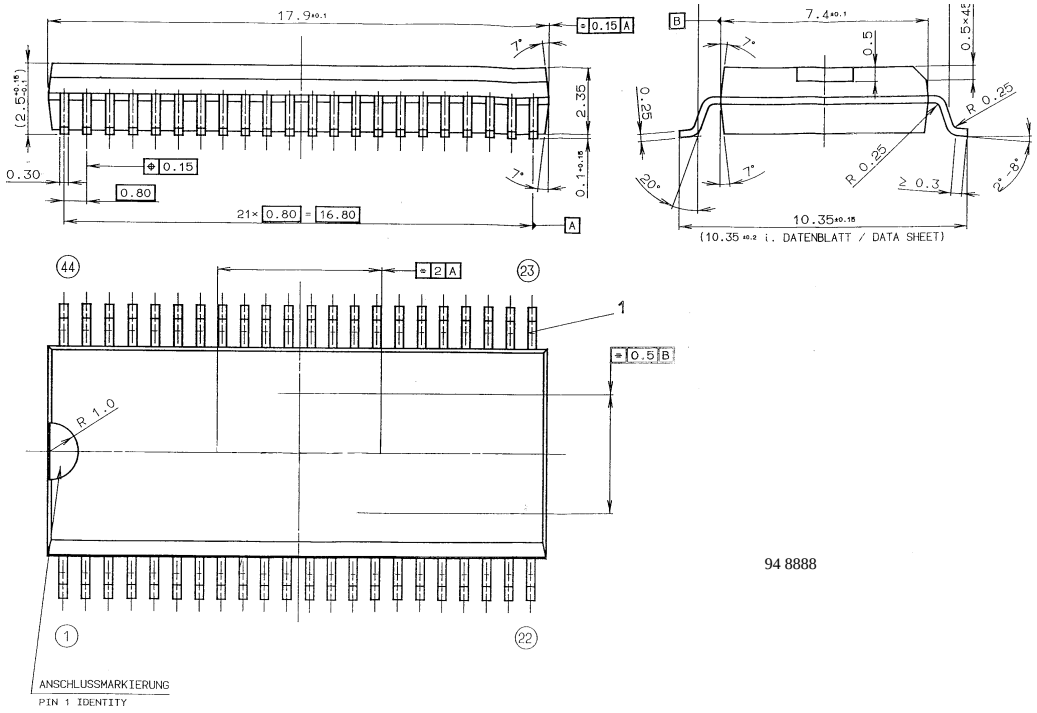


Dimensions in mm

Package: SDIP 40



Package: SSO 44



Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic 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.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division 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.

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

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