No.2711

LC7363N, 7363NM

CMOS LSI

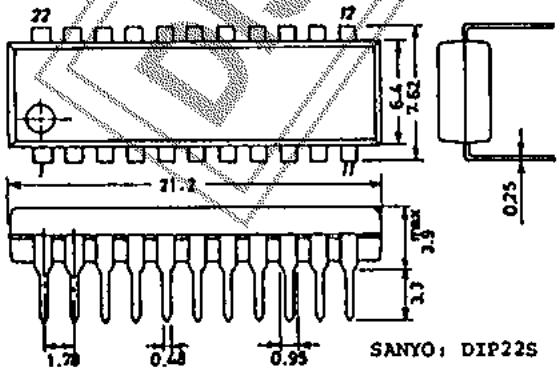
DTMF/PULSE SWITCHABLE DIALER

The LC7363N,7363NM are DTMF/OUTPUT-PULSE dialer CMOS LSIs with redial function for use in pushbutton telephones. The LC7363N is packaged in a 22-pin (shrink) DIP. The LC7363NM is packaged in a 30-pin MFP.

Features

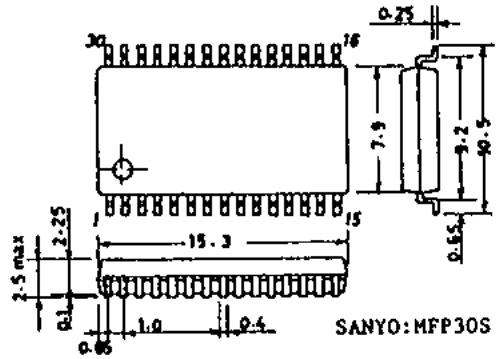
(1) Low voltage CMOS process for direct operation from telephone line.
(2) Possible to use single contact or standard 2-of-7, 2-of-8 key pad.
(3) Possible to use color-burst crystal resonator for on-chip oscillator (f_{OSC}=3.58MHz)
(4) Possible to use either mode select pin (P/T) or function key (4 x 4 matrix key) to select DTMF mode/OUTPUT-PULSE mode.
(5) Delivers 12 DTMF signals when in DTMF mode.
(6) On-chip 31-digit redial memory.
(7) Possible to provide mix redial (31 digits-PAUSE-MC) of DTMF/OUTPUT-PULSE modes.
(8) Either auto pause select (4sec. x n) or manual release available for mode select standby time during redial operation.
(9) Output pulse make rate of OUTPUT-PULSE mode: Pin-selectable (33.2% or 40%)
(10) Output pulse rate of OUTPUT-PULSE mode: Pin-selectable (10pps or 20pps)
(11) On-chip circuit to prevent malfunction due to noise pulse caused by key entry.
(12) Key touch tone (pacifier tone) output capability
OUTPUT-PULSE mode: 621.5Hz/50ms
(13) Supply voltage/operating temperature
DTMF mode: V_{DD}=2.0 to 6V/Ta=-30 to +70°C
OUTPUT-PULSE mode: V_{DD}=1.5 to 6V/Ta=-30 to +70°C
(14) Operating current
DTMF mode: I_{DD}=1.0mAmax/V_{DD}=3.5V
OUTPUT-PULSE mode: I_{DD}=500uAmax/V_{DD}=3.5V
(15) Data retention current
I_{DR}≦0.5uA/V_{DD}=1.0V

LC7363N
Case Outline 3059-D22SIC
(unit:mm)



SANYO: DIP22S

LC7363NM
Case Outline 3073A-M30IC
(unit:mm)



SANYO: MFP30S

Specifications and information herein are subject to change without notice.

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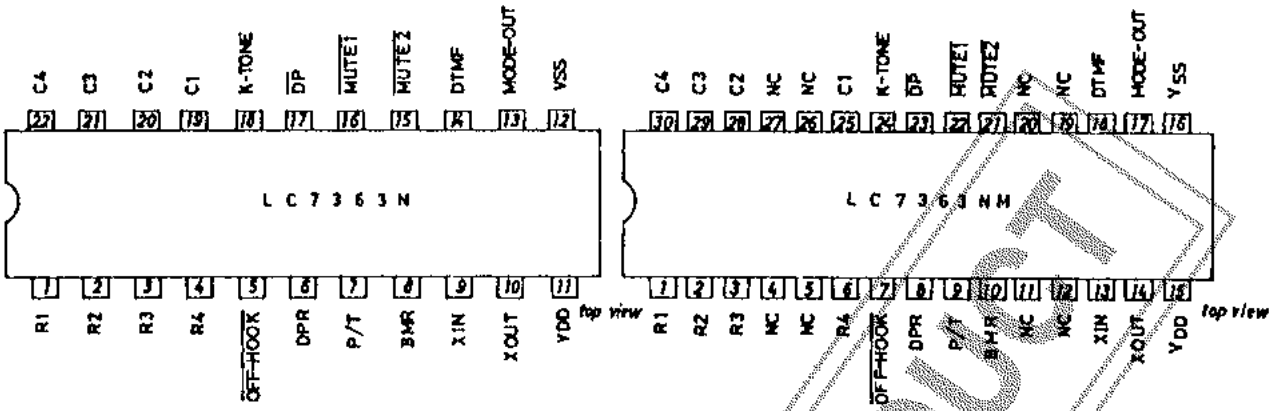
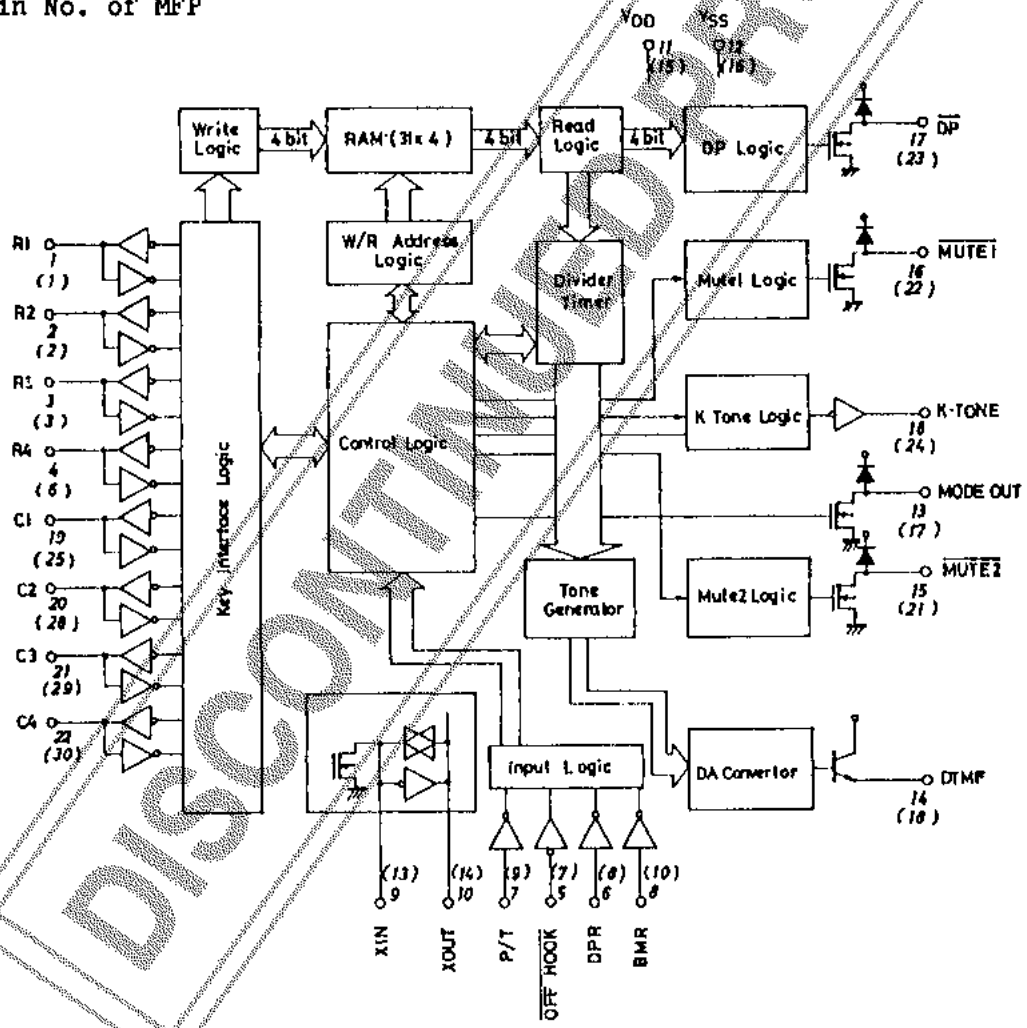
Pin Assignment (top view)

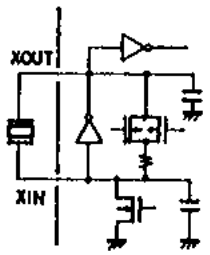
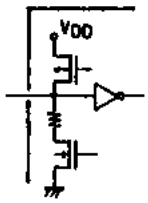
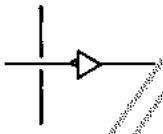
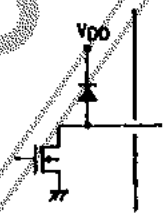
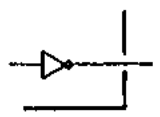
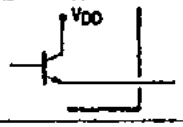


Equivalent Circuit Block Diagram

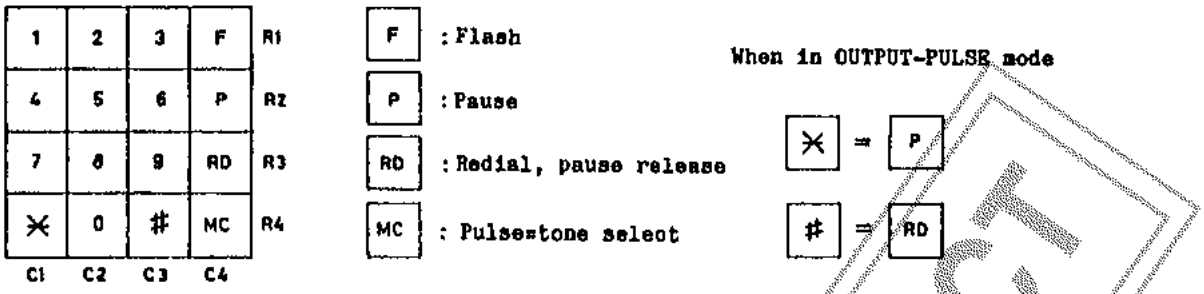
( ):Pin No. of MFP



Pin Description ( ):Pin No. of MFP

Pin Name	Pin No.	I/O Configuration	Function
VDD	11(15)		Power supply pin.
VSS	12(16)		
XIN	9 (13)		Used to generate the reference frequency. Uses a crystal resonator of 3.579545MHz With the feedback resistor and capacitors contained to form the OSC circuit, a crystal resonator is simply connected across the pins. When using a ceramic resonator, a capacitor of approximately 30pF must be connected to each pin.
XOUT	10 (14)		
R1toR4 C1toC4	1to4 22to19 [1to3 6 25 28to30]		Row and column input pin. High-active input. Contains a P-channel transistor for keyboard scan and an N-channel transistor for pull-down. When in the ON-HOOK state, the P-channel transistor is turned OFF and the N-channel transistor is turned ON.
$\overline{\text{OFF-HOOK}}$	5 (7)		HOOK SW input. "H" level=ON-HOOK "L" level=OFF-HOOK
DPR	6 (8)		Dial pulse rate select input. "H" level=20pps "L" level=10pps
P/T	7 (9)		Pulse/tone select input. "H" level=Pulse mode "L" level=DTMF mode
BMR	8 (10)		Make rate select input. "H" level=33.2% "L" level=40%
$\overline{\text{DP}}$	17(23)		Dial pulse output.
$\overline{\text{MUTE1}}$	16 (22)		Mute output. Operates at the OUTPUT-PULSE mode. Capable of being wired-ORed with $\overline{\text{MUTE2}}$.
$\overline{\text{MUTE2}}$	15 (21)		Mute output. Operates at the DTMF mode. Capable of being wired-ORed with $\overline{\text{MUTE1}}$.
MODE-OUT	13 (17)		DTMF/OUTPUT-PULSE mode output. OUTPUT-PULSE mode="L" level DTMF mode="H" impedance
K-TONE	18 (24)		When a key is pushed at the OUTPUT-PULSE mode, the K-TONE (pacifier tone) of 621.5Hz/50ms is outputted.
DTMF	14 (18)		The DTMF signal is outputted. NPN transistor-used emitter follower output.

Key Assignment



Absolute Maximum Ratings at Ta=25±2°C

				unit
Maximum Supply Voltage	V_{DD}		-0.3 to +7	V
Maximum Input Voltage	V_{IN}		-0.3 to V_{DD}+0.3	V
Maximum Output Voltage	V_{OUT}		-0.3 to V_{DD}+0.3	V
Allowable Power Dissipation	$P_d$max	Ta=70°C	300	mW
Minimum Load Resistance	$R_L$min	Across DTMF and V_{SS} pin	100	ohm
Operating Temperature	Topg		-30 to +70	°C
Storage Temperature	Tstg		-40 to +125	°C

Allowable Operating Conditions at Ta=-30 to +70°C, V_{DD}=1.5 to 6V

			min	typ	max	unit
Supply Voltage	V_{DDP}	OUTPUT-PULSE mode	1.5		6.0	V
	V_{DDT}	DTMF mode	2.0		6.0	V
"H"-Level Input Voltage	V_{IH}	All input pins	0.7V_{DD}		V_{DD}	V
"L"-Level Input Voltage	V_{IL}	All input pins	V_{SS}		0.3V_{DD}	V
Key Contact Resistance	R_{KI}				3.0	kohm
Keyboard Capacitance	C_{KI}				330	pF
Resonator Spec.	f		3.579545MHz±0.7%			
	R_S			<100ohms		

Electrical Characteristics at Ta=25±2°C, V_{DD}=1.5 to 6.0V

			min	typ	max	unit
Operating Current	I_{DDP}	OUTPUT-PULSE mode, output open, V_{DD}=3.5V		0.3	0.5	mA
	I_{DDT}	DTMF mode, output open, V_{DD}=3.5V		0.5	1.0	mA
Quiescent Current	$I_{DD(ST)}$	OFF-HOOK pin=V_{DD}, V_{DD}=1.5 to 6.0V, output open			1	uA
Data Retention Voltage	V_{DR}				1	V
Data Retention Current	I_{DR}	V_{DD}=1V			0.5	uA
"H"-Level Input Current	I_{IH}	(OFF-HOOK,DPR,P/T,BMR)pin, V_{IH}=V_{DD}			1	uA
"L"-Level Input Current	I_{IL}	(OFF-HOOK,DPR,P/T,BMR)pin, V_{IL}=V_{SS}	-1			uA
Key Pin Current	I_{IHK}	V_{DD}=1.5V, V_{IH}=V_{DD}			20	uA
		V_{DD}=6V, V_{IH}=V_{DD}			300	uA
	I_{OHK}	V_{DD}=1.5V, V_{OH}=0.8V_{DD}			-50	uA
		V_{DD}=6V, V_{OH}=0.8V_{DD}			-700	uA
Output OFF-State Leakage Current	I_{OFF}	V_O=V_{DD}, V_{DD}=6V, output OFF, (DP,MUTE1,MUTE2,MODE-OUT)			1	uA

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			min	typ	max	unit
Output Pin Voltage	V_{OH}	K-TONE pin: V_{DD}=1.5V, I_{OH}=-125uA	V_{DD}-0.5			V
		K-TONE pin: V_{DD}=3.5V, I_{OH}=-500uA	V_{DD}-1			V
	V_{OL}	(K-TONE, DP, $\overline{MUTE1}$, $\overline{MUTE2}$, MODE-OUT) pin: V_{DD}=1.5V, I_{OL}=120uA			0.4	V
		(K-TONE, DP, $\overline{MUTE1}$, $\overline{MUTE2}$, MODE-OUT) pin: V_{DD}=3.5V, I_{OL}=500uA			0.4	V

AC Characteristics at Ta=25±2°C, V_{DD}=1.5 to 6V, fosc=3.579545MHz

			min	typ	max	unit
Key Debounce Time	T_{KD}		10.8		11.6	ms
K-TONE Frequency	f_{KT}			621.5		Hz
K-TONE Output Time	T_{KT}			50.9		ms
Auto Pause Time	T_{AP}			3.99		s
Single Tone Output	V_{OR}	ROW TONE output, V_{DD}=3.5V, R_L=10kohms	170	205	245	mVrms
Tone Output Ratio	dB_{CR}	V_{DD}=2.0 to 6V, R_L=10kohms	1	2	3	dB
Tone Output Distortion	%DIS	V_{DD}=2.5 to 6V, R_L=10kohms, f=300 to 3400Hz			7	%
		V_{DD}=2 to 6V, R_L=10kohms f=300 to 3400Hz			10	%
Oscillation Start Time	T_{START}	V_{DD}=1.7 to 6V			20	ms
		V_{DD}=3.5V			8	ms
DTMF Output Time	T_{MFON}		97.6			ms
DTMF Interdigit Pause	T_{MFOFF}		100.6			ms
Flash Time	T_{FLASH}			605.0		ms

. Dial pulse output

fosc=3.579545MHz

Pin DPR	Pin BMR	Dial pulse rate	Interdigit pause	Make ratio
VSS	VDD	9.94 PPS	838.1 ms	33.2 %
VDD	VDD	19.89 PPS	519.6 ms	33.2 %
VSS	VSS	9.94 PPS	844.8 ms	40 %
VDD	VSS	19.89 PPS	523.0 ms	40 %

. DTMF output

fosc=3.579545MHz

Input	Output frequency (Hz)		Deviation (%)
	Standard	LC7363N	
R1	697	699.1	+0.30
R2	770	766.2	-0.49
R3	852	847.4	-0.54
R4	941	948.0	+0.74
C1	1209	1215.9	+0.57
C2	1336	1331.7	-0.32
C3	1477	1471.9	-0.35

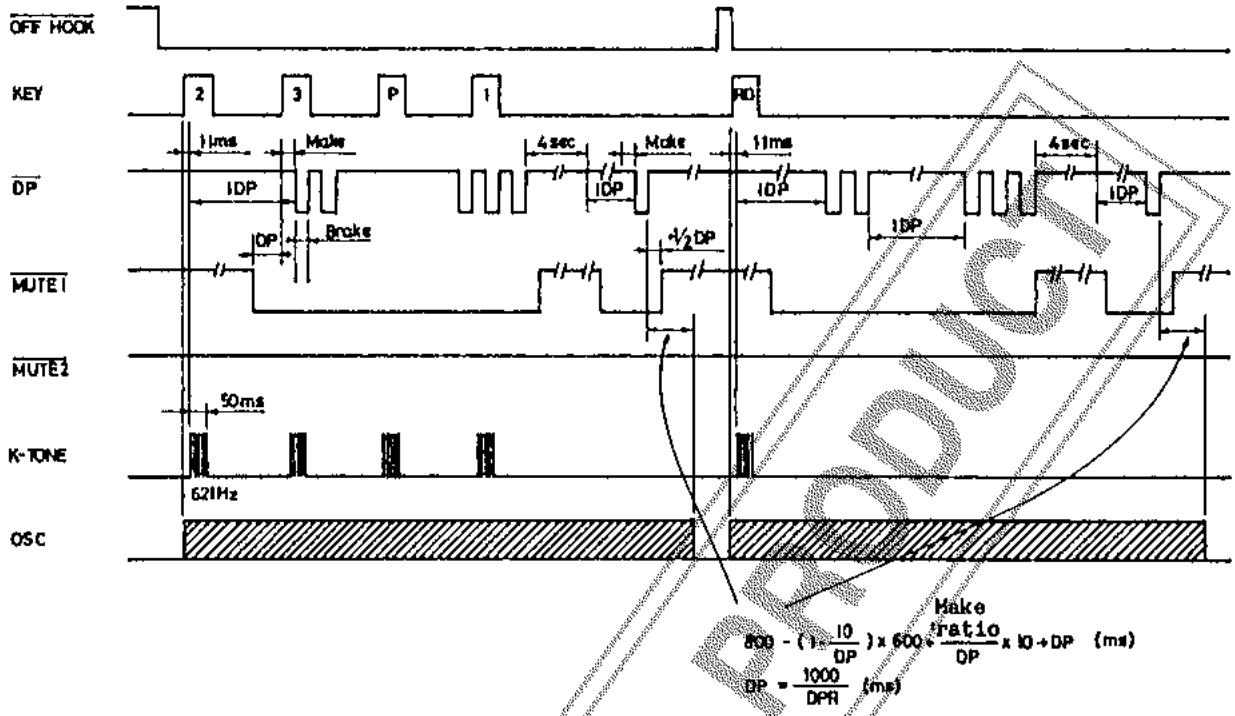
. Redial operation

fosc=3.579545MHz

Parameter	Time	
	1st digit	2nd digit onward
DTMF output	97.6ms	100.6ms
Interdigit pause	100.6ms	100.6ms
Period	198.2ms	201.2ms

Timing Chart

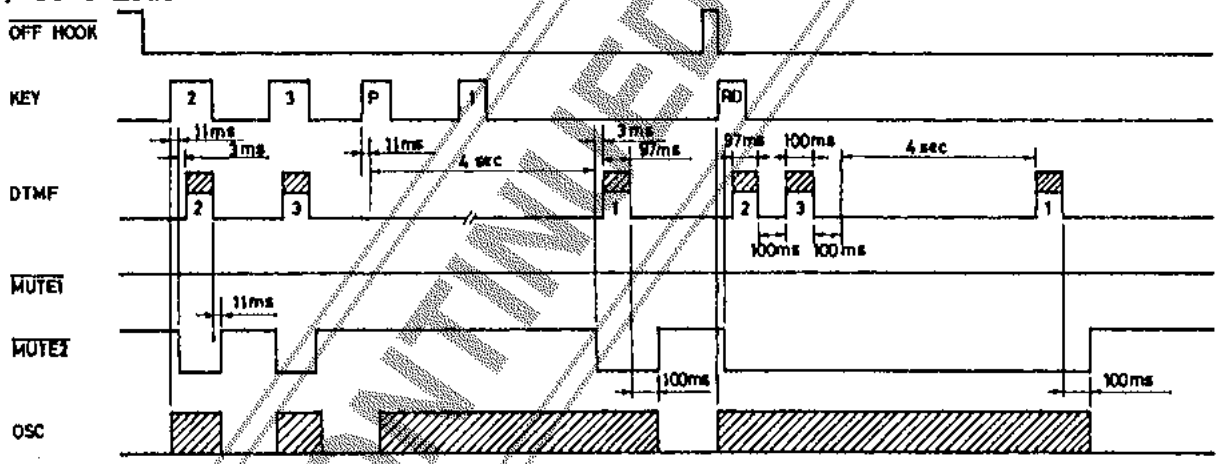
(1) OUTPUT-PULSE mode



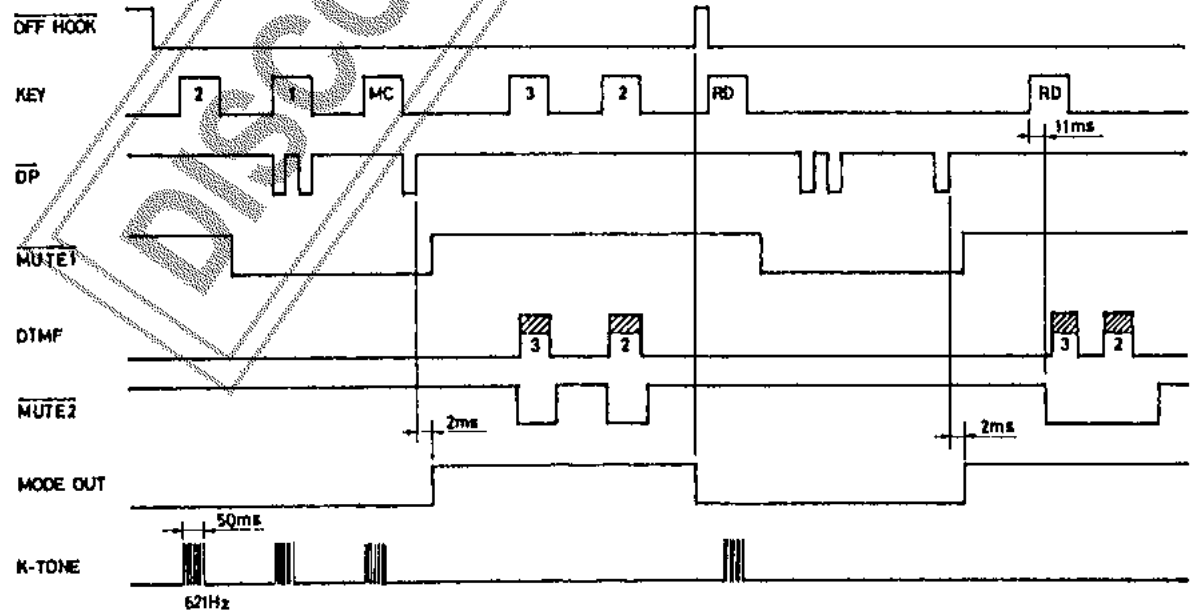
$$\text{Make ratio} = \left(1 - \frac{10}{DP}\right) \times 600 \div \frac{\text{Make ratio}}{DP} \times 10 \rightarrow DP \quad (ms)$$

$$DP = \frac{1000}{DPR} \quad (ms)$$

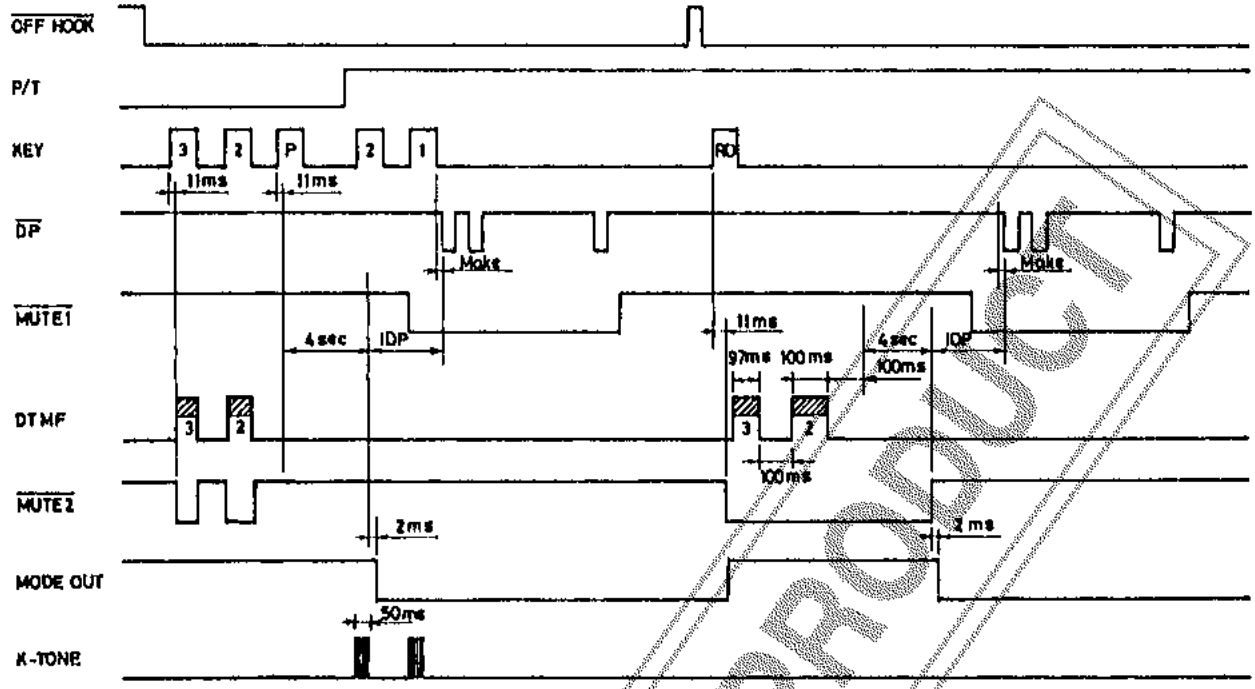
(2) Tone mode



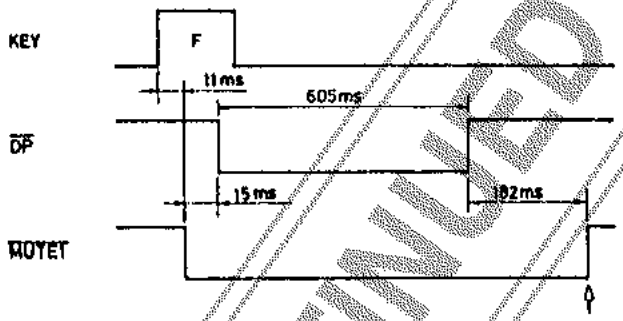
(3) Pulse → tone mix (P/T='H')



(4) Tone → pulse mix

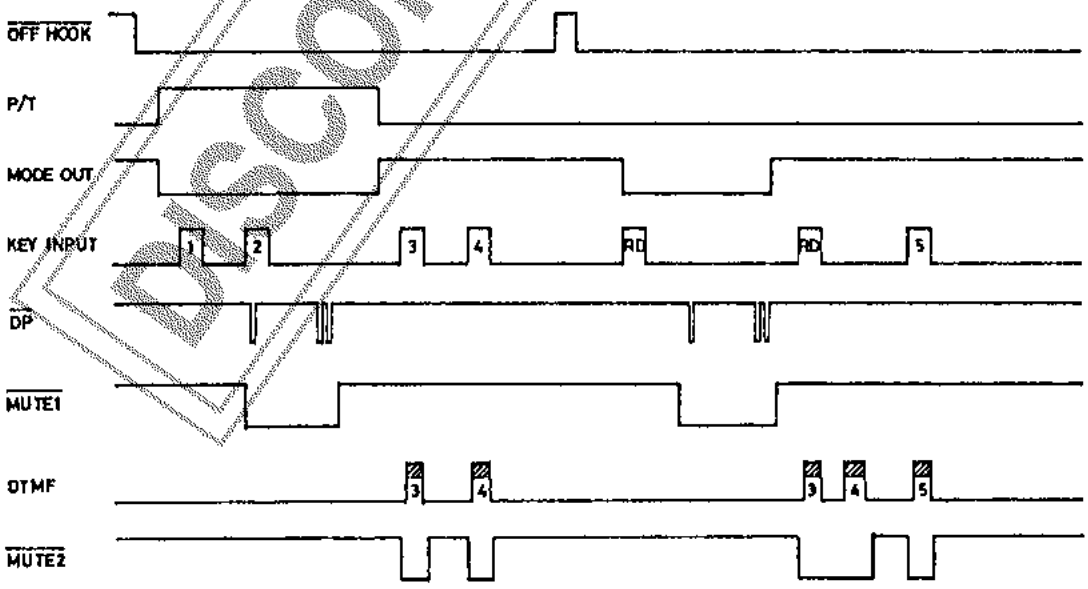


(5) Timing of flash



Same state as after off-hook

(6) Mix dial and redial (key entry available after redial) by P/T input (Slide SW, etc.)



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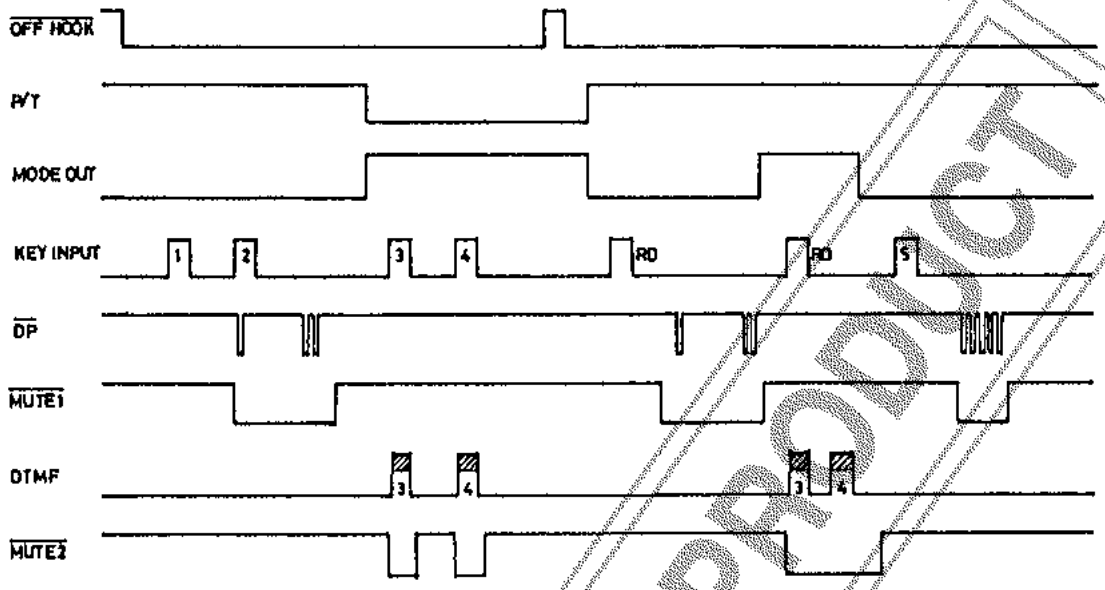
- Even when the tone mode (P/T SW: "Tone") is entered at the OFF-HOOK state, the OUTPUT-PULSE mode can be entered (P/T SW: "Pulse").
- The output mode provided when redialing is the one provided when dialed previously (regardless of the P/T SW position when the RD key is pushed).



- The mode after completion of redialing is set again by the P/T SW position provided when redialing is completed.

Since the $\overline{DP}$, $\overline{MUTE1}$, $\overline{MUTE2}$, MODE-OUT outputs are of the Nch open drain type, the output transistor OFF-state ("H" impedance) provides "H" level.
Likewise, since the DTMF output is of the emitter follower type, the output transistor OFF-state ("H" impedance) provides "L" level.

Key operation

(1) Normal dial

Off-hook → [D1] [D2] · · · · [Dn]

Redial

Off-hook → [RD]

(2) PBX dial

Off-hook → [D0] [P] [D1] [D2] · · · · [Dn]

Redial

Off-hook → [RD]

(3) Pulse/tone mix

1 In case where there is no pause during mode select

Off-hook → [D1] [D2] [MC] [D3] [D4] [MC] [D5] [D6] (P/T='H')
Pulse: D1, D2 — Tone: D3, D4 — Pulse: D5, D6

Redial

Off-hook → [RD] D1, D2 [RD] D3, D4 [RD] D5, D6
Pulse: D1, D2 — Tone: D3, D4 — Pulse: D5, D6

2 In case where there are pauses during mode select

Off-hook → [D1] [D2] [P] [MC] [D3] [D4] [MC] [P] [D5] [D6] (P/T='L')
Tone: D1, D2 — Pulse: D3, D4 — Tone: D5, D6

Redial

Off-hook → [RD] D1, D2 — 4sec — D3, D4 — 4sec — D5, D6
Tone: D1, D2 — Pulse: D3, D4 — Tone: D5, D6

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(Note) (a) When in OUTPUT-PULSE mode [P] = [✳] [RD] = [#]

(b) Pause: 4 sec./1 push of [P], 8 sec./2 pushes of [P], 4 x n sec./n pushes of [P]

(c) For pause release, push [RD]. All pauses can be also released by pushing [RD] once.

Sample Application Circuit (Tentative)

Pin Nos. are for DIP.