

SANYO

No.2413

LC7363, 7363M

CMOS LSI

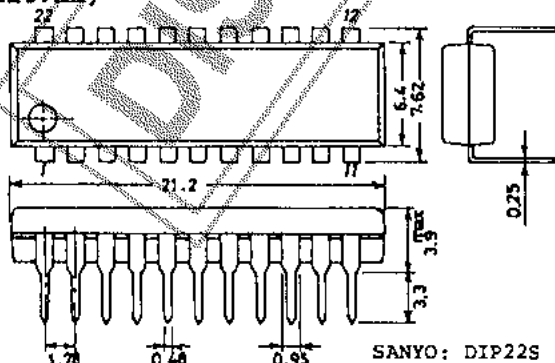
DTMF/PULSE SWITCHABLE DIALER

The LC7363,7363M are DTMF/OUTPUT-PULSE dialer CMOS LSIs with redial function for use in pushbutton telephones. The LC7363 is packaged in a 22-pin (shrink) DIP. The LC7363M is packaged in a 30-pin MFP.

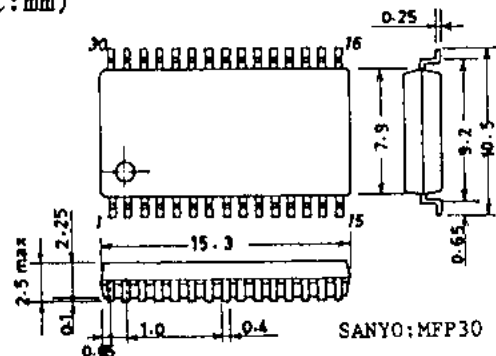
Features

- (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 ($f_{OSC}=3.58\text{MHz}$)
- (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 $6\text{V}/T_a=-30$ to $+70^\circ\text{C}$
OUTPUT-PULSE mode: $V_{DD}=1.5$ to $6\text{V}/T_a=-30$ to $+70^\circ\text{C}$
- (14) Operating current
DTMF mode: $I_{DD}=1.0\text{mAmax}/V_{DD}=3.5\text{V}$
OUTPUT-PULSE mode: $I_{DD}=500\mu\text{Amax}/V_{DD}=3.5\text{V}$
- (15) Data retention current
 $I_{DR}\leq 0.5\mu\text{A}/V_{DD}=1.0\text{V}$

LC7363

Case Outline 3059-D22SIC
(unit:mm)

LC7363M

Case Outline 3073A-M30IC
(unit:mm)

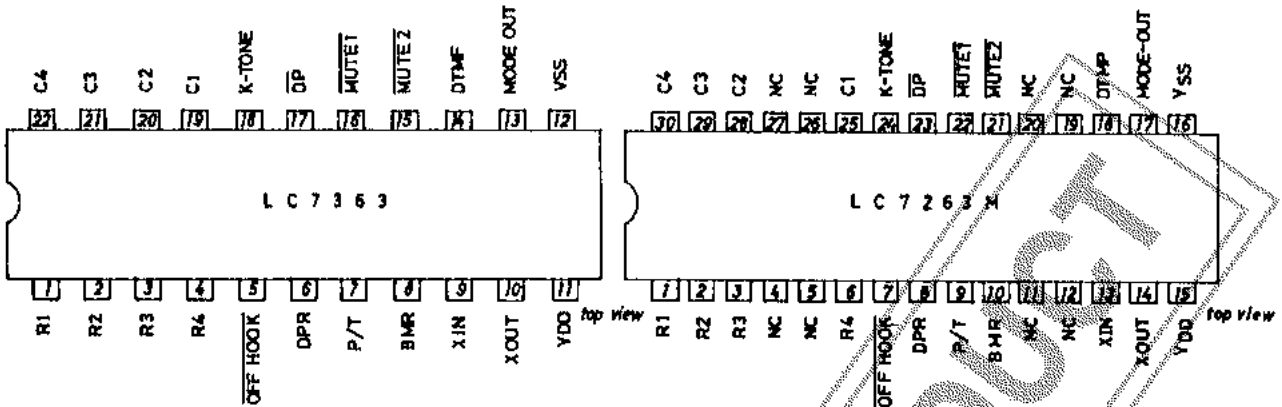
Specifications and information herein are subject to change without notice.

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D096KI TS No.2413-1/9

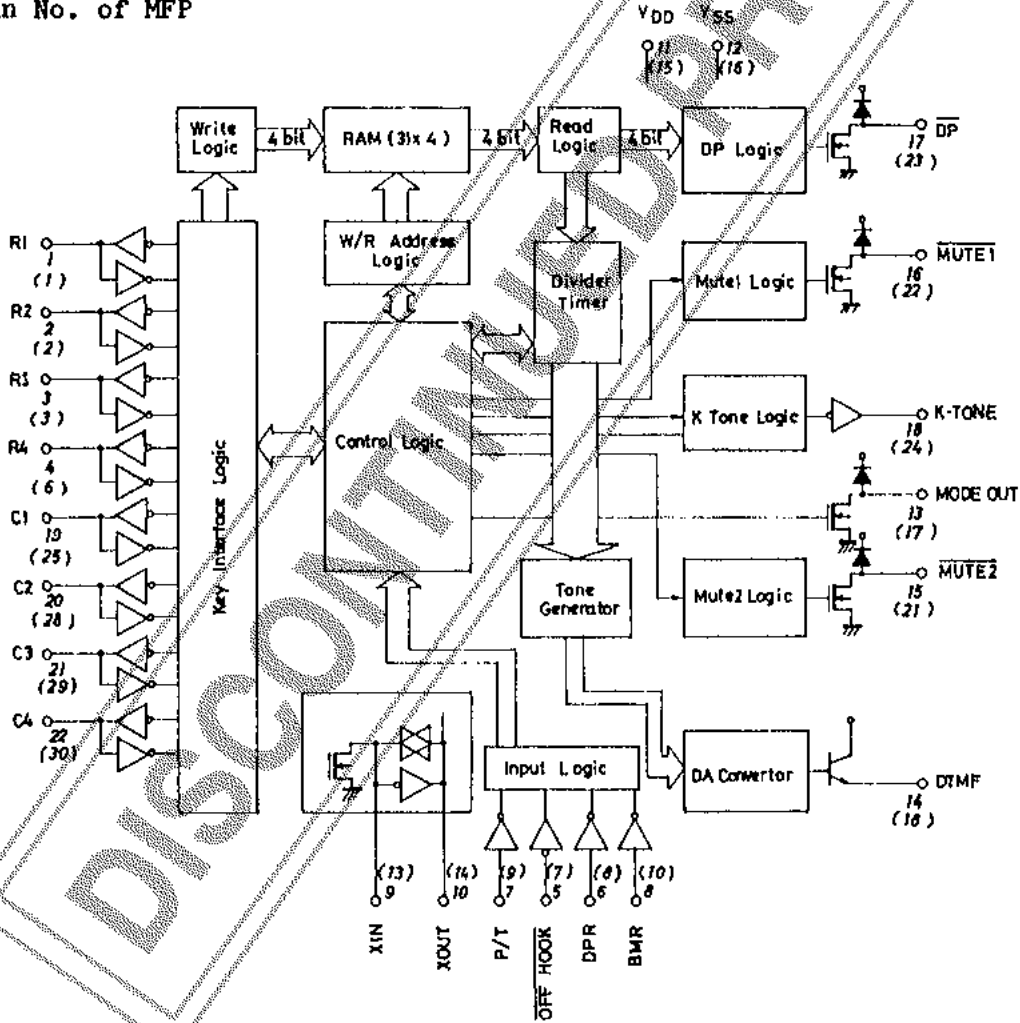
LC7363,7363M

Pin Assignment (top view)

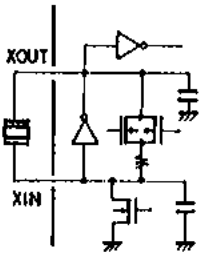
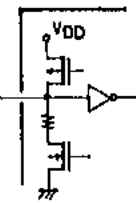
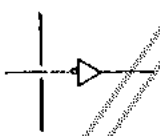

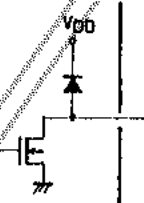
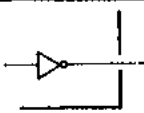
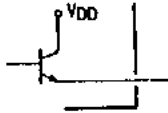


Equivalent Circuit Block Diagram

(): Pin No. of MFP



Pin Description (): Pin No. of MFP

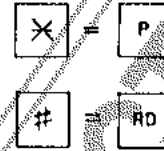
Pin Name	Pin No.	I/O Configuration	Function
VDD	11(15)		Power supply pin.
VSS	12(16)		
XIN	9 (13)		Used to generate the reference frequency. Uses a crystal resonator of 3.579545MHz. With the feedback resistor and capacitors contained to form the OSC circuit, a crystal resonator is simply connected across 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.
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%
DP	17(23)		Dial pulse output.
MUTE1	16 (22)		Mute output. Operates at the OUTPUT-PULSE mode. Capable of being wired-ORed with MUTE2.
MUTE2	15 (21)		Mute output. Operates at the DTMF mode. Capable of being wired-ORed with 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

Key Assignment

1	2	3	F	R1
4	5	6	P	R2
7	8	9	RD	R3
×	0	#	MC	R4
C1	C2	C3	C4	

- F** : Flash
- P** : Pause
- RD** : Redial, pause release
- MC** : Pulse=tone select

When in OUTPUT-PULSE mode



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	T _{opg}	-30 to +70 °C
Storage Temperature	T _{stg}	-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 _s			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, -1 V _{IL} =V _{SS}				uA
Key Pin Current	I _{IHK} V _{DD} =1.5V, V _{IH} =V _{DD}			20	uA
	I _{OHK} V _{DD} =6V, V _{IH} =V _{DD}			300	uA
	I _{OHK} V _{DD} =1.5V, V _{OH} =0.8V _{DD}			-50	uA
	I _{OHK} 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: $V_{DD}=1.5V$, $V_{DD}-0.5$ $I_{OH}=-40\mu A$				V
		K-TONE pin: $V_{DD}=3.5V$, $V_{DD}-1$ $I_{OH}=-200\mu A$				V
	V_{OL}	(K-TONE, DP MUTE1, MUTE2 MODE-OUT) pin	$V_{DD}=1.5V, I_{OL}=40\mu A$		0.4	V
			$V_{DD}=3.5V, I_{OL}=200\mu A$		0.4	V

AC Characteristics at $T_a=25\pm 2^\circ C, V_{DD}=1.5$ to $6V, f_{osc}=3.579545MHz$

			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, $V_{DD}=3.5V$, $R_L=10k\Omega$	170	205	245	mVrms
Tone Output Ratio	dB_{CR}	$V_{DD}=2.0$ to $6V, R_L=10k\Omega$	1	2	3	dB
Tone Output Distortion	$\%DIS$	$V_{DD}=2.5$ to $6V, R_L=10k\Omega$, $f=300$ to $3400Hz$			7	%
		$V_{DD}=2$ to $6V, R_L=10k\Omega$, $f=300$ to $3400Hz$			10	%
Oscillation Start Time	T_{START}	$V_{DD}=1.7$ to $6V$ $V_{DD}=3.5V$			20	ms
					8	ms
DTMF Output Time	T_{MFON}			97.6		ms
DTMF Interdigit Pause	T_{MFOFF}			100.6		ms

. Dial pulse output

$f_{osc}=3.579545MHz$

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

$f_{osc}=3.579545MHz$

Input	Output frequency (Hz)		Deviation (%)
	Standard	LC7363	
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

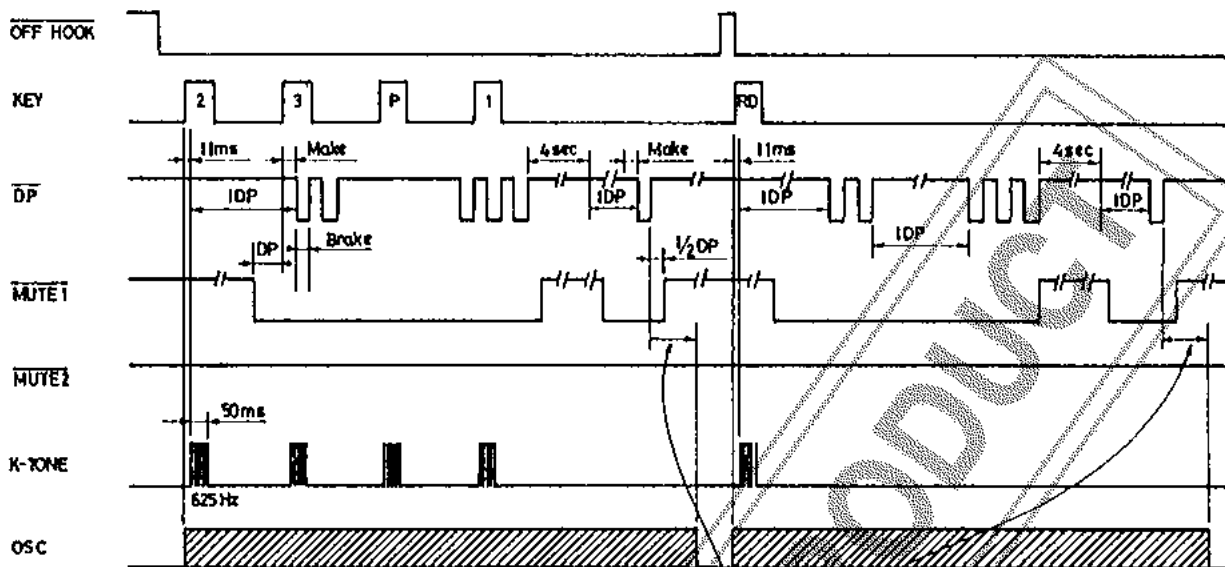
. Redial operation

$f_{osc}=3.579545MHz$

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

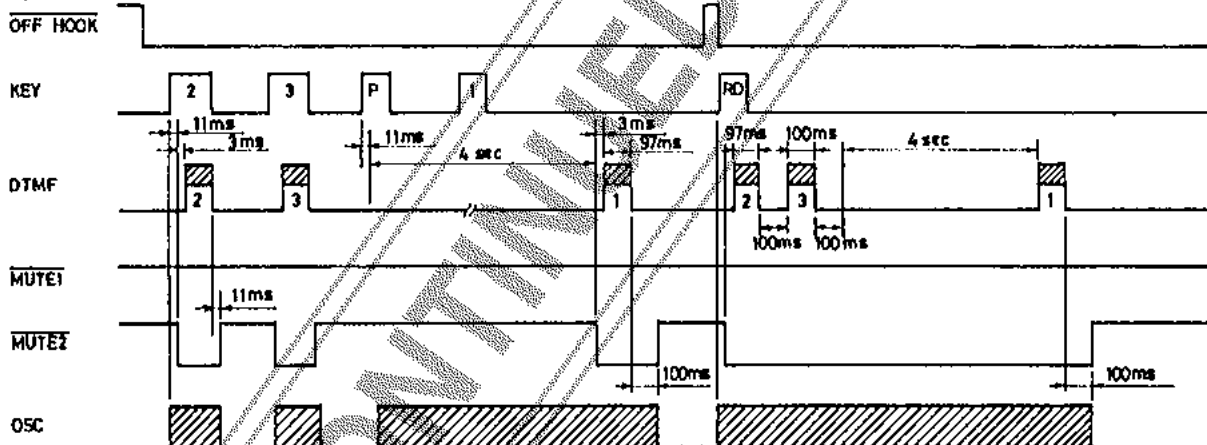
(1) OUTPUT-PULSE mode



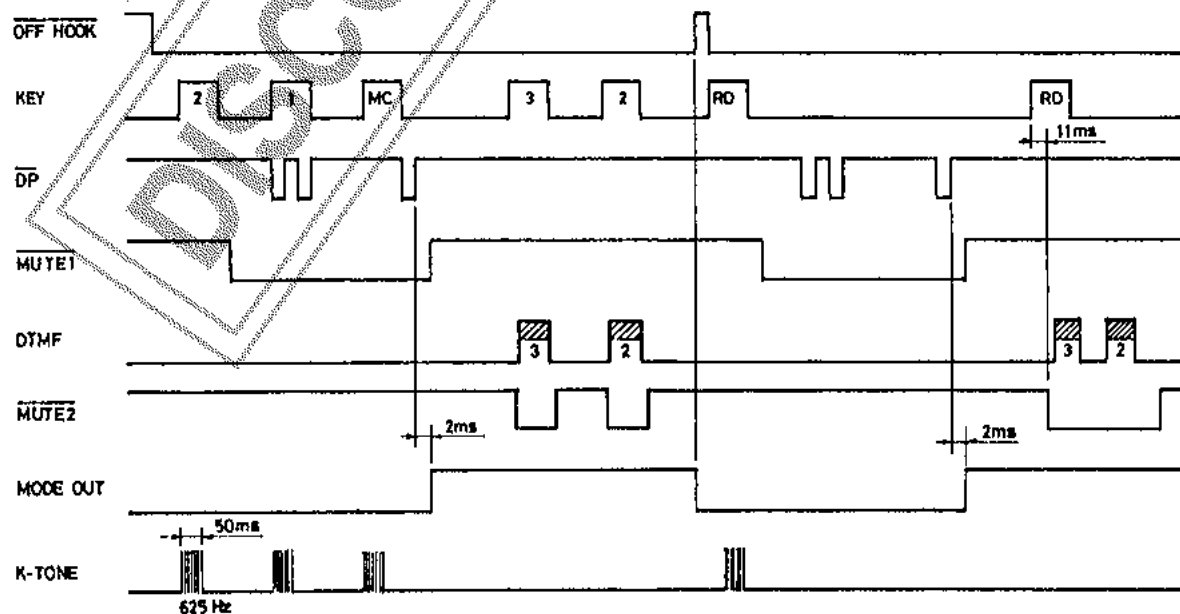
$$600 = \left(1 - \frac{10}{DP}\right) \times 600 + \frac{\text{Make Ratio}}{DP} \times 10 \rightarrow DP \text{ (ms)}$$

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

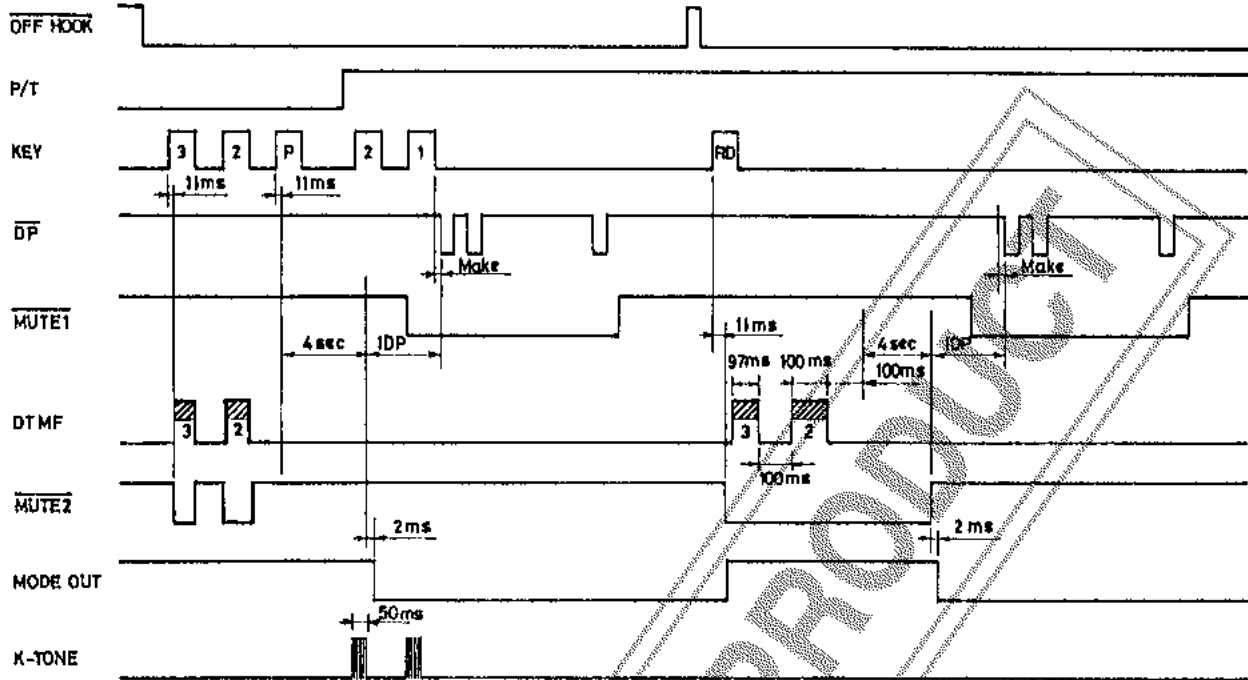
(2) Tone mode



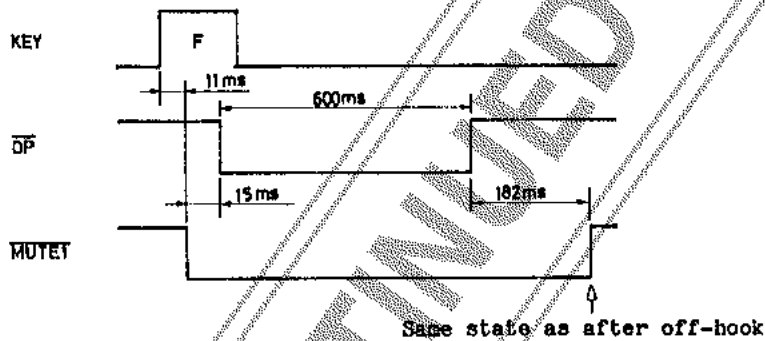
(3) Pulse-tone mix (P/T='H')



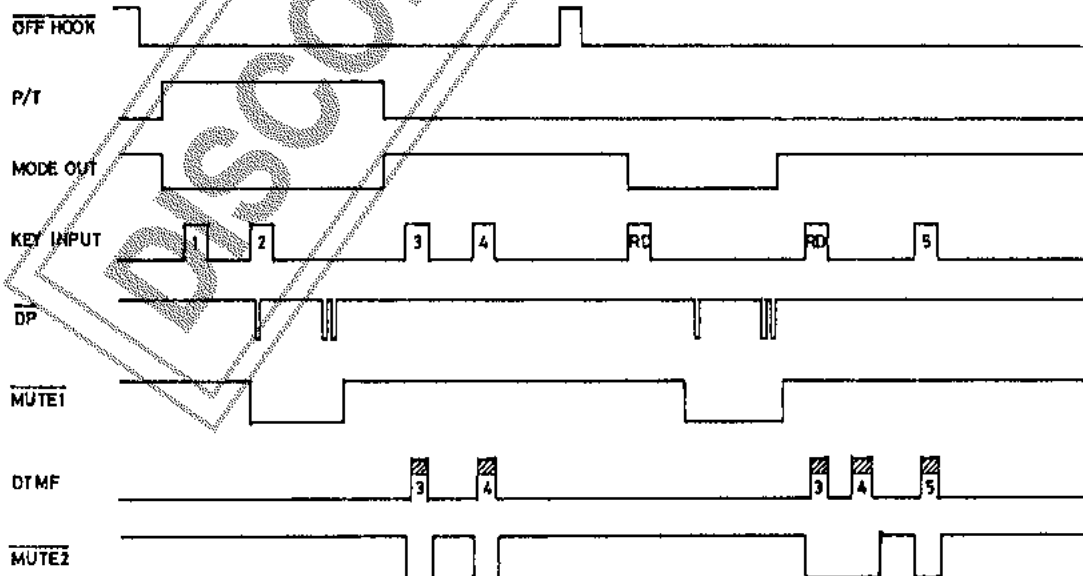
(4) Tone → pulse mix



(5) Timing of flash



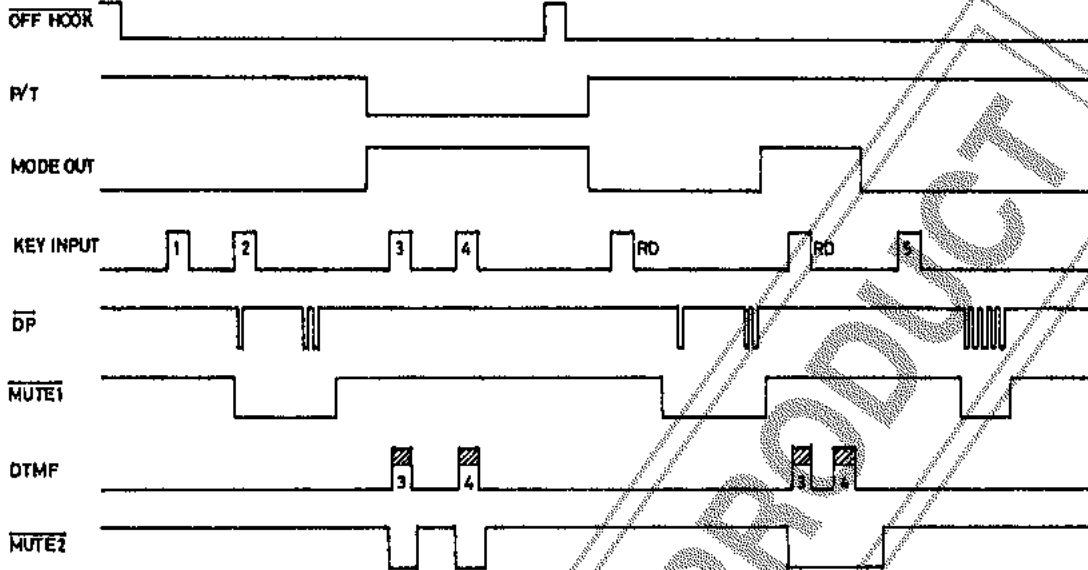
(6) Mix dial and redial (key entry available after redial) by P/T input (Slide SW, etc.)



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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} , $\overline{MUTE1}$, $\overline{MUTE2}$, $\overline{MODE-OUT}$ 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



Redial



(2) PBX dial

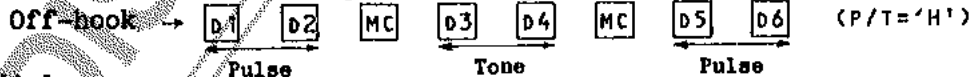


Redial

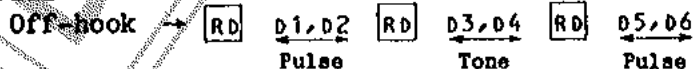


(3) Pulse/tone mix

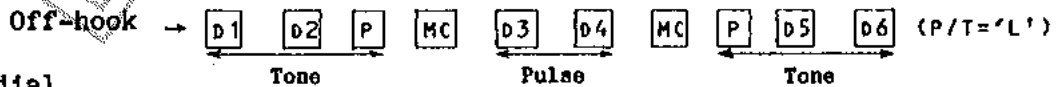
① In case where there is no pause during mode select



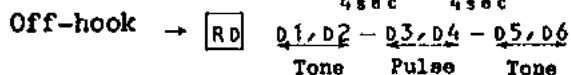
Redial



② In case where there are pauses during mode select



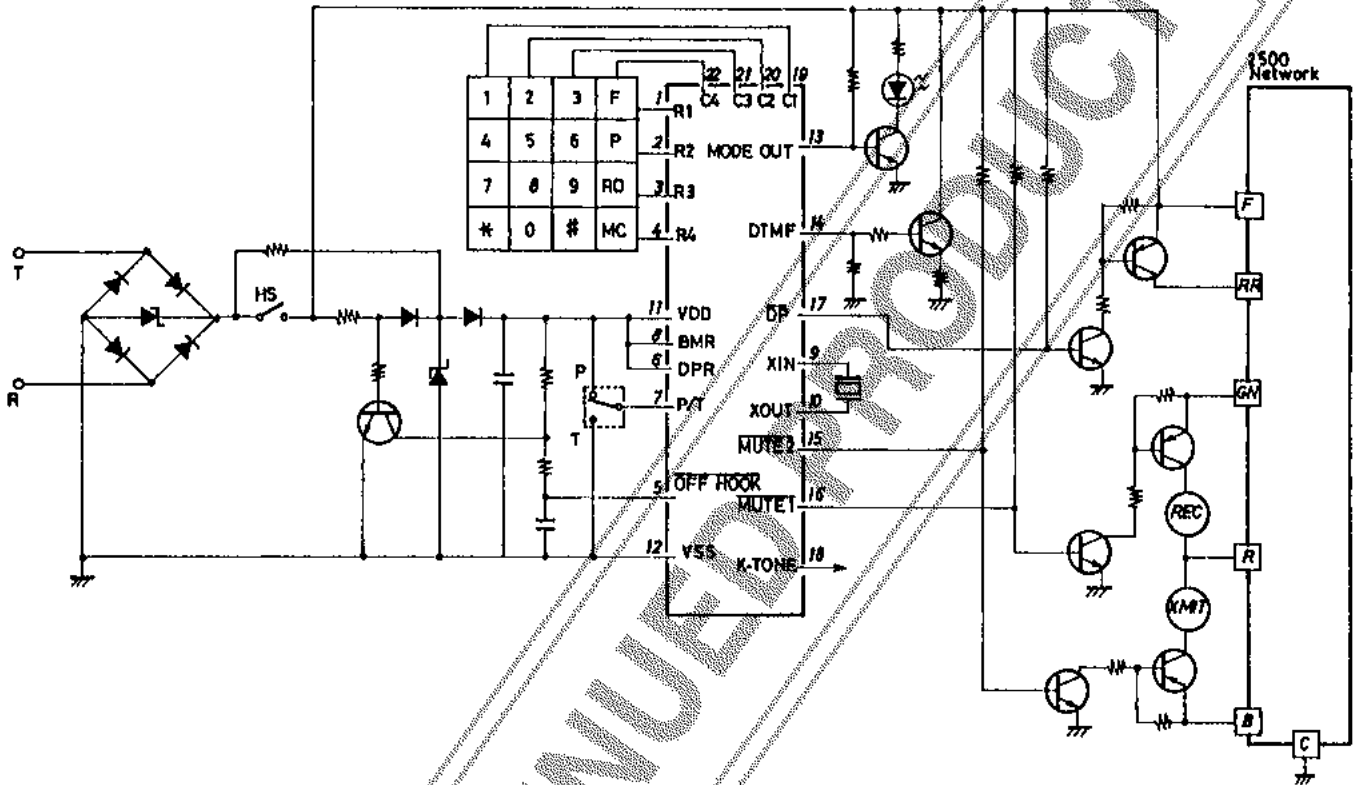
Redial



- (Note) (a) When in OUTPUT-PULSE mode $P = \text{X}$ $RD = \text{\#}$
 (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.



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