

SANYO

No.2787

LC7364N

CMOS LSI

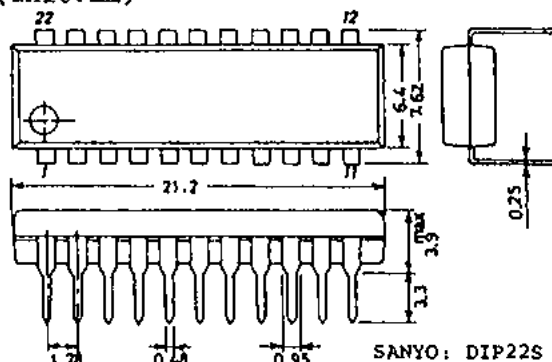
DTMF/PULSE Switchable Dialer

The LC7364N is a DTMF/OUTPUT-PULSE dialer CMOS LSI with redial function for use in pushbutton telephones.

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 board.
- (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) Mode change with MC key is made in one direction only - from pulse mode to tone mode.
- (6) Delivers 12 DTMF signals when in DTMF mode.
- (7) On-chip 31-digit redial memory.
- (8) Possible to provide mix redial (31 digits-PAUSE-MC) of DTMF/OUTPUT-PULSE modes.
- (9) Either auto pause select (4sec. x n) or manual release available for mode select standby time during redial operation.
- (10) Output pulse make rate of OUTPUT-PULSE mode: Pin-selectable (33.2% or 40%)
- (11) Output pulse rate of OUTPUT-PULSE mode: Pin-selectable (10pps or 20pps)
- (12) On-chip circuit to prevent malfunction due to noise pulse caused by key-in
- (13) Key touch tone (pacifier tone) output capability
OUTPUT-PULSE mode: 621.5Hz/50ms
- (14) Supply voltage/operating temperature
DTMF mode: $V_{DD}=2.0$ to $6.0\text{V}/T_a=-30$ to $+70^\circ\text{C}$
OUTPUT-PULSE mode: $V_{DD}=1.5$ to $6.0\text{V}/T_a=-30$ to $+70^\circ\text{C}$
- (15) Operating current
DTMF mode: $I_{DD}=1.0\text{mAmax}/V_{DD}=3.5\text{V}$
OUTPUT-PULSE mode: $I_{DD}=500\mu\text{Amax}/V_{DD}=3.5\text{V}$
- (16) Data retention current
 $I_{DR} \leq 0.5\mu\text{A}/V_{DD}=1.0\text{V}$
- (17) Package
LC7364N: Dual-in-line shrink 22-pin package

Case Outline 3059-D22SIC
(unit:mm)



SANYO: DIP22S

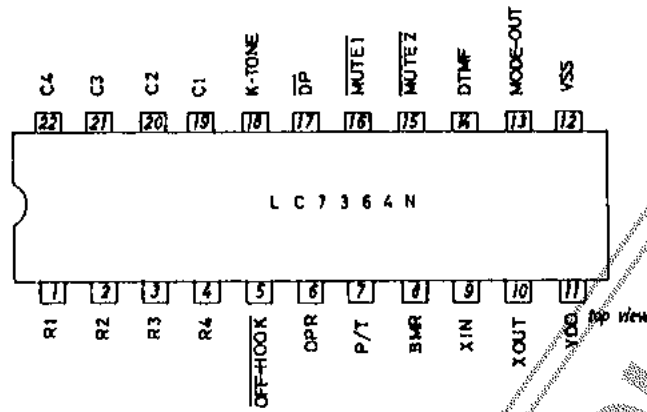
Specifications and information herein are subject to change without notice.

SANYO Electric Co., Ltd. Semiconductor Overseas Marketing Div.
Natsume Bldg., 18-6, 2-chome, Yushima, Bunkyo-ku, TOKYO 113 JAPAN

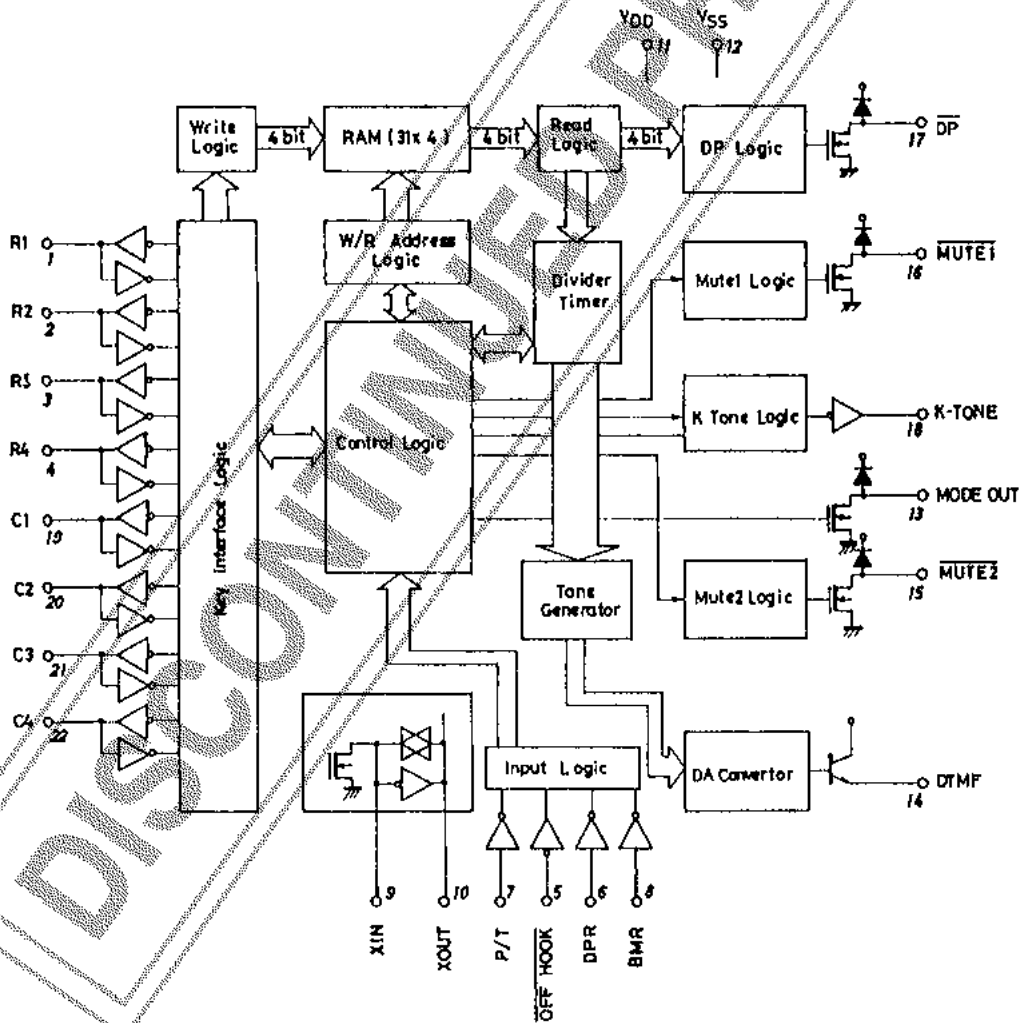
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Pin Assignment

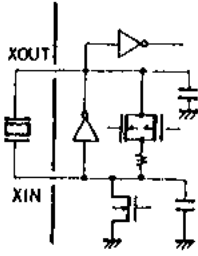
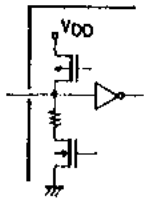
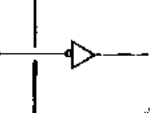

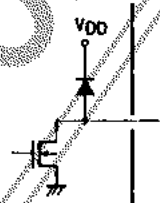
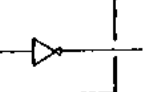
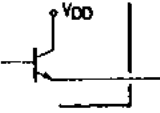


Equivalent Circuit Block Diagram



LC7364N

Pin Description

Pin Name	Pin No.	I/O Configuration	Function
VDD	11		Power supply pin.
VSS	12		
XIN	9		Used to generate the reference frequency. Uses a crystal resonator of 3.579545MHz.
XOUT	10		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.
R1toR4 C1toC4	1to4 22to19		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		HOOK SW input. "H" level=ON-HOOK "L" level=OFF-HOOK
DPR	6		Dial pulse rate select input. "H" level=20pps "L" level=10pps
P/T	7		Pulse/tone select input. "H" level=Pulse mode "L" level=DTMF mode
BMR	8		Make rate select input. "H" level=33.2% "L" level=40%
DP	17		Dial pulse output.
MUTE1	16		Mute output. Operates at the OUTPUT-PULSE mode. Capable of being wired-ORed with MUTE2.
MUTE2	15		Mute output. Operates at the DTMF mode. Capable of being wired-ORed with MUTE1.
MODE-OUT	13		DTMF/OUTPUT-PULSE mode output. OUTPUT-PULSE mode="L" level DTMF mode="H" impedance
K-TONE	18		When a key is pushed at the OUTPUT-PULSE mode, the K-TONE (pacifier tone) of 621Hz/50ms is outputted.
DTMF	14		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
- ×** = **P**
 - #** = **RD**

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 _{dmax} Ta=70°C	300 mW
Minimum Load Resistance	R _{Lmin} 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	$V_{DD}=1.5V, I_{OL}=125\mu A$		0.4	V
			$V_{DD}=3.5V, I_{OL}=500\mu A$		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
Flash Time	T_{FLASH}				270.3	ms

. Dial pulse output

$f_{osc}=3.579545MHz$

Pin DPR	Pin BMR	Dial pulse rate	Interdigit pause	Make rate
VSS	V_{DD}	9.94 PPS	838.1 ms	33.2 %
V_{DD}	V_{DD}	19.89 PPS	519.6 ms	33.2 %
VSS	VSS	9.94 PPS	844.8 ms	40 %
V_{DD}	VSS	19.89 PPS	523.0 ms	40 %

. DTMF output

$f_{osc}=3.579545MHz$

Input	Output frequency (Hz)		Deviation (%)
	Standard	LC7364	
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

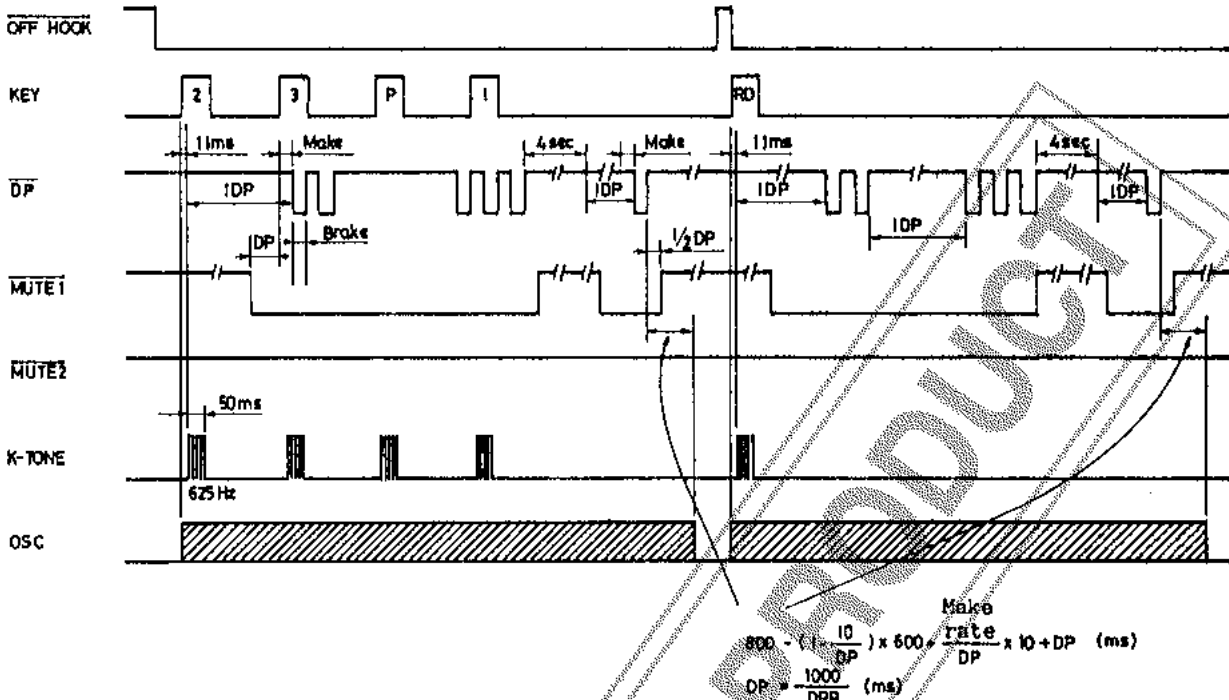
. Redial operation

$f_{osc}=3.579545MHz$

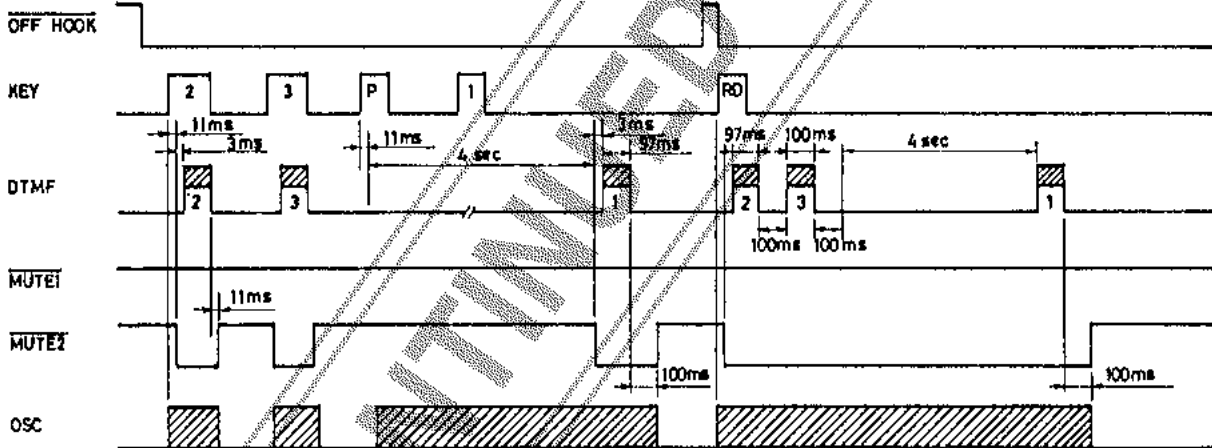
Parameter	Time	
	1st digit	2nd digit onward
DTMF output	97.6ms	100.6ms
Interdigit pause	100.6ms	100.6ms
Period	198.2ms	201.2ms

Timing Chart

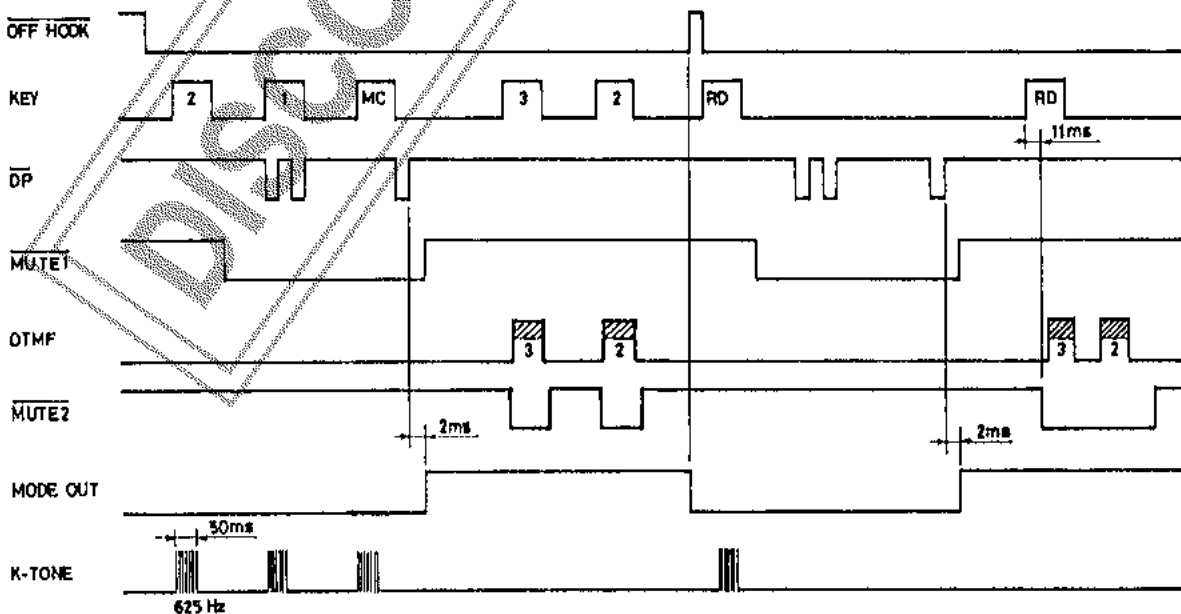
(1) OUTPUT-PULSE mode



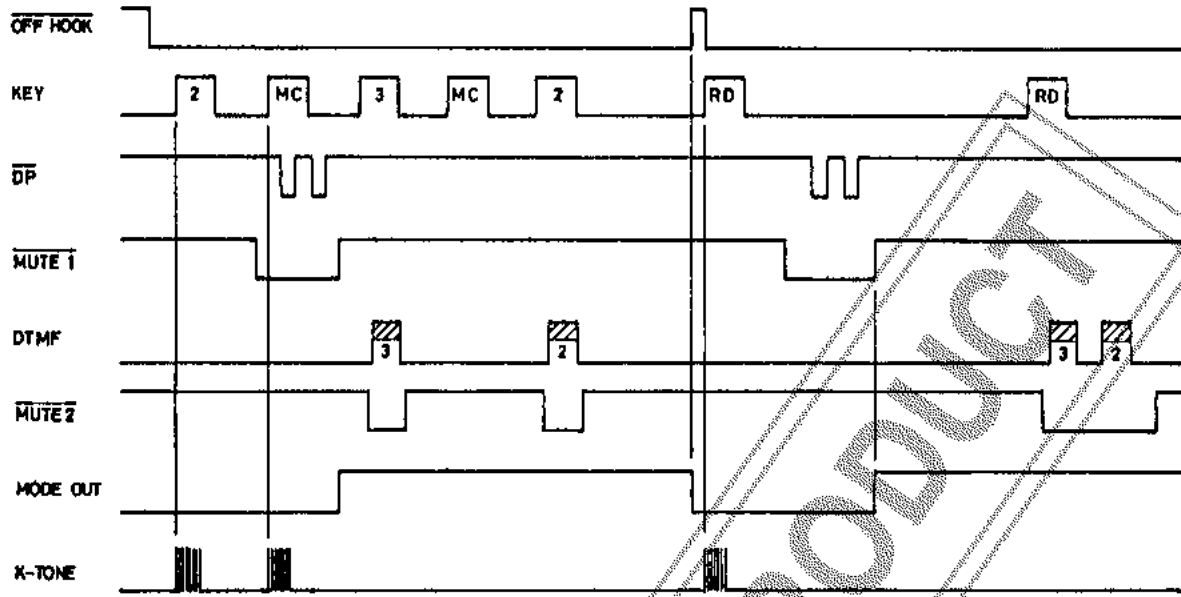
(2) Tone mode



(3) Pulse Tone mix (P/T='H')

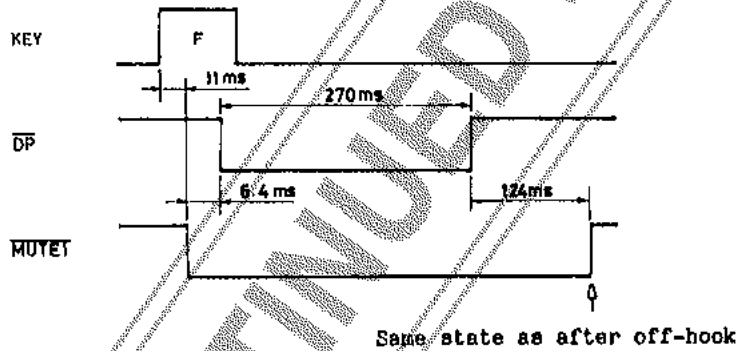


(4) Pulse Tone (P/H='H')

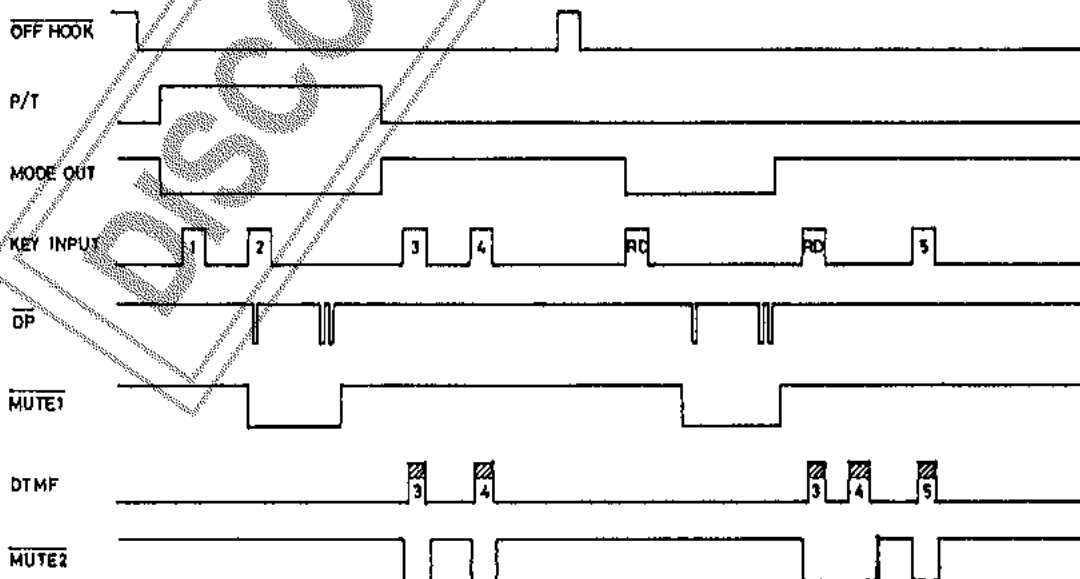


2nd MC key-in is invalid.

(5) Timing of flash



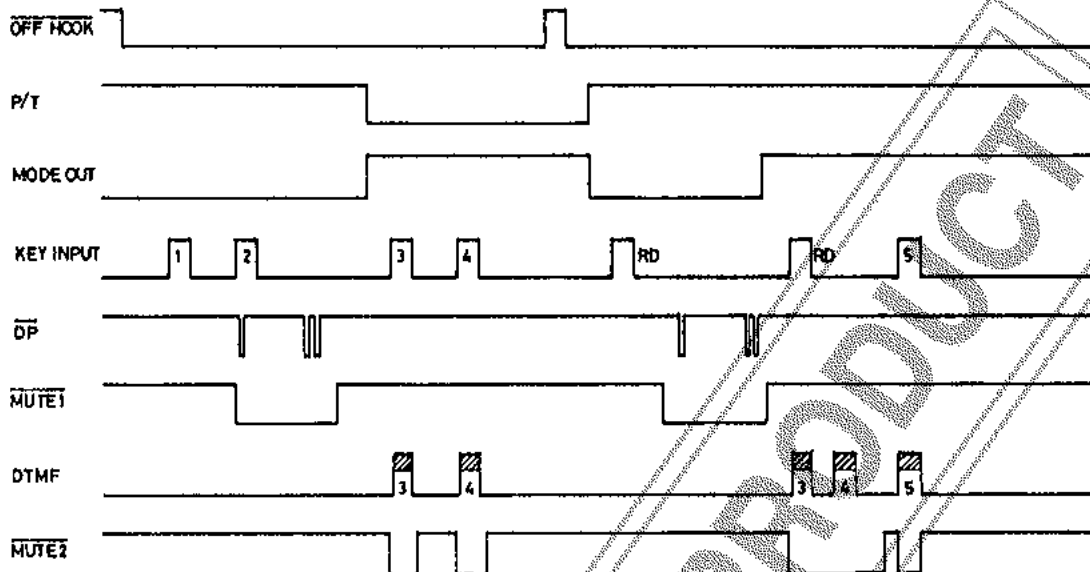
(6) Mix dial and redial (key-in available after redial) by P/T input (Slide SW, etc.)



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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)

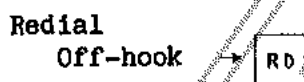


- The mode after completion of redialing is set again by the P/T SW position provided when redialing is completed.

Since the \overline{DP} , $\overline{MUTE1}$, $\overline{MUTE2}$, MODE-OUT outputs are of the Noh 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

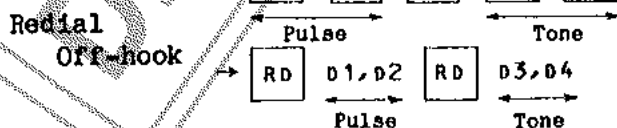
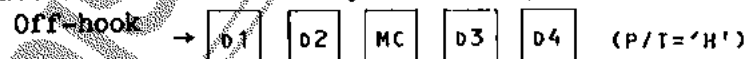


(2) PBX dial

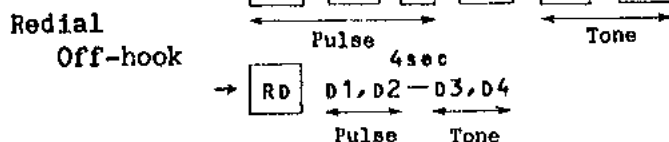
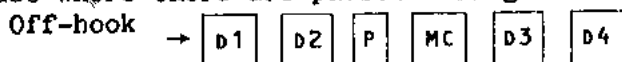


(3) Pulse/tone mix

1 In case where there is no pause during mode select



2 In case where there are pauses during mode select



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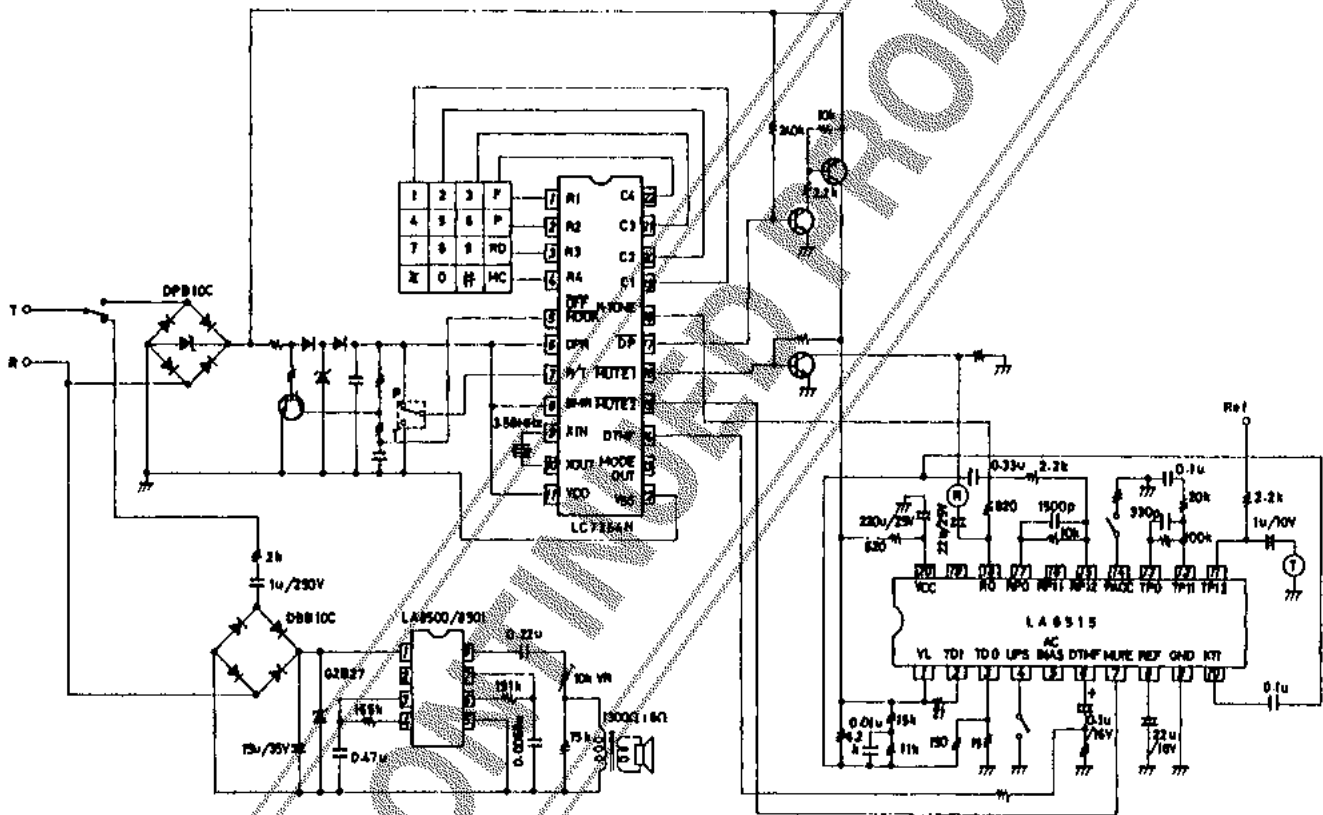
(Note) (a) When in OUTPUT-PULSE mode $P = \times$ $RD = \#$

(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.



LC7364N

Comparison between LC7364N and LC7364

The LC7364N is a modified/improved version of the LC7364. The LC7364N is different from the LC7364 in the following two points. The package and pin assignment remain unchanged.

1. Enhanced output drive capability

the LC7364N is more enhanced than the LC7364 in the drive capability of the DP, MUTE1, MUTE2, MODE-OUT, K-TONE pins.

LC7364	40 μ A ($V_{DD}=1.5V$) 200 μ A ($V_{DD}=3.5V$)
LC7364N	125 μ A ($V_{DD}=1.5V$) 500 μ A ($V_{DD}=3.5V$)

*: Specified as the conditions for V_{OH} , V_{OL} in the catalog.

2. Change in key double push processing

The key double push processing in the OUTPUT-PULSE mode is different.

The LC7364N is so designed that next key-in is accepted only after all keys are turned OFF.



The application circuit diagrams and circuit constants herein are included as an example and provide no guarantee for designing equipment to be mass-produced.
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