



RCL Semiconductors Ltd.

Six Digits Multiplexed LCD Watch CMOS IC

C1935

With Alarm and Chronograph

GENERAL DESCRIPTION

C1935 is a 6 digits and 6 function watch CMOS LSI circuit with an alarm and chronograph function. It can directly drive 6 digits 1/2 duty multiplexed LCD and display Hours, Minutes, Seconds, Month, Date and Day of the Week. The user's option enables 12 hour or 24 hour format. C1935 is typically used in wrist watch and suitable for many other watch applications.

FUNCTION

- 6 digits and 6 function: Hour, Minute, Second, Month, Date, Day-of-Week.
- Alarm and Hourly chime(alarm time: 30 second)
- Alarm function daily detect the setting time (hours and minutes), and alarm buzzer activated by intermitted 4 kHz signal
- Chronograph (start, stop, lap, reset) with confirmation chime
- 1/100 second resolution chronograph up to 40 minutes
- 12/24 Hour format and Month-Date, Date-Month display are selectable by switch
- Built-in 1/2 duty multiplexed LCD driver
- Sound demonstration capability
- Full display function for quick connection checking in the assembling line
- Auto-clear after power on

FEATURES

- Power supply voltage 1.5V
- 32768 Hz quartz crystal frequency
- On-chip oscillator
- On-chip voltage reducer
- 3 buttons operation
- Alarm output drive external melody
- Piezo direct drive
- Direct interface to 1/2-duty multiplexed LCD with 6 digits and 11 flags(7 days flag, AM/PM flag, chime and alarm flag)
- Colon display
- Single chip CMOS construction
- Low power dissipation

ABSOLUTE MAXIMUM RATINGS

(Ta=25 °C, VSS1=0V)

Parameter	Symbol	Limits
Supply voltage (1) VDD-Vss1	VDD	- 0.3 V to +1.8V
Supply voltage (2) Vss2-Vss1	Vss2	- 1.8 V to +0.3V
Input voltage range	Vin	Vss1 -0.3 to VDD +0.3
Operating temperature range	Topr	-20 to +60°C
Storage temperature range	Tstg	-40 to +70°C

DC ELECTRICAL CHARACTERISTICS

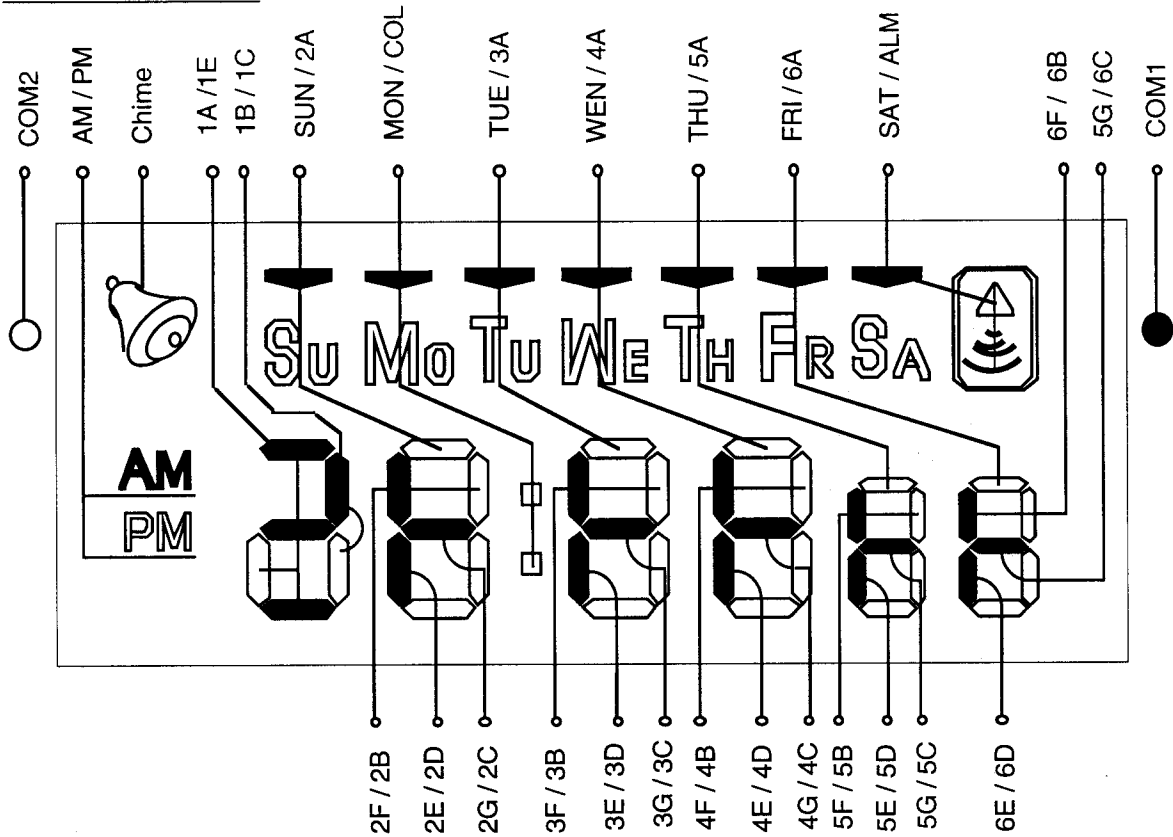
(Unless otherwise specified, Ta = 25°C, VDD = 1.5V, VSS1= 0V, VSS2=-1.5V, Fosc =32768Hz)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	
Operating voltage (1)	VDD	1.25	1.5	1.8	V		
Operating voltage (2)	VSS2	-1.25	-1.5	-1.8	V		
Current consumption	ISUP	-	-	1.5	μA	Time Mode and No load	
Output current (1) (COM1, COM2)	IOH1	-	-	-3.0	μA	VOH1= 1.45V	VSS2
	IOL1	3.0	-	-		VOL1= -1.45V	=-1.5V
Output current (2) (Segment)	IOH2	-	-	-0.15	μA	VOH2= 1.45V	VSS2
	IOL2	0.15	-			VOL2= -1.45V	=-1.5V
Output current (3) (φ 1)	IOH3	-	-	-12	μA	VOH3= 1.15V	VSS1
	IOL3	12	-			VOL3= 0.1V	=0V
Output current (4) (Dcarry, MSI)	IOH	-	-	-70	μA	VOH4= 0V	VSS2
	IOL	10	-			VOL4= 0V	=-1.5V
Input current (1) (S1, S2, S3)	IiH1	0.08	-	2.00	μA	ViH1= 1.5V	VSS1
	IiL1	-0.10	-			ViL1= 0V	=0V
Input current (2) (T1, T2, T3, T4, AC INPUT)	IiH2	-	-	60	μA	ViH2= 1.5V	VSS2
	IiL2	-	-	-		ViL2= -1.5V	=-1.5V
Osc starting voltage	VSTA			1.3	V		
Alarm output current (ALO-)	IAL			-500	μA	VOH= 0V VSS2=-1.5V	
Alarm output current (BD, BD-)	IOHB			-4.0	mA	VOH = 0V	VSS2
	IOLB	4.0				VOL = 0V	=-1.5V

PIN DESCRIPTION

Function	Name	Number	Description
Oscillator stage	XI, CG	2	Oscillator Input
	XO	1	Oscillator Output
Switch and Test Inputs	S1	1	Switch 1
	S2	1	Switch 2
	S3	1	Switch 3
	T1, T3, T4	3	Test Inputs
	AC	1	All Clear
Weekly Melody Output	ALO	1	Signal to Drive Melody
	Dcarry	1	Signal to Advance the Day
	MSI	1	Signal to Select Melody
Voltage Doubler Outputs(256HZ, Duty = 50%)	φ 1	1	
	φ 2	1	
	Segments (32 HZ)	26	
LCD Drive Outputs	COM1, COM2	2	
	BD, BD-	2	
Alarm Output	BD, BD-	2	
Power Supply	VDD (+1.5 V)	1	
	VSS1 (0V)	1	
	VSS2(-1.5 V)	1	

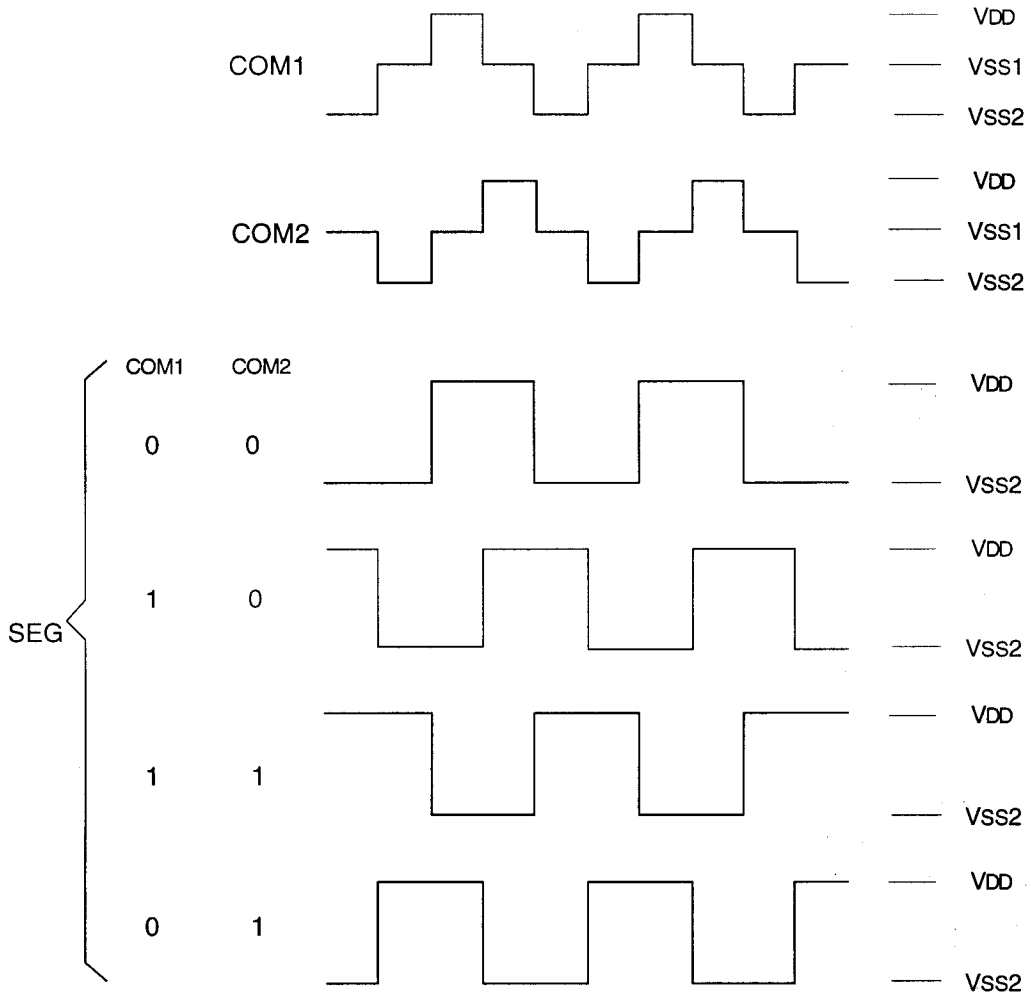
LCD FORMAT



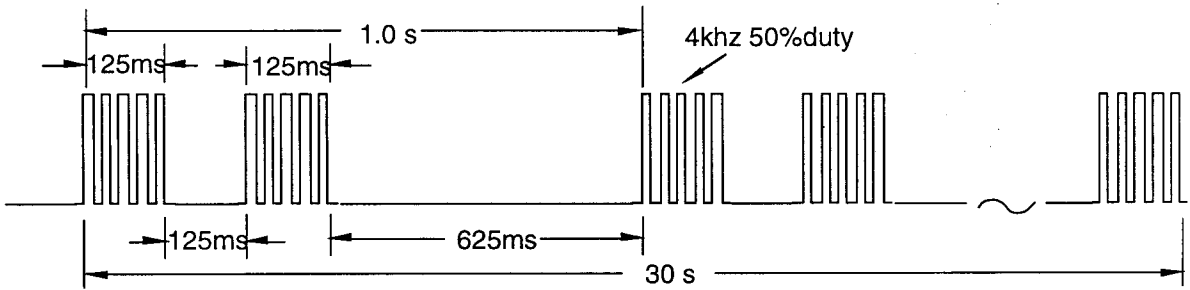
Pad Name	2F/2B	2E/2D	2G/2C	3F/3B	3E/3D	3G/3C	4F/4B	4E/4D	4G/4C
COM1	2F	2E	2G	3F	3E	3G	4F	4E	4G
COM2	2B	2D	2C	3B	3D	3C	4B	4D	4C
Pad Name	5F/5B	5E/5D	5G/5C	6E/6D	AM/PM	Chime	1A/1E	1B/1C	SUN/2A
COM1	5F	5E	5G	6E	AM	-	1A	1B	SUN
COM2	5B	5D	5C	6D	PM	TMS	1E	1C	2A
Pad Name	MON/ COL	TUE/3A	WED/4A	THU/5A	FRI/6A	SAT/ ALM	6F/6B	6G/6C	
COM1	MON	TUE	WED	THU	FRI	SAT	6F	6G	
COM2	COL	3A	4A	5A	6A	ALM	6B	6C	

LCD PANEL WAVEFORM

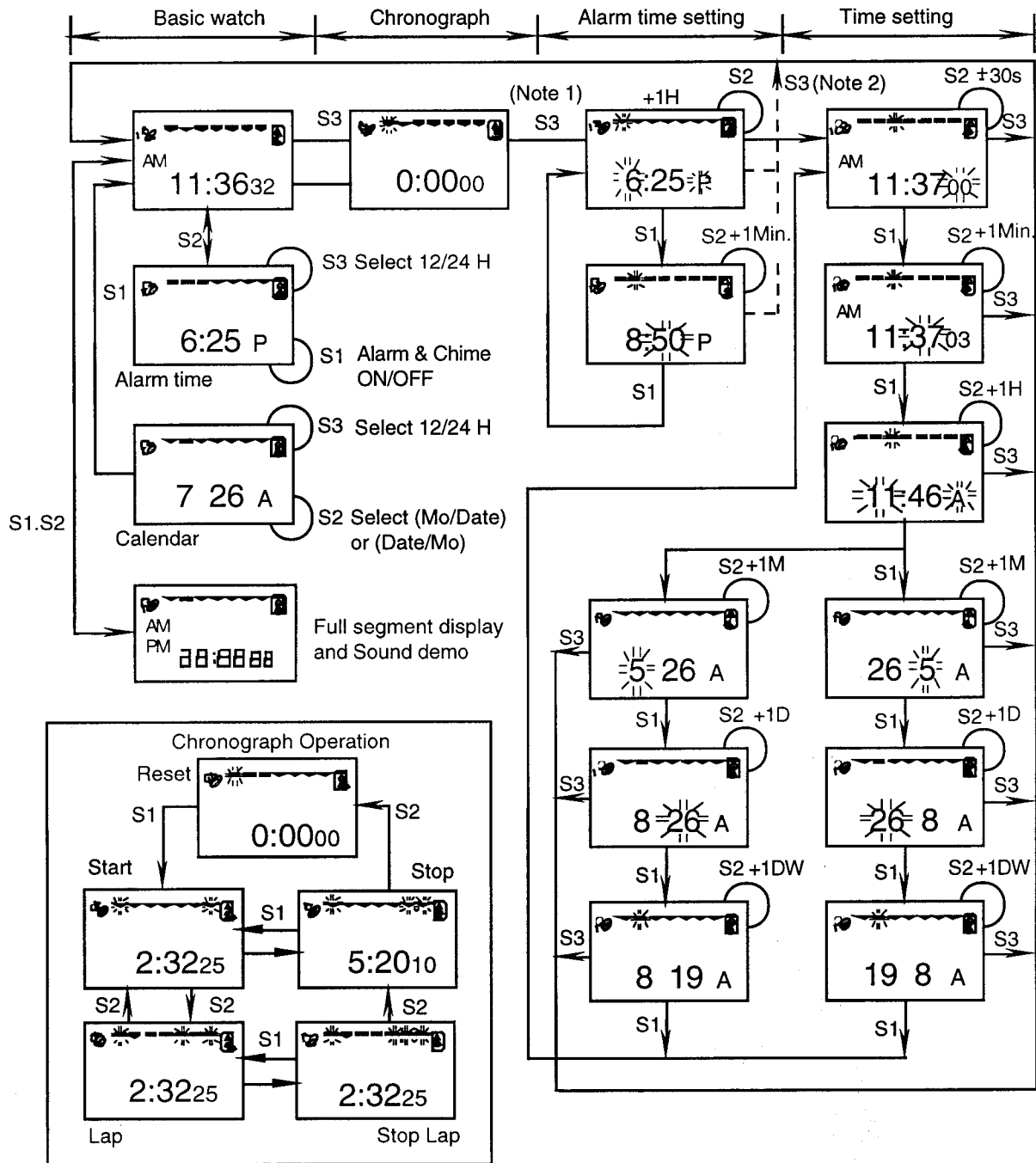
Multiplex drive with ternary voltage: VDD , VSS1 , VSS2,
 Frame frequency : 32Hz



ALARM OUTPUT WAVEFORM



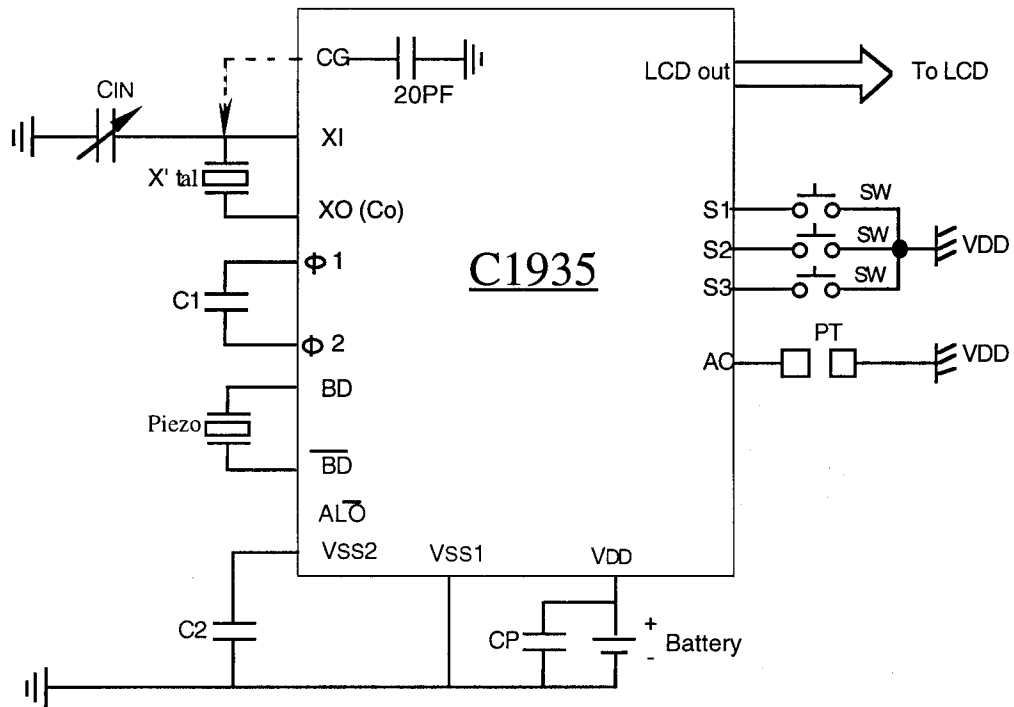
SETTING SEQUENCE AND SWITCH OPERATION



Notes:

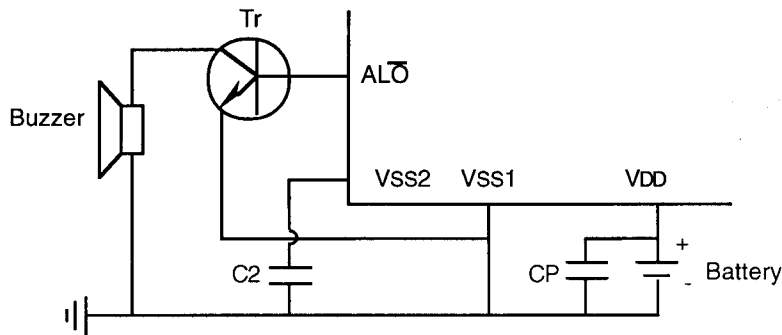
- In basic watch or chronograph mode, when S3 switch depressed continuously for 1 - 2 second, the mode changes to alarm time setting.
- In alarm time setting mode, after S1 or S2 switch is operated, the mode changes back to basic watch mode.
- Depressing S2 switch for time setting:
 - + 1 advance per pushing
 - When S2 switch depressed continuously for 1 - 2 second, the digit will be advanced + 8 per second. (except second reset)
- Flashing mark is shown that the digits or marks are flashing at 2 Hz.
- In chronograph and alarm setting modes, 7 -day flags show the following respectively :
chronograph mode (Su), alarm set mode (Mo), time set (Tu), lap (Thu), stop (Fr) and 1/100 sec (Sa).

APPLICATION CIRCUIT



Note: Substrate should be connected to Vdd

DRIVING ELECTROMAGNETIC SPEAKER BY BIPOLAR TRANSISTOR

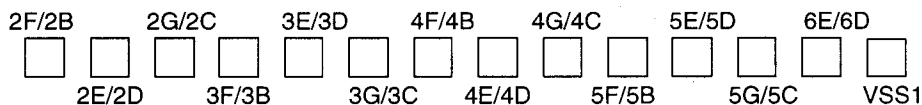
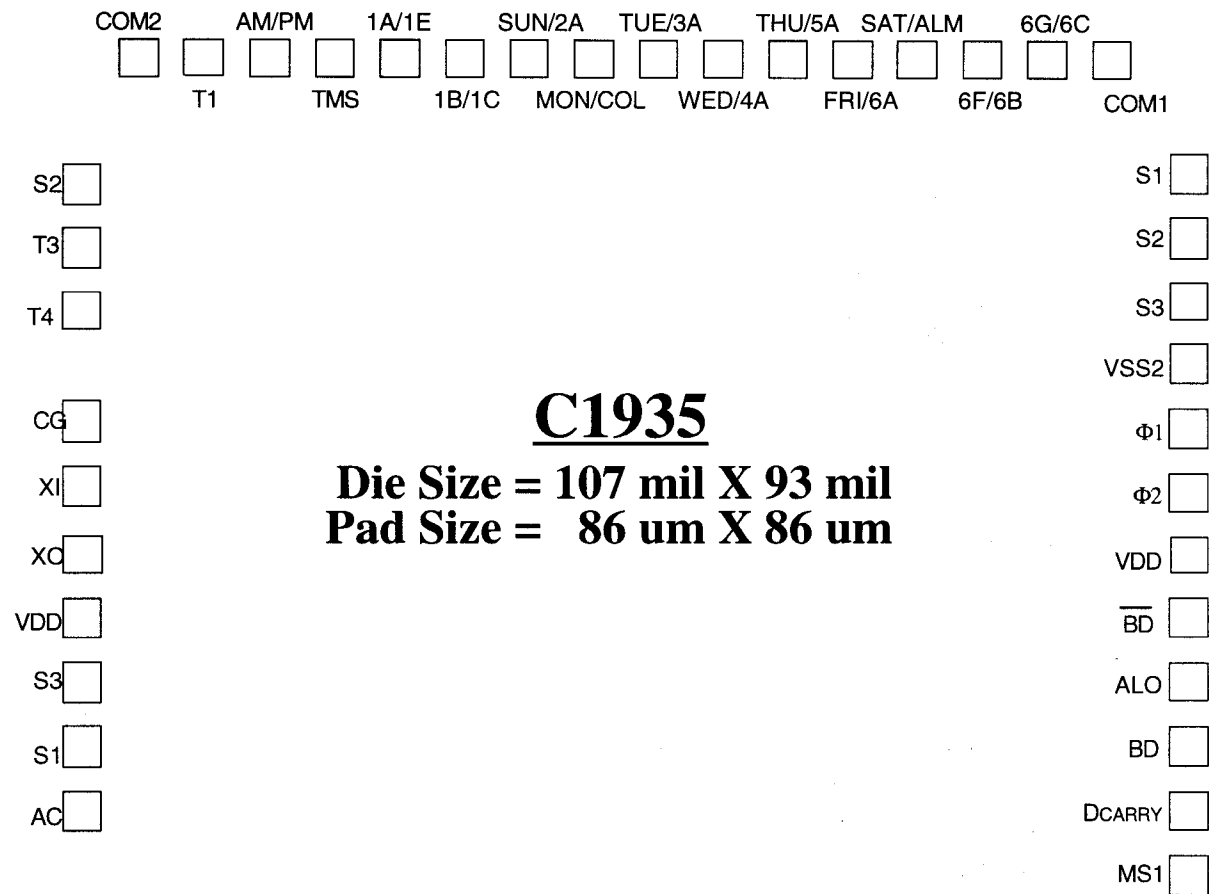


Tr : NPN transistor

Buzzer : Electromagnetic speaker

Symbol	DESCRIPTION	Value	Units
CIN	Oscillator input trim capacitor	5 - 33	pF
Co	Oscillator output internal capacitor	20 (TYP.)	
CG	Oscillator input internal capacitor CG connected to XI by bonding	20 (TYP.)	
C1	Doubler capacitor	0.05	μF
C2	Doubler capacitor	0.05	
Battery	Single cell battery	1.5 (TYP.)	V
X' tal	$f_0 = 32768 \text{ Hz}$ $R_s = 30k\Omega \text{ Max.}$	-	-
SW	3P ST switch	-	-
Cp	By pass capacitor		
Piezo	Piezo buzzer speaker $f_0 =$	4	KHz
PT	Terminals for manual reset	-	-

PAD ASSIGNMENT



The Co-ordinate of Low Left Corner for Each Pad

2F/2B(-707.2, -1098.4)	MS1 (1162.3, -791.9)	6G/6C (849.55, 1012.4)	COM2(-1124.45, 1012.4)
2E/2D(-566.2, -1098.4)	DCARRY(1162.3, -650.9)	6F/6B (708.55, 1012.4)	S2 (-1248.3, 734.3)
2G/2C(-425.2, -1098.4)	BD (1162.3, -509.9)	SAT/ALM(567.55, 1012.4)	T3 (-1248.3, 593.3)
3F/3B(-284.2, -1098.4)	ALO (1162.3, -368.9)	FRI/6A (426.55, 1012.4)	T4 (-1248.3, 452.3)
3E/3D(-143.2, -1098.4)	BD (1162.3, -227.9)	THU/5A (285.55, 1012.4)	CG (-1248.3, 207.95)
3G/3C(-2.2, -1098.4)	VDD (1162.3, -86.9)	WED/4A (144.55, 1012.4)	XI (-1248.3, 66.85)
4F/4B(138.8, -1098.4)	Φ2 (1162.3, 54.1)	TUE/3A (3.55, 1012.4)	XO (-1248.3, -87.35)
4E/4D(279.8, -1098.4)	Φ1 (1162.3, 195.1)	MON/COL(-137.45, 1012.4)	VDD (-1248.3, -228.35)
4G/4C(420.8, -1098.4)	VC (1162.3, 336.1)	SUN/2A (-278.45, 1012.4)	S3 (-1248.3, -369.35)
5F/5B(561.8, -1098.4)	S3 (1162.3, 477.1)	1B/1C (-419.45, 1012.4)	S1 (-1248.3, -510.35)
5E/5D(702.8, -1098.4)	S2 (1162.3, 618.1)	1A/1E (-560.45, 1012.4)	AC (-1248.3, -651.35)
5G/5C(843.8, -1098.4)	S1 (1162.3, 759.1)	TMS (-701.45, 1012.4)	
6E/6D(984.8, -1098.4)	COM1 (990.55, 1012.4)	AM/PM (-842.45, 1012.4)	
VSS (1125.8, -1098.4)		T1 (-983.45, 1012.4)	