

5233/38,

T-49-15-02

5458/63/74, 5604

2-FUNCTION, 4-DIGIT VF AUTOMOTIVE CLOCKS

These devices are 2-function digital automotive clock circuits fabricated on a single monolithic chip using CMOS technology. They feature low cost, low power, and high reliability. The six devices in this series offer a variety of display and setting options and provide all of the functions normally desired in a 4-digit automotive clock.

All versions provide a push-button "time tone" setting that will zero the minutes and seconds counters if the displayed time is within two minutes of the hour. This feature allows the user to instantly set the clock according to the time tone commonly provided on radio stations.

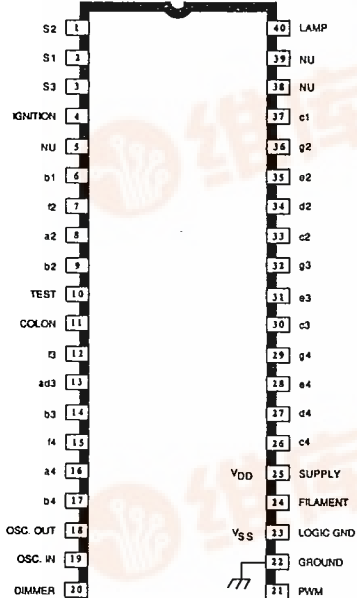
The display driver outputs will directly drive standard vacuum fluorescent displays. A dimmer input controls the display intensity by varying the pulse width rather than by lowering the output voltage. This technique results in a more uniform display intensity. The rise and fall times of the output drivers are optimized to reduce RF interference.

All devices are supplied in a 40-pin dual in-line plastic package with 0.600" (15.24 mm) row centers and are rated for continuous operation over the automotive temperature range of -40°C to +85°C. Other packages are available on special order.

FEATURES

- Push-Button "Time Tone" Setting
- Variable Pulse-Width Display Dimming
- 12- or 24-Hour Timekeeping Option
- Rollover Protection on Minutes Set
- High Noise Immunity
- Diode Protection on all Inputs
- RFI/EMI Minimized

SCL5604E



NOTE: d1 = SEGMENT D, DIGIT 1

Dwg. PC-002

ABSOLUTE MAXIMUM RATINGS

Logic Supply Current, I_{SS}	-7.0 mA
Total Supply Current, I_{DD}	20 mA
Input Voltage Range (Ref. V_{SS}), V_{IN}	-0.5 V to $V_{DD} + 0.5$ V
Input Current, I_{IN}	± 10 mA
Package Power Dissipation, P_D	300 mW
Operating Temperature Range, T_A	-40°C to +85°C
Storage Temperature Range, T_S	-65°C to +150°C

Caution: These CMOS devices have static protection but are susceptible to damage if exposed to extremely high static electrical charges.

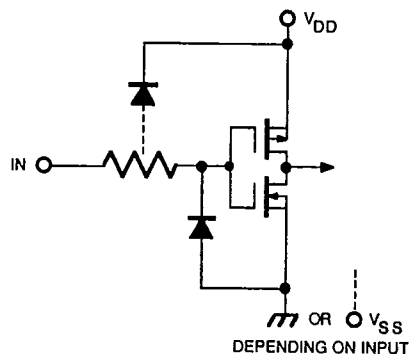
Always order by complete part number, e.g. **SCL5233E**.

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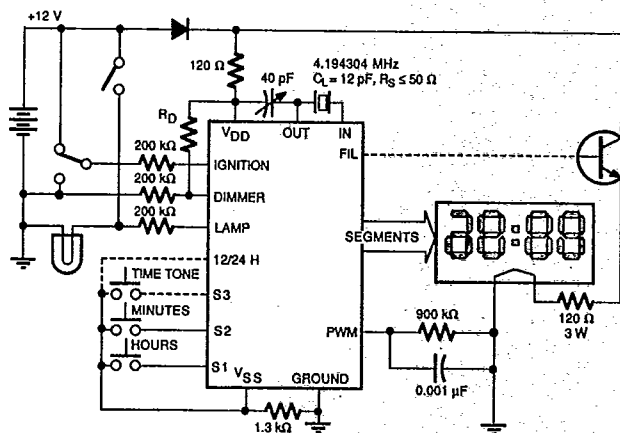
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TYPICAL INPUT CIRCUITRY



Dwg. EP-010-8

TYPICAL APPLICATION



Dwg. EC-003

ELECTRICAL CHARACTERISTICS at $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{SS} = 0\text{ V}$,
in Typical Application (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Min. Operating Voltage	V_{DD}	$T_A = +25^{\circ}\text{C}$	4.5	—	—	V
		$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	5.0	—	—	V
Zener Voltage	V_{Z1}	$I_{SS} = -6.0\text{ mA}$, $T_A = +25^{\circ}\text{C}$	6.2	6.9	7.5	V
	V_{Z2}	$I_{GND} = -17\text{ mA}$, $T_A = +25^{\circ}\text{C}$	15	16.5	18	V
Output Breakdown Voltage	$V_{(BR)DS}$	$I_{OUT} = -5\text{ μA}$, $T_A = +25^{\circ}\text{C}$	15	—	—	V
Segment Output Current	I_{OUT}	$V_{DD} = 6.0\text{ V}$, $V_{OUT} = 5.5\text{ V}$	-150	—	—	μA
Filament Output Current	I_{FIL}	$V_{DD} = 6.0\text{ V}$, $V_{FIL} = 5.0\text{ V}$	-2.0	—	—	mA
Oscillator Frequency	f_{OSC}	$T_A = +25^{\circ}\text{C}$	—	4.194304	—	MHz
Input Resistance	R_{IN}	S1, S2, or S3 only	300	—	—	kΩ
Switch Debounce Time	t_{DB}		0	31	62.5	ms
Segment Switching Time	t_r	$\Delta V_{OUT} = 5.0\text{ V}$	1.0	—	—	μs
Zener Temperature Coefficient	ΔV_{Z1}	$T_A = +25^{\circ}\text{C}$	—	+6.0	—	mV/°C
Supply Current	I_{DD}	$V_{DD} = 5.0\text{ V}$, $T_A = +25^{\circ}\text{C}$	—	—	1.0	mA

NOTE: Negative current is defined as coming out of (sourcing) the specified device terminal.

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FUNCTIONAL DESCRIPTION

V_{DD} The positive supply.

V_{SS} The clock logic reference; current limiting is normally required.

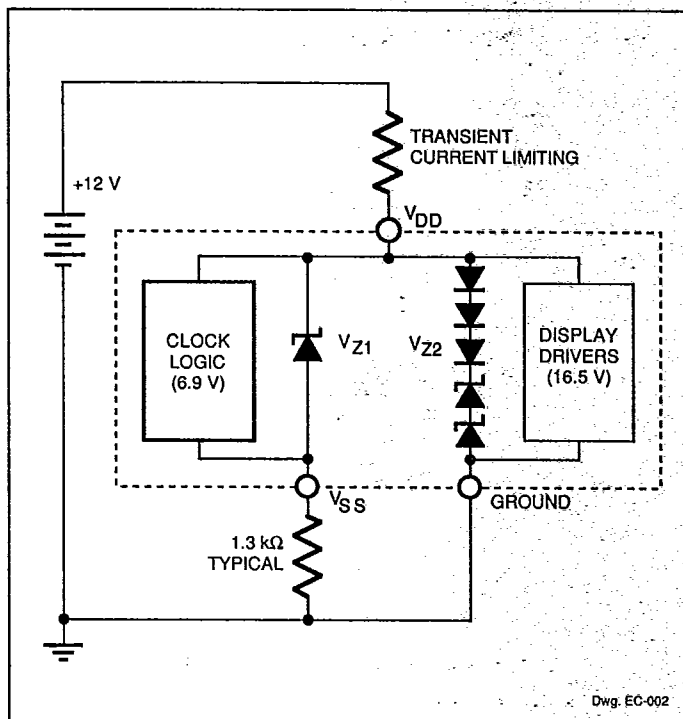
GROUND Power ground.

12/24 H A switch or hard wiring here controls the clock timebase: Open = 24 h, Low (V_{SS}) = 12 h. This function is not available in the SCL5604E and that device operates in the 12-hour mode only.

S1 Pulling S1 Low (V_{SS}) increments the hours as shown in the table.

S2 Pulling S2 Low (V_{SS}) increments the minutes as shown in the table.

S3 Momentary switch for time tone, to start clock, and display command. This switch is required for the A5238EA, optional for all other devices.



Clock Version	S1 (Set Hours)	S2 (Set Minutes)	S3	Colon
SCL5233E	one increment per depression	one increment per depression, start clock	optional ... time tone and display command*	steady
SCL5238E	one increment per depression	one increment per depression	time tone, display command*, start clock	steady
SCL5458E	one increment per depression	one increment per depression, start clock	optional ... time tone and display command*	one second flashing
SCL5463E	one increment per second while depressed	one increment per second while depressed, start clock	optional ... time tone and display command*	one second flashing
SCL5474E SCL5604E	two increments per second while depressed	two increments per second while depressed, start clock	optional ... time tone and display command*	steady

* See IGNITION

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2-FUNCTION, 4-DIGIT VF AUTOMOTIVE CLOCKS

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For all devices except the SCL5238E, the first depression of S2 stops the clock and resets the seconds. Simultaneous depressions of S1 and S2 reset the clock to the 1:00:00 state; the clock restarts when S2 is released. With the SCL5238E, after the first depression of S2, if more than four seconds elapse between S1 or S2 depressions, the entire display flashes at a one-second rate to indicate that the clock has been reset. Simultaneous depressions of S1 and S2 reset the clock to the 1:00:00 state; the clock restarts when S3 is operated.

If the clock is running and the time is within two minutes after the hour, depressing S3 causes seconds and minutes to reset, and the hour to remain the same. If the time is within two minutes before the hour, depressing S3 causes seconds and minutes to reset and the hour to increment by one. The clock resumes operation in the real time mode when S3 is released. Any operation outside the ± 2 minute window will not affect the clock.

LAMP Controls display brightness in conjunction with IGNITION.

IGNITION Controls display brightness in conjunction with LAMP.

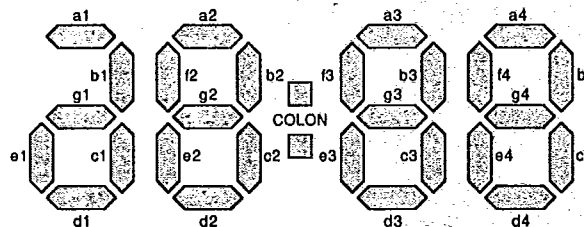
IGNITION Input	LAMP Input	
	12 V (ON)	Ground (OFF)
12 V (ON)	50% brightness†, dimmer enabled, S1, S2, S3 enabled	100% brightness, dimmer disabled, S1, S2, S3 enabled
Ground (OFF)	50% brightness†, display command enabled, dimmer enabled	display OFF, display command enabled

† 25% for SCL5604E

With IGNITION at ground (OFF), a depression of S3 will turn ON the display for 4 ± 1 seconds at 100% brightness. The time tone function is disabled when the IGNITION input is ground.

FILAMENT The enable output for the VF display filament. If S3 is omitted, the discrete transistor can also be omitted if the display filament is connected directly to the 12 V supply through the accessory switch.

SEGMENTS The output drives for the VF display segments.

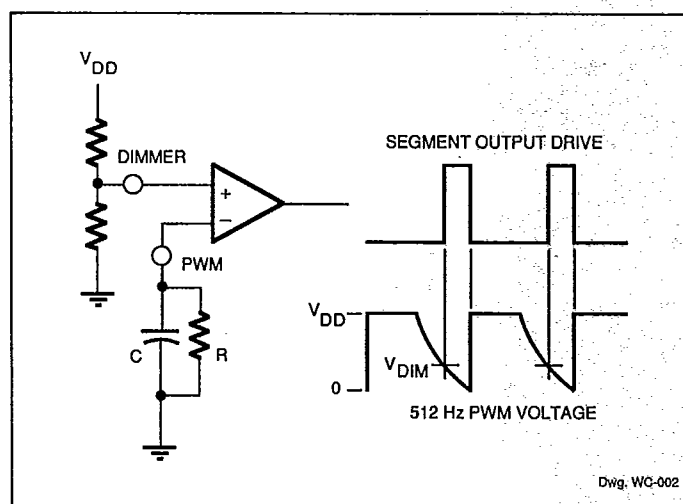


Dwg. OC-001-1

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T-49-1.5-0.2

- COLON** The output drive for the VF display colon. For the SCL5233E, SCL5238E, SCL5474E, and SCL5604E the colon is steady; for the SCL5458E and SCL5463E the colon is in a one-second flashing mode.
- DIMMER** A voltage input to control the display brightness. This can be from a fixed (R_D) or light-dependent resistor divider, or a linear voltage control signal.
- PWM** An RC network for controlling the display duty cycle (dimming).

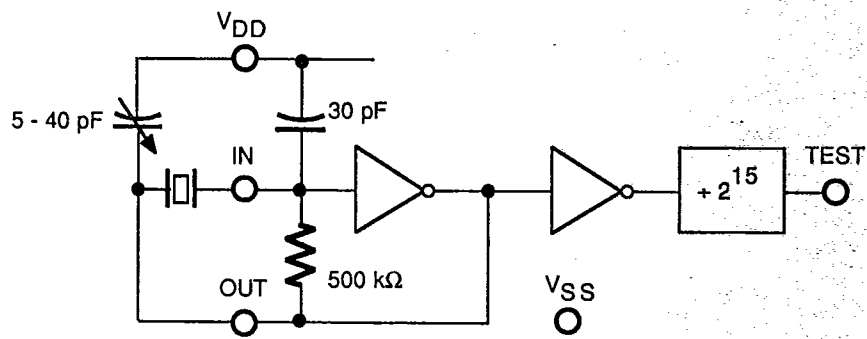


R_D	or	V_{DIM}/V_{DD}	Per Cent Duty Cycle (at $T_A = +25^\circ\text{C}$)	
			RC = 0.9 ms	RC = 1.72 ms
370 k Ω		0.35	1	0
245 k Ω		0.45	10	0
165 k Ω		0.55	20	0
108 k Ω		0.65	29	4
67 k Ω		0.75	36	20
35 k Ω		0.85	42	33
10.5 k Ω		0.95	48	45

- IN & OUT** These are the oscillator connections for the external crystal and frequency adjustment.
- TEST** This is a test point for adjustment of the crystal oscillator frequency. When properly aligned, the output at this terminal is a 128 Hz square-wave signal.

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Dwg. EC-004

PIN DESIGNATIONS

Pin	SCL5604E	All Other Devices	Pin	SCL5604E	All Other Devices
1	S2	S2	21	PWM	PWM
2	S1	LAMP	22	GROUND	DIMMER
3	S3	adeg1	23	V _{SS}	OSC. IN
4	IGNITION	12/24 H	24	FILAMENT	OSC. OUT
5	NU	c1	25	V _{DD}	b4
6	b1	g2	26	c4	a4
7	f2	e2	27	d4	f4
8	a2	d2	28	e4	b3
9	b2	c2	29	g4	ad3
10	TEST	g3	30	c3	f3
11	COLON	e3	31	e3	COLON
12	f3	c3	32	g3	TEST
13	ad3	g4	33	c2	b2
14	b3	e4	34	d2	a2
15	f4	d4	35	e2	f2
16	a4	c4	36	g2	b1
17	b4	V _{DD}	37	c1	NU
18	OSC. OUT	FILAMENT	38	NU	IGNITION
19	OSC. IN	V _{SS}	39	NU	S3
20	DIMMER	GROUND	40	LAMP	S1

NU = Internal connection, do not use.