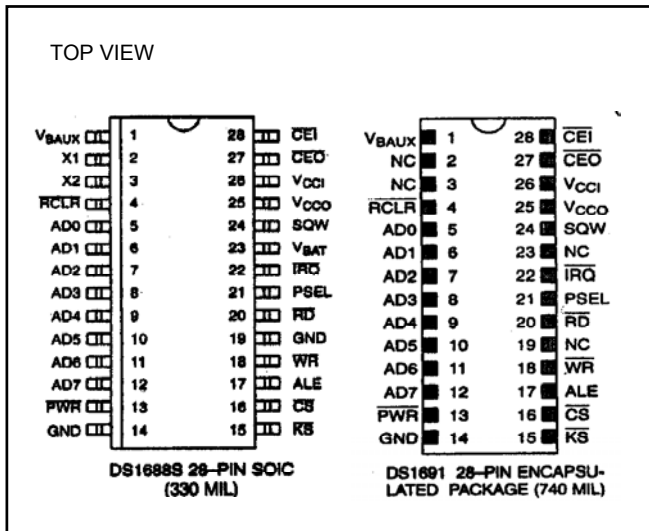


### GENERAL DESCRIPTION

The DS1688/DS1691 are real-time clocks (RTCs) designed as successors to the industry standard DS1285, DS1385, DS1485, and DS1585 PC real-time clocks. These devices provide the industry standard DS1285 clock function with the new feature of either +3.0V or +5.0V operation and automatic backup and write protection to an external SRAM. The DS1688 also incorporates a number of enhanced features including a silicon serial number, power-on/off control circuitry, 114 bytes of user NV SRAM, power-on elapsed timer, and power-cycle counter.

### PIN CONFIGURATIONS



### FEATURES

**Incorporates Industry Standard DS1287 PC Clock Plus Enhanced Features:**

- +3V or +5V Operation
- 64-Bit Silicon Serial Number
- 64-Bit Customer Specific ROM or Additional Serial Number Available
- Power Control Circuitry Supports System Power-On from Date/Time Alarm or Key Closure
- Automatic Battery Backup and Write Protection to External SRAM
- Crystal Select Bit Allows RTC to Operate with 6Pf or 12.5Pf Crystal
- 114 Bytes User NV RAM
- Auxiliary Battery Input
- RAM Clear Input
- Century Register
- 32kHz Output for Power Management
- 32-Bit V<sub>CC</sub> Powered Elapsed Time Counter
- 32-Bit V<sub>BAT</sub> Powered Elapsed Time Counter
- 16-Bit Power-Cycle Counter
- Compatible with Existing BIOS for Original DS1287 Functions
- Available as IC (DS1688) or Stand-Alone Module with Embedded Battery and Crystal (DS1691)
- Timekeeping Algorithm Includes Leap Year Compensation Valid Up to 2100

### ORDERING INFORMATION

PART	TEMP RANGE	VOLTAGE (V)	PIN-PACKAGE	TOP MARK*
DS1688S	0°C to +70°C	3 to 5	28 SO (0.330")	DS1688S
DS1688S+	0°C to +70°C	3 to 5	28 SO (0.330")	DS1688S
DS1691	0°C to +70°C	3 to 5	28 EDIP (0.740")	DS1691

+ Denotes a lead-free/RoHS-compliant device.

+ A "+" anywhere on the top mark denotes a lead-free/RoHS-compliant device.

## DETAILED DESCRIPTION

Each DS1688/DS1691 is individually manufactured with a unique 64-bit serial number as well as an additional 64-bit customer-specific ROM or serial number. The serial number is programmed and tested at Dallas to ensure that no two devices are alike. The serial number can be used to electronically identify a system for purposes such as establishment of a network node address or for maintenance tracking. Customers can reserve blocks of available numbers from Dallas Semiconductor.

The serialized RTCs also incorporate power-control circuitry, which allows the system to be powered on via an external stimulus, such as a keyboard or by a time and date (wake up) alarm. The  $\overline{\text{PWR}}$  output pin can be triggered by one or either of these events, and can be used to turn on an external power supply. The  $\overline{\text{PWR}}$  pin is under software control, so that when a task is complete, the system power can then be shut down.

The DS1688/DS1691 incorporate a power-on elapsed time counter, a power-on cycle counter, and a battery powered continuous counter. These three counters provide valuable information for maintenance and warranty requirements.

Automatic backup and write protection for an external SRAM is provided through the  $V_{\text{CCO}}$  and  $\overline{\text{CEO}}$  pins. The lithium energy source used to permanently power the RTC is also used to retain RAM data in the absence of  $V_{\text{CC}}$  power through the  $V_{\text{CCO}}$  pin. The chip enable output to RAM ( $\overline{\text{CEO}}$ ) is controlled during power transients to prevent data corruption.

The DS1688 is a clock/calendar chip with the features described above. An external crystal and battery are the only components required to maintain time-of-day and memory status in the absence of power. The DS1691 incorporates the DS1688 chip, a 32.768kHz crystal, and a lithium battery in a complete, self-contained timekeeping module. The entire unit is fully tested at Dallas Semiconductor such that a minimum of 10 years of timekeeping and data retention in the absence of  $V_{\text{CC}}$  is guaranteed.

For a complete description of operating conditions, electrical characteristics, bus timing, and pin descriptions other than the SQW output, refer to the DS1689/DS1693 data sheet, available online at [www.maxim-ic.com/DS1689](http://www.maxim-ic.com/DS1689).

**PIN DESCRIPTION**

PIN		NAME	FUNCTION
SO	EDIP		
1	1	V <sub>BAUX</sub>	Auxiliary Battery Supply
2, 3	—	X1, X2	Crystal Input, Crystal Output
4	4	$\overline{\text{RCLR}}$	Active-Low RAM Clear Input
5–12	5–12	AD0–AD7	Muxed Address/Data Bus
13	13	$\overline{\text{PWR}}$	Active-Low Power-On Interrupt Output
14, 19	14	GND	Ground
15	15	$\overline{\text{KS}}$	Active-Low Kickstart Input
16	16	$\overline{\text{CS}}$	Active-Low Chip Select Input
17	17	ALE	Address Strobe
18	18	$\overline{\text{WR}}$	Active-Low Write Data Strobe
20	20	$\overline{\text{RD}}$	Active-Low Read Data Strobe
21	21	PSEL	+3V or +5V Power Select
22	22	$\overline{\text{IRQ}}$	Active-Low Interrupt Request Output
23	—	V <sub>BAT</sub>	Battery + Supply
24	24	SQW	Square-Wave Output. This signal functions identical to the DS1689/DS1693 with an exception occurring at power-up. A 32kHz square wave is output on this pin, t <sub>REC</sub> , after a power-up condition has been detected. This condition sets the following bits, enabling the 32kHz output: DV1 = 1, SQWE = 1, and E32K = 1. The square wave is output on this pin if either SQWE = 1 or E32K = 1.
25	25	V <sub>CCO</sub>	RAM Power-Supply Output
26	26	V <sub>CCI</sub>	+3V or +5V Main Supply
27	27	$\overline{\text{CEO}}$	Active-Low RAM Chip Enable Out
28	28	$\overline{\text{CEI}}$	Active-Low RAM Chip Enable In
—	2, 3, 19, 23	N.C.	No Connection

# PACKAGE INFORMATION

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/DallasPackInfo](http://www.maxim-ic.com/DallasPackInfo).)

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	NEW DRAWING		

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.100	.120	2.55	3.05
A1	.002	.014	0.05	0.35
c	.006	.013	0.14	0.32
phi	0"	8"	0"	8"
L	.016	.050	0.40	1.27
e1	.050 BSC		1.27 BSC	
B	.014	.020	0.35	0.50
n	28			
D	.697	.728	17.70	18.50
E	.324	.350	8.23	8.90
H	.453	.500	11.50	12.70

**NOTES:**

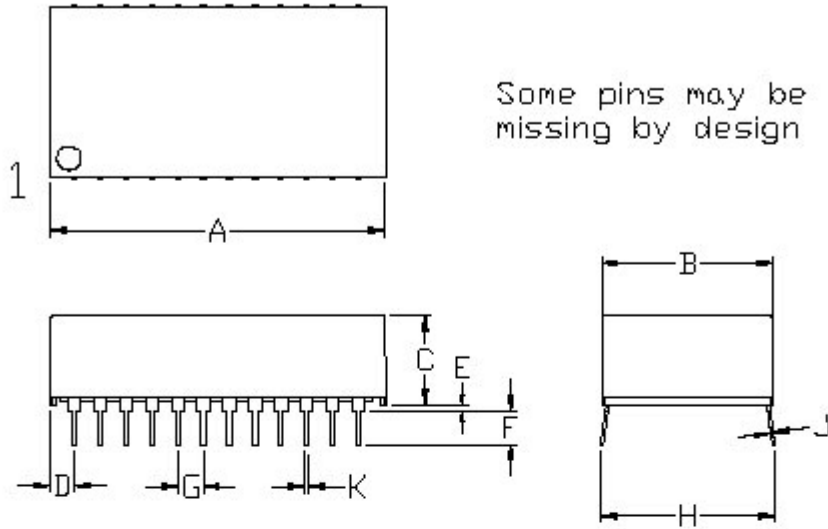
- DIMENSIONS "D" AND "E" ARE MEASURED AT MOLD PARTING LINE AND DO NOT INCLUDE MOLD FLASH.
- CONTROLLING DIMENSIONS: MM

SIGNATURE	DATE	
DOC. CONTROL:		
ENGR. MGR:		
WFG. ENGR:		
CHECKED BY: T.W.M.	8/11/99	
DRAWN BY: N.L.K.	8/11/99	TITLE MARKETING OUTLINE, 28-LD SOIC, .330 INCH
DO NOT SCALE DWG.		SIZE: A    PSCM ID:    PART NO. 56-G2009-028    REV A
SCALE N/A		SHEET 1 OF 1

# PACKAGE INFORMATION (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/DallasPackInfo](http://www.maxim-ic.com/DallasPackInfo).)

REVISIONS			
UTR	DESCRIPTION	DATE	APPROVED
A	ECN 35439		



ALL DIMENSIONS ARE IN INCHES. See page 2 for dimensions in mm

	24 PIN		28 PIN		32 PIN 740		40 PIN 720	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	1.320	1.340	1.520	1.540	1.680	1.720	2.075	2.115
C	0.330	0.370	0.330	0.370	0.330	0.370	0.280	0.320
D	0.100	0.130	0.100	0.130	0.070	0.100	0.070	0.100

	MIN	MAX	
B	0.68	0.72	24 PIN 720, 28 PIN 720 and 40 PIN 720
B	0.720	0.740	24 PIN 740, 28 PIN 740 and 32 PIN 740

ALL PACKAGES	
	MIN
	MAX
E	0.010 0.040
F	0.120 0.160
G	0.090 0.110
H	0.590 0.630
J	0.008 0.012
K	0.015 0.021

SIGNATURE	DATE				
DOC. CONTROL:					
ENGR. MGR:					
WFB. ENGR:					
CHECKED BY:		TITLE Marketing Outline Encapsulated DIP Package			
DRAWN BY: RMA	2/03	SIZE: A	FCOM NO:	DWG NO: 56-G0001-001	REV: A
DIP_ModuleC_SLDRAW		SCALE: N/A	SHEET 1 OF 2		

**PACKAGE INFORMATION (continued)**

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/DallasPackInfo](http://www.maxim-ic.com/DallasPackInfo).)


REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ECN 35439		

ALL DIMENSIONS ARE IN MM

	24 PIN		28 PIN		32 PIN 740		40 PIN 720	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	33.53	34.04	38.61	39.12	42.67	43.69	52.71	53.72
C	0.30	9.40	8.38	9.40	8.38	9.40	7.11	0.13
D	2.54	3.30	2.54	3.30	1.78	2.54	1.78	2.54

	MIN	MAX	
B	17.27	10.29	24 PIN 720, 28 PIN 720 and 40 PIN 720
B	18.29	18.00	24 PIN 740, 28 PIN 740 and 32 PIN 740

ALL PACKAGES		
	MIN	MAX
E	0.25	1.02
F	3.05	4.06
G	2.29	2.79
H	14.99	16.00
J	0.20	0.30
K	0.38	0.53

	SIZE	PSCH NO	DWG NO.	REV
	A		56-G0001-001	A
	SCALE	N/A		SHEET 2 OF 2

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