

Programming the UCD9080

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ABSTRACT

The operation of the Texas Instruments UCD9080 is configured by programmable (flash) memory within the device. The memory can be written and read using a command protocol over a standard I²C bus interface. This document provides the hardware and software details necessary to program the UCD9080 with the configuration data.

See the UCD9080 data sheet ([SLVS692](#)) for a complete description of the device.

1 Hardware

1.1 Package

RHB (S-PQFP-N32), 32-pin Plastic Quad Flatpack

1.2 Hardware/Device Pinning

Pin Number	Pin Name	Connection/Description
1	Vss	Ground
2	NC	Do Not Connect
3	XIN	Vcc
4	NC	Vss
5	RST	Device reset
6	MON1	Do Not Connect
7	MON2	Do Not Connect
8	MON3	Do Not Connect
9	MON6	Do Not Connect
10	EN4	Do Not Connect
11	EN3	Do Not Connect
12	EN5	Do Not Connect
13	EN6	Do Not Connect
14	EN7	Do Not Connect
15	MON7	Do Not Connect
16	MON8	Do Not Connect
17	NC	Vss
18	MON4	Do Not Connect
19	MON5	Do Not Connect
20	NC	Vss
21	SDA	I ² C data
22	SCL	I ² C clock

Pin Number	Pin Name	Connection/Description
23	EN1	Do Not Connect
24	EN2	Do Not Connect
25	EN8/ADDR1/GPO1	Vss
26	ADDR2/GPO2	Vss
27	ADDR3/GPO3	Vss
28	ADDR4/GPO4	Vss
29	TEST	Vss
30	Vcc	3.3 V
31	NC	Vss
32	ROSC	100K to Vcc, or 1.75 V

1.3 Detailed Pin Descriptions

- **RST**: Device reset. Input. Active low. Minimum pulse width: 2 μ s. The UCD9080 can process commands on the I²C bus 15mSec following the negation of RST.
- **SDA**: I²C Serial Data. Input/Output. The SDA complies with the Phillips specification for an I²C Slave device. An external pullup resistor is required on this pin. The specification for the Philips I²C bus can be found at:
http://www.semiconductors.philips.com/acrobat_download/literature/9398/39340011.pdf
- **SCL**: I²C Serial Clock. Input. The SCL complies with the Phillips specification for an I²C Slave device. An external pullup resistor is required on this pin. The SCL has a minimum frequency of 10 kHz and a maximum frequency of 100 kHz.
- **ADDRx**: Device Address. Input. The Vss levels on these four pins locate the device at an I²C address of 0x60.
- **ROSC**: Oscillator. Input. This pin controls the device operating speed. Either a 100K pullup to Vcc is required, or 1.75 V can be applied to this pin.

2 Software

Data File Format: The configuration data is supplied in standard Intel hexadecimal format. Beginning at address 0x1080, 128 bytes of data are programmed and beginning at address 0xE000, 512 bytes of data are programmed. Appendix A presents a sample configuration data file.

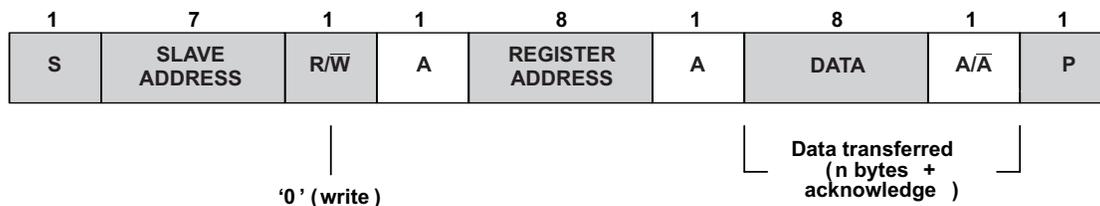
I²C Transactions: Programming the device with the configuration data requires I²C Write transactions; commands and configuration data are written to the device. Reading the configuration data from the device requires I²C Write transactions and I²C Read transactions; “read” commands are written, and the configuration data is read. Reading the configuration data can be used to verify the correct programming of the data following a write data operation. Appendix B presents the format of the I²C Write and Read transactions. Appendix C presents the set of pseudo I²C transactions necessary to write and read the sample configuration data presented in Appendix A.

Note: The I²C write and read data transactions presented in Appendix B assume a maximum data transfer block size of 32 bytes. Each block is preceded by the target address. The UCD9080 is capable of supporting blocks sized from 2 bytes to 512 bytes., in multiples of two bytes (i.e., a 16-bit *word*). When writing data, it is critical that all 128 bytes of the data beginning at address 0x1080 are written, and that all 512 bytes of data beginning at address 0xE000 are written (i.e., it is not permitted to do a *partial* write of a data area).

Device Identification: An I2C Read transaction can be used to read register 0x27; a value of zero in the second byte read indicates a UCD9080.

Appendix B I²C Write and Read Transaction Formats

B.1 I²C Write Transaction



From master to slave

A = acknowledge (SDA low)

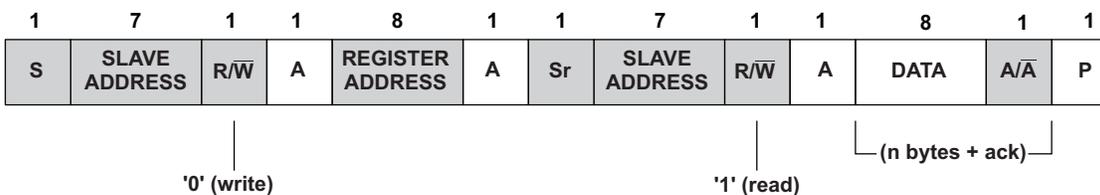
 \bar{A} = Not acknowledge (SDA high)


From slave to master

S = START condition

P = STOP condition

B.2 I²C Read Transaction



From master to slave

A = acknowledge (SDA low)

 \bar{A} = Not acknowledge (SDA high)


From slave to master

S = START condition

P = STOP condition

Sr = Repeated START

Appendix C Pseudo I²C Write and Read Transactions

A pseudo I²C transaction code follows. The user should ensure that data written to the user configuration area of the device (0xE000-0xE1FF) matches that specified in the data sheet except for the user-unique configurable areas.

Note: In the following pseudo I²C transactions, a Data Length is specified. This value is not directly part of the I²C transaction. Rather, its value is used within the Master to count the data transferred after which a NACK is generated to the slave to stop the transaction.

C.1 UCD9080 I²C Transactions for Writing User Data and PARAMS

C.1.1 I²C Write (Open Flash Memory)

Device Address: 0x60
Register Address: 0x2E
Data Length: 1
Data: 0x02

C.1.2 I²C Write (Base Address: 0x1080)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0x10

C.1.3 I²C Write (Unlock and Erase Flash Memory)

Device Address: 0x60
Register Address: 0x32
Data Length: 2
Data: 0xDC 0xBA

C.1.4 I²C Write (Data Address: 0x1080)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0x10

C.1.5 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x54 0x65 0x78 0x61 0x73 0x20 0x49 0x6E 0x73 0x74 0x72 0x75 0x6D 0x65 0x6E 0x74 0x73 0x20
0x55 0x43 0x44 0x39 0x30 0x38 0x30 0x20 0x38 0x2D 0x43 0x68 0x61 0x6E

C.1.6 I²C Write (Data Address: 0x10A0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xA0 0x10

C.1.7 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x6E 0x65 0x6C 0x20 0x50 0x6F 0x77 0x65 0x72 0x20 0x53 0x75 0x70 0x70 0x6C 0x79 0x20 0x53
 0x65 0x71 0x75 0x65 0x6E 0x63 0x65 0x72 0x20 0x61 0x6E 0x64 0x20 0x4D

C.1.8 I²C Write (Data Address: 0x10C0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xC0 0x10

C.1.9 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x6F 0x6E 0x69 0x74 0x6F 0x72 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.10 I²C Write (Data Address: 0x10E0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xE0 0x10

C.1.11 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.12 I²C Write (Base Address: 0xE000)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0x00 0xE0

C.1.13 I²C Write (Unlock and Erase the FLASH)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 2
 Data: 0xDC 0xBA

C.1.14 I²C Write (Data Address: 0xE000)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0x00 0xE0

C.1.15 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x00

C.1.16 I²C Write (Data Address: 0xE020)

Device Address: 0x60
Register Address: 0x30
Length: 2
Data: 0x20 0xE0

C.1.17 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x00

C.1.18 I²C Write (Data address: 0xE040)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x40 0xE0

C.1.19 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0xFF 0xFF 0x00 0x02

C.1.20 I²C Write (Data Address: 0xE060)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x60 0xE0

C.1.21 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x00 0x00 0x0F 0x00 0x02 0x00 0x02 0xFF 0x0F 0x00 0x50 0x00 0xA8 0xDC 0xBA

C.1.22 I²C Write (Data Address: 0xE080)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0xE0

C.1.23 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x50 0x51 0x52 0x53 0x54 0x55 0x56 0x57 0x00 0x49 0x4A 0x4B 0x01 0x00 0x01 0x04 0x01 0x04
 0x05 0x06 0x00 0x00 0x00 0x00 0x05 0xE0 0x05 0xA0 0x32 0xE0 0x33 0xE0

C.1.24 I²C Write (Data Address: 0xE0A0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xA0 0xE0

C.1.25 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x33 0xE0 0x35 0xE0 0x00 0xFF 0x7F
 0xFF 0x7F 0xFF 0x7F 0xFF 0x7F 0xFF 0x7F 0xFF 0x7F 0xFF 0x7F 0xFF 0x7F

C.1.26 I²C Write (Data Address: 0xE0C0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xC0 0xE0

C.1.27 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.28 I²C Write (Data Address: 0xE0E0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 : 0xE0 0xE0

C.1.29 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.30 I²C Write (Data Address: 0xE100)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0x00 0xE1

C.1.31 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x7F 0x00 0x01 0x00 0x02 0x00 0x04 0x00 0x08 0x00 0x10 0x00 0x20 0x00 0x40 0x00 0x00 0x00
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.32 I²C Write (Data address: 0xE120)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x20 0xE1

C.1.33 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x04 0xA0 0x0F
0xA0 0x0F 0xA0 0x0F 0xA0 0x0F 0xA0 0x0F 0xA0 0x0F 0xA0 0x0F 0xA0 0x0F

C.1.34 I²C Write (Data Address: 0xE140)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x40 0xE1

C.1.35 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x10 0x00 0xFF 0xC0
0xFF 0xC1 0xFF 0xC2 0xFF 0xC3 0xFF 0xC4 0xFF 0xC5 0xFF 0xC6 0xFF 0xC7

C.1.36 I²C Write (Data Address: 0xE160)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x60 0xE1

C.1.37 I²C Write (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32
Data: 0x00 0x00 0x00 0xC0 0x00 0xC0 0x00 0xC0 0x04 0x20 0x08 0x20 0x04 0x18 0x02 0x18 0x08 0x18
0x10 0x18 0x20 0x18 0x10 0x20 0x00 0x20 0x20 0x20 0x40 0x20 0x80 0x20

C.1.38 I²C Write (Data Address: 0xE180)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0xE1

C.1.39 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00 0x00 0x00 0x04 0x94 0x02 0xF2 0x08 0x10 0x03 0x05 0xC0 0x40 0x00 0xFF 0x08 0x05 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.40 I²C Write (Data Address: 0xE1A0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xA0 0xE1

C.1.41 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.42 I²C Write (Data Address: 0xE1C0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xC0 0xE1

C.1.43 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.44 I²C Write (Data Address: 0xE1E0)

Device Address: 0x60
 Register Address: 0x30
 Data Length: 2
 Data: 0xE0 0xE1

C.1.45 I²C Write (Data)

Device Address: 0x60
 Register Address: 0x32
 Data Length: 32
 Data: 0x00
 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

C.1.46 I²C Write (Lock and Close the FLASH)

Device Address: 0x60
 Register Address: 0x2E
 Data Length: 1
 Data: 0x00

C.2 UCD9080 I²C Transactions for Reading User Data and PARAMS

C.2.1 I²C Write (Data address: 0x1080)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0x10

C.2.2 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.3 I²C Write (Data Address: 0x10A0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xA0 0x10

C.2.4 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.5 I²C Write (Data Address: 0x10C0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xC0 0x10

C.2.6 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.7 I²C Write (Data Address: 0x10E0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xE0 0x10

C.2.8 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.9 I²C Write (Data Address: 0xE000)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x00 0xE0

C.2.10 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.11 I²C Write (Data Address: 0xE020)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x20 0xE0

C.2.12 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.13 I²C Write (Data Address: 0xE040)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x40 0xE0

C.2.14 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.15 I²C Write (Data Address: 0xE060)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x60 0xE0

C.2.16 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.17 I²C Write (Data Address: 0xE080)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0xE0

C.2.18 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.19 I²C Write (Data Address: 0xE0A0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xA0 0xE0

C.2.20 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.21 I²C Write (Data Address: 0xE0C0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xC0 0xE0

C.2.22 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.23 I²C Write (Data Address: 0xE0E0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xE0 0xE0

C.2.24 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.25 I²C Write (Data Address: 0xE100)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x00 0xE1

C.2.26 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.27 I²C Write (Data Address: 0xE120)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x20 0xE1

C.2.28 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.29 I²C Write (Data Address: 0xE140)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x40 0xE1

C.2.30 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.31 I²C Write (Data Address: 0xE160)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x60 0xE1

C.2.32 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.33 I²C Write (Data Address: 0xE180)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0x80 0xE1

C.2.34 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.35 I²C Write (Data Address: 0xE1A0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xA0 0xE1

C.2.36 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.37 I²C Write (Data Address: 0xE1C0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xC0 0xE1

C.2.38 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

C.2.39 I²C Write (Data Address: 0xE1E0)

Device Address: 0x60
Register Address: 0x30
Data Length: 2
Data: 0xE0 0xE1

C.2.40 I²C Read (Data)

Device Address: 0x60
Register Address: 0x32
Data Length: 32

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