

### INTRODUCTION

Dallas Semiconductor's 1-Wire<sup>®</sup> devices each have a 64-bit unique registration number in read-only-memory (ROM) that is used to address them individually by a 1-Wire master in a 1-Wire network. If the ROM numbers of the slave devices on the 1-Wire network are not known, then they can be discovered by using a search algorithm. This document explains the search algorithm in detail and provides an example implementation for rapid integration. This algorithm is valid for all current and future devices that feature a 1-Wire interface.

### 64-BIT UNIQUE ROM 'REGISTRATION' NUMBER Figure 1

MSB						64-Bit 'Registration' ROM number						LSB					
8-Bit CRC				48-Bit Serial Number								8-Bit Family Code					
MSB		LSB		MSB		LSB		MSB		LSB		MSB		LSB			

### SEARCH ALGORITHM

The search algorithm is a binary tree search where branches are followed until a device ROM number, or leaf, is found. Subsequent searches then take the other branch paths until all of the leaves present are discovered.

The search algorithm begins with the devices on the 1-Wire being reset using the reset and presence pulse sequence. If this is successful then the 1-byte search command is sent. The search command readies the 1-Wire devices to begin the search.

There are two types of search commands. The normal search command (0F hex) will perform a search with all devices participating. The alarm or conditional search command (EC hex) will perform a search with only the devices that are in some sort of alarm state. This reduces the search pool to quickly respond to devices that need attention.

Following the search command, the actual search begins with all of the participating devices simultaneously sending the first bit (least significant) in their ROM number (also called registration number). (See Figure 1.) As with all 1-Wire communication, the 1-Wire master starts every bit whether it is data to be read or written to the slave devices. Due to the characteristics of the 1-Wire, when all devices respond at the same time, the result will be a logical AND of the bits sent. After the devices send the first bit of their ROM number, the master initiates the next bit and the devices then send the complement of the first bit. From these two bits, information can be derived about the first bit in the ROM numbers of the participating devices. (See Table 1.)

**BIT SEARCH INFORMATION Table 1**

Bit (true)	Bit (complement)	Information Known
0	0	There are both 0s and 1s in the current bit position of the participating ROM numbers. This is a discrepancy.
0	1	There are only 0s in the bit of the participating ROM numbers.
1	0	There are only 1s in the bit of the participating ROM numbers.
1	1	No devices participating in search.

According to the search algorithm, the 1-Wire master must then send a bit back to the participating devices. If the participating device has that bit value, it continues participating. If it does not have the bit value, it goes into a wait state until the next 1-Wire reset is detected. This 'read two bits' and 'write one bit' pattern is then repeated for the remaining 63 bits of the ROM number (see Table 2). In this way the search algorithm forces all but one device to go into this wait state. At the end of one pass, the ROM number of this last device is known. On subsequent passes of the search, a different path (or branch) is taken to find the other device ROM numbers. Note that this document refers to the bit position in the ROM number as bit 1 (least significant) to bit 64 (most significant). This convention was used instead of bit 0 to bit 63 for convenience to allow initialization of discrepancy counters to 0 for later comparisons.

**1-WIRE MASTER AND SLAVE SEARCH SEQUENCE Table 2**

Master	Slave
1-Wire reset stimulus	Produce presence pulse.
Write search command (normal or alarm)	Each slave readies for search.
Read 'AND' of bit 1	Each slave sends bit 1 of its ROM number.
Read 'AND' of complement bit 1	Each slave sends complement bit 1 of its ROM number.
Write bit 1 direction (according to algorithm)	Each slave receives the bit written by master, if bit read is not the same as bit 1 of its ROM number then go into a wait state.
Read 'AND' of bit 64	Each slave sends bit 64 of its ROM number.
Read 'AND' of complement bit 64	Each slave sends complement bit 64 of its ROM number.
Write bit 64 direction (according to algorithm)	Each slave receives the bit written by master, if bit read is not the same as bit 64 of its ROM number then go into a wait state.

On examination of Table 1, it is obvious that if all of the participating devices have the same value in a bit position then there is only one choice for the branch path to be taken. The condition where no devices are participating is an atypical situation that may arise if the device being discovered is removed from the 1-Wire during the search. The condition where there are both 0s and 1s in the bit position is called a discrepancy and is the key to finding devices in the subsequent searches. The search algorithm specifies that on the first pass, when there is a discrepancy (bit/complement = 0/0), the '0' path is taken. Note that this is arbitrary for this particular algorithm. Another algorithm could be devised to use the '1' path first. The bit position for the last discrepancy is recorded for use in the next search. Table 3 describes the paths that are taken on subsequent searches when a discrepancy occurs.

### SEARCH PATH DIRECTION Table 3

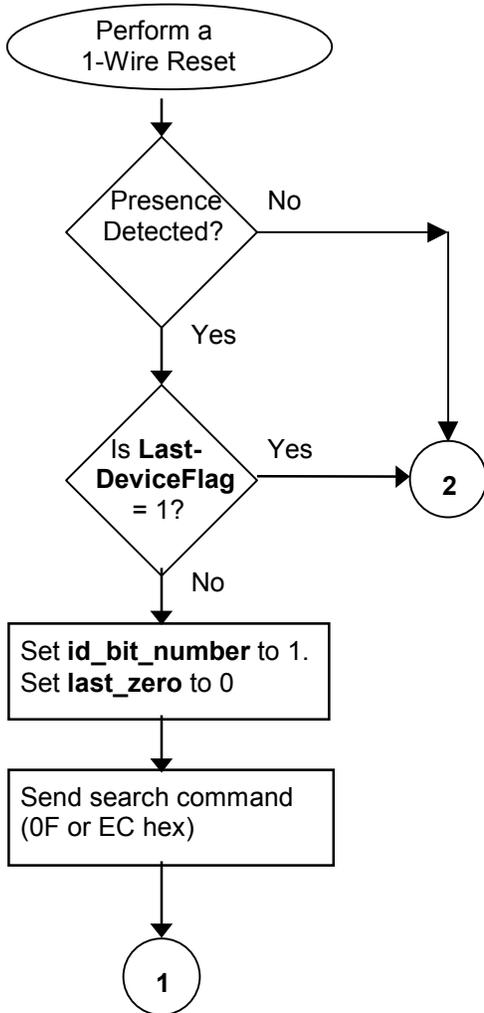
Search Bit Position vs Last Discrepancy	Path Taken
=	take the '1' path
<	take the same path as last time (from last ROM number found)
>	take the '0' path

The search algorithm also keeps track of the last discrepancy that occurs within the first eight bits of the algorithm. The first eight bits of the 64-bit registration number is a family code. As a result, the devices discovered during the search are grouped into family types. The last discrepancy within that family code can be used to selectively skip whole groups of 1-Wire devices. See the description of *ADVANCED SEARCH VARIATIONS* for doing selective searches. The 64-bit ROM number also contains an 8-bit cyclic-redundancy-check (CRC). This CRC value is verified to ensure that only the correct ROM numbers are discovered. See Figure 1 for the layout of the ROM number.

The DS2480B Serial to 1-Wire Line Driver performs some of this same search algorithm in hardware. Please see the *DS2480B data sheet* and *Application Note 188, Using the DS2480B Serial 1-Wire Line Driver* for details. The DS2490 USB to 1-Wire Bridge performs the entire search in hardware.

Figure 2 shows a flow chart of the search sequence. Note the *Reference* side bar that explains the terms used in the flow chart. These terms are also used in the source code appendix to this document.

## SEARCH FLOW Figure 2 (continued on the following pages)



### Reference

**cmp\_id\_bit** - the complement of the id\_bit.

This bit is the AND of the complement of all of the id\_bit\_number bits of the devices that are still participating in the search.

**id\_bit** - the first bit read in a bit search sequence. This bit is the AND of all of the id\_bit\_number bits of the devices that are still participating in the search.

**id\_bit\_number** - the ROM bit number 1 to 64 currently being searched

**LastDeviceFlag** - flag to indicate previous search was the last device.

**LastDiscrepancy** - bit index that identifies from which bit the (next) search discrepancy check should start.

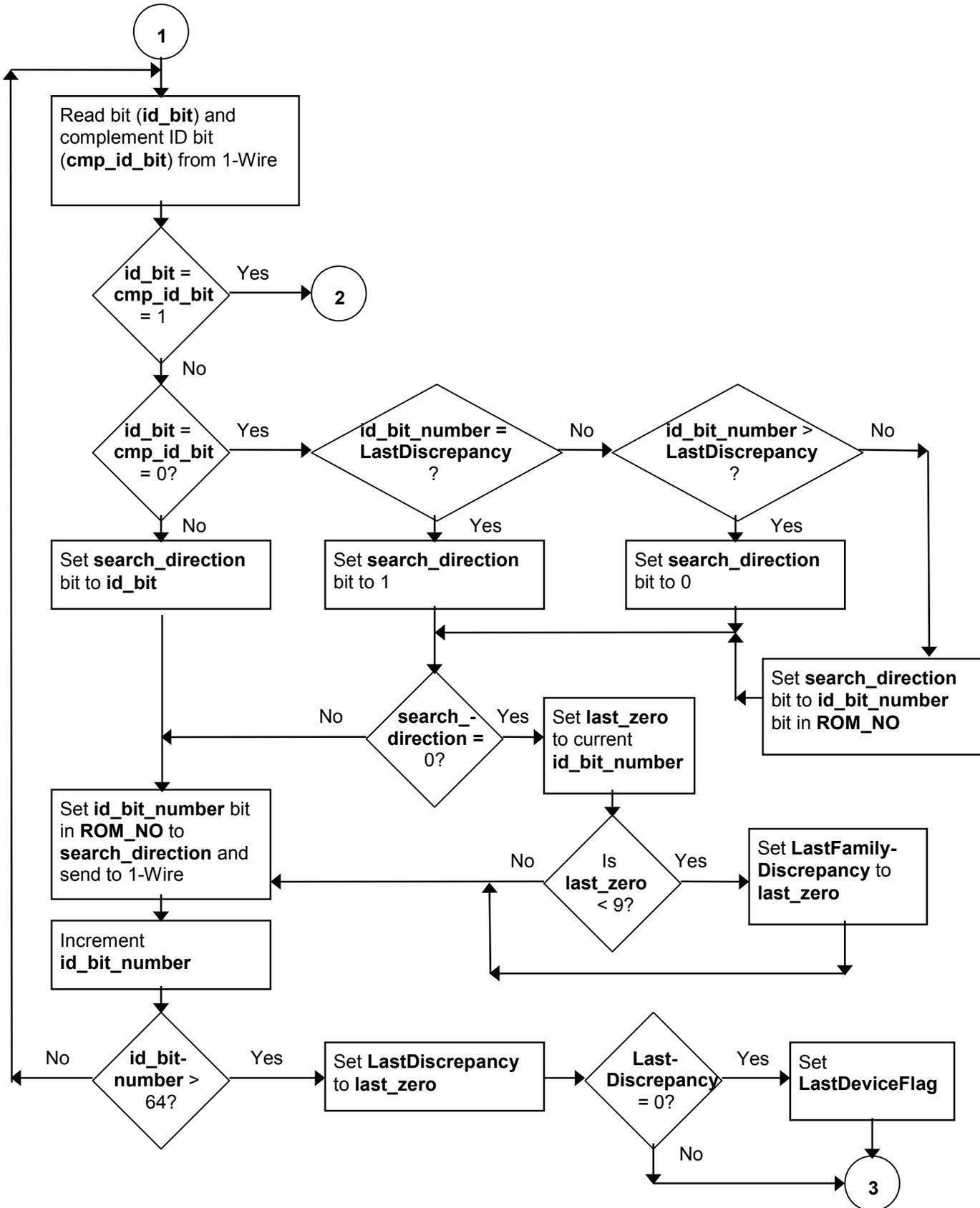
**LastFamilyDiscrepancy** - bit index that identifies the LastDiscrepancy within the first 8-bit family code of ROM number.

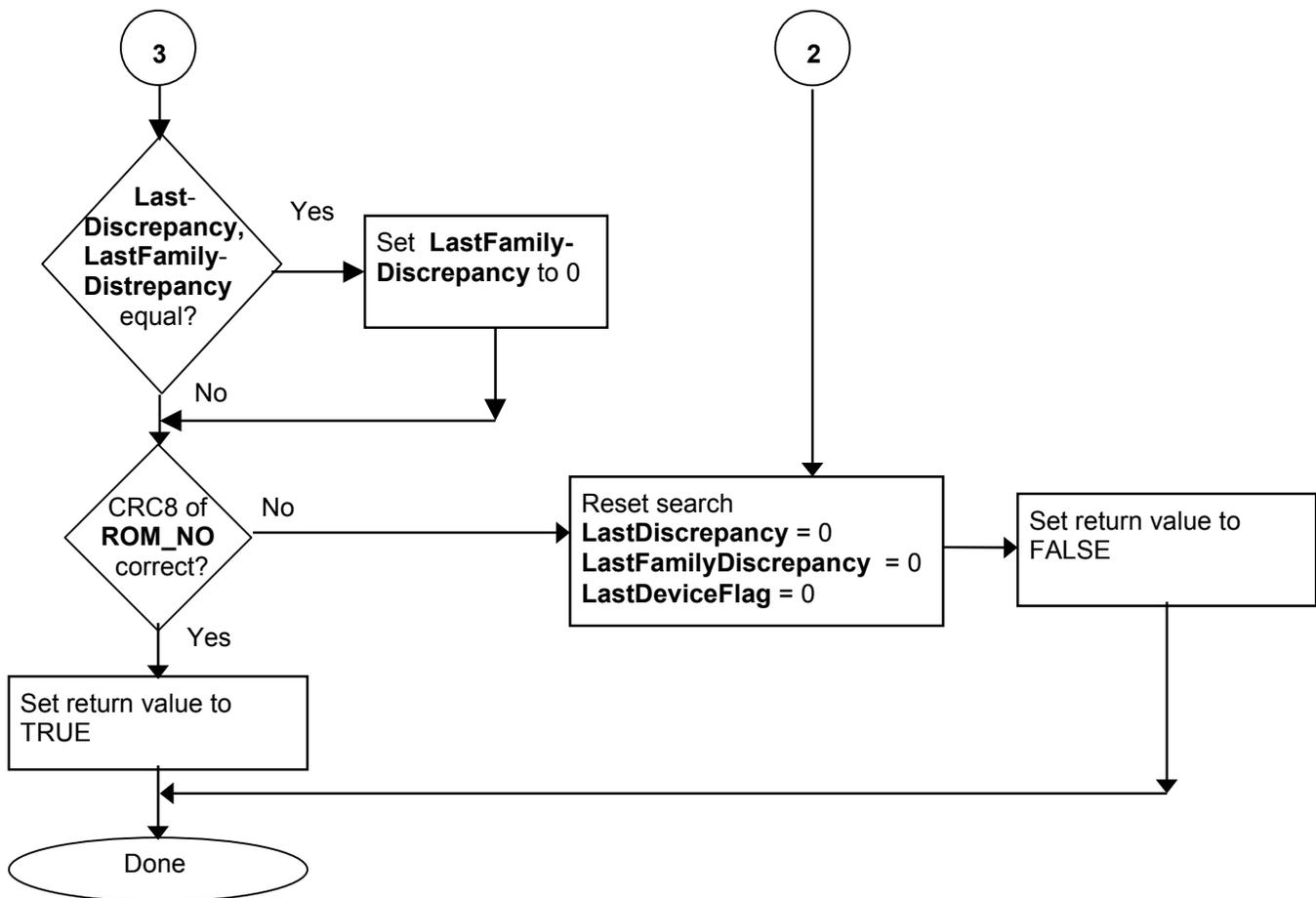
**last\_zero** - bit position of the last zero written where there was a discrepancy

**ROM\_NO** - 8-byte buffer that contains the current ROM registration number discovered.

**search\_direction** - bit value indicating the direction of the search. All devices with this bit stay in the search and the rest go into a wait state for a 1-Wire reset.

**SEARCH FLOW** Figure 2 (continued)



**SEARCH FLOW** Figure 2 (continued)

There are two basic types of operations that can be performed by using the search algorithm by manipulating the LastDiscrepancy, LastFamilyDiscrepancy, LastDeviceFlag, and ROM\_NO register values (see Table 4). These operations concern basic discovery of the ROM numbers of 1-Wire devices.

**FIRST**

The 'FIRST' operation is to search on the 1-Wire for the first device. This is performed by setting LastDiscrepancy, LastFamilyDiscrepancy, and LastDeviceFlag to zero and then doing the search. The resulting ROM number can then be read from the ROM\_NO register. If no devices are present on the 1-Wire the reset sequence will not detect a presence and the search is aborted.

**NEXT**

The 'NEXT' operation is to search on the 1-Wire for the next device. This search is usually performed after a 'FIRST' operation or another 'NEXT' operation. It is performed by leaving the state unchanged from the previous search and performing another search. The resulting ROM number can then be read from the ROM\_NO register. If the previous search was the last device on the 1-Wire then the result will be FALSE and the condition will be set to execute a 'FIRST' with the next call of the search algorithm.

Figure 3 (a, b, c) goes through a simple search example with three devices. For illustration, this example assumes devices with a 2-bit ROM number only.

**SEARCH EXAMPLE Figure 3a**

**Devices**

A = 01 (binary: bit 2, bit 1)  
 B = 00  
 C = 11

**FIRST**

**bit 1**

	Read bit	Read complement-bit	Write direction
A	1	0	
B	0	1	
C	1	0	
	0	0	0 (bit position > LastDiscrepancy)

AND result of 'true' bit read

AND result of the 'complement' bit read

Bit written by master, path taken

**bit 2**

	Read bit	Read complement-bit	Write direction
A	(wait state)		
B	0	1	
C	(wait state)		
	0	1	0 (only one path available)

*Device B is found 00, LastDiscrepancy is now 1*

**NEXT**

**bit 1**

	Read bit	Read complement-bit	Write direction
A	1	0	
B	0	1	
C	1	0	
	0	0	1 (bit position = LastDiscrepancy)

**bit 2**

	Read bit	Read complement-bit	Write direction
A	0	1	
B	(wait state)		
C	1	0	
	0	0	0 (bit position > LastDiscrepancy)

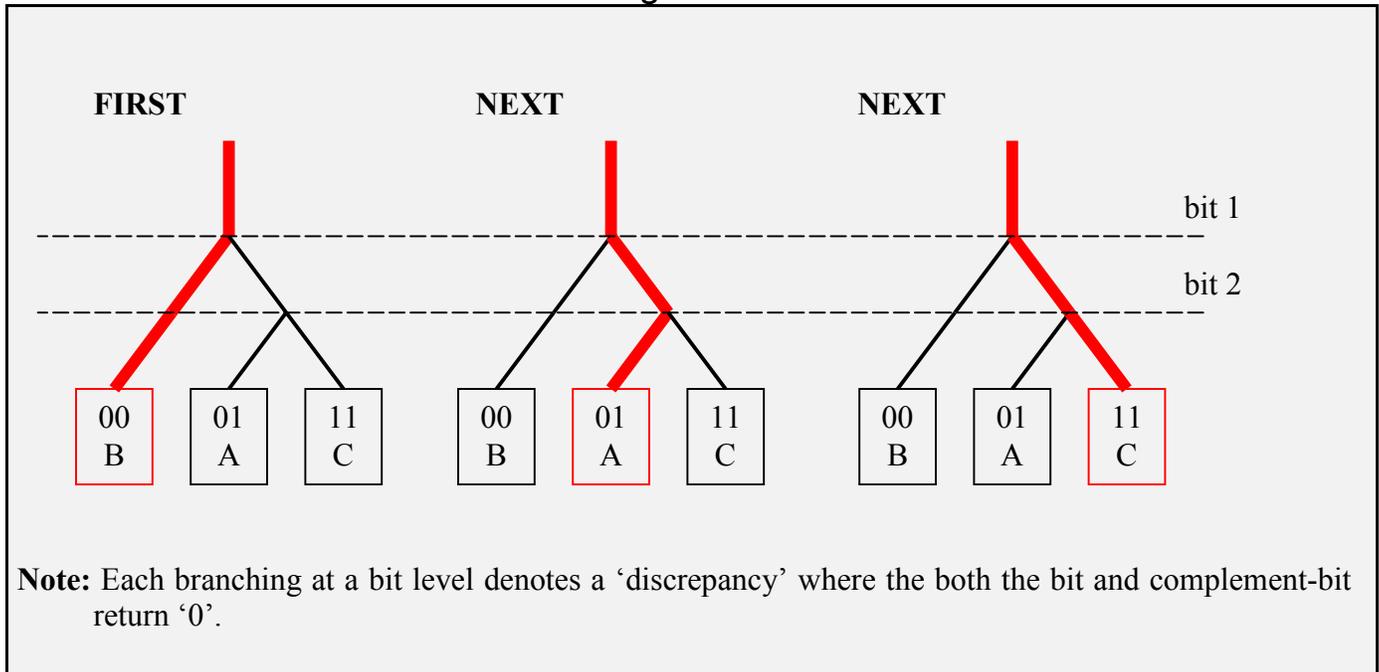
*Device A is found 01, LastDiscrepancy is now 2*

**NEXT**

<b>bit 1</b>	Read bit	Read complement-bit	Write direction
A	1	0	
B	0	1	
C	1	0	(bit position < LastDiscrepancy)
	0	0	1
<b>bit 2</b>	Read bit	Read complement-bit	Write direction
A	0	1	
B	(wait state)		
C	1	0	(bit position = LastDiscrepancy)
	0	0	1

*Device C is found 11, LastDeviceFlag is TRUE*

**SEARCH EXAMPLE TREE GRAPH Figure 3b**



**SEARCH EXAMPLE PSEUDO CODE Figure 3c**

(for simplicity the family discrepancy register and tracking has been left out of this example)

**FIRST**

- ◆ **LastDiscrepancy = LastDeviceFlag = 0**
- ◆ Do 1-Wire reset and wait for presence pulse, if no presence pulse then done
- ◆ **id\_bit\_number = 1, last\_zero = 0**
- ◆ Send search command, 0F hex
- ◆ Read first bit **id\_bit**: 1 (Device A) AND 0 (Device B) AND 1 (Device C) = 0
- ◆ Read complement of first bit **cmp\_id\_bit**: 0 (Device A) AND 1 (Device B) AND 0 (Device C) = 0
- ◆ Since **id\_bit\_number > LastDiscrepancy** then **search\_direction = 0, last\_zero = 1**
- ◆ **Send search\_direction bit of 0**, both Devices A and C go into wait state
- ◆ Increment **id\_bit\_number** to 2
- ◆ Read second bit **id\_bit**: 0 (Device B) = 0
- ◆ Read complement of second bit **cmp\_id\_bit**: 1 (Device B) = 1
- ◆ Since bit and complement are different then **search\_direction = id\_bit**
- ◆ **Send search\_direction bit of 0**, **Device B is discovered with ROM\_NO of '00'** and is now selected
- ◆ **LastDiscrepancy = last\_zero**

**NEXT**

- ◆ Do 1-Wire reset and wait for presence pulse, if no presence pulse then done
- ◆ **id\_bit\_number = 1, last\_zero = 0**
- ◆ Send search command, 0F hex
- ◆ Read first bit **id\_bit**: 1 (Device A) AND 0 (Device B) AND 1 (Device C) = 0
- ◆ Read complement of first bit **cmp\_id\_bit**: 0 (Device A) AND 1 (Device B) AND 0 (Device C) = 0
- ◆ Since **id\_bit\_number = LastDiscrepancy** then **search\_direction = 1**
- ◆ **Send search\_direction bit of 1**, Device B goes into wait state
- ◆ Increment **id\_bit\_number** to 2
- ◆ Read second bit **id\_bit**: 0 (Device A) AND 1 (Device C) = 0
- ◆ Read complement of second bit **cmp\_id\_bit**: 1 (Device A) AND 0 (Device C) = 0
- ◆ Since **id\_bit\_number > LastDiscrepancy** then **search\_direction = 0, last\_zero = 2**
- ◆ **Send search\_direction bit of 0**, Device C goes into wait state
- ◆ **Device A is discovered with ROM\_NO of '01'** and is now selected
- ◆ **LastDiscrepancy = last\_zero**

**NEXT**

- ◆ Do 1-Wire reset and wait for presence pulse, if no presence pulse then done
- ◆ **id\_bit\_number** = 1, **last\_zero** = 0
- ◆ Send search command, 0F hex
- ◆ Read first bit **id\_bit**: 1 (Device A) AND 0 (Device B) AND 1 (Device C) = 0
- ◆ Read complement of first bit **cmp\_id\_bit**: 0 (Device A) AND 1 (Device B) AND 0 (Device C) = 0
- ◆ Since **id\_bit\_number** < **LastDiscrepancy** then **search\_direction** = **ROM\_NO** (first bit) = 1
- ◆ **Send search\_direction bit of 1**, Devices B goes into wait state
- ◆ Increment **id\_bit\_number** to 2
- ◆ Read second bit **id\_bit**: 0 (Device A) AND 1 (Device C) = 0
- ◆ Read complement of second bit **cmp\_id\_bit**: 1 (Device A) AND 0 (Device C) = 0
- ◆ Since **id\_bit\_number** = **LastDiscrepancy** then **search\_direction** = 1
- ◆ **Send search\_direction bit of 1**, Devices A goes into wait state
- ◆ **Device C is discovered with ROM\_NO of '11'** and is now selected
- ◆ **LastDiscrepancy** = **last\_zero** which is 0 so **LastDeviceFlag** = TRUE

**NEXT**

- ◆ **LastDeviceFlag** is true so return FALSE
- ◆ **LastDiscrepancy** = **LastDeviceFlag** = 0

**ADVANCED SEARCH VARIATIONS**

There are three advanced search variations using the same state information, namely **LastDiscrepancy**, **LastFamilyDiscrepancy**, **LastDeviceFlag**, and **ROM\_NO**. These variations allow specific family types to be targeted or skipped and device present verification (see Table 4).

**VERIFY**

The 'VERIFY' operation verifies if a device with a known ROM number is currently connected to the 1-Wire. It is accomplished by supplying the ROM number and doing a targeted search on that number to verify it is present. First, set the **ROM\_NO** register to the known ROM number. Then set the **LastDiscrepancy** to 64 (40 hex) and the **LastDeviceFlag** to 0. Perform the search operation and then read the **ROM\_NO** result. If the search was successful and the **ROM\_NO** remains the ROM number that was being searched for, then the device is currently on the 1-Wire.

**TARGET SETUP**

The 'TARGET SETUP' operation is a way to preset the search state to first find a particular family type. Each 1-Wire device has a one byte *family code* embedded within the ROM number (see Figure 1). This family code allows the 1-Wire master to know what operations this device is capable of. If there are multiple devices on the 1-Wire it is common practice to target a search to only the family of devices that are of interest. To target a particular family, set the desired family code byte into the first byte of the **ROM\_NO** register and fill the rest of the **ROM\_NO** register with zeros. Then set the **LastDiscrepancy** to 64 (40 hex) and both **LastDeviceFlag** and **LastFamilyDiscrepancy** to 0. When the search algorithm is next performed the first device of the desired family type will be discovered and placed in the **ROM\_NO** register. Note that if no devices of the desired family are currently on the 1-Wire, then another type will be found, so the family code in the resulting **ROM\_NO** must be verified after the search.

## FAMILY SKIP SETUP

The 'FAMILY SKIP SETUP' operation sets the search state to skip all of the devices that have the family code that was found in the previous search. This operation can only be performed after a search. It is accomplished by copying the LastFamilyDiscrepancy into the LastDiscrepancy and clearing out the LastDeviceFlag. The next search will then find devices that come after the current family code. If the current family code group was the last group in the search then the search will return with the LastDeviceFlag set.

## SEARCH VARIATIONS STATE SETUP Table 4

	LastDiscrepancy	LastFamily-Discrepancy	LastDeviceFlag	ROM_NO
<b>FIRST</b>	0	0	0	result
<b>NEXT</b>	leave unchanged	leave unchanged	leave unchanged	result
<b>VERIFY</b>	64	don't care	0	set with ROM to verify, check if same after search
<b>TARGET SETUP</b>	64	0	0	set first byte to family code, set rest to zeros
<b>FAMILY SKIP SETUP</b>	copy from LastFamilyDiscrepancy	leave unchanged	0	leave unchanged

## CONCLUSION

The supplied search algorithm allows the discovery of the individually unique ROM numbers from any given group of 1-Wire devices. This is essential to any multidrop 1-Wire application. With the ROM numbers in hand, each 1-Wire device can be selected individually for operations. This document also discussed search variations to find or skip particular 1-Wire device types. See *Appendix* for a 'C' code example implementation of the search and all of the search variations.

## APPENDIX

Figure 4 shows a 'C' code implementation of the search algorithm along with a function for each search variation. The FamilySkipSetup and TargetSetup functions don't actually do a search, they just setup the search registers so that the next 'Next' skips or finds the desired type. Note that the low-level 1-Wire functions are implemented with calls to the TMEX API. These calls are for test purposes and can be replaced with platform specific calls. See *Application Note 155* for a description of the TMEX API and other 1-Wire APIs. For a description of creating a 1-Wire master, see *Application Note 153, 1-Wire Bus Master Programming Guide*.

The TMEX API test implementation of the following code example can be download from the following link:

[ftp://ftp.dalsemi.com/pub/auto\\_id/public/an187.zip](ftp://ftp.dalsemi.com/pub/auto_id/public/an187.zip)

### SEARCH 'C' CODE SAMPLE Figure 4 (continued on the following pages)

```
// TMEX API TEST BUILD DECLARATIONS
#define TMEXUTIL
#include "ibtmexcw.h"
long session_handle;
// END TMEX API TEST BUILD DECLARATIONS

// definitions
#define FALSE 0
#define TRUE 1

// method declarations
int  OWFirst();
int  OWNext();
int  OWVerify();
void OWTargetSetup(unsigned char family_code);
void OWFamilySkipSetup();
int  OWReset();
void OWWriteByte(unsigned char byte_value);
void OWWriteBit(unsigned char bit_value);
unsigned char OWReadBit();
int  OWSearch();
unsigned char docrc8(unsigned char value);

// global search state
unsigned char ROM_NO[8];
int  LastDiscrepancy;
int  LastFamilyDiscrepancy;
int  LastDeviceFlag;
unsigned char crc8;

//-----
// Find the 'first' devices on the 1-Wire bus
// Return TRUE  : device found, ROM number in ROM_NO buffer
//          FALSE : no device present
//
int OWFirst()
{
    // reset the search state
    LastDiscrepancy = 0;
    LastDeviceFlag = FALSE;
    LastFamilyDiscrepancy = 0;

    return OWSearch();
}
```

```

//-----
// Find the 'next' devices on the 1-Wire bus
// Return TRUE : device found, ROM number in ROM_NO buffer
//          FALSE : device not found, end of search
//
int OWNext()
{
    // leave the search state alone
    return OWSearch();
}

//-----
// Perform the 1-Wire Search Algorithm on the 1-Wire bus using the existing
// search state.
// Return TRUE : device found, ROM number in ROM_NO buffer
//          FALSE : device not found, end of search
//
int OWSearch()
{
    int id_bit_number;
    int last_zero, rom_byte_number, search_result;
    int id_bit, cmp_id_bit;
    unsigned char rom_byte_mask, search_direction;

    // initialize for search
    id_bit_number = 1;
    last_zero = 0;
    rom_byte_number = 0;
    rom_byte_mask = 1;
    search_result = 0;
    crc8 = 0;

    // if the last call was not the last one
    if (!LastDeviceFlag)
    {
        // 1-Wire reset
        if (!OWReset())
        {
            // reset the search
            LastDiscrepancy = 0;
            LastDeviceFlag = FALSE;
            LastFamilyDiscrepancy = 0;
            return FALSE;
        }

        // issue the search command
        OWWriteByte(0xF0);
    }
}

```

```

// loop to do the search
do
{
    // read a bit and its complement
    id_bit = OWReadBit();
    cmp_id_bit = OWReadBit();

    // check for no devices on 1-wire
    if ((id_bit == 1) && (cmp_id_bit == 1))
        break;
    else
    {
        // all devices coupled have 0 or 1
        if (id_bit != cmp_id_bit)
            search_direction = id_bit; // bit write value for search
        else
        {
            // if this discrepancy is before the Last Discrepancy
            // on a previous next then pick the same as last time
            if (id_bit_number < LastDiscrepancy)
                search_direction = ((ROM_NO[rom_byte_number] & rom_byte_mask) > 0);
            else
                // if equal to last pick 1, if not then pick 0
                search_direction = (id_bit_number == LastDiscrepancy);

            // if 0 was picked then record its position in LastZero
            if (search_direction == 0)
            {
                last_zero = id_bit_number;

                // check for Last discrepancy in family
                if (last_zero < 9)
                    LastFamilyDiscrepancy = last_zero;
            }
        }

        // set or clear the bit in the ROM byte rom_byte_number
        // with mask rom_byte_mask
        if (search_direction == 1)
            ROM_NO[rom_byte_number] |= rom_byte_mask;
        else
            ROM_NO[rom_byte_number] &= ~rom_byte_mask;

        // serial number search direction write bit
        OWWriteBit(search_direction);

        // increment the byte counter id_bit_number
        // and shift the mask rom_byte_mask
        id_bit_number++;
        rom_byte_mask <<= 1;

        // if the mask is 0 then go to new SerialNum byte rom_byte_number and reset mask
        if (rom_byte_mask == 0)
        {
            docrc8(ROM_NO[rom_byte_number]); // accumulate the CRC
            rom_byte_number++;
            rom_byte_mask = 1;
        }
    }
}
while(rom_byte_number < 8); // loop until through all ROM bytes 0-7

```

```

// if the search was successful then
if (!(id_bit_number < 65) || (crc8 != 0))
{
    // search successful so set LastDiscrepancy,LastDeviceFlag,search_result
    LastDiscrepancy = last_zero;

    // check for last device
    if (LastDiscrepancy == 0)
        LastDeviceFlag = TRUE;

    // check for last family group
    if (LastFamilyDiscrepancy == LastDiscrepancy)
        LastFamilyDiscrepancy = 0;

    search_result = TRUE;
}
}

// if no device found then reset counters so next 'search' will be like a first
if (!search_result || !ROM_NO[0])
{
    LastDiscrepancy = 0;
    LastDeviceFlag = FALSE;
    LastFamilyDiscrepancy = 0;
    search_result = FALSE;
}

return search_result;
}

//-----
// Verify the device with the ROM number in ROM_NO buffer is present.
// Return TRUE : device verified present
//          FALSE : device not present
//
int OWVerify()
{
    unsigned char rom_backup[8];
    int i,rslt,ld_backup,ldf_backup,lfd_backup;

    // keep a backup copy of the current state
    for (i = 0; i < 8; i++)
        rom_backup[i] = ROM_NO[i];
    ld_backup = LastDiscrepancy;
    ldf_backup = LastDeviceFlag;
    lfd_backup = LastFamilyDiscrepancy;

    // set search to find the same device
    LastDiscrepancy = 64;
    LastDeviceFlag = FALSE;

    if (OWSearch())
    {
        // check if same device found
        rslt = TRUE;
        for (i = 0; i < 8; i++)
        {
            if (rom_backup[i] != ROM_NO[i])
            {
                rslt = FALSE;
                break;
            }
        }
    }
    else
        rslt = FALSE;
}

```

```

// restore the search state
for (i = 0; i < 8; i++)
    ROM_NO[i] = rom_backup[i];
LastDiscrepancy = ld_backup;
LastDeviceFlag = ldf_backup;
LastFamilyDiscrepancy = lfd_backup;

// return the result of the verify
return rslt;
}

//-----
// Setup the search to find the device type 'family_code' on the next call
// to OWNext() if it is present.
//
void OWTargetSetup(unsigned char family_code)
{
    int i;

    // set the search state to find SearchFamily type devices
    ROM_NO[0] = family_code;
    for (i = 1; i < 8; i++)
        ROM_NO[i] = 0;
    LastDiscrepancy = 64;
    LastFamilyDiscrepancy = 0;
    LastDeviceFlag = FALSE;
}

//-----
// Setup the search to skip the current device type on the next call
// to OWNext().
//
void OWFamilySkipSetup()
{
    // set the Last discrepancy to last family discrepancy
    LastDiscrepancy = LastFamilyDiscrepancy;

    // check for end of list
    if (LastDiscrepancy == 0)
        LastDeviceFlag = TRUE;
}

//-----
// 1-Wire Functions to be implemented for a particular platform
//-----

//-----
// Reset the 1-Wire bus and return the presence of any device
// Return TRUE : device present
//          FALSE : no device present
//
int OWReset()
{
    // platform specific
    // TMEX API TEST BUILD
    return (TMTouchReset(session_handle) == 1);
}

```

```

//-----
// Send 8 bits of data to the 1-Wire bus
//
void OWWriteByte(unsigned char byte_value)
{
    // platform specific

    // TMEX API TEST BUILD
    TMTouchByte(session_handle,byte_value);
}

//-----
// Send 1 bit of data to teh 1-Wire bus
//
void OWWriteBit(unsigned char bit_value)
{
    // platform specific

    // TMEX API TEST BUILD
    TMTouchBit(session_handle,(short)bit_value);
}

//-----
// Read 1 bit of data from the 1-Wire bus
// Return 1 : bit read is 1
//       0 : bit read is 0
//
unsigned char OWReadBit()
{
    // platform specific

    // TMEX API TEST BUILD
    return (unsigned char)TMTouchBit(session_handle,0x01);
}

// TEST BUILD
static unsigned char dscrc_table[] = {
    0, 94,188,226, 97, 63,221,131,194,156,126, 32,163,253, 31, 65,
    157,195, 33,127,252,162, 64, 30, 95, 1,227,189, 62, 96,130,220,
    35,125,159,193, 66, 28,254,160,225,191, 93, 3,128,222, 60, 98,
    190,224, 2, 92,223,129, 99, 61,124, 34,192,158, 29, 67,161,255,
    70, 24,250,164, 39,121,155,197,132,218, 56,102,229,187, 89, 7,
    219,133,103, 57,186,228, 6, 88, 25, 71,165,251,120, 38,196,154,
    101, 59,217,135, 4, 90,184,230,167,249, 27, 69,198,152,122, 36,
    248,166, 68, 26,153,199, 37,123, 58,100,134,216, 91, 5,231,185,
    140,210, 48,110,237,179, 81, 15, 78, 16,242,172, 47,113,147,205,
    17, 79,173,243,112, 46,204,146,211,141,111, 49,178,236, 14, 80,
    175,241, 19, 77,206,144,114, 44,109, 51,209,143, 12, 82,176,238,
    50,108,142,208, 83, 13,239,177,240,174, 76, 18,145,207, 45,115,
    202,148,118, 40,171,245, 23, 73, 8, 86,180,234,105, 55,213,139,
    87, 9,235,181, 54,104,138,212,149,203, 41,119,244,170, 72, 22,
    233,183, 85, 11,136,214, 52,106, 43,117,151,201, 74, 20,246,168,
    116, 42,200,150, 21, 75,169,247,182,232, 10, 84,215,137,107, 53};

//-----
// Calculate the CRC8 of the byte value provided with the current
// global 'crc8' value.
// Returns current global crc8 value
//
unsigned char docrc8(unsigned char value)
{
    // See Application Note 27

    // TEST BUILD
    crc8 = dscrc_table[crc8 ^ value];
    return crc8;
}

```

```

//-----
// TEST BUILD MAIN
//
int main(short argc, char **argv)
{
    short PortType=5,PortNum=1;
    int rslt,i,cnt;

    // TMEX API SETUP
    // get a session
    session_handle = TMExtendedStartSession(PortNum,PortType,NULL);
    if (session_handle <= 0)
    {
        printf("No session, %d\n",session_handle);
        exit(0);
    }

    // setup the port
    rslt = TMSetup(session_handle);
    if (rslt != 1)
    {
        printf("Fail setup, %d\n",rslt);
        exit(0);
    }
    // END TMEX API SETUP

    // find ALL devices
    printf("\nFIND ALL\n");
    cnt = 0;
    rslt = OWFirst();
    while (rslt)
    {
        // print device found
        for (i = 7; i >= 0; i--)
            printf("%02X", ROM_NO[i]);
        printf("  %d\n",++cnt);

        rslt = OWNext();
    }

    // find only 0x1A
    printf("\nFIND ONLY 0x1A\n");
    cnt = 0;
    OWTargetSetup(0x1A);
    while (OWNext())
    {
        // check for incorrect type
        if (ROM_NO[0] != 0x1A)
            break;

        // print device found
        for (i = 7; i >= 0; i--)
            printf("%02X", ROM_NO[i]);
        printf("  %d\n",++cnt);
    }
}

```

```
// find all but 0x04, 0x1A, 0x23, and 0x01
printf("\nFIND ALL EXCEPT 0x10, 0x04, 0x0A, 0x1A, 0x23, 0x01\n");
cnt = 0;
rslt = OWFirst();
while (rslt)
{
    // check for incorrect type
    if ((ROM_NO[0] == 0x04) || (ROM_NO[0] == 0x1A) ||
        (ROM_NO[0] == 0x01) || (ROM_NO[0] == 0x23) ||
        (ROM_NO[0] == 0x0A) || (ROM_NO[0] == 0x10))
        OWFamilySkipSetup();
    else
    {
        // print device found
        for (i = 7; i >= 0; i--)
            printf("%02X", ROM_NO[i]);
        printf("  %d\n", ++cnt);
    }

    rslt = OWNext();
}

// TMEX API CLEANUP
// release the session
TMEndSession(session_handle);
// END TMEX API CLEANUP
}
```