Integrated Device Technology, Inc.

32-BIT CMOS ERROR DETECTION AND CORRECTION UNIT

IDT49C460
IDT49C460A
IDT49C460B
IDT49C460C
IDT49C460D
IDT49C460E

FEATURES:

- Fast

	Detect	Correct
— IDT49C460E	10ns (max.)	14ns (max.)
— IDT49C460D	12ns (max.)	18ns (max.)
— IDT49C460C	16ns (max.)	24ns (max.)
— IDT49C460B	25ns (max.)	30ns (max.)
— IDT49C460A	30ns (max.)	36ns (max.)
— IDT49C460	40ns (max.)	49ns (max.)

- Low-power CMOS
  - — Commercial: 95mA (max.)
  - — Military: 125mA (max.)
- Improves system memory reliability
  - — Corrects all single bit errors, detects all double and some triple-bit errors
- Cascadable
  - — Data words up to 64-bits
- Built-in diagnostics
  - — Capable of verifying proper EDC operation via software control
- Simplified byte operations
  - — Fast byte writes possible with separate byte enables
- Functional replacement for 32- and 64-bit configurations of the AM29C60 and AM29C660
- Available in PGA, PLCC and Fine Pitch Flatpack
- Military product compliant to MIL-STD-883, Class B
- Standard Military Drawing #5962–88533

DESCRIPTION:

The IDT49C460s are high-speed, low-power, 32-bit Error Detection and Correction Units which generate check bits on a 32-bit data field according to a modified Hamming Code and correct the data word when check bits are supplied. The IDT49C460s are performance-enhanced functional replacements for 32-bit versions of the 2960. When performing a read operation from memory, the IDT49C460s will correct 100% of all single bit errors and will detect all double bit errors and some triple bit errors.

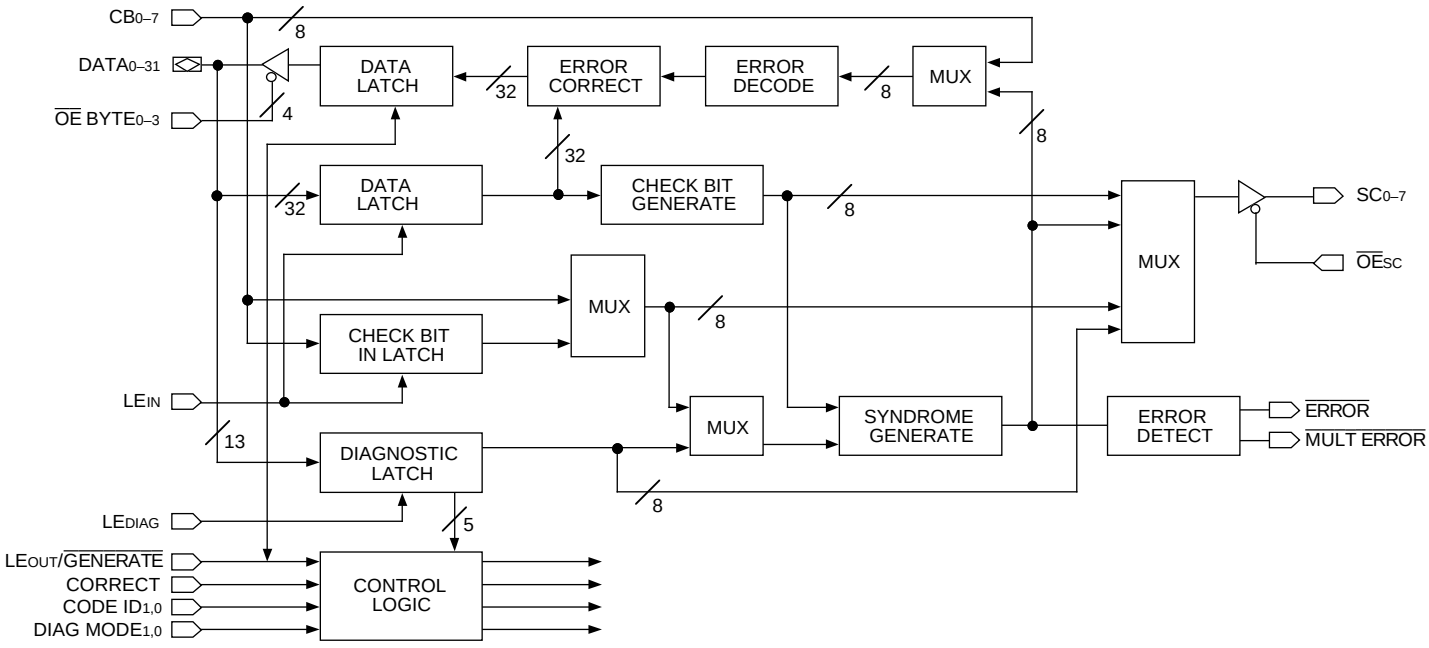
The IDT49C460s are easily cascadable to 64-bits. Thirty-two-bit systems use 7 check bits and 64-bit systems use 8 check bits. For both configurations, the error syndrome is made available.

The IDT49C460s incorporate two built-in diagnostic modes. Both simplify testing by allowing for diagnostic data to be entered into the device and to execute system diagnostics functions.

They are fabricated using a CMOS technology designed for high-performance and high-reliability. The devices are packaged in a 68-pin ceramic PGA, PLCC and Ceramic Quad Flatpack.

Military grade product is manufactured in compliance with the latest revision of MIL-STD-883, Class B, making it ideally suited to military temperature applications demanding the highest level of performance and reliability.

FUNCTIONAL BLOCK DIAGRAM



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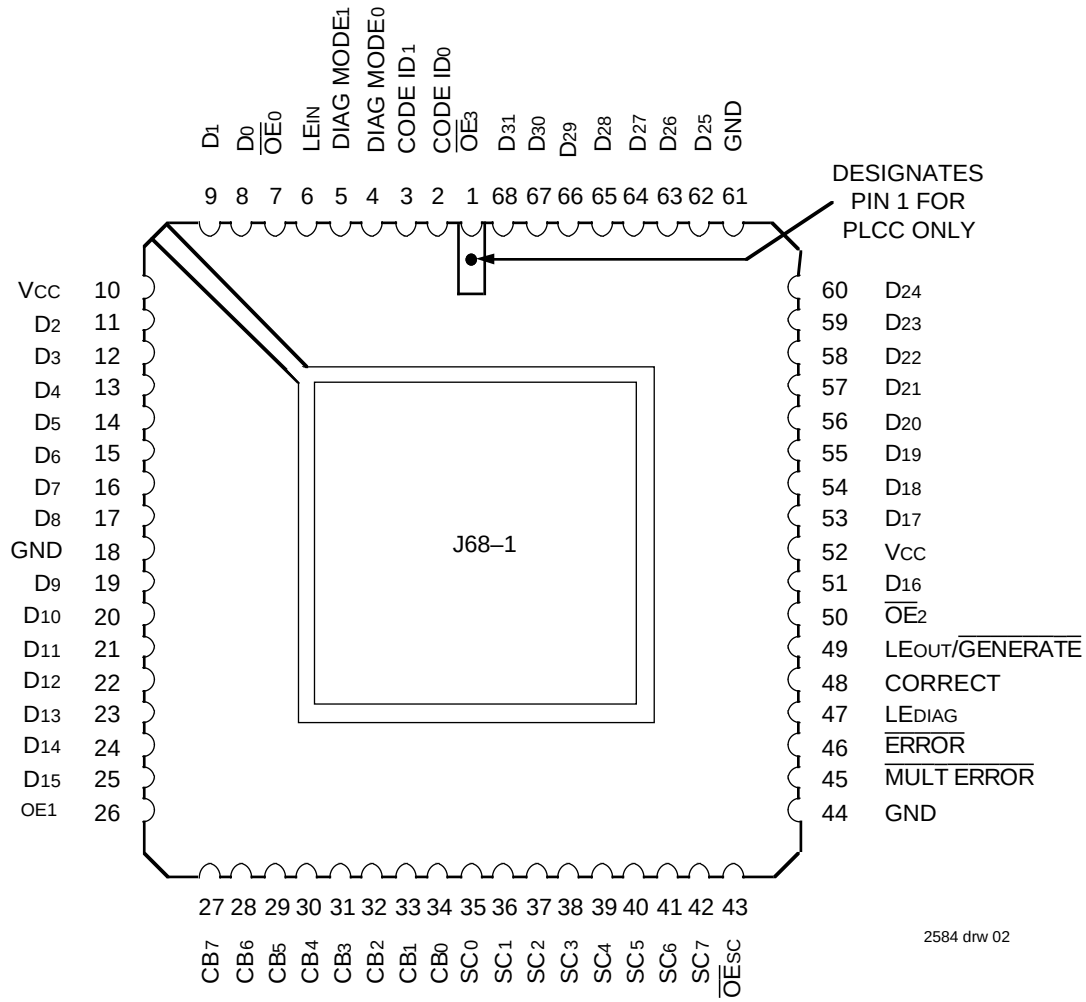
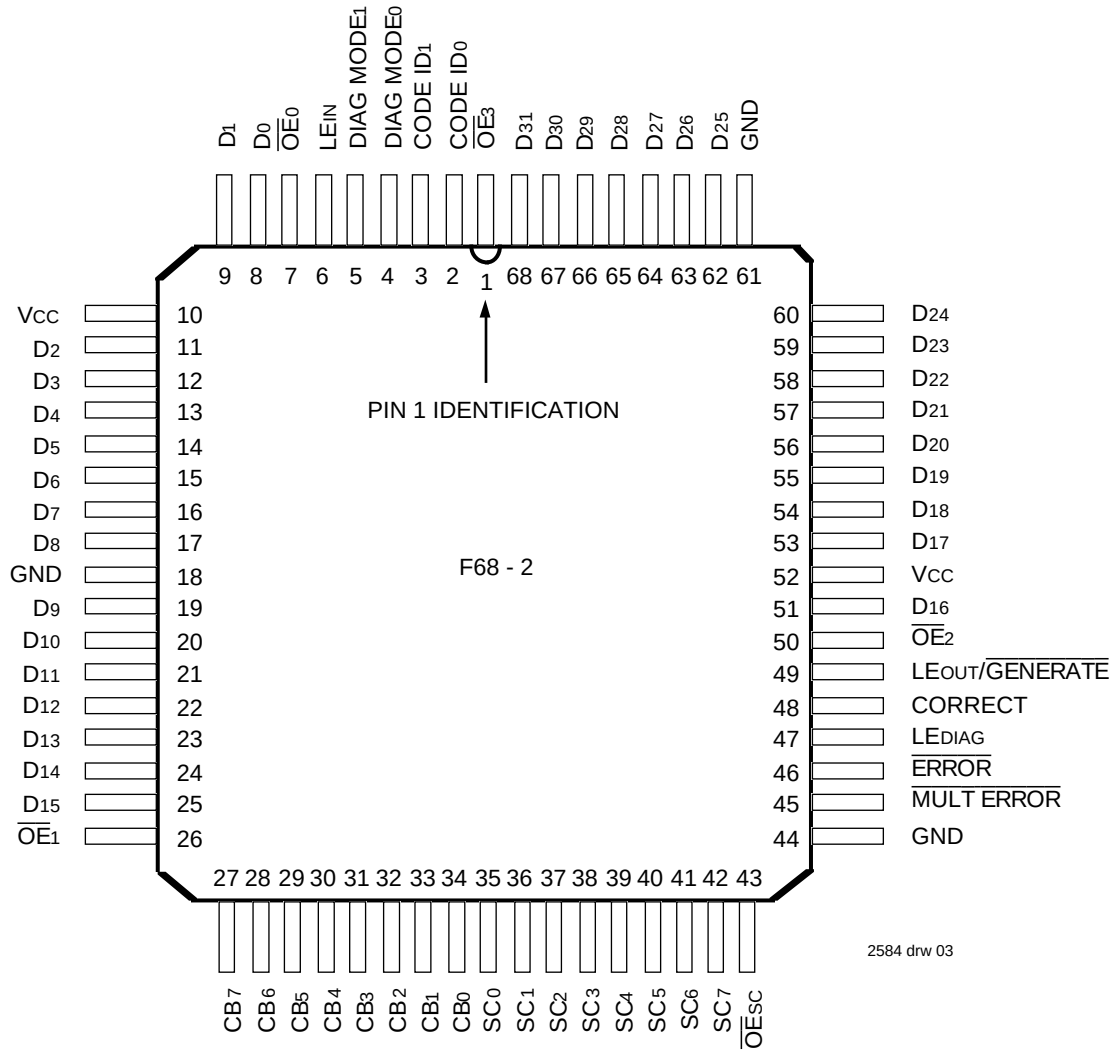
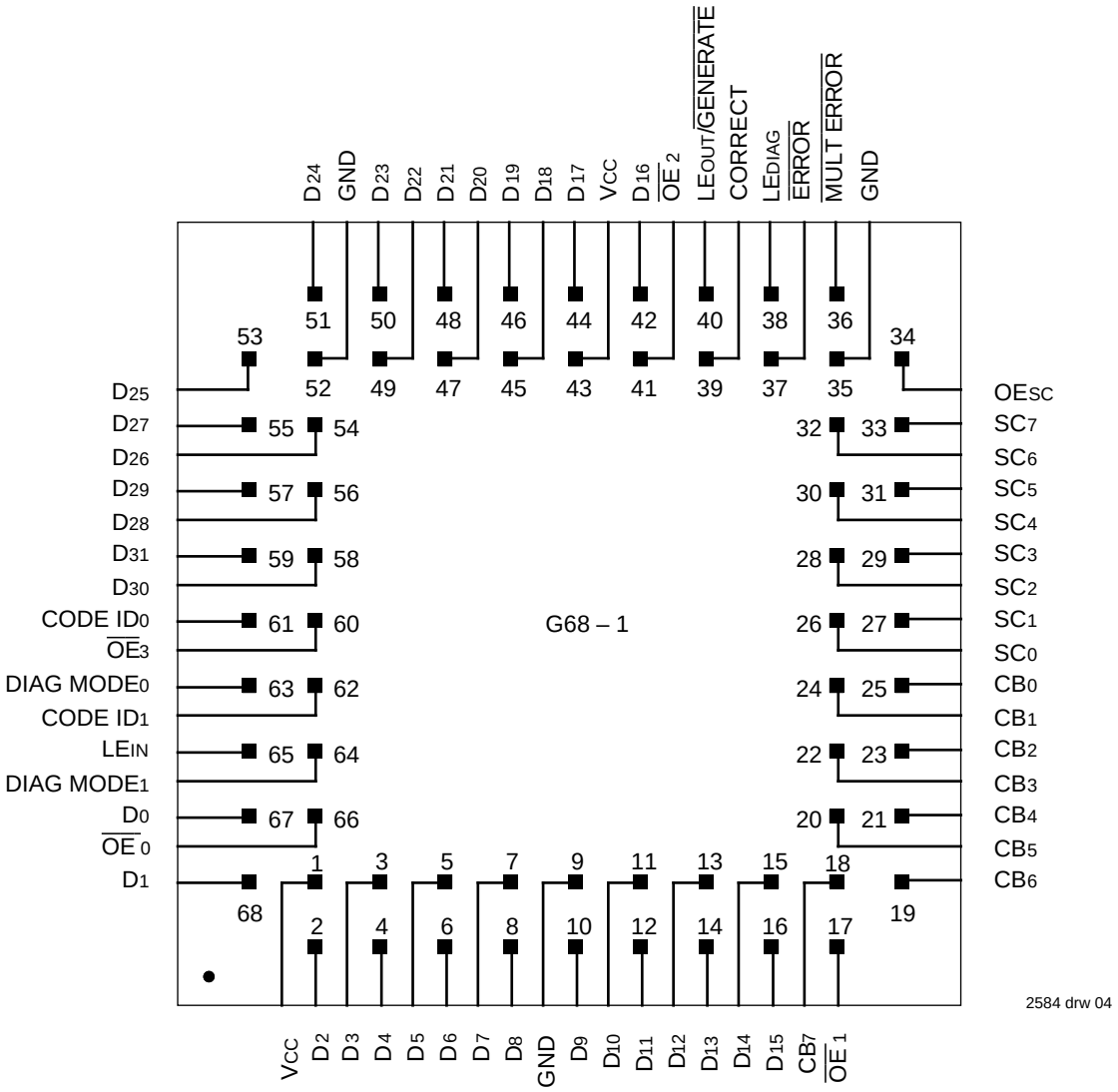
PIN CONFIGURATIONS



PLCC
TOPVIEW



FINE PITCH FLATPACK
TOPVIEW


D24 GND D23 D22 D21 D20 D19 D18 D17 VCC D16 OE2 LEOUT/GENERATE CORRECT LEDIAG ERROR MULT ERROR GND
51 50 48 46 44 42 40 38 36
53 52 49 47 45 43 41 39 37 35 34
D25 D27 D26 D29 D28 D31 D30 CODE ID0 OE3 DIAG MODE0 CODE ID1 LEIN DIAG MODE1 D0 OE0 D1
55 54 57 56 59 58 61 60 63 62 65 64 67 66
68 1 3 5 7 9 11 13 15 18 19
2 4 6 8 10 12 14 16 17
32 33 30 31 28 29 26 27 24 25 22 23 20 21
OESC SC7 SC6 SC5 SC4 SC3 SC2 SC1 SC0 CB0 CB1 CB2 CB3 CB4 CB5 CB6
G68 – 1
2584 drw 04
VCC D2 D3 D4 D5 D6 D7 D8 GND D9 D10 D11 D12 D13 D14 D15 CB7 OE1

PGA
TOPVIEW

PIN DESCRIPTIONS

Pin Name	I/O	Description
$DATA_{0-31}$	I/O	32 bidirectional data lines provide input to the Data Input Latch and Diagnostic Latch and also receive output from the Data Output Latch. $DATA_0$ is the LSB; $DATA_{31}$ is the MSB.
CB_{0-7}	I	Eight check bit input lines input check bits for error detection and also used to input syndrome bits for error correction in 64-bit applications.
LE_{IN}	I	Latch Enable is for the Data Input Latch. Controls latching of the input data. Data Input Latch and Check Bit Input Latch are latched to their previous state when LOW. When HIGH, the Data Input Latch and Check Bit Input Latch follow the input data and input check bits.
LE_{OUT}/ $\overline{GENERATE}$		A multifunction pin which, when LOW, is in the Check Bit Generate Mode. In this mode, the device generates the check bits or GENERATE partial check bits specific to the data in the Data Input Latch. The generated check bits are placed on the SC outputs. Also, when LOW, the Data Out Latch is latched to its previous state. When HIGH, the device is in the Detect or Correct Mode. In this mode, the device detects single and multiple errors and generates syndrome bits based upon the contents of the Data Input Latch and Check Bit Input Latch. In the Correct Mode, single bit errors are also automatically corrected and the corrected data is placed at the inputs of the Data Output Latch. The syndrome result is placed on the SC outputs and indicates in a coded form the number of errors and the specific bit-in-error. When HIGH, the Data Output Latch follows the output of the Data Input Latch as modified by the correction logic network. In Correct Mode, single bit errors are corrected by the network before being loaded into the Data Output Latch. In Detect Mode, the contents of the Data Input Latch are passed through the correction network unchanged into the Data Output Latch. The Data Output Latch is disabled, with its contents unchanged, if the EDC is in the Generate Mode.
SC_{0-7}	O	Syndrome Check Bit outputs. Eight outputs which hold the check bits and partial check bits when the EDC is in the Generate Mode and will hold the syndrome/partial syndrome bits when the device is in the Detect or Correct modes. All are 3-state outputs.
$\overline{OE}_{SC}$	I	Output Enable—Syndrome Check Bits. In the HIGH condition, the SC outputs are in the high impedance state. When LOW, all SC output lines are enabled.
$\overline{ERROR}$	O	In the Detect or Correct Mode, this output will go LOW if one or more data or check bits contain an error. When HIGH, no errors have been detected. This pin is forced HIGH in the Generate Mode.
$\overline{MULT}$ $\overline{ERROR}$	O	In the Detect or Correct Mode, this output will go LOW if two or more bit errors have been detected. A HIGH level indicates that either one or no errors have been detected. This pin is forced HIGH in the Generate Mode.
CORRECT	I	The correct input which, when HIGH, allows the correction network to correct any single-bit error in the Data Input Latch (by complementing the bit-in-error) before putting it into the Data Output Latch. When LOW, the device will drive data directly from the Data Input Latch to the Data Output Latch without correction.
$\overline{OE}$ $BYTE_{0-3}$	I	Output Enable—Bytes 0, 1, 2, 3. Data Output Latch. Control the three-state output buffers for each of the four bytes of the Data Output Latch. When LOW, they enable the output buffer of the Data Output Latch. When HIGH, they force the Data Output Latch buffer into the high impedance mode. One byte of the Data Output Latch is easily activated by separately selecting the four enable lines.
DIAG $MODE_{1,0}$	I	Select the proper diagnostic mode. They control the initialization, diagnostic and normal operation of the EDC.
CODE $ID_{1,0}$	I	These two code identification inputs identify the size of the total data word to be processed. The two allowable data word sizes are 32 and 64 bits and their respective modified Hamming Codes are designated 32/39 and 64/72. Special CODE $ID_{1,0}$, input 01 is also used to instruct the EDC that the signals CODE $ID_{1,0}$, DIAG $MODE_{1,0}$ and CORRECT are to be taken from the Diagnostic Latch rather than from the input control lines.
LE_{DIAG}	I	This is the Latch Enable for the Diagnostic Latch. When HIGH, the Diagnostic Latch follows the 32-bit data on the input lines. When LOW, the outputs of the Diagnostic Latch are latched to their previous states. The Diagnostic Latch holds diagnostic check bits and internal control signals for CODE $ID_{1,0}$, DIAG $MODE_{1,0}$ and CORRECT.

2584 tbl 01

EDC ARCHITECTURE SUMMARY

The IDT49C460s are high-performance cascadable EDCs used for check bit generation, error detection, error correction and diagnostics. The function blocks for this 32-bit device consist of the following:

- Data Input Latch
- Check Bit Input Latch
- Check Bit Generation Logic
- Syndrome Generation Logic
- Error Detection Logic
- Error Correction Logic
- Data Output Latch
- Diagnostic Latch
- Control Logic

DATA INPUT/OUTPUT LATCH

The Latch Enable Input, LE_{IN}, controls the loading of 32 bits of data to the Data In Latch. The data from the DATA lines can be loaded in the Diagnostic Latch under control of the Diagnostic Latch Enable, LE_{DIAG}, giving check bit information in one byte and control information in another byte. The Diagnostic Latch is used in the Internal Control Mode or in one of the diagnostic modes. The Data Output Latch has buffers that place data on the DATA lines. These buffers are split into four 8-bit buffers, each having their own output enable controls. This feature facilitates byte read and byte modify operations.

CHECK BIT GENERATION LOGIC

This generates the appropriate check bits for the 32 bits of data in the Data Input Latch. The modified Hamming Code is the basis for generating the proper check bits.

SYNDROME GENERATION LOGIC

In both the Detect and Correct modes, this logic does a comparison on the check bits read from memory against the newly generated set of check bits produced for the data read in from memory. Matching sets of check bits mean no error was detected. If there is a mismatch, one or more of the data or check bits is in error. Syndrome bits are produced by an exclusive-OR of the two sets of check bits. Identical sets of check bits mean the syndrome bits will be all zeros. If an error results, the syndrome bits can be decoded to determine the number of errors and the specific bit-in-error.

ERROR DETECTION LOGIC

This part of the device decodes the syndrome bits generated by the Syndrome Generation Logic. With no errors in either the input data or check bits, both the $\overline{ERROR}$ and $\overline{MULTERROR}$ outputs are HIGH. $\overline{ERROR}$ will go low if one error is detected. $\overline{MULTERROR}$ and $\overline{ERROR}$ will both go low if two or more errors are detected.

ERROR CORRECTION LOGIC

In single error cases, this logic complements (corrects) the single data bit-in-error. This corrected data is loaded into the Data Output Latch, which can then be read onto the bidirectional data lines. If the error is resulting from one of the check bits, the correction logic does not place corrected check bits on the syndrome/check bit outputs. If the corrected check bits are needed, the EDC must be switched to the Generate Mode.

DATA OUTPUT LATCH AND OUTPUT BUFFERS

The Data Output Latch is used for storing the result of an error correction operation. The latch is loaded from the correction logic under control of the Data Output Latch Enable, LE_{OUT}. The Data Output Latch may also be directly loaded from the Data Input Latch in the PASSTHRU mode. The Data Output Latch buffer is split into 4 individual buffers which can be enabled by $\overline{OE}_{0–3}$ separately for reading onto the bidirectional data lines.

DIAGNOSTIC LATCH

The diagnostic latch is loadable under control of the Diagnostic Latch Enable, LE_{DIAG}, from the bidirectional data lines. Check bit information is contained in one byte while the other byte contains the control information. The Diagnostic Latch is used for driving the device when in the Internal Control Mode, or for supplying check bits when in one of the diagnostic modes.

CONTROL LOGIC

Specifies in which mode the device will be operating in. Normal operation is when the control logic is driven by external control inputs. In the Internal Control Mode, the control signals are read from the Diagnostic Latch. Since LE_{OUT} and $\overline{GENERATE}$ are controlled by the same pin, the latching action (LE_{OUT} from high to low) of the Data Output Latch causes the EDC to go into the Generate Mode.

DETAILED PRODUCT DESCRIPTION

The IDT49C460 EDC units contain the logic necessary to generate check bits on 32 bits of data input according to a modified Hamming Code. The EDC can compare internally generated check bits against those read with the 32-bit data to allow correction of any single bit data error and detection of all double (and some triple) bit errors. The IDT49C460s can be used for 32-bit data words (7 check bits) and 64-bit (8 check bits) data words.

WORD SIZE SELECTION

The two code identification pins, CODE $ID_{1,0}$, are used to determine the data word size that is 32 or 64 bits. They also select the Internal Control Mode. Table 4 defines all possible slice identification codes.

CHECK AND SYNDROME BITS

The IDT49C460s provide either check bits or syndrome bits on the three-state output pins, SC_{0-7}. Check bits are generated from a combination of the Data Input bits, while syndrome bits are an exclusive-OR of the check bits generated from read data with the read check bits stored with the data. Syndrome bits can be decoded to determine the single bit in error or that a double (some triple) error was detected. The check bits are labeled:

$C_0, C_1, C_2, C_3, C_4, C_5, C_6$ for the 32-bit configuration
$C_0, C_1, C_2, C_3, C_4, C_5, C_6, C_7$ for the 64-bit configuration

Syndrome bits are similarly labeled S_0 through S_7.

Correct	Diag $Mode_0$	Diag $Mode_1$	Diagnostic Mode Selected
X	0	0	**Non-diagnostic Mode.** Normal EDC function in this mode.
X	0	1	**Diagnostic Generate.** The contents of the Diagnostic Latch are substituted for the normally generated check bits when in the Generate Mode. The EDC functions normally in the Detect or Correct modes.
0/1	1	0	**Diagnostic Detect/Correct.** In either mode, the contents of the Diagnostic Latch are substituted for the check bits normally read from the Check Bit Input Latch. The EDC functions normally in the Generate Mode.
1	1	1	**Initialize.** The Data Input Latch outputs are forced to zeros and latched upon removal of Initialize Mode.
0	1	1	**PASSTHRU.**

2584 tbl 02

Table 2. Diagnostic Mode Control

Operating Mode	DM_0	DM_1	Generate	Correct	$DATA_{OUT}$ Latch	SC_{0-7} ($\overline{OE}_{SC}$ = LOW)	$\overline{ERROR}$ / $\overline{MULT\ ERROR}$
Generate	0 1	0 0	0	X	LE_{OUT} = LOW (1)	Check Bits Generated from $DATA_{IN}$ Latch	High
Detect	0 0	0 1	1	0	$DATA_{IN}$ Latch	Syndrome Bits $DATA_{IN}$/ Check Bit Latch	Error Dep (2)
Correct	0 0	0 1	1	1	$DATA_{IN}$ Latch w/ Single Bit Correction	Syndrome Bits $DATA_{IN}$/ Check Bit Latch	Error Dep
PASSTHRU	1	1	1	0	$DATA_{IN}$ Latch	Check Bit Latch	High
Diagnostic Generate	0	1	0	X	—	Check Bits from Diagnostic Latch	High
Diagnostic Detect	1	0	1	0	$DATA_{IN}$ Latch	Syndrome Bits $DATA_{IN}$/ Diagnostic Latch	Error Dep
Diagnostic Correct	1	0	1	1	$DATA_{IN}$ Latch w/ Single Bit Correction	Syndrome Bits $DATA_{IN}$/ Diagnostic Latch	Error Dep
Initialization	1	1	1	1	$DATA_{IN}$ Latch Set to 0000(3)	—	—
Internal	CODE $ID_{1,0}$ = 01 (Control Signals CODE $ID_{1,0}$, DIAG $MODE_{1,0}$ and CORRECT are taken from Diagnostic Latch.)						

NOTES:

2584 tbl 03

1. In Generate Mode, data is read into the EDC unit and the check bits are generated. The same data is written to memory along with the check bits. Since the $DATA_{OUT}$ Latch is not used in the Generate Mode, LE_{OUT} (being LOW since it is tied to Generate) does not affect the writing of check bits.
2. Error Dep (Error Dependent): $\overline{ERROR}$ will be low for single or multiple errors, with $\overline{MULT\ ERROR}$ low for double or multiple errors. Both signals are high for no errors.
3. LE_{IN} is LOW.

Table 3. IDT49C460 Operating Modes

OPERATING MODE SELECTION

Tables 2 and 3 describe the nine operating modes of the IDT49C460s. The Diagnostic Mode pins — DIAG MODE$_{0,1}$ — define four basic areas of operation. $\overline{\text{GENERATE}}$ and CORRECT further divide operation into 8 functions, with CODE ID$_{1,0}$ defining the ninth mode as the Internal Mode.

Generate Mode is used to display the check bits on the outputs SC$_{0–7}$. The Diagnostic Generate Mode displays check bits as stored in the Diagnostic Latch.

Detect Mode provides an indication of errors or multiple errors on the outputs $\overline{\text{ERROR}}$ and $\overline{\text{MULT ERROR}}$. Single bit errors are not corrected in this mode. The syndrome bits are provided on the outputs SC$_{0–7}$. For the Diagnostic Detect Mode, the syndrome bits are generated by comparing the internally generated check bits from the Data In Latch with check bits stored in the diagnostic latch rather than with the check bit latch contents.

Correct Mode is similar to the Detect Mode except that single bit errors will be complemented (corrected) and made available as input to the Data Out Latches. Again, the Diagnostic Correct Mode will correct single bit errors as determined by syndrome bits generated from the data input and contents of the diagnostic latches.

The Initialize Mode provides check bits for all zero bit data. Data Input Latches are set, latched to a logic zero and made available as input to the Data Out Latches.

The Internal Mode disables the external control pins DIAG MODE$_{0,1}$ and CORRECT to be defined by the Diagnostic Latch. Even CODE ID$_{1,0}$, although externally set to the 01 code, can be redefined from the Diagnostic Latch data.

Code ID$_1$	Code ID$_0$	Slice Selected
0	0	32-Bit
0	1	Internal Control Mode
1	0	64-Bit, Lower 32–Bit (0–31)
1	1	64-Bit, Upper 32-Bit (32–63)

2584 tbl 04

Table 4. Slice Identification

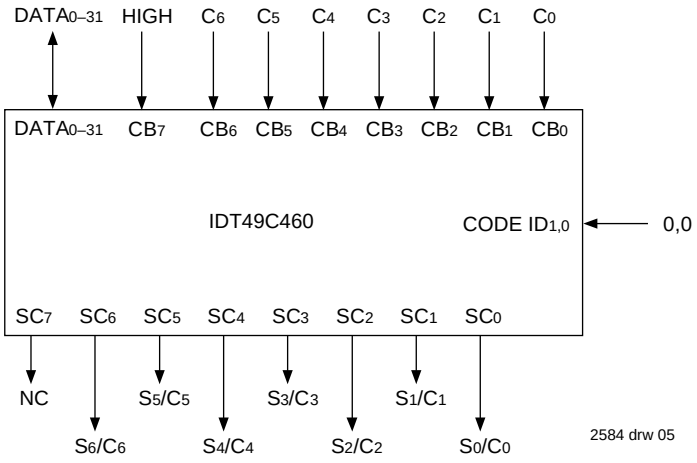


Figure 1. 32-Bit Configuration

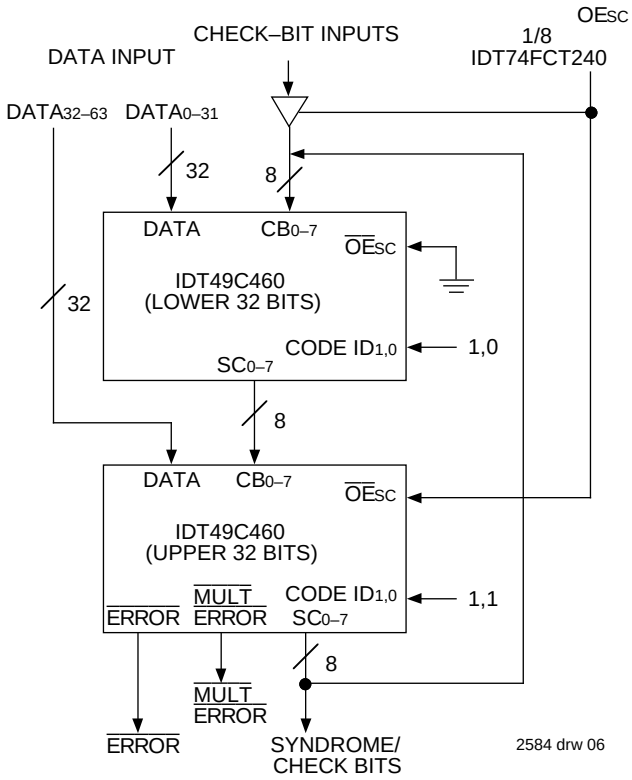


Figure 2. 64-Bit Configuration

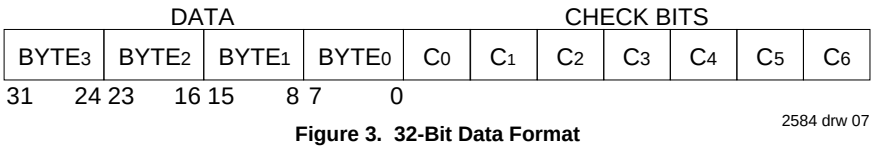


Figure 3. 32-Bit Data Format

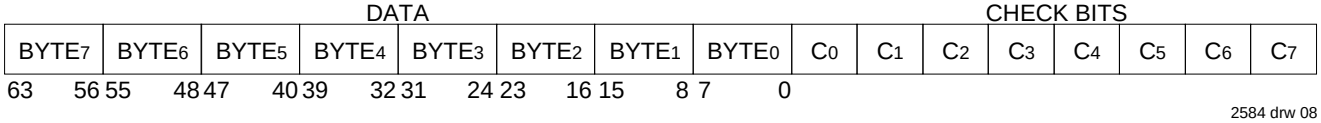


Figure 4. 64-Bit Data Format

32-BIT DATA WORD CONFIGURATION

A single IDT49C460 EDC unit, connected as shown in Figure 1, provides all the logic needed for single bit error correction and double bit error detection of a 32-bit data field. The identification code indicates 7 check bits are required. The CB_7 pin should be HIGH.

Figure 3 indicates the 39-bit data format for two bytes of data and 7 check bits. Table 3 describes the operating mode available.

Table 6 indicates the data bits participating in the check bit generation. For example, check bit C_0 is the exclusive-OR function of the 16 data input bits marked with an X. Check bits are generated and output in the Generate and Initialization Mode. Check bits from the respective latch are passed, unchanged, in the PASSTHRU or Diagnostic Generate Mode.

Syndrome bits are generated by an exclusive-OR or the generated check bits with the read check bits. For example, S_n is the XOR of check bits C_n from those read with those generated. Table 7 indicates the decoding of the seven syndrome bits to identify the bit-in-error for a single bit error, or whether a double or triple bit error was detected. The all zero case indicates no errors detected.

In the Correct Mode, the syndrome bits are used to complement (correct) single bit errors in the data bits. For double or multiple error detection, the data available as input to the Data Out Latch is not defined.

Table 5 defines the bit definition for the Diagnostic Latch. As defined in Table 3, several modes will use the diagnostic check bits to determine syndrome bits or to pass as check bits to the SC_{0-7} outputs. The Internal Mode substitutes the indicated bit position for the external control signals.

BIT 0	CB_0 DIAGNOSTIC
BIT 1	CB_1 DIAGNOSTIC
BIT 2	CB_2 DIAGNOSTIC
BIT 3	CB_3 DIAGNOSTIC
BIT 4	CB_4 DIAGNOSTIC
BIT 5	CB_5 DIAGNOSTIC
BIT 6	CB_6 DIAGNOSTIC
BIT 7	CB_7 DIAGNOSTIC
BIT 8	CODE ID_0
BIT 9	CODE ID_1
BIT 10	DIAG $MODE_0$
BIT 11	DIAG $MODE_1$
BIT 12	CORRECT
BIT 13–31	DON'T CARE

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Table 5. 32-Bit Diagnostic Latch Coding Format

Generated Check Bits	Parity	Participating Data Bits															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C_0	Even (XOR)	X				X		X	X	X	X		X			X	
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)	X	X	X	X	X	X	X	X								

2584 tbl 06

Generated Check Bits	Parity	Participating Data Bits															
		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
C_0	Even (XOR)		X	X	X		X					X		X	X		X
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)									X	X	X	X	X	X	X	X

2584 tbl 07

Table 6. 32–Bit Modified Hamming Code–Check Bit Encode Chart

					Hex	0	1	2	3	4	5	6	7
	Syndrome Bits				S_6	0	0	0	0	1	1	1	1
					S_5	0	0	1	1	0	0	1	1
					S_4	0	1	0	1	0	1	0	1
Hex	S_3	S_2	S_1	S_0									
0	0	0	0	0		*	C4	C5	T	C6	T	T	30
1	0	0	0	1		C0	T	T	14	T	M	M	T
2	0	0	1	0		C1	T	T	M	T	2	24	T
3	0	0	1	1		T	18	8	T	M	T	T	M
4	0	1	0	0		C2	T	T	15	T	3	25	T
5	0	1	0	1		T	19	9	T	M	T	T	31
6	0	1	1	0		T	20	10	T	M	T	T	M
7	0	1	1	1		M	T	T	M	T	4	26	T
8	1	0	0	0		C3	T	T	M	T	5	27	T
9	1	0	0	1		T	21	11	T	M	T	T	M
A	1	0	1	0		T	22	12	T	1	T	T	M
B	1	0	1	1		17	T	T	M	T	6	28	T
C	1	1	0	0		T	23	13	T	M	T	T	M
D	1	1	0	1		M	T	T	M	T	7	29	T
E	1	1	1	0		16	T	T	M	T	M	M	T
F	1	1	1	1		T	M	M	T	0	T	T	M

NOTES: 2584 tbl 08

1. * = No errors detected
2. Number = The number of the single bit-in-error
3. T = Two errors detected
4. M = Three or more errors detected

Table 7. Syndrome Decode to Bit-in-Error (32-Bit)

64-BIT DATA WORD CONFIGURATION

Two IDT49C460 EDC units, connected as shown in Figure 2, provide all the logic needed for single bit error detection and double bit error detection of a 64-bit data field. Table 4 gives the CODE $ID_{1,0}$ values needed for distinguishing the upper 32 bits from the lower 32 bits. Valid syndrome, check bits and the $\overline{ERROR}$ and $\overline{MULT\ ERROR}$ signals come from the IC with the CODE $ID_{1,0}$ = 11. Control signals not indicated are connected to both units in parallel. The EDC with the CODE $ID_{1,0}$ = 10 has the $\overline{OE}_{SC}$ grounded. The $\overline{OE}_{SC}$ selects the syndrome bits from the EDC with CODE $ID_{1,0}$ = 11 and also controls the check bit buffers from memory.

Data In bits 0 through 31 are connected to the same numbered inputs of the EDC unit with CODE $ID_{1,0}$ = 10, while Data In bits 32 through 63 are connected to Data Inputs 0 to 31, respectively, for the EDC unit with CODE $ID_{1,0}$ = 11.

Figure 4 indicates the 72-bit data format of 8 bytes of data and 8 check bits. Check bits are input to the EDC unit with CODE $ID_{1,0}$ = 10 through a three-state buffer unit such as the IDT74FCT244. Correction of single bit errors of the 64-bit configuration requires a feedback of syndrome bits from the upper EDC unit to the lower EDC unit. The MUX shown on the functional block diagram is used to select the CB_{0-7} pins as the syndrome bits rather than internally generated syndrome bits.

Table 3 describes the operating modes available for the 64/72 configuration.

Table 11 indicates the data bits participating in the check bit generation. For example, check bit C_0 is the exclusive-OR function of the 32 data input bits marked with an X. Check bits are generated and output in the Generate and Initialization modes. Check bits are passed as stored in the PASSTHRU or Diagnostic Generate modes.

Syndrome bits are generated by an exclusive-OR of the generated check bits with the read check bits. For example, S_n is the XOR of check bits C_n from those read with those generated. Table 9 indicates the decoding of the 8 syndrome bits to determine the bit in error for a single bit error or whether a double or triple bit error was detected. The all zero case indicates no errors detected.

In the Correct Mode, the syndrome bits are used to complement (correct) single bit errors in the data bits. For double or multiple error detection, the data available as input to the Data Out Latch is not defined.

Tables 8A and 8B define the bit definition for the Diagnostic Latch. As defined in Table 3, several modes will use the Diagnostic Check Bits to determine syndrome bits or to pass as check bits to the SC_{0-7} outputs. The Internal Mode substitutes the indicated bit position for the external control signals.

Performance data is provided in Table 10, relating a single IDT49C460 EDC with the two cascaded units of Figure 2. As indicated, a summation of propagation delays is required from the cascading arrangement of EDC units.

Bit	Internal Function
0	CB_0 DIAGNOSTIC
1	CB_1 DIAGNOSTIC
2	CB_2 DIAGNOSTIC
3	CB_3 DIAGNOSTIC
4	CB_4 DIAGNOSTIC
5	CB_5 DIAGNOSTIC
6	CB_6 DIAGNOSTIC
7	CB_7 DIAGNOSTIC
8	CODE ID_0 LOWER 32-BIT
9	CODE ID_1 LOWER 32-BIT
10	DIAG $MODE_0$ LOWER 32-BIT
11	DIAG $MODE_1$ LOWER 32-BIT
12	CORRECT LOWER 32-BIT
13–31	DON'T CARE
32–39	DON'T CARE
40	CODE ID_0 UPPER 32-BIT
41	CODE ID_1 UPPER 32-BIT
42	DIAG $MODE_0$ UPPER 32-BIT
43	DIAG $MODE_1$ UPPER 32-BIT
44	CORRECT UPPER 32-BIT
45–63	DON'T CARE

2584 tbl 09

Table 8A. 64-Bit Diagnostic Latch–Coding Format (Diagnostic and Correct Mode)

Bit	Internal Function
0–7	DON'T CARE
8	CODE ID_0 LOWER 32-BIT
9	CODE ID_1 LOWER 32-BIT
10	DIAG $MODE_0$ LOWER 32-BIT
11	DIAG $MODE_1$ LOWER 32-BIT
12	CORRECT LOWER 32-BIT
13–31	DON'T CARE
32	CB_0 DIAGNOSTIC
33	CB_1 DIAGNOSTIC
34	CB_2 DIAGNOSTIC
35	CB_3 DIAGNOSTIC
36	CB_4 DIAGNOSTIC
37	CB_5 DIAGNOSTIC
38	CB_6 DIAGNOSTIC
39	CB_7 DIAGNOSTIC
40	CODE ID_0 UPPER 32-BIT
41	CODE ID_1 UPPER 32-BIT
42	DIAG $MODE_0$ UPPER 32-BIT
43	DIAG $MODE_1$ UPPER 32-BIT
44	CORRECT UPPER 32-BIT
45–63	DON'T CARE

2584 tbl 10

Table 8B. 64-Bit Diagnostic Latch–Coding Format (Diagnostic and Correct Mode)

					Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
					S_7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				Syndrome Bits	S_6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
					S_5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
					S_4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Hex	S_3	S_2	S_1	S_0																	
0	0	0	0	0		*	C4	C5	T	C6	T	T	62	C7	T	T	46	T	M	M	T
1	0	0	0	1		C0	T	T	14	T	M	M	T	T	M	M	T	M	T	T	30
2	0	0	1	0		C1	T	T	M	T	34	56	T	T	50	40	T	M	T	T	M
3	0	0	1	1		T	18	8	T	M	T	T	M	M	T	T	M	T	2	24	T
4	0	1	0	0		C2	T	T	15	T	35	57	T	T	51	41	T	M	T	T	31
5	0	1	0	1		T	19	9	T	M	T	T	63	M	T	T	47	T	3	25	T
6	0	1	1	0		T	20	10	T	M	T	T	M	M	T	T	M	T	4	26	T
7	0	1	1	1		M	T	T	M	T	36	58	T	T	52	42	T	M	T	T	M
8	1	0	0	0		C3	T	T	M	T	37	59	T	T	53	43	T	M	T	T	M
9	1	0	0	1		T	21	11	T	M	T	T	M	M	T	T	M	T	5	27	T
A	1	0	1	0		T	22	12	T	33	T	T	M	49	T	T	M	T	6	28	T
B	1	0	1	1		17	T	T	M	T	38	60	T	T	54	44	T	1	T	T	M
C	1	1	0	0		T	23	13	T	M	T	T	M	M	T	T	M	T	7	29	T
D	1	1	0	1		M	T	T	M	T	39	61	T	T	55	45	T	M	T	T	M
E	1	1	1	0		16	T	T	M	T	M	M	T	T	M	M	T	0	T	T	M
F	1	1	1	1		T	M	M	T	32	T	T	M	48	T	T	M	T	M	M	T

NOTES:
* = No errors detected
Number = The number of the single bit-in-error
T = Two errors detected
M = Three or more errors detected

2584 tbl 11

Table 9. Syndrome Decode to Bit–In–Error (64–Bit Configuration)

64–Bit Propagation Delay		Component Delay for IDT49C460 AC Specifications
From	To	
DATA	Check Bits Out	(DATA TO SC) + (CB TO SC, CODE ID 11)
DATA	Corrected $DATA_{OUT}$	(DATA TO SC) + (CB TO SC, CODE ID 11) + (CB TO DATA, CODE ID 10)
DATA	Syndromes Out	(DATA TO SC) + (CB TO SC, CODE ID 11)
DATA	$\overline{ERROR}$ for 64 Bits	(DATA TO SC) + (CB TO $\overline{ERROR}$, CODE ID 11)
DATA	$\overline{MULT\ ERROR}$ for 64 Bits	(DATA TO SC) + (CB TO $\overline{MULT\ ERROR}$, CODE ID 11)

2584 tbl 12

Table 10. Key Calculations for the 64–Bit Configuration

Generated Check Bits	Parity	Participating Data Bits															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C_0	Even (XOR)		X	X	X		X			X	X		X			X	
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)	X	X	X	X	X	X	X	X								
C_7	Even (XOR)	X	X	X	X	X	X	X	X								

2584 tbl 13

Generated Check Bits	Parity	Participating Data Bits															
		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
C_0	Even (XOR)		X	X	X		X			X	X		X			X	
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)									X	X	X	X	X	X	X	X
C_7	Even (XOR)									X	X	X	X	X	X	X	X

2584 tbl 14

Generated Check Bits	Parity	Participating Data Bits															
		32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
C_0	Even (XOR)	X				X		X	X			X		X	X		X
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)	X	X	X	X	X	X	X	X								
C_7	Even (XOR)									X	X	X	X	X	X	X	X

2584 tbl 15

Generated Check Bits	Parity	Participating Data Bits															
		48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
C_0	Even (XOR)	X				X		X	X			X		X	X		X
C_1	Even (XOR)	X	X	X		X		X		X		X		X			
C_2	Odd (XNOR)	X			X	X			X		X	X			X		X
C_3	Odd (XNOR)	X	X				X	X	X				X	X	X		
C_4	Even (XOR)			X	X	X	X	X	X							X	X
C_5	Even (XOR)									X	X	X	X	X	X	X	X
C_6	Even (XOR)									X	X	X	X	X	X	X	X
C_7	Even (XOR)	X	X	X	X	X	X	X	X								

NOTE:
1. The check bit is generated as either an XOR or XNOR of the 32 data bits noted by an “X” in the table.

2584 tbl 16

Table 11. 64–Bit Modified Hamming Code–Check Bit Encoding

SC OUTPUTS

The tables below indicate how the SC_{0-7} outputs are generated in each control mode of various CODE IDs (Internal Control Mode not applicable).

Generate	CODE ID1,0 = 00	CODE ID1,0 = 10	CODE ID1,0 = 11
$SC_0 \leftarrow$	PH0	PH1	PH2 ⊕ CB_0
$SC_1 \leftarrow$	PA	PA	PA ⊕ CB_1
$SC_2 \leftarrow$	PB	PB	PB ⊕ CB_2
$SC_3 \leftarrow$	PC	PC	PC ⊕ CB_3
$SC_4 \leftarrow$	PD	PD	PD ⊕ CB_4
$SC_5 \leftarrow$	PE	PE	PE ⊕ CB_5
$SC_6 \leftarrow$	PF	PF	PF ⊕ CB_6
$SC_7 \leftarrow$	—	PF	PG ⊕ CB_7
	Final Check Bits	Partial Check Bits	Final Check Bits

2584 tbl 17

Correct/ Detect	CODE ID1,0 = 00	CODE ID1,0 = 10	CODE ID1,0 = 11
$SC_0 \leftarrow$	PH0 ⊕ C_0	PH1 ⊕ C_0	PH2 ⊕ CB_0
$SC_1 \leftarrow$	PA ⊕ C_1	PA ⊕ C_1	PA ⊕ CB_1
$SC_2 \leftarrow$	PB ⊕ C_2	PB ⊕ C_2	PB ⊕ CB_2
$SC_3 \leftarrow$	PC ⊕ C_3	PC ⊕ C_3	PC ⊕ CB_3
$SC_4 \leftarrow$	PD ⊕ C_4	PD ⊕ C_4	PD ⊕ CB_4
$SC_5 \leftarrow$	PE ⊕ C_5	PE ⊕ C_5	PE ⊕ CB_5
$SC_6 \leftarrow$	PF ⊕ C_6	PF ⊕ C_6	PF ⊕ CB_6
$SC_7 \leftarrow$	—	PF ⊕ C_7	PG ⊕ CB_7
	Final Syndrome	Partial Syndrome	Final Syndrome

2584 tbl 19

Diagnostic Generate	CODE ID1,0 = 00	CODE ID1,0 = 10	CODE ID1,0 = 11
$SC_0 \leftarrow$	DL0	DL0	DL32
$SC_1 \leftarrow$	DL1	DL1	DL33
$SC_2 \leftarrow$	DL2	DL2	DL34
$SC_3 \leftarrow$	DL3	DL3	DL35
$SC_4 \leftarrow$	DL4	DL4	DL36
$SC_5 \leftarrow$	DL5	DL5	DL37
$SC_6 \leftarrow$	DL6	DL6	DL38
$SC_7 \leftarrow$	—	DL7	DL39
	Final Check Bits	Partial Check Bits	Final Check Bits

2584 tbl 18

Diagnostic Correct/ Detect	CODE ID1,0 = 00	CODE ID1,0 = 10	CODE ID1,0 = 11
$SC_0 \leftarrow$	PH0 ⊕ DL0	PH1 ⊕ DL0	PH2 ⊕ CB_0
$SC_1 \leftarrow$	PA ⊕ DL1	PA ⊕ DL1	PA ⊕ CB_1
$SC_2 \leftarrow$	PB ⊕ DL2	PB ⊕ DL2	PB ⊕ CB_2
$SC_3 \leftarrow$	PC ⊕ DL3	PC ⊕ DL3	PC ⊕ CB_3
$SC_4 \leftarrow$	PD ⊕ DL4	PD ⊕ DL4	PD ⊕ CB_4
$SC_5 \leftarrow$	PE ⊕ DL5	PE ⊕ DL5	PE ⊕ CB_5
$SC_6 \leftarrow$	PF ⊕ DL6	PF ⊕ DL6	PF ⊕ CB_6
$SC_7 \leftarrow$	—	PF ⊕ DL7	PG ⊕ CB_7
	Final Syndrome	Partial Syndrome	Final Syndrome

2584 tbl 20

PASSTHRU	CODE ID1,0 = 00	CODE ID1,0 = 10	CODE ID1,0 = 11
$SC_0 \leftarrow$	C0	C0	CB_0
$SC_1 \leftarrow$	C1	C1	CB_1
$SC_2 \leftarrow$	C2	C2	CB_2
$SC_3 \leftarrow$	C3	C3	CB_3
$SC_4 \leftarrow$	C4	C4	CB_4
$SC_5 \leftarrow$	C5	C5	CB_5
$SC_6 \leftarrow$	C6	C6	CB_6
$SC_7 \leftarrow$	—	C7	CB_7

2584 tbl 21

Table 12. SC0-7 Outputs For Different Control Modes

DATA CORRECTION

The tables below indicate which data output bits are corrected depending upon the syndromes and the CODE $ID_{1,0}$ position. The syndromes that determine data correction are, in some cases, syndromes input externally via the CB inputs and, in some cases, syndromes input externally by that EDC (S_i are the internal syndromes and are the same as the value of the SC_i output of that EDC if enabled).

FUNCTIONAL EQUATIONS

The equations below describe the IDT49C460 output values as defined by the value of the inputs and internal states.

DEFINITIONS

$$PA = D_0 \oplus D_1 \oplus D_2 \oplus D_4 \oplus D_6 \oplus D_8 \oplus D_{10} \oplus D_{12} \oplus D_{16} \oplus D_{17} \oplus D_{18} \oplus D_{20} \oplus D_{22} \oplus D_{24} \oplus D_{26} \oplus D_{28}$$

$$\overline{PB} = D_0 \oplus D_3 \oplus D_4 \oplus D_7 \oplus D_9 \oplus D_{10} \oplus D_{13} \oplus D_{15} \oplus D_{16} \oplus D_{19} \oplus D_{20} \oplus D_{23} \oplus D_{25} \oplus D_{26} \oplus D_{29} \oplus D_{31}$$

$$\overline{PC} = D_0 \oplus D_1 \oplus D_5 \oplus D_6 \oplus D_7 \oplus D_{11} \oplus D_{12} \oplus D_{13} \oplus D_{16} \oplus D_{17} \oplus D_{21} \oplus D_{22} \oplus D_{23} \oplus D_{27} \oplus D_{28} \oplus D_{29}$$

$$PD = D_2 \oplus D_3 \oplus D_4 \oplus D_5 \oplus D_6 \oplus D_7 \oplus D_{14} \oplus D_{15} \oplus D_{18} \oplus D_{19} \oplus D_{20} \oplus D_{21} \oplus D_{22} \oplus D_{23} \oplus D_{30} \oplus D_{31}$$

$$PE = D_8 \oplus D_9 \oplus D_{10} \oplus D_{11} \oplus D_{12} \oplus D_{13} \oplus D_{14} \oplus D_{15} \oplus D_{24} \oplus D_{25} \oplus D_{26} \oplus D_{27} \oplus D_{28} \oplus D_{29} \oplus D_{30} \oplus D_{31}$$

$$PF = D_0 \oplus D_1 \oplus D_2 \oplus D_3 \oplus D_4 \oplus D_5 \oplus D_6 \oplus D_7 \oplus D_{24} \oplus D_{25} \oplus D_{26} \oplus D_{27} \oplus D_{28} \oplus D_{29} \oplus D_{30} \oplus D_{31}$$

$$PG = D_8 \oplus D_9 \oplus D_{10} \oplus D_{11} \oplus D_{12} \oplus D_{13} \oplus D_{14} \oplus D_{15} \oplus D_{16} \oplus D_{17} \oplus D_{18} \oplus D_{19} \oplus D_{20} \oplus D_{21} \oplus D_{22} \oplus D_{23}$$

$$PH0 = D_0 \oplus D_4 \oplus D_6 \oplus D_7 \oplus D_8 \oplus D_9 \oplus D_{11} \oplus D_{14} \oplus D_{17} \oplus D_{18} \oplus D_{19} \oplus D_{21} \oplus D_{26} \oplus D_{28} \oplus D_{29} \oplus D_{31}$$

$$PH1 = D_1 \oplus D_2 \oplus D_3 \oplus D_5 \oplus D_8 \oplus D_9 \oplus D_{11} \oplus D_{14} \oplus D_{17} \oplus D_{18} \oplus D_{19} \oplus D_{21} \oplus D_{24} \oplus D_{25} \oplus D_{27} \oplus D_{30}$$

$$PH2 = D_0 \oplus D_4 \oplus D_6 \oplus D_7 \oplus D_{10} \oplus D_{12} \oplus D_{13} \oplus D_{15} \oplus D_{16} \oplus D_{20} \oplus D_{22} \oplus D_{23} \oplus D_{26} \oplus D_{28} \oplus D_{29} \oplus D_{31}$$

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Com'l.	Mil.	Unit
V_{TERM}	Terminal Voltage with Respect to GND	–0.5 to V_{CC} + 0.5V	–0.5 to V_{CC} + 0.5V	V
V_{CC}	Power Supply Voltage	-0.5 to +7.0	-0.5 to +7.0	V
T_A	Operating Temperature	0 to +70	–55 to +125	°C
T_{BIAS}	Temperature Under Bias	–55 to +125	–65 to +135	°C
T_{STG}	Storage Temperature	–55 to +125	–65 to +150	°C
I_{OUT}	DC Output Current	30	30	mA

NOTE: 2584 tbl 24

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

CAPACITANCE (T_A = + 25°C, f = 1.0MHz)

Symbol	Parameter (1)	Conditions	Typ.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	5	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7	pF

NOTE: 2584 tbl 25

1. This parameter is sampled and not 100% tested.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified: V_{LC} = 0.2V; V_{HC} = V_{CC} – 0.2V
Commercial: T_A = 0°C to +70°C, V_{CC} = 5.0V ± 5%; Military: T_A = –55°C to +125°C, V_{CC} = 5.0V ± 10%

Symbol	Parameter	Test Conditions (1)		Min.	Typ. (2)	Max.	Unit
V_{IH}	Input HIGH Level	Guaranteed Logic HIGH Level(4)		2.0	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level(4)		—	—	0.8	V
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}		—	0.1	10.0	µA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND		—	–0.1	–10.0	µA
V_{OH}	Output HIGH Voltage	V_{CC} = Min.	I_{OH} = 300µA	V_{CC}	—	—	V
			I_{OH} = –12mA Mil.	2.4	4.3	—	
			I_{OH} = –15mA Com'l.	2.4	4.3	—	
V_{OL}	Output LOW Voltage	V_{CC} = Min.	I_{OL} = 300µA	—	—	GND	V
			I_{OL} = 12mA Mil.	—	0.3	0.5	
			I_{OL} = 16mA Com'l.	—	0.3	0.5	
I_{OZ}	Off State (High Impedance) Output Current	V_{CC} = Max.	V_O = 0V	—	–0.1	–20.0	µA
			V_O = V_{CC} (Max.)	—	0.1	20.0	
I_{OS}	Output Short Circuit Current	V_{CC} = Max., V_{OUT} = 0V (3)		–30.0	—	—	mA

NOTES: 2584 tbl 26

1. For conditions shown as Max. or Min. use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, + 25°C ambient and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the circuit test should not exceed one second.
4. These input levels provide zero noise immunity and should only be static tested in a noise-free environment.

DC ELECTRICAL CHARACTERISTICS (Cont'd.)

Commercial: T_A = 0°C to +70°C, V_{CC} = 5.0V ± 5%; Military: T_A = –55°C to +125°C, V_{CC} = 5.0V ± 10%
V_{LC} = 0.2V; V_{HC} = V_{CC} – 0.2V

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
I_{CCQ}	Quiescent Power Supply Current (CMOS Inputs)	V_{CC} = Max.; All Inputs $V_{HC} \le V_{IN}$, $V_{IN} \le V_{LC}$ f_{OP} = 0; Outputs Disabled		—	3.0	10	mA
I_{CCT}	Quiescent Input Power Supply Current (per Input @ TTL High) (5)	V_{CC} = Max., V_{IN} = 3.4V, f_{OP} = 0		—	0.3	0.75	mA/ Input
I_{CCD}	Dynamic Power Supply Current	V_{CC} = Max. $V_{HC} \le V_{IN}$, $V_{IN} \le V_{LC}$ Outputs Open, $\overline{OE}$ = L	MIL. COM'L.	— —	6 6	10 7	mA/ MHz
I_{CC}	Total Power Supply Current (6)	V_{CC} = Max., f_{OP} = 10MHz Outputs Open, $\overline{OE}$ = L 50 % Duty cycle $V_{HC} \le V_{IN}$, $V_{IN} \le V_{LC}$	MIL. COM'L.	— —	60 60	110 80	mA
		V_{CC} = Max., f_{OP} = 10MHz Outputs Open, $\overline{OE}$ = L 50 % Duty cycle V_{IH} = 3.4V, V_{IL} = 0.4V	MIL. COM'L.	— —	70 70	125 95	

NOTES: 2584 tbl 27

5. I_{CCT} is derived by measuring the total current with all the inputs tied together at 3.4V, subtracting out I_{CCQ}, then dividing by the total number of inputs.
6. Total Supply Current is the sum of the Quiescent current and the Dynamic current (at either CMOS or TTL input levels). For all conditions, the Total Supply Current can be calculated by using the following equation:
   $I_{CC} = I_{CCQ} + I_{CCT} (N_T \times D_H) + I_{CCD} (f_{OP})$
   D_H = Data duty cycle TTL high period (V_{IN} = 3.4V).
   N_T = Number of dynamic inputs driven at TTL levels.
   f_{OP} = Operating frequency in Megahertz.

CMOS TESTING CONSIDERATIONS

Special test board considerations must be taken into account when applying high-speed CMOS products to the automatic test environment. Large output currents are being switched in very short periods and proper testing demands that test set-ups have minimized inductance and guaranteed zero voltage grounds. The techniques listed below will assist the user in obtaining accurate testing results:

1) All input pins should be connected to a voltage potential during testing. If left floating, the device may oscillate, causing improper device operation and possible latchup.
2) Placement and value of decoupling capacitors is critical. Each physical set-up has different electrical characteristics and it is recommended that various decoupling capacitor sizes be experimented with. Capacitors should be positioned using the minimum lead lengths. They should also be distributed to decouple power supply lines and be placed as close as possible to the DUT power pins.
3) Device grounding is extremely critical for proper device testing. The use of multi-layer performance boards with radial decoupling between power and ground planes is necessary. The ground plane must be sustained from the performance board to the DUT interface board and wiring unused interconnect pins to the ground plane is recommended. Heavy gauge stranded wire should be used for power wiring, with twisted pairs being recommended for minimized inductance.
4) To guarantee data sheet compliance, the input thresholds should be tested per input pin in a static environment. To allow for testing and hardware-induced noise, IDT recommends using $V_{IL} \le 0V$ and $V_{IH} \ge 3V$ for AC tests.

IDT49C460E AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to +70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC 0–7	To Output: DATA 0–31	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		11	14(2)	10	11	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		9	12	7	9	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		9	10	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	9	↓ 7	↓ 8	ns
		↓	13	—	↑ 7	↑ 8	ns
	CORRECT Not Internal Control Mode		—	11	—	—	ns
	DIAG MODE Not Internal Control Mode		11	18	8	14	ns
	$CODE\ ID_{1,0}$		13(6)	17	12	15	ns
	LE_{IN} From latched to Transparent		16	19	13	16	ns
	LE_{DIAG} From latched to Transparent	↑	11(6)	17	11	13	ns
Internal Control Mode	LE_{DIAG} (Internal Control Mode) From latched to Transparent	↑	11(6)	16	11	13	ns
Internal Control Mode	$DATA_{0-31}$ (Internal Control Mode) Via Diagnostic Latch	↑	11	17(2)	9	11	ns

2584 tbl 70

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	3	3	ns
CB_{0-7} (4)		↓	LE_{IN}	2	3	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	5(15)	0	ns
CB_{0-7} (CODE ID 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	11	0	ns
CB_{0-7} (CODE ID 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	6	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	6	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	13	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	8	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	3	3	ns

NOTE: (15) above applies to correction path.

2584 tbl 71

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	7	0	6	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	7	0	6	ns

2584 tbl 72

MINIMUM PULSE WIDTHS

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	5		ns

NOTES:

2584 tbl 73

1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

PRELIMINARY

IDT49C460D AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to +70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		14	18(2)	12	15	ns
	CB_{0-7} (CODE $ID_{1,0}$ = 00, 11)		11	16	10	12	ns
	CB_{0-7} (CODE $ID_{1,0}$ = 10)		12	12	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	9	↓ 7	↓ 8	ns
		↓	14	—	↑ 7	↑ 8	ns
	CORRECT Not Internal Control Mode		—	12	—	—	ns
	DIAG MODE Not Internal Control Mode		12	20	10	15	ns
	$CODE\ ID_{1,0}$		14(6)	18	13	16	ns
	LE_{IN} From latched to Transparent		17	21	14	17	ns
	LE_{DIAG} From latched to Transparent	↑	12(6)	18	12	14	ns
Internal Control Mode	LE_{DIAG} (Internal Control Mode) From latched to Transparent	↑	12(6)	17	12	14	ns
	$DATA_{0-31}$ (Internal Control Mode) Via Diagnostic Latch	↑	12	19(2)	10	12	ns

2584 tbl 28

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	3	3	ns
CB_{0-7} (4)		↓	LE_{IN}	2	3	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	5(15)	0	ns
CB_{0-7} (CODE ID 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	11	0	ns
CB_{0-7} (CODE ID 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	6	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	6	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	13	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	8	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	3	3	ns

NOTE: (15) above applies to correction path.

2584 tbl 29

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	8	0	10	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	8	0	10	ns

2584 tbl 30

MINIMUM PULSE WIDTHS(6)

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	5		ns

NOTES:

2584 tbl 31

1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460D AC ELECTRICAL CHARACTERISTICS

(Guaranteed Military Range Performance) Temperature range: –55°C to +125°C, V_{CC} = 5.0V ± 10%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-3}$(3)		17	22(2)	16	18	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		13	17	12	14	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		13	14	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	10	↓ 8	↓ 8	ns
		↓	15	—	↑ 8	↑ 9	ns
	CORRECT Not Internal Control Mode		—	13	—	—	ns
	DIAG MODE Not Internal Control Mode		14	22	12	17	ns
	$CODE\ ID_{1,0}$		16(6)	20	15	18	ns
	LE_{IN} From latched to Transparent		18	24	16	19	ns
	LE_{DIAG} From latched to Transparent	↑	14(6)	20	13	16	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	14(6)	19	14	16	ns
Internal Control Mode	$DATA_{0-31}$ Via Diagnostic Latch	↑	14	22 (2)	11	14	ns

2584 tbl 32

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	3	3	ns
CB_{0-7}(4)		↓	LE_{IN}	2	3	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	6(15)	0	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	12	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	8	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	7	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	9	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	16	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	3	3	ns

NOTE: (15) above applies to correction path.

2584 tbl 33

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE\ Byte}_{0-3}$	↓	↑	$DATA_{0-31}$	0	10	0	12	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	10	0	12	ns

2584 tbl 34

MINIMUM PULSE WIDTHS(6)

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	5		ns

NOTES:

2584 tbl 35

1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5F.
6. Not production tested, guaranteed by characterization.

IDT49C460C AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to +70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		19	24(2)	16	20	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		14	21	12	16	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		14	16	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	12	↓ 9	↓ 11	ns
		↓	18	—	↑ 9	↑ 11	ns
	CORRECT Not Internal Control Mode		—	16	—	—	ns
	DIAG MODE Not Internal Control Mode		16	26	11	20	ns
	$CODE\ ID_{1,0}$		18(6)	23	17	21	ns
	LE_{IN} From latched to Transparent		22	28(2)	19	22	ns
	LE_{DIAG} From latched to Transparent	↑	15(6)	24	15	19	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	16(6)	22	15	18	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	15	25(2)	13	16	ns

2584 tbl 36

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	3	4	ns
CB_{0-7}(4)		↓	LE_{IN}	2	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	6(16)	0	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	8	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	8	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	17	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	10	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	19	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	3	3	ns

NOTE: (16) above applies to correction path.

2584 tbl 37

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE\ Byte}_{0-3}$	↓	↑	$DATA_{0-31}$	0	10	0	12	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	10	0	12	ns

2584 tbl 38

MINIMUM PULSE WIDTHS(6)

	Min.		Unit
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	6		ns

NOTES:

2584 tbl 39

1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460C AC ELECTRICAL CHARACTERISTICS

(Guaranteed Military Range Performance) Temperature range: –55°C to +125°C, V_{CC} = 5.0V ± 10%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		22	29(2)	21	24	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		17	23	16	18	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		17	18	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	13	↓ 10	↓ 12	ns
		↓	20	—	↑ 10	↑ 12	ns
	CORRECT Not Internal Control Mode		—	17	—	—	ns
	DIAG MODE Not Internal Control Mode		18	29	12	23	ns
	$CODE\ ID_{1,0}$		21 (6)	26	20	24	ns
	LE_{IN} From latched to Transparent		24	32	21	25	ns
	LE_{DIAG} From latched to Transparent	↑	18 (6)	27	17	21	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	19 (6)	25	18	21	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	18	29(2)	14	18	ns

2584 tbl 40

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	3	4	ns
CB_{0-7}(4)		↓	LE_{IN}	2	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	7(19)	3	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	16	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	10	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	9	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	19	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	12	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	21	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	3	3	ns

Note: (19) above applies to correction path.

2584 tbl 41

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	12	0	14	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	12	0	14	ns

2584 tbl 42

MINIMUM PULSE WIDTHS(6)

	Min.		Unit
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	6		ns

2584 tbl 43

NOTES:
1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5F.
6. Not production tested, guaranteed by characterization.

IDT49C460B AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to +70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		25	30(2)	25	27	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		14	30	17	20	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		16	18	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↓	—	12	↑ 23	↑ 23	ns
		↑	21	—	↓ 23	↓ 23	ns
	CORRECT Not Internal Control Mode		—	23	—	—	ns
	DIAG MODE Not Internal Control Mode		17	26	20	24	ns
	$CODE\ ID_{1,0}$		18(6)	26	21	26	ns
	LE_{IN} From latched to Transparent		27	38 (2)	30	3	ns
	LE_{DIAG} From latched to Transparent	↓	15(6)	29	19	22	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↓	16(6)	32	19	24	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↓	16	32 (2)	20	25	ns

2584 tbl 44

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↑	LE_{IN}	4	4	ns
CB_{0-7}(4)		↑	LE_{IN}	4	4	ns
$DATA_{0-31}$(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	19	0	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	15	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	15	0	ns
CORRECT(4, 6)	↓	↑	$LE_{OUT}/\overline{GENERATE}$	11	0	ns
DIAG MODE(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	17	0	ns
$CODE\ ID_{1,0}$(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	17	0	ns
LE_{IN}(4, 6)	↓	↑	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	4	3	ns

2584 tbl 45

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↑	↓	$DATA_{0-31}$	0	12	0	14	ns
$\overline{OE}_{SC}$	↑	↓	SC_{0-7}	0	12	0	14	ns

2584 tbl 46

MINIMUM PULSE WIDTHS

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↓↑ (Positive–going pulse)	9		ns

2584 tbl 47

NOTES:
1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460B AC ELECTRICAL CHARACTERISTICS

(Guaranteed Military Range Performance) Temperature range: –55°C to +125°C, V_{CC} = 5.0V ± 10%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		28	33(2)	28	30	ns
	CB_{0-7} (CODE $ID_{1,0}$ = 00, 11)		17	33	20	23	ns
	CB_{0-7} (CODE $ID_{1,0}$ = 10)		19	23	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	15	↓ 26	↓ 26	ns
		↓	24	—	↑ 26	↑ 26	ns
	CORRECT Not Internal Control Mode		—	26	—	—	ns
	DIAG MODE Not Internal Control Mode		20	29	23	27	ns
	$CODE\ ID_{1,0}$		21	29	24	29	ns
	LE_{IN} From latched to Transparent		30	41	33	36	ns
	LE_{DIAG} From latched to Transparent	↑	18	32	22	25	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	19	35	22	27	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	19	35(2)	23	28	ns

2584 tbl 48

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	4	4	ns
CB_{0-7} (4)		↓	LE_{IN}	4	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	23	0	ns
CB_{0-7} (CODE ID 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	18	0	ns
CB_{0-7} (CODE ID 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	18	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	23	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	4	3	ns

2584 tbl 49

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	12	0	14	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	12	0	14	ns

2584 tbl 50

MINIMUM PULSE WIDTHS

	Min.		Unit
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	12		ns

2584 tbl 51

NOTES:
1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460A AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to 70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$		To Output: $\overline{MULT\ ERROR}$		Unit
	$DATA_{0-31}$(3)		27	36(2)	30		33		ns
	CB_{0-7} (CODE $ID_{1,0}$ = 00, 11)		16	34	19		23		ns
	CB_{0-7} (CODE $ID_{1,0}$ = 10)		16	20	—		—		ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	12	↓	25	↓	25	ns
		↓	21	—	↑	25	↑	25	ns
	CORRECT Not Internal Control Mode		—	23	—		—		ns
	DIAG MODE Not Internal Control Mode		17	26	20		24		ns
	$CODE\ ID_{1,0}$		18	26	21		26		ns
	LE_{IN} From latched to Transparent		27	38	30		33		ns
	LE_{DIAG} From latched to Transparent	↑	15	29	19		22		ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	16	32	29		24		ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	16	32(2)	20		25		ns

2584 tbl 52

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	5	4	ns
CB_{0-7}(4)		↓	LE_{IN}	5	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	23	0	ns
CB_{0-7} (CODE ID 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	15	0	ns
CB_{0-7} (CODE ID 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	15	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	11	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	17	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	17	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	25	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	5	3	ns

2584 tbl 53

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}$ $Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	12	0	14	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	12	0	14	ns

2584 tbl 54

MINIMUM PULSE WIDTHS

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	9		ns

NOTES:
2584 tbl 55

1. Cl = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with Cl = 5pF and measured to 0.5V change of output level. Testing is performed at Cl = 50pF and correlated to Cl = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460A AC ELECTRICAL CHARACTERISTICS

(Guaranteed Military Range Performance) Temperature range: –55°C to +125°C, V_{CC} = 5.0V ± 10%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		30	39(2)	33	36	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		19	37	22	26	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		19	23	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	15	↓ 28	↓ 28	ns
		↓	24	—	↑ 28	↑ 28	ns
	CORRECT Not Internal Control Mode		—	26	—	—	ns
	DIAG MODE Not Internal Control Mode		20	29	23	27	ns
	$CODE\ ID_{1,0}$		21	29	24	29	ns
	LE_{IN} From latched to Transparent		30	41	33	36	ns
	LE_{DIAG} From latched to Transparent	↑	18	32	22	25	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	19	35	22	27	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	19	35(2)	23	28	ns

2584 tbl 56

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-3}$(4)		↓	LE_{IN}	5	4	ns
CB_{0-7}(4)		↓	LE_{IN}	5	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	27	0	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	18	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	18	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	14	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
LE_{IN}(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	28	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	5	3	ns

2584 tbl 57

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↓	↑	$DATA_{0-31}$	0	12	0	14	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	12	0	14	ns

2584 tbl 58

MINIMUM PULSE WIDTHS

	Min.		Unit
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	12		ns

NOTES:
2584 tbl 59

1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460 AC ELECTRICAL CHARACTERISTICS

(Guaranteed Commercial Range Performance) Temperature range: 0°C to +70°C, V_{CC} = 5.0V ± 5%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		37	49(2)	40	45	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		22	46	26	31	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		22	30	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↑	—	17	↓ 30	↓ 30	ns
		↓	29	—	↑ 30	↑ 30	ns
	CORRECT Not Internal Control Mode		—	31	—	—	ns
	DIAG MODE Not Internal Control Mode		23	35	27	33	ns
	$CODE\ ID_{1,0}$		25	35	29	35	ns
	LE_{IN} From latched to Transparent		37	51	41	45	ns
	LE_{DIAG} From latched to Transparent	↑	21	38	26	30	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↑	22	42	26	33	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↑	22	42(2)	27	34	ns

2584 tbl 60

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↓	LE_{IN}	6	4	ns
CB_{0-7}(4)		↓	LE_{IN}	5	4	ns
$DATA_{0-31}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	30	0	ns
CB_{0-7} ($CODE\ ID$ 00, 11)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
CB_{0-7} ($CODE\ ID$ 10)(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
CORRECT(4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	16	0	ns
DIAG MODE(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	23	0	ns
$CODE\ ID_{1,0}$(4, 6)		↓	$LE_{OUT}/\overline{GENERATE}$	23	0	ns
LE_{IN} (4, 6)	↑	↓	$LE_{OUT}/\overline{GENERATE}$	31	0	ns
$DATA_{0-31}$ (4, 6)			LE_{DIAG}	6	3	ns

2584 tbl 61

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE\ Byte}_{0-3}$	↓	↑	$DATA_{0-31}$	0	15	0	17	ns
$\overline{OE}_{SC}$	↓	↑	SC_{0-7}	0	15	0	17	ns

2584 tbl 62

MINIMUM PULSE WIDTHS

	Min.		
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} ↑↓ (Positive–going pulse)	12		ns

2584 tbl 63

NOTES:
1. CI = 50pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

IDT49C460 AC ELECTRICAL CHARACTERISTICS

(Guaranteed Military Range Performance) Temperature range: –55°C to +125°C, V_{CC} = 5.0V ± 10%
The inputs switch between 0V to 3V with signal measured at the 1.5V level.

PROPAGATION DELAYS(1)

	From Input		To Output: SC_{0-7}	To Output: $DATA_{0-31}$	To Output: $\overline{ERROR}$	To Output: $\overline{MULT\ ERROR}$	Unit
	$DATA_{0-31}$(3)		40	52(2)	44	48	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 00, 11)		25	49	29	34	ns
	CB_{0-7} ($CODE\ ID_{1,0}$ = 10)		25	33	—	—	ns
	$LE_{OUT}/\overline{GENERATE}$	↓	—	20	↑ 33	↑ 33	ns
		↑	32	—	↓ 33	↓ 33	ns
	CORRECT Not Internal Control Mode		—	34	—	—	ns
	DIAG MODE Not Internal Control Mode		26	38	30	36	ns
	$CODE\ ID_{1,0}$		28	38	32	38	ns
	LE_{IN} From latched to Transparent		40	54	44	48	ns
	LE_{DIAG} From latched to Transparent	↓	24	42	29	33	ns
Internal Control Mode	LE_{DIAG} From latched to Transparent	↓	25	47(2)	29	36	ns
	$DATA_{0-31}$ Via Diagnostic Latch	↓	25	47	30	37	ns

2584 tbl 64

SET-UP AND HOLD TIMES RELATIVE TO LATCH ENABLES

From Input		To Input (Latching Data)		Set-up Time Min.	Hold Time Min.	Unit
$DATA_{0-31}$(4)		↑	LE_{IN}	6	4	ns
CB_{0-7}(4)		↑	LE_{IN}	5	4	ns
$DATA_{0-31}$(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	36	0	ns
CB_{0-7} (CODE ID 00, 11)(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	24	0	ns
CB_{0-7} (CODE ID 10)(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	24	0	ns
CORRECT(4, 6)	↓	↑	$LE_{OUT}/\overline{GENERATE}$	20	0	ns
DIAG MODE(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	28	0	ns
$CODE\ ID_{1,0}$(4, 6)		↑	$LE_{OUT}/\overline{GENERATE}$	28	0	ns
LE_{IN}(4, 6)	↓	↑	$LE_{OUT}/\overline{GENERATE}$	37	0	ns
$DATA_{0-31}$(4, 6)			LE_{DIAG}	6	3	ns

2584 tbl 65

OUTPUT ENABLE/DISABLE TIMES(5)

From Input	Enable	Disable	To Output	Enable Min.	Enable Max.	Disable Min.	Disable Max.	Unit
$\overline{OE}\ Byte_{0-3}$	↑	↓	$DATA_{0-31}$	0	15	0	17	ns
$\overline{OE}_{SC}$	↑		SC_{0-7}	0	15	0	17	ns

2584 tbl 66

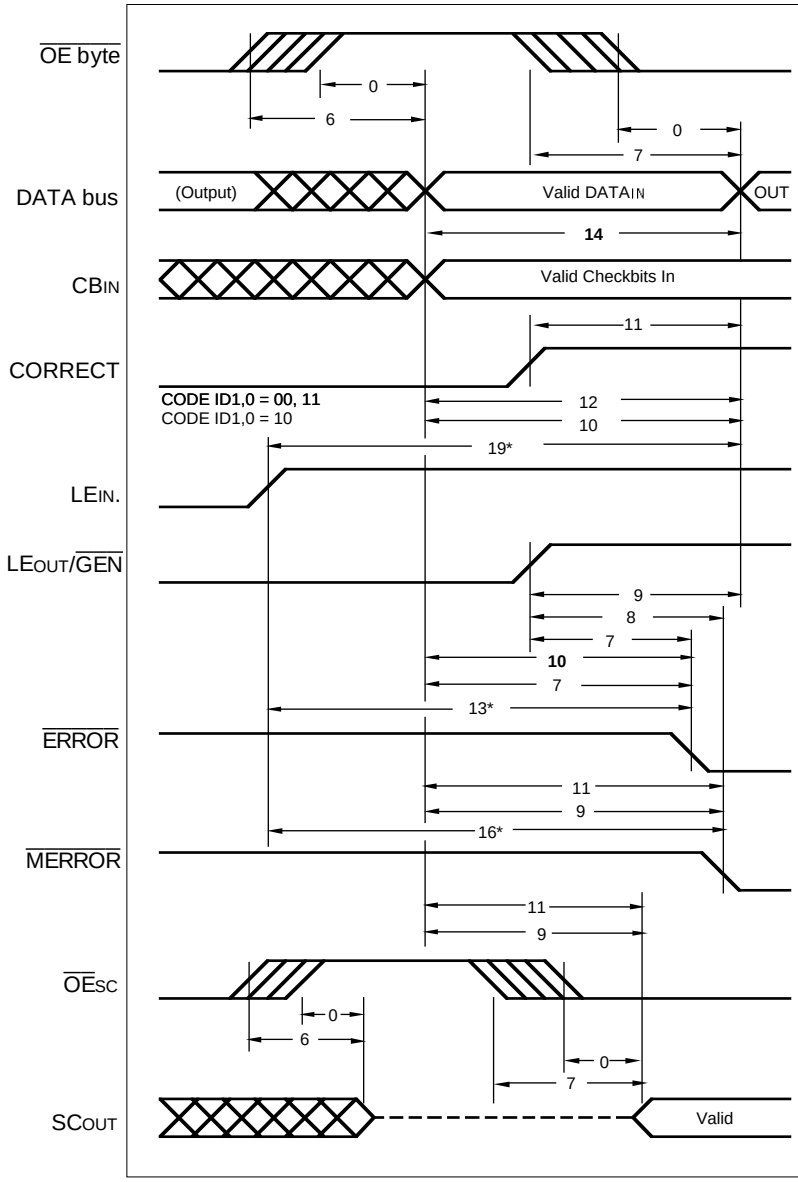
MINIMUM PULSE WIDTHS

	Min.		Unit
LE_{IN}, $LE_{OUT}/\overline{GENERATE}$, LE_{DIAG} (Positive–going pulse)	15		ns

2584 tbl 67

NOTES:
1. CI = 5pF.
2. These parameters are combinational propagation delay calculations, and are not tested in production.
3. Data In or Correct Data Out measurement requires timing as shown in the Switching Waveforms.
4. Set-up and Hold times relative to Latch Enables (Latching Data).
5. Output tests specified with CI = 5pF and measured to 0.5V change of output level. Testing is performed at CI = 50pF and correlated to CI = 5pF.
6. Not production tested, guaranteed by characterization.

DETECT OR CORRECTION MODE (FROM GENERATE MODE)

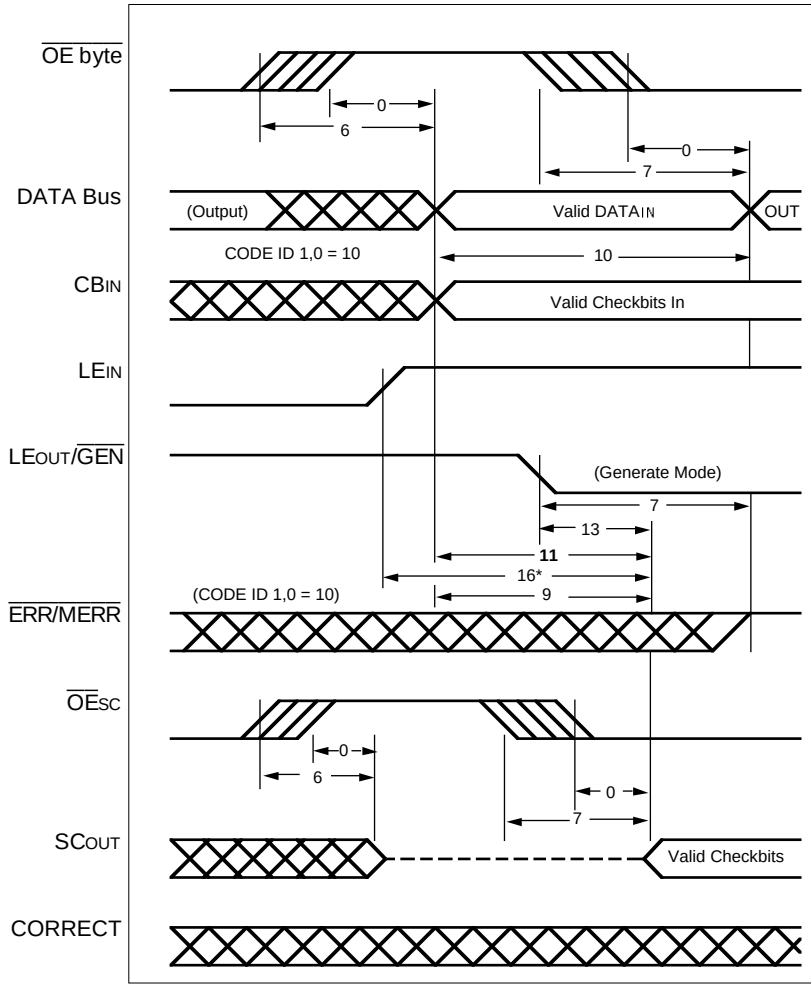


Propagation Delay From	To	Min./Max.
OE byte = High to DATAOUT Disabled		Min.
OE byte = High to DATAOUT Disabled		Max.
OE byte = Low to DATAOUT Enabled		Min.
OE byte = Low to DATAOUT Enabled		Max.
(Corrected DATA if Correct Mode) (DATAIN if Detect Mode)		
DATAIN	**to DATAOUT**	**Max.**
CORRECT = High to DATAOUT		Max.
CBIN	to DATAOUT	Max.
CBIN	to DATAOUT	Max.
*LEIN = High to DATAOUT		Max.
LEOUT/GEN = High to DATAOUT		Max.
LEOUT/GEN = High to MERROR = Low		Max.
LEOUT/GEN = High to ERROR = Low		Max.
DATAIN to ERROR = Low		**Max.**
CBIN to ERROR = Low		Max.
LEIN = High to ERROR = Low		Max.
(Low = Error) DATAIN to MERROR = Low		Max.
CBIN to MERROR = Low		Max.
LEIN = High to MERROR = Low		Max.
(Low = Error) DATAIN to SCOUT		Max.
CBIN to SCOUT		Max.
OESC = High to SCOUT Disabled		Min.
OESC = High to SCOUT Disabled		Max.
OESC = Low to SCOUT Enabled		Min.
OESC = Low to SCOUT Enabled		Max.
(Syndrome Bits Come Out)		

NOTES:
1. BOLD indicates critical parameters.
2. This is "E" version timing spec. Check appropriate table for other speed versions.
* Assumes "CBIN" and/or "DATAIN" are valid at least 4ns before "LEIN" goes high.

2584 drw 10

GENERATE MODE (FROM DETECT OR CORRECTION MODE)



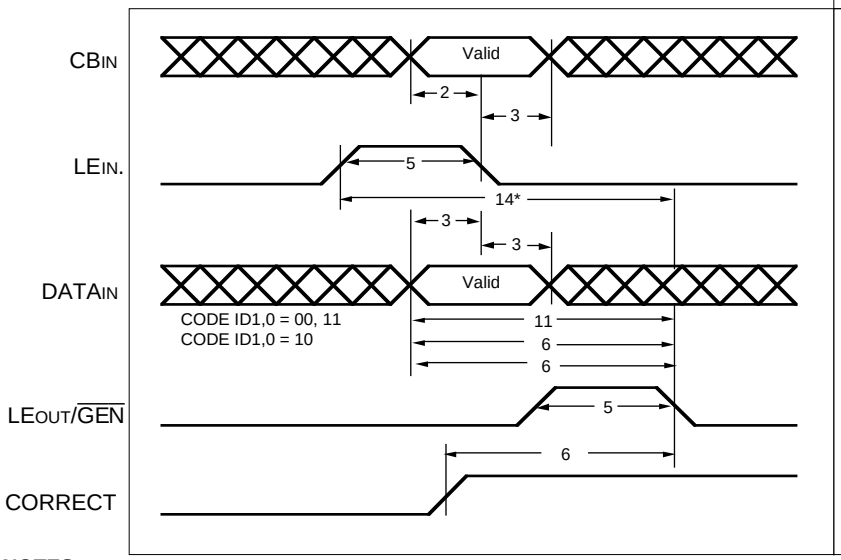
Propagation Delay From	To	Min./Max.
$\overline{OE}$ byte	= High to DATAOUT Disabled	Min.
$\overline{OE}$ byte	= High to DATAOUT Disabled	Max.
$\overline{OE}$ byte	= Low to DATAOUT Enabled	Min.
$\overline{OE}$ byte	= Low to DATAOUT Enabled	Max.
CBIN	to DATAOUT	Max.
LEOUT/$\overline{GENERATE}$	= Low to $\overline{ERROR}$ = High	Max.
LEOUT/$\overline{GENERATE}$	= Low to SCOUT	Max.
DATAIN	**to SCOUT**	**Max.**
*LEIN	= High to SCOUT*	Max.
CBIN	to SCOUT	Max.
(Forced High)		
$\overline{OE}$SC	= High to SCOUT Disabled	Min.
$\overline{OE}$SC	= High to SCOUT Disabled	Max.
$\overline{OE}$SC	= Low to SCOUT Enabled	Min.
$\overline{OE}$SC	= Low to SCOUT Enabled	Max.
(Check Bits Exit)		
(Don't Care)		

2584 drw 09

NOTES:
1. **BOLD** indicates critical parameters.
2. Valiid "DATA" and valid CBIN" are shown to occur simultaneously, since both buses are latched and opened by the "LEIN" input.
3. This is "E" version timing spec. Check appropriate table for other speed versions.

* Assumes DATA bus becomes input 4ns before LEIN goes high.

SET-UP AND HOLD TIMES AND MINIMUM PULSE WIDTHS



Of	Set-up/Hold Time With Respect To	Min./Max.
CBIN	Set-up to LEIN = Low	Min.
CBIN	Hold to LEIN = Low	Min.
LEIN	width	Min.
*LEIN	= High to LEOUT/$\overline{GEN}$ = Low*	Min.
DATA	Set-up to LEIN = Low	Min.
DATA	Hold to LEIN = Low	Min.
CBIN	Set-up to LEOUT/$\overline{GEN}$ = Low	Min.
CBIN	Set-up to LEOUT/$\overline{GEN}$ = Low	Min.
DATA	Set-up to LEOUT/$\overline{GEN}$ = Low	Min.
LEOUT/$\overline{GENERATE}$	Width	Min.
CORRECT	Set-up to LEOUT/$\overline{GEN}$ = Low	Min.

2584 drw 11

NOTES:
1. **BOLD** indicates critical parameters.
2. This is "E" version timing spec. Check appropriate table for other speed versions.

* Enable to enable timing requirement to ensure that the last DATA word applied to "DATAIN" is made available as DATAOUT"; assumes that "DATAIN" is valid at least 4ns before "LEIN" goes high.

INPUT/OUTPUT INTERFACE CIRCUIT

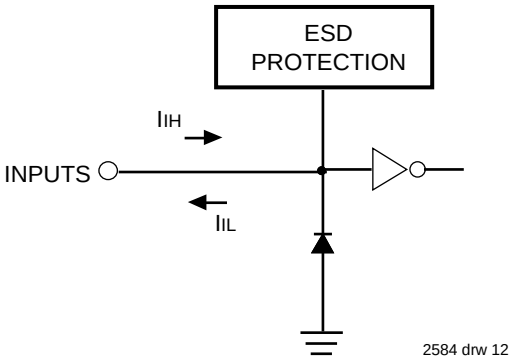


Figure 5. Input Structure (All Inputs)

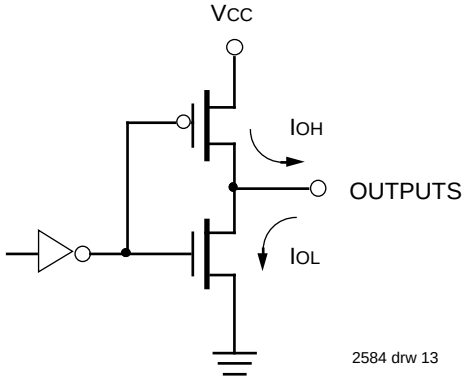
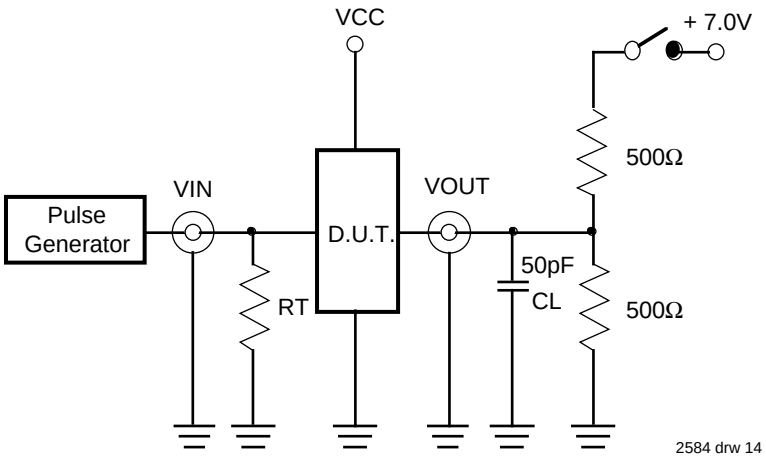


Figure 6. Out put Structure

TEST LOAD CIRCUIT



DEFINITIONS:
C_L = Load capacitance: includes jig and probe capacitance
R_L = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator

Figure 7.

AC TEST CONDITIONS

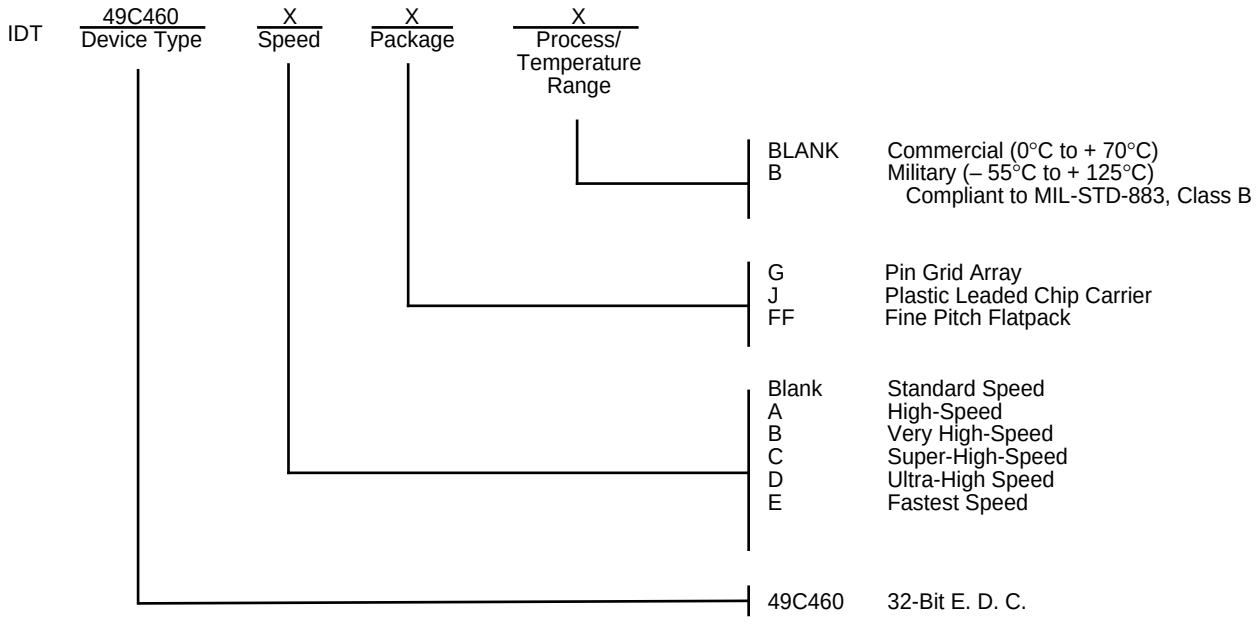
Input Pulse Levels	GND to 3.0V
Input Rise/Fall Times	1V/ns
Input Timing Reference Levels	1.5V
Output Reference Levels	1.5V
Output Load	See Figure 7

2584 tbl 69

Test	Switch
Disable Low Enable Low	Closed
All other Tests	Open

2584 tbl 68

ORDERING INFORMATION



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