

FEATURES

- DS3 payload access, bit-serial or nibble-parallel
- C-bit parity or M13 operating mode
- C-bit interface (13 C-bits in, 14 out)
- Detect and generate DS3 AIS, and idle signals
- Transmit reference generator for serial operation
- Transmit and receive Far End Alarm and Control (FEAC) with double word capability and automatic transmission
- Maskable hardware interrupt for eight alarms
- Transmit single errors: framing, FEBE, C-bit parity, and P-bit parity
- FEBE, C-bit, and P-bit performance counters
- Counters for F-bit and M-bit errors
- Counter for coding violations and excessive zeros
- Transmit-to-Receive and Receive-to-Transmit loopbacks
- Outputs can be set to high-impedance state
- Selectable mode for TXC-03401 emulation
- Single +5 volt power supply
- Available as 68-pin plastic leaded chip carrier or 80-pin thin plastic quad flat package (TQFP)

DESCRIPTION

The DS3F is designed for DS3 framer applications in which broadband payloads are mapped into the 44.736 Mbit/s DS3 frame format. Although the C-bit parity format is recommended, the DS3F can also operate in the M13 mode. In the C-bit parity format, the DS3F provides a separate interface for selected C-bits. The DS3F also provides for transmitting and receiving the FEAC channel and Blue code AIS conditions, and generates and detects DS3 AIS, DS3 idle, P-bit parity and C-bit parity. In addition, performance counters are provided, as well as the ability to generate single framing, FEBE, C-bit parity and P-bit parity errors. The device also provides X-bit inversion, receive loop timing and indications for FEAC idle channel, FEAC word stack overflow and Severely Errored Frame. The payload interface is selectable through software as either a bit-serial or nibble-parallel format.

APPLICATIONS

- Subrate multiplexing
- Wideband data or video transport
- DS3 monitor and test
- Channel extenders
- DS3 test sets

LINE SIDE

TERMINAL SIDE

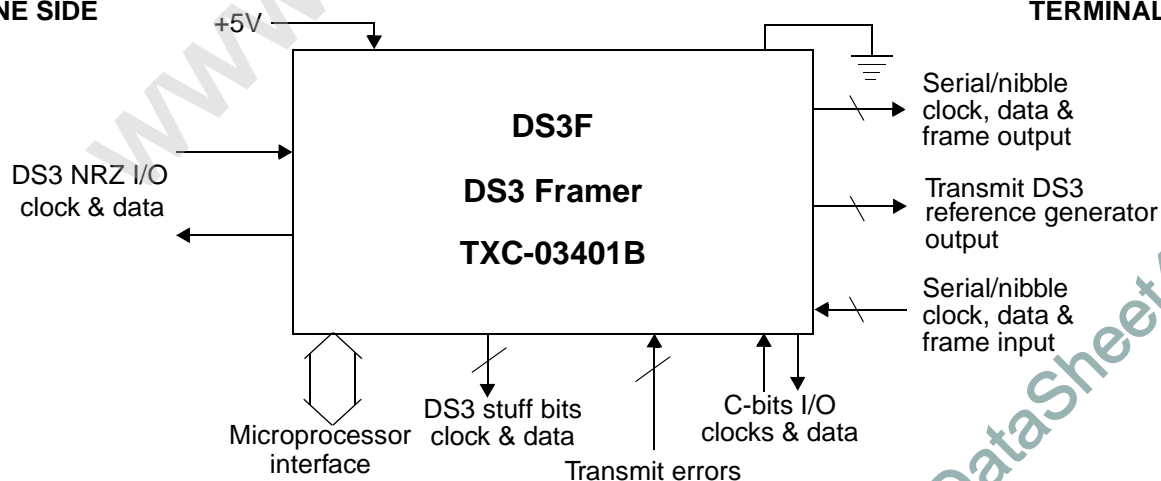


TABLE OF CONTENTS

Section	Page
List of Figures	2
Block Diagram	3
Block Diagram Description	4
Pin Diagrams	6
Pin Descriptions	8
Absolute Maximum Ratings and Environmental Limitations	17
Thermal Characteristics	17
Power Requirements	17
Input, Output And Input/Output Parameters	18
Timing Characteristics	20
Operation	32
Power, Ground And External Components	32
Throughput Delays	32
Memory Map	33
Memory Map Descriptions	34
Package Information	45
Ordering Information	47
Related Products	47
Standards Documentation Sources	48
List of Data Sheet Changes	50
Documentation Update Registration Form*	53

* Please note that TranSwitch provides documentation for all of its products. Current editions of many documents are available from the Products page of the TranSwitch Web site at www.transwitch.com. Customers who are using a TranSwitch Product, or planning to do so, should register with the TranSwitch Marketing Department to receive relevant updated and supplemental documentation as it is issued. They should also contact the Applications Engineering Department to ensure that they are provided with the latest available information about the product, especially before undertaking development of new designs incorporating the product.

LIST OF FIGURES

Figure	Page
1 DS3F TXC-03401B Block Diagram	3
2 DS3F TXC-03401B 68-Pin PLCC Pin Diagram	6
3 DS3F TXC-03401B 80-Pin TQFP Pin Diagram	7
4 Line Side DS3 Receive Input Timing	20
5 Line Side DS3 Transmit Output Timing	21
6 Terminal Side Receive Nibble Output Timing	21
7 Terminal Side Transmit Nibble Input Timing	22
8 Terminal Side Receive Serial Output Timing	23
9 Terminal Side Transmit Serial Input Timing	24
10 C-Bit Transmit Input Timing	25
11 C-Bit Receive Output Timing	26
12 Transmit Reference Generator Timing	27
13 Force Error Timing (C-Bit Parity, P-Bit Parity, FEBE)	28
14 Force Overhead Bit Error Timing	28
15 Stuff Opportunity Bit Timing (M13 Mode)	29
16 Microprocessor Read Cycle	30
17 Microprocessor Write Cycle	31
18 Power Supply Connections	32
19 DS3F TXC-03401B 68-Pin Plastic Leaded Chip Carrier	45
20 DS3F TXC-03401B 80-Pin Thin Profile Plastic Quad Flat Package	46

BLOCK DIAGRAM

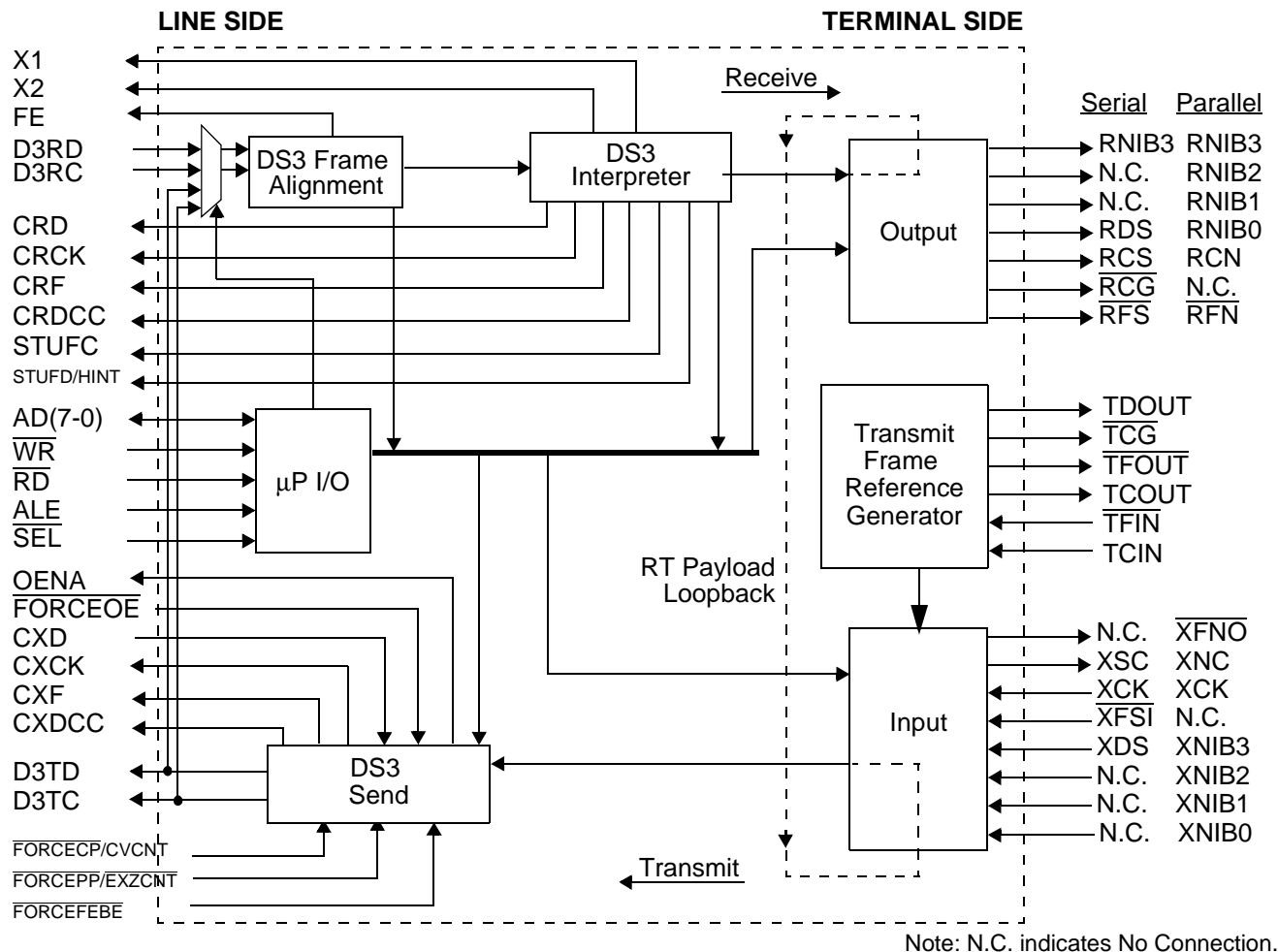


Figure 1. DS3F TXC-03401B Block Diagram

BLOCK DIAGRAM DESCRIPTION

Figure 1 shows the block diagram of the DS3F device.

The DS3F is designed to operate in both "Normal" (N) and "Extended-features" (E) modes of operation. In the Normal mode, the device emulates the TranSwitch TXC-03401 DS3F device. In the Extended-features mode, all the additional capabilities described in this Data Sheet are available. Technical Bulletin TB-511 describes the differences between the TXC-03401 and the TXC-03401B (document number TXC-03401-TB1). Either mode of operation can be selected by setting control bit EMODE in the memory map. Two input pins ($\overline{\text{FORCECP/CVCNT}}$ and $\overline{\text{FORCEPP/EXZCNT}}$) and one output pin (STUFD/HINT) can change their functions according to the mode selected (N/E). Memory map addresses above 07H are effective only in the Extended-features mode.

The DS3F receives a line side DS3 data signal (D3RD) and a clock signal (D3RC) from a line interface device such as the TranSwitch ART/ARTE VLSI device (TXC-02020/02021) or DS3LIM-SN module (TXC-20153D or TXC-20153G). The DS3 Frame Alignment Block performs DS3 frame alignment that will not lock to a false framing pattern. There are internal 8-bit F- and M-bit error counters included in the Extended-features mode of the framer to monitor errors. The DS3F also monitors the signal and the input clock for loss of signal (LOS), out of frame (OOF), and loss of clock (LOC). A framing error (FE) output is provided to indicate when any of the 31 framing bits in the DS3 signal are in error.

The DS3 Interpreter Block performs P-bit and C-bit parity detection and error counting, receive AIS and idle pattern detection, far end block error (FEBE) detection and error counting, far end alarm and control (FEAC) code word detection of up to 4 different types, C-bit reception and X-bit reception. Serial interfaces are provided for the received X-bits and for 14 of the 21 C-bits. In the Extended-features mode, groups of the C-bits can be set by writing to the memory map. The receive C-bit interface consists of a serial data signal (CRD), clock signal (CRCK), framing pulse (CRF), and a data communication link clock signal (CRDCC). The clock signal (CRCK) is gapped and is available only for clocking out C-bits C2 through C6, and C13 through C21. The CRDCC clock signal is present only for C-bits C13, C14 and C15, which are assigned as a data communication channel when operating in the C-bit parity mode. In the Extended-features mode, the timing of the CRDCC receive clock edges can be reversed by setting a control bit in the memory map.

When operating in the M13 mode, an interface (output pin STUFD) that indicates the state of the stuff opportunity bit during each of the seven DS3 subframes and a clock signal (STUFC) are also provided. The Stuff Data Status (STUFD) output pin is shared with the Hardware Interrupt (HINT) pin for the Extended-features mode. The Hardware Interrupt output is used to inform the microprocessor that a severe alarm condition has occurred. The polarity of the Hardware Interrupt output is selectable by a control bit to meet the requirements of the microprocessor's interrupt input pin. When a hardware interrupt does occur, it can be isolated to one of up to up to eight different latched alarm types if they are enabled in the memory map.

The Output Block provides a bit-serial or a nibble-parallel interface for C-bit parity mode. The M13 mode uses the bit-serial interface only. Note that since the sum of the payload and C-bits in a DS3 frame is not evenly divisible by four, M13 nibble mode operation is not feasible. The interface type is selected by writing to a control bit in the memory map (SER), and is common to the DS3F receive and transmit circuitry. The signals provided for the bit-serial interface consist of a data signal (RDS), a clock signal (RCS), a receive clock gap signal ($\overline{\text{RCG}}$) and framing pulse ($\overline{\text{RFS}}$). The nibble-parallel interface consists of the nibble data signal (RNIB3 through RNIB0), a clock out signal (RCN), and a framing pulse output ($\overline{\text{RFN}}$). The RNIB3 bit corresponds to the first bit received in a four-bit serial bit stream segment.

In the transmit direction, the Input Block provides either a bit-serial or nibble-parallel interface. The bit-serial interface consists of a data signal (XDS), clock signals (XCK and optionally XSC), and a framing pulse ($\overline{\text{XFSI}}$). The nibble-parallel interface consists of the nibble data (XNIB3 through XNIB0), a clock out signal (XCK), a framing pulse ($\overline{\text{XFNO}}$), and a nibble clock signal (XNC). The XNIB3 bit corresponds to the first bit transmitted.

The DS3 Send Block performs P-bit and C-bit parity generation, AIS and idle pattern generation, far end alarm and control (single or double FEAC word) transmission, X-bit insertion, and C-bit insertion. For C-bit Parity

mode, the C-bits may be generated internally (such as C-bit parity), written by the microprocessor (such as the FEAC channel), or provided from the external C-bit interface. In C-bit Parity mode, the C1 bit is always transmitted as a 1. The transmit C-bit interface consists of a data input signal (CXD), a clock signal (CXCK), a framing pulse (CXF) and a data communication link clock (CXDCC). For M13 mode, all of the C-bits are input from the terminal side's bit-serial interface. The DS3 transmit line side interface consists of the data signal (D3TD) and a clock signal (D3TC).

DS3F transmit-to-receive (TR) loopback is controlled by setting a bit in the memory map (3LOOP). The entire device is used when loopback is in effect, but the line side input data and clock are blocked (by the gate preceding the DS3 Frame Alignment Block shown in Figure 1). In the Extended-features mode of operation, a receive-to-transmit payload (RTP) loopback is also available by use of control bit RTPLOOP.

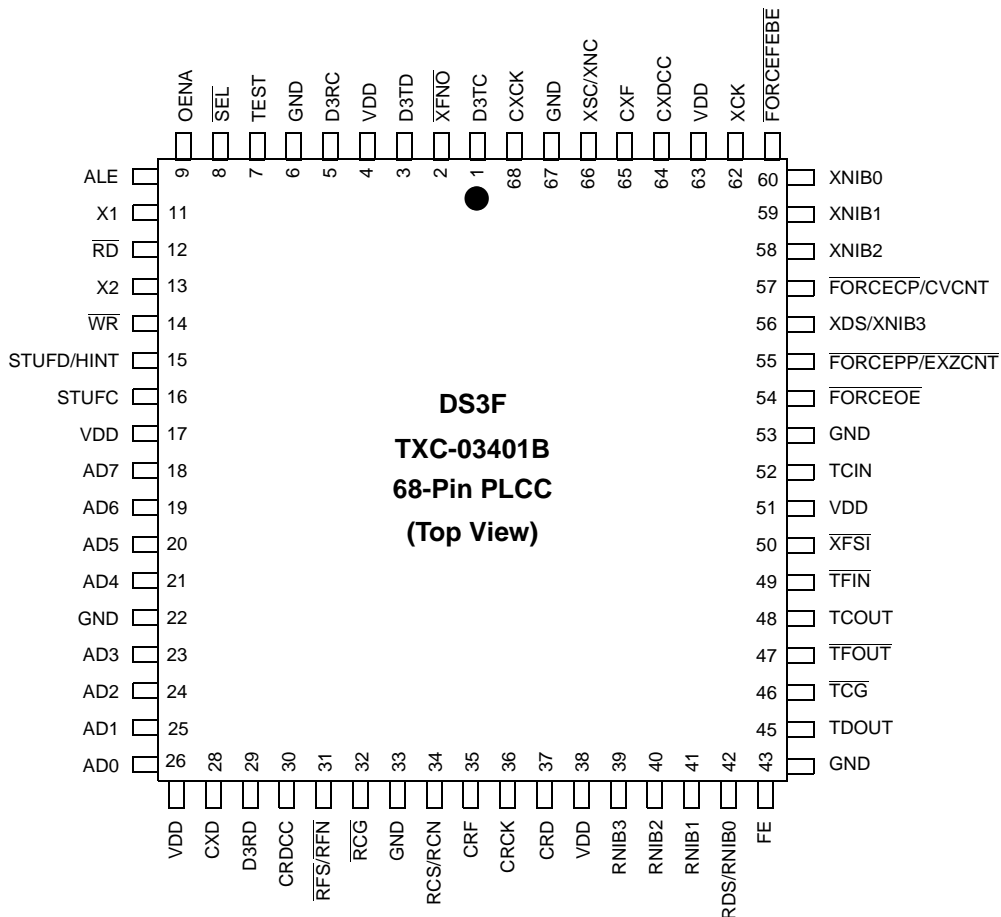
The capability to generate and transmit single overhead bit errors is also provided. External interfaces are provided for transmitting a far end block error ($\overline{\text{FORCEFEBE}}$), a P-bit parity error ($\overline{\text{FORCEPP}}$), a C-bit parity error ($\overline{\text{FORCECP}}$) and an overhead bit error ($\overline{\text{FORCEOE}}$). The $\overline{\text{FORCEOE}}$ signal is used in conjunction with the enable signal (OENA) for introducing an overhead bit error in the next 85-bit segment of the DS3 frame. When the Extended-features mode (EMODE), Coding Violation Enable (CVEN) and Excessive Zeros Enable (EXZEN) control bits in the memory map are set to 1, the Coding Violations Count (CVCNT) function and Excessive Zeros Count ($\overline{\text{EXZCNT}}$) functions pin replace the $\overline{\text{FORCECP}}$ and $\overline{\text{FORCEPP}}$ functions, respectively. The purpose of these pins is to utilize the DS3F's 16-bit counter CVEXZ to count coding violation and/or excessive zeros events. Indications of these events are provided to the DS3F by TranSwitch's ART or ARTE devices (TXC-02020/02021). The ART's CV output pin indicates both coding violations and excessive zeros. Therefore, only the CVCNT input pin to the DS3F is required to count both types of event. When the ARTE is used in conjunction with the DS3F, there are separate CV and $\overline{\text{EXZ}}$ inputs available to the DS3F, which can be or-gated together in the DS3F's 16-bit counter, if required. The DS3F has an internal 16-bit shadow counter incorporated into its counter design. This prevents CV or $\overline{\text{EXZ}}$ counts being lost during a read cycle.

The Transmit Frame Reference Generator Block provides reference timing for bit-serial operation. This block accepts an external 44.736MHz clock signal (TCIN) and derives a clock signal (TCOUT), a framing pulse ($\overline{\text{TFOUT}}$), a clock gap signal ($\overline{\text{TCG}}$) and a data signal (TDOUT). The DS3 data signal consists of framing bits and zeros elsewhere. An optional input framing pulse ($\overline{\text{TFIN}}$) is also provided, but is not required for normal operation.

The DS3F microprocessor bus interface consists of eight bidirectional data and address pins (AD0-AD7), along with other microprocessor control pins. The microprocessor bus is used to write control information and to read status information and alarms. When operating in the Extended-features mode the DS3F memory map contains twenty-one effective addresses (00H-14H), compared with eight (00H-07H) in the Normal mode.

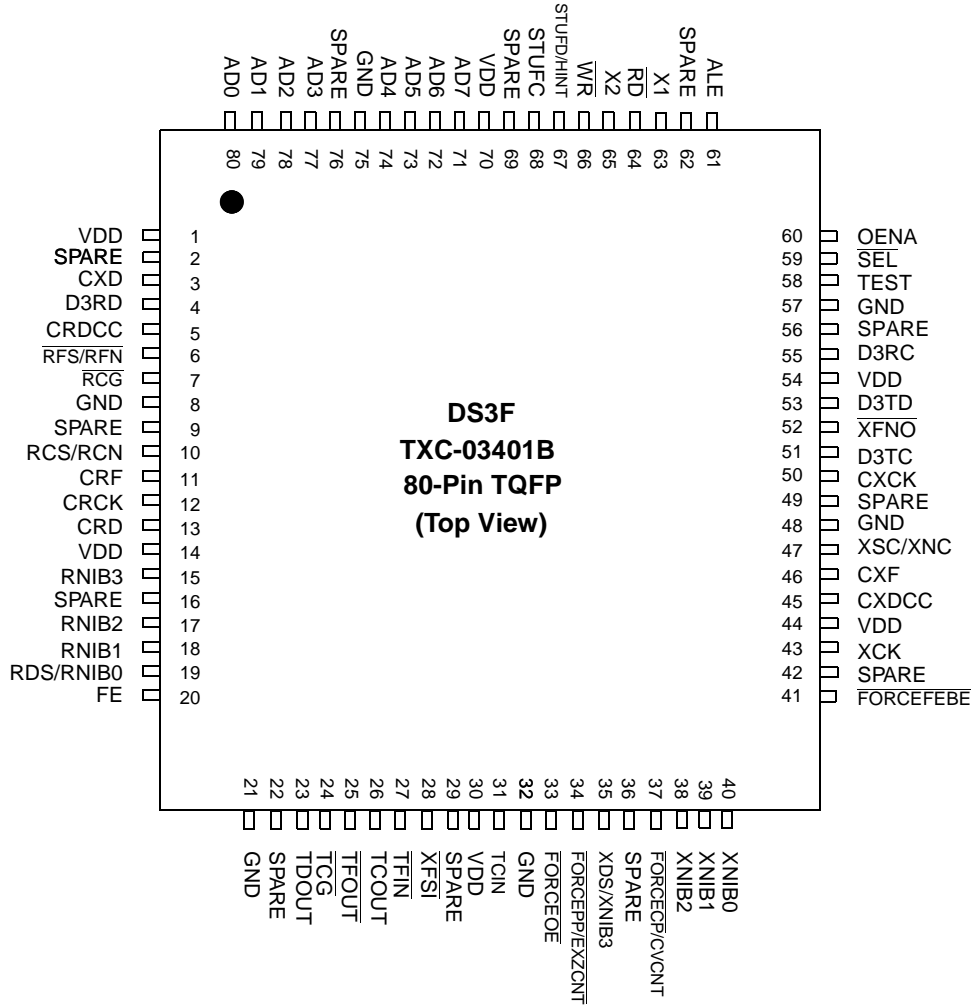
When the DS3F is operating in the Extended-features mode, its many additional features may be activated via control bits in the memory map. These features include: ability to tri-state all output ports, X-bit inversion, receive loop timing, receive and transmit Blue Code AIS conditions, FEAC Idle Channel Indication, a receive FEAC FIFO stack overflow bit, a Severely Errored Frame indication, and double FEAC word handling.

PIN DIAGRAMS



Please see Figure 19 for package dimensions.

Figure 2. DS3F TXC-03401B 68-Pin PLCC Pin Diagram



Please see Figure 20 for package dimensions.

Figure 3. DS3F TXC-03401B 80-Pin TQFP Pin Diagram



PIN DESCRIPTIONS

POWER SUPPLY AND GROUND

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P*	Type	Name/Function
VDD	4, 17, 27 38, 51, 63	1, 14, 30 44, 54, 70	P		VDD: +5 volt supply voltage, $\pm 5\%$
GND	6, 22, 33 44, 53, 67	8, 21, 32 48, 57, 75	P		Ground: 0 volts reference.
SPARE	-	2, 9, 16, 22 29, 36, 42, 49, 56, 62, 69, 76			SPARE: These pins must not be connected to each other, to ground, or to any external circuit. Connection could impair performance or cause damage.

*Note: I = Input; O = Output; P = Power

DS3 RECEIVE LINE SIDE INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type*	Name/Function
D3RC	5	55	I	CMOS	DS3 Receive Clock: A 44.736 MHz clock used for clocking in receive data, and as the time base for the DS3F receiver. Line side serial data is clocked into the DS3F on rising edges of the clock.
D3RD	29	4	I	TTL	DS3 Receive Data: DS3 line side serial receive data.

* See Input, Output and Input/Output Parameters section for Type definitions.

DS3 TRANSMIT LINE SIDE INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
D3TC	1	51	O	CMOS 4mA	DS3 Transmit Clock: A 44.736 MHz clock that is derived from the transmit clock (XCK) signal and is used for clocking out the line side DS3 data signal. Data (D3TD) is clocked out on rising edges of the clock.
D3TD	3	53	O	CMOS 4mA	DS3 Transmit Data: DS3 line side serial transmit data.



RECEIVE TERMINAL SIDE INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
$\overline{\text{RFS}}$ / RFN	31	6	O	CMOS 4mA	Receive Framing Pulse Serial/Nibble Interface: The framing pulse is active low for one clock cycle (RCS/RCN), and is synchronous with the first bit 1 in the DS3 frame. For the nibble interface, the framing pulse is synchronous with nibble 1175.
RCS/ RCN	34	10	O	CMOS 4mA	Receive Clock Serial/Nibble Interface: Clock used for clocking out the terminal side receive serial and nibble data. This clock is derived from the line side clock (D3RC). Data is clocked out of the DS3F on falling edges of the RCS clock and on rising edges of the RCN clock.
RNIB3 RNIB2 RNIB1 RDS/ RNIB0	39 40 41 42	15 17 18 19	O	TTL 4mA	Receive Nibble/Serial Interface: Nibble data is clocked out on rising edges of the nibble clock (RCN). There are 1176 nibbles provided each frame. The data and clock are stretched to accommodate the 56 individual overhead bits (first bit in the 85-bit group), which are not provided at the interface. The first bit received in a nibble is present on RNIB3. The nibble interface is operational in the C-bit parity operating mode only. Serial data (RDS) consists of all the bits in the frame (including the states of the overhead bits), and is operational in either operating mode, M13 or C-bit parity. Serial data is clocked out on falling edges of the receive clock (RCS). For serial data, a gapped clock signal is generated by the receive circuitry and provided on the RNIB3 pin when control bits SER and RGCEN are both set to 1.
$\overline{\text{RCG}}$	32	7	O	CMOS 4mA	Receive Clock Gap Signal: The active low gap signal is synchronous with each overhead bit in the serial DS3 frame (first bit in the 85-bit group).



DATA SHEET

DS3F
TXC-03401B

TRANSMIT TERMINAL SIDE INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
$\overline{\text{XFNO}}$	2	52	O	TTL 4mA	Transmit Nibble Interface Framing Pulse: An active low, one nibble clock cycle wide (XNC) pulse that occurs during the second nibble time.
$\overline{\text{XFSI}}$	50	28	I	TTLp	Serial Data Transmit Framing Pulse: A framing pulse whose leading edge must be synchronous with bit 1 in the transmit serial data DS3 frame. The DS3F rewrites the 56 overhead bits based on the location of the transmit framing pulse. If this signal is held low for a duration greater than 1 frame, then all register bit positions at Addresses 02H-04H, 05H bit 6 and 08H-14H (except 10H bit 6) will be reset to 0 until the pin is taken high. The $\overline{\text{XFSI}}$ pulse must not be applied while control bit RTPLOOP is set to 1.
XDS/ XNIB3 XNIB2 XNIB1 XNIB0	56 58 59 60	35 38 39 40	I	TTL	Transmit Nibble/Serial Interface: Nibble data is clocked in on rising edges of the nibble clock (XNC). There are 1176 nibbles in each frame. The clock is stretched to accommodate the 56 overhead bits which are not required at the interface. The DS3F inserts the X, F, C, P, and M overhead bits into the transmitted frame based on the framing pulse $\overline{\text{XFNO}}$. The first bit transmitted in a nibble is present on XNIB3. The nibble interface is operational in the C-bit parity mode only. The serial data should consist of all the bits in the frame (4760 bits). The DS3F rewrites the 56 overhead bits in the frame based on the location of the framing pulse $\overline{\text{XFSI}}$, when operating in the C-bit parity mode. In the M13 operating mode, the 21 C-bits are treated as user data, while the other overhead bits (X, F, P, and M bits) are written into the DS3 frame by the DS3F. Serial data is clocked into the DS3F on rising edges of the transmit clock (XCK).
XCK	62	43	I	CMOS	Transmit Clock: Provides the time base for the transmitter in the DS3F. In order to meet cross-connect objectives, the clock must operate at 44.736 Mbit/s with a stability of ± 20 ppm and a duty cycle of $(50 \pm 10)\%$. If XCK fails, the DS3F uses the D3RC receive clock in its place.



DATA SHEET

DS3F
TXC-03401B

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
XSC/ XNC	66	47	O	CMOS 4mA	Transmit Nibble/Serial Clock: Clock signal derived from the Transmit Reference Generator Clock (TCIN). For nibble data, this clock (XNC) is stretched in order to accommodate the 56 overhead bit positions which are not required by the external terminal circuitry for the nibble interface (XNIBn). For serial data, a gapped clock signal (XSC) is generated and provided on this pin when control bits SER and TGCEN are both set to 1. This signal is synchronous with bit 1 in each 85-bit group (56 overhead bits) in the DS3 frame.

TRANSMIT REFERENCE GENERATOR INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
TDOUT	45	23	O	TTL 4mA	Transmit Reference Generator Data Output: DS3 frames are provided on this output that contain either all zeros or all ones. The number of frames with ones is 7 of every 18 frames. The pattern of the ones is one frame of every three for 15 frames and two of the last 3 of the 18-frame group; this completes the 7 of 18 pattern. The purpose of this pattern is to ease the requirement to provide an all-ones and all-zeros C-bit pattern to insure a DS2 frequency that is very nearly equal to its specified value.
$\overline{\text{TCG}}$	46	24	O	TTL 4mA	Transmit Reference Generator Clock Gap Signal: An active low, one clock cycle wide (TCOUT) signal that is synchronous with bit 1 in each 85-bit group (56 overhead bits) in the DS3 frame.
$\overline{\text{TFOUT}}$	47	25	O	TTL 4mA	Transmit Reference Generator Framing Pulse: An active low, one clock cycle wide (TCOUT) pulse that is synchronous with bit 1 in the DS3 frame. May be used as the serial data transmit framing pulse ($\overline{\text{XFSI}}$) if properly delayed such that $\overline{\text{XFSI}}$ is aligned with an overhead-bit clock cycle.



DATA SHEET

DS3F
TXC-03401B

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
TCOUT	48	26	O	CMOS 4mA	Transmit Reference Generator Clock Out: Clock signal that is derived from the transmit reference generator clock input (TCIN). Provides a time base for multiplexing an external payload into the serial signal TDOUT provided by the reference generator. May be used as the transmit input clock (XCK) in the serial mode. Transmit reference generator signals are clocked out on rising edges of this clock.
TCIN	52	31	I	TTL	Transmit Reference Generator Clock In: Provides a time base for generating the various signals in the DS3F transmit reference generator. In order to meet DS3 cross-connect objectives, this clock must operate at 44.736 Mbit/s with a stability of ± 20 ppm and a duty cycle of $(50 \pm 10)\%$.

RECEIVE C-BIT INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
CRDCC	30	5	O	TTL 4mA	C-Bit Receive Data Link Clock: A gapped clock provided for clocking the three data link bits (C13, C14, and C15) into external circuitry from the serial data (CRD). The rising edge of CRDCC indicates when valid data is available. In Extended mode, control bits are available to convert the three cycles into a single envelope pulse and/or to invert the signal's polarity (see Figure 11).
CRF	35	11	O	TTL 4mA	C-Bit Receive Framing Pulse: Provides a time base reference for clocking in the C-bits in a DS3 frame.
CRCK	36	12	O	TTL 4mA	C-Bit Receive Clock: A gapped clock which clocks C-bit data out of the DS3F. The falling edge of CRCK indicates when valid data is available.
CRD	37	13	O	TTL 4mA	C-Bit Receive Data: Serial interface for receiving the following C-bits in the C-bit parity mode: C2, C3, C4, C5, C6, C13, C14, C15, C16, C17, C18, C19, C20, and C21. Availability of data is indicated by the clock signals CRDCC and CRCK, described above.



TRANSMIT C-BIT INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
CXD	28	3	I	TTL	C-Bit Transmit Data: Serial interface for transmitting the following C-bits in the C-bit parity mode: C2, C4, C5, C6, C13, C14, C15, C16, C17, C18, C19, C20, and C21. C-bit data is clocked into the DS3F on rising edges of the C-bit gapped clock (CXCK). A C-bit must be transmitted as a one if not used.
CXDCC	64	45	O	TTL 4mA	C-Bit Transmit Data Link Clock: A gapped clock provided for clocking the three data link bits (C13, C14, and C15). In Extended mode, a control bit is available to convert the three cycles into a single envelope pulse (see Figure 10).
CXF	65	46	O	TTL 4mA	C-Bit Transmit Framing Pulse: Identifies the location of the first C-bit in the DS3 frame.
CXCK	68	50	O	TTL 4mA	C-Bit Transmit Clock: A gapped clock which clocks the external C-bit serial data into the DS3F on rising edges.

OTHER SIGNALS

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
TEST	7	58	I	TTLp	TranSwitch Test Pin: Leave open.
OENA	9	60	O	TTL 4mA	Overhead Enable: An active high signal that enables an overhead error to be introduced into the overhead bit in the next 85th group by placing a low on the FORCEOE pin.
X1	11	63	O	TTL 4mA	DS3 Received X-Bit 1: An output indication of the state of the first X-bit received in the DS3 frame (bit 1). The indication is active until the next X1 state is detected.
X2	13	65	O	TTL 4mA	DS3 Received X-Bit 2: An output indication of the state of the second X-bit received in the DS3 frame (bit 680). The indication is active until the next X2 state is detected.



DATA SHEET

DS3F
TXC-03401B

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
STUFD/HINT	15	67	O	TTL 4mA	<p>Stuff Data Status / Hardware Interrupt: In the Normal mode of operation (EMODE=0), this pin performs the Stuff Data Status function. This output pin provides an indication of the state of the stuff opportunity bit from the receive DS3 frame when operating in the M13 mode. For an M13 DS3 formatted signal, the first stuff opportunity bit occurs in the first bit after F4 (last 85-bit group) in subframe 1, and the last stuff opportunity bit in the frame occurs in the seventh bit after F4 (last 85-bit group) in subframe 7.</p> <p>In the Extended-features mode of operation (EMODE=1), this output pin can be used (if HINTEN=1) to perform the Hardware Interrupt function. It may be used as input to the interrupt pin of the microprocessor. When at least one of the eight interrupt enable mask bits (Address 11H, bits 7-0) is 1, occurrence of a corresponding alarm condition causes the pin to go high. This pin is used to inform the microprocessor that a severe alarm condition has occurred. The Hardware Interrupt signal may be changed to active low by setting control bit HINTINV to 1.</p>
STUFC	16	68	O	TTL 4mA	<p>Stuff Clock: Provided for clocking out the stuff opportunity bit state. The rising edge occurs at the start of the second F-bit in a subframe and the falling edge occurs at the end of the fifth 85-bit group.</p>
FE	43	20	O	TTL 4mA	<p>Framing Error Indication: The FE pin will go high for every F-bit or M-bit framing error. It stays high for a period of 1.9μs (85 clock periods). During an Out of Frame condition the FE pin is held low.</p>
$\overline{\text{TFIN}}$	49	27	I	TTLp	<p>Transmit Framing Input: An optional active low input signal which resets the counters of the Transmit Frame Reference Generator block to zero and holds the output signals of the block to their corresponding states.</p>
$\overline{\text{FORCEOE}}$	54	33	I	TTLp	<p>Force DS3 Overhead Bit Error: An active low signal used in conjunction with the overhead enable signal (OENA) for introducing an overhead bit error in the next transmitted 85-bit group.</p>



DATA SHEET

DS3F
TXC-03401B

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
FORCEPP/ EXZCNT	55	34	I	TTLp	<p>Force P-Bit Parity Error / Excessive Zeros Count: In the Normal mode of operation (EMODE=0), this pin performs the Force DS3 P-Bit Parity Error function. An active low signal generates and transmits a P-bit error by inverting both P-bits. If an active low signal is applied during the first subframe of the DS3 frame, the error is transmitted in that frame. Otherwise the error is transmitted in the next frame.</p> <p>In the Extended-features mode of operation (EMODE=1), this pin performs the Excessive Zeros Count function when EXZEN=1. An internal 16-bit counter, CVEXZ at Addresses 12H and 13H, is incremented when the pin is low during the rising edge of D3RC. This pin is intended to be driven by the $\overline{\text{EXZ}}$ Excessive Zeros output pin of the TranSwitch TXC-02021 ARTE device.</p>
FORCECP/ CVCNT	57	37	I	TTLp	<p>Force C-Bit Parity Error / Coding Violation Count: In the Normal mode of operation (EMODE=0), this pin performs the Force DS3 C-Bit Parity Error function. An active low signal generates and transmits a C-bit parity error when operating in the C-bit parity mode. The error is transmitted by inverting C7, C8 and C9 (C-bit parity value) in subframe 3. If the active low signal is applied during the first subframe of the DS3 frame, the error is transmitted in that frame. Otherwise the error is transmitted in the next frame.</p> <p>In the Extended-features mode of operation (EMODE=1), this pin performs the performs the Coding Violation Count function when CVEN=1. An internal 16-bit counter, CVEXZ at Addresses 12H and 13H, is incremented when the pin is high during the rising edge of D3RC. This pin is intended to be driven by the CV Coding Violation / Excessive Zeros output pin of the TranSwitch TXC-02020 ART device or the CV Coding Violation output pin of the TranSwitch TXC-02021 ARTE device.</p>
FORCEFEBE	61	41	I	TTLp	<p>Force FEBE Error: An active low signal generates and transmits a far end block error (FEBE) when operating in the C-bit parity mode. If the active low signal is applied during the first subframe of the DS3 frame, the error is transmitted in that frame. Otherwise the error is transmitted in the next frame.</p>



DATA SHEET

DS3F
TXC-03401B

MICROPROCESSOR INTERFACE

Symbol	68-Pin PLCC Pin No.	80-Pin TQFP Pin No.	I/O/P	Type	Name/Function
$\overline{\text{SEL}}$	8	59	I	TTL	Microprocessor Select: A low enables the microprocessor to access the DS3F memory map for control, status and alarm information.
ALE	10	61	I	TTL	Address Latch Enable: An active high signal generated by the microprocessor. Used by the microprocessor to hold an address stable during a read/write bus cycle on the falling edge.
$\overline{\text{RD}}$	12	64	I	TTL	Read: An active low signal generated by the microprocessor for reading the registers which reside in the DS3F memory map. The DS3F memory I/O is selected by placing a low on the select pin.
$\overline{\text{WR}}$	14	66	I	TTL	Write: An active low signal generated by the microprocessor for writing to the registers which reside in the memory map. The DS3F memory I/O is selected by placing a low on the select pin.
AD(7-4) AD(3-0)	18-21 23-26	71-74 77-80	I/O	TTL 8mA	Address/Data Bus: These pins constitute the time multiplexed address and data bus for accessing the registers which reside in the DS3F memory map.

**ABSOLUTE MAXIMUM RATINGS AND ENVIRONMENTAL LIMITATIONS**

Parameter	Symbol	Min	Max	Unit	Conditions
Supply voltage	V_{DD}	-0.3	+6.0	V	Note 1
DC input voltage	V_{IN}	-0.3	$V_{DD} + 0.3$	V	Note 1
Storage temperature range	T_S	-55	150	°C	Note 1
Ambient operating temperature range	T_A	-40	85	°C	0 ft/min linear airflow
Moisture Exposure Level	ME	5		Level	per EIA/JEDEC JESD22-A112-A
Relative Humidity, during assembly	RH	30	60	%	Note 2
Relative Humidity, in-circuit	RH	0	100	%	non-condensing
ESD Classification	ESD	Absolute Value 2000		V	Note 3

Notes:

1. Conditions exceeding the Min or Max values may cause permanent failure. Exposure to conditions near the Min or Max values for extended periods may impair device reliability.
2. Pre-assembly storage in non-drypack conditions is not recommended. Please refer to the instructions on the "CAUTION" label on the drypack bag in which devices are supplied.
3. Test method for ESD per MIL-STD-883D method 3015.7.

THERMAL CHARACTERISTICS

Parameter	Min	Type	Max	Unit	Test Conditions
Thermal resistance: junction to ambient for PLCC		40	42	°C/W	0 ft/min linear airflow
Thermal resistance: junction to ambient for TQFP		48.3	50.7	°C/W	0 ft/min linear airflow

POWER REQUIREMENTS

Parameter	Min	Type	Max	Unit	Test Conditions
V_{DD} , supply voltage	4.75	5.0	5.25	V	
I_{DD} , supply current			150	mA	
P_{DD} , supply power			790	mW	Inputs switching

**INPUT, OUTPUT AND INPUT/OUTPUT PARAMETERS****Input Parameters For TTL**

Parameter	Min	Type	Max	Unit	Test Conditions
V_{IH}	2.0			V	$4.75 \leq V_{DD} \leq 5.25$
V_{IL}			0.8	V	$4.75 \leq V_{DD} \leq 5.25$
Input leakage current			10	μA	$V_{DD} = 5.25$
Input capacitance		5.5		pF	

Input Parameters For TTLp

Parameter	Min	Type	Max	Unit	Test Conditions
V_{IH}	2.0			V	$4.75 \leq V_{DD} \leq 5.25$
V_{IL}			0.8	V	$4.75 \leq V_{DD} \leq 5.25$
Input leakage current			0.2	mA	$V_{DD} = 5.25$; Input = 0 volts
Input capacitance		5.5		pF	

Note: Input has an internal pull-up resistor.

Input Parameters For CMOS

Parameter	Min	Type	Max	Unit	Test Conditions
V_{IH}	3.15			V	$4.75 \leq V_{DD} \leq 5.25$
V_{IL}			1.65	V	$4.75 \leq V_{DD} \leq 5.25$
Input leakage current			10	μA	$V_{DD} = 5.25$
Input capacitance		5.5		pF	

Output Parameters For TTL4mA

Parameter	Min	Type	Max	Unit	Test Conditions
V_{OH}	$V_{DD} - 0.5$			V	$V_{DD} = 4.75$; $I_{OH} = -2.0$
V_{OL}			0.4	V	$V_{DD} = 4.75$; $I_{OL} = 4.0$
I_{OL}			4.0	mA	
I_{OH}			-2.0	mA	
t_{RISE}		1.4		ns	$C_{LOAD} = 15$ pF
t_{FALL}		2.7		ns	$C_{LOAD} = 15$ pF

Output Parameters For CMOS4mA

Parameter	Min	Type	Max	Unit	Test Conditions
V_{OH}	$V_{DD} - 0.5$			V	$V_{DD} = 4.75$; $I_{OH} = -4.0$
V_{OL}			0.4	V	$V_{DD} = 4.75$; $I_{OL} = 4.0$



DATA SHEET

DS3F
TXC-03401B

Parameter	Min	Type	Max	Unit	Test Conditions
I _{OL}			4.0	mA	
I _{OH}			-4.0	mA	
t _{RISE}		1.9		ns	C _{LOAD} = 15 pF
t _{FALL}		2.0		ns	C _{LOAD} = 15 pF

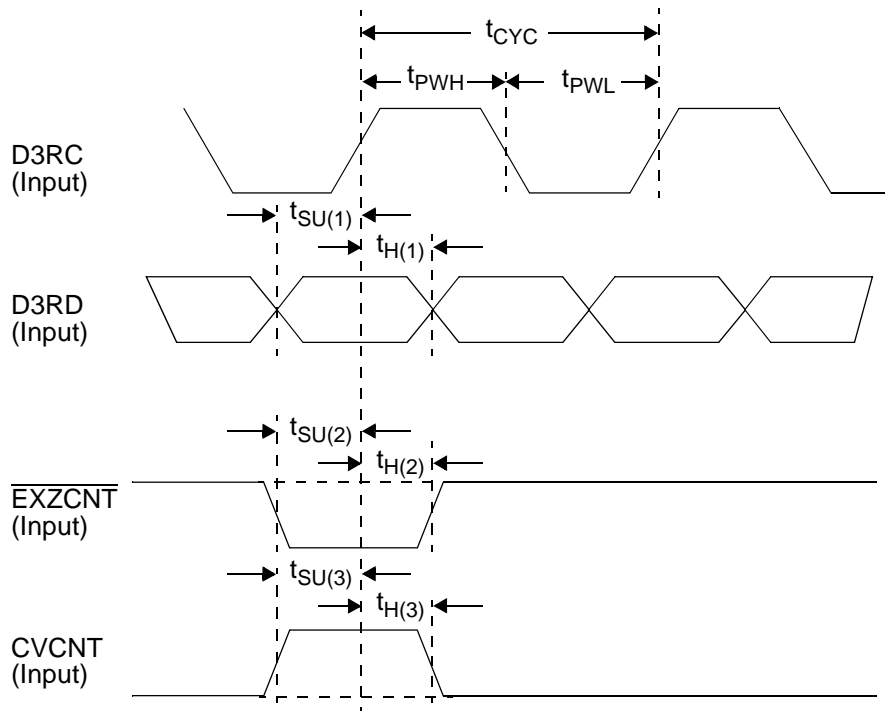
Input/Output Parameters For TTL8mA

Parameter	Min	Type	Max	Unit	Test Conditions
V _{IH}	2.0			V	4.75 ≤ V _{DD} ≤ 5.25
V _{IL}			0.8	V	4.75 ≤ V _{DD} ≤ 5.25
Input leakage current			10	μA	V _{DD} = 5.25
Input capacitance		5.5		pF	
V _{OH}	V _{DD} - 0.5			V	V _{DD} = 4.75; I _{OH} = -4.0
V _{OL}			0.4	V	V _{DD} = 4.75; I _{OL} = 8.0
I _{OL}			8.0	mA	
I _{OH}			-4.0	mA	
t _{RISE}		1.3		ns	C _{LOAD} = 25 pF
t _{FALL}		2.5		ns	C _{LOAD} = 25 pF

TIMING CHARACTERISTICS

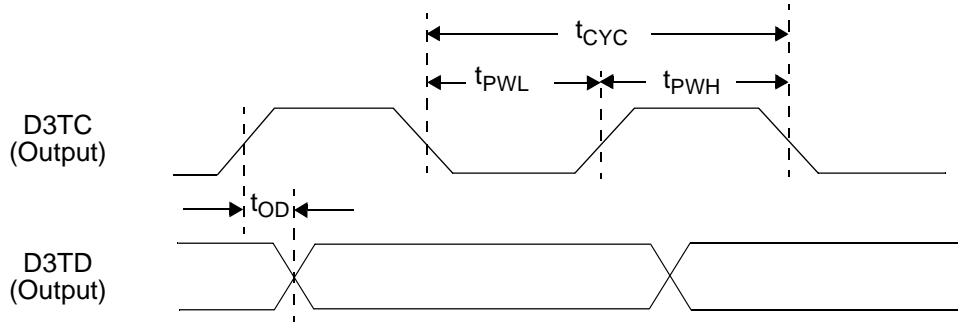
Detailed timing diagrams for the DS3F are illustrated in Figures 3 through 16, with values of the timing intervals tabulated below each diagram. All output times are measured with a maximum 75 pF load capacitance. Timing parameters are measured at voltage levels of $(V_{IH} + V_{IL})/2$ for input signals or $(V_{OH} + V_{OL})/2$ for output signals.

Figure 4. Line Side DS3 Receive Input Timing



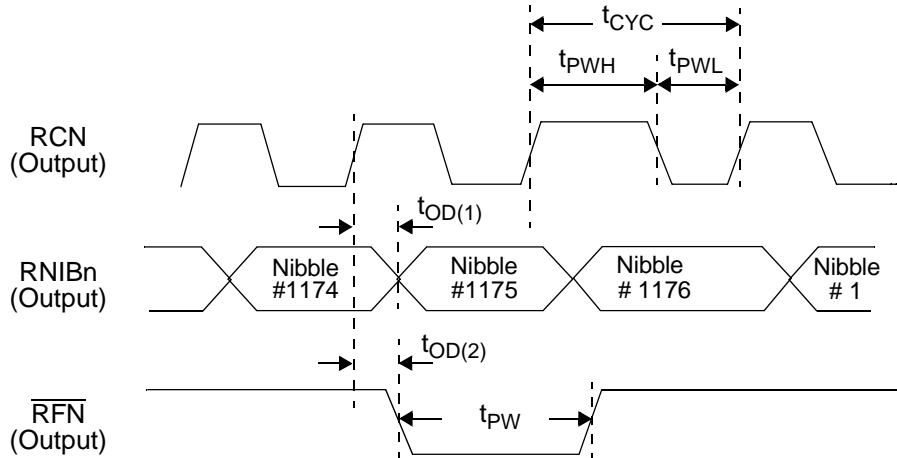
Parameter	Symbol	Min	Type	Max	Unit
D3RC clock period	t_{CYC}	20	22.35		ns
D3RC high time	t_{PWH}	8.0			ns
D3RC low time	t_{PWL}	8.0			ns
D3RC duty cycle (t_{PWH}/t_{CYC})	--	40	50	60	%
D3RD set-up time to D3RC \uparrow	$t_{SU(1)}$	4.0			ns
D3RD hold time after D3RC \uparrow	$t_{H(1)}$	6.0			ns
\overline{EXZCNT} set-up time to D3RC \uparrow	$t_{SU(2)}$	4.0			ns
\overline{EXZCNT} hold time after D3RC \uparrow	$t_{H(2)}$	6.0			ns
CVCNT set-up time to D3RC \uparrow	$t_{SU(3)}$	4.0			ns
CVCNT hold time after D3RC \uparrow	$t_{H(3)}$	6.0			ns

Figure 5. Line Side DS3 Transmit Output Timing



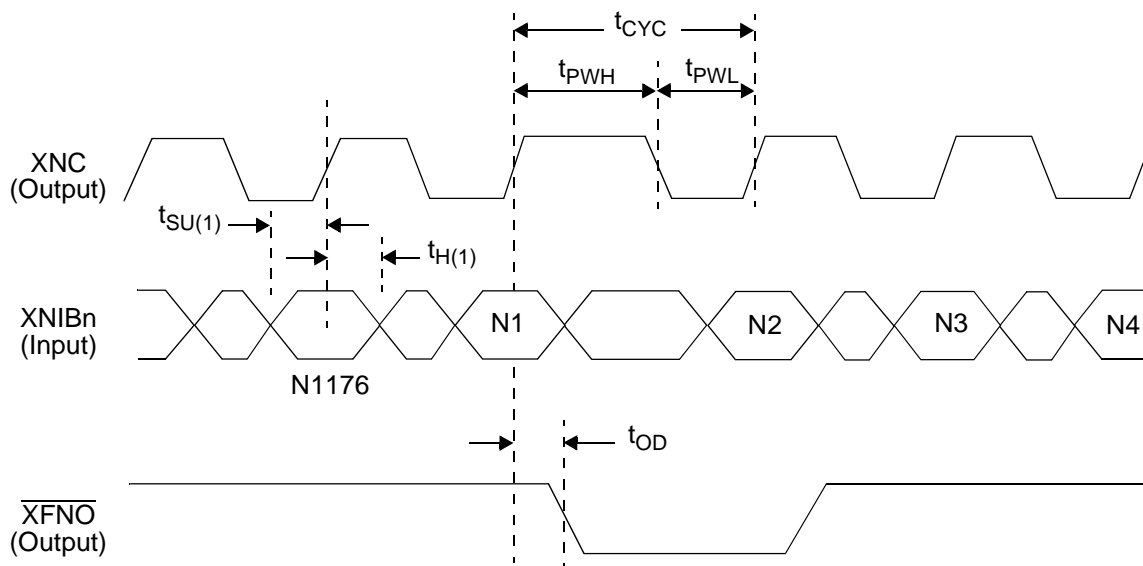
Parameter	Symbol	Min	Type	Max	Unit
D3TC clock period	t_{CYC}	20	22.35		ns
D3TC high time	t_{PWH}	8.0			ns
D3TC low time	t_{PWL}	8.0			ns
D3TD output delay after D3TC \uparrow	t_{OD}	3.0		12	ns

Figure 6. Terminal Side Receive Nibble Output Timing



Parameter	Symbol	Min	Type	Max	Unit
RCN clock period	t_{CYC}	89	90.5	111	ns
RCN high time	t_{PWH}	40			ns
RCN low time	t_{PWL}	40			ns
RNIBn delay after RCN \uparrow	$t_{OD(1)}$	20	23	26	ns
RFN delay after RCN \uparrow	$t_{OD(2)}$	20	23	26	ns
RFN pulse width	t_{PW}	89	$1 \times t_{CYC}$	93	ns

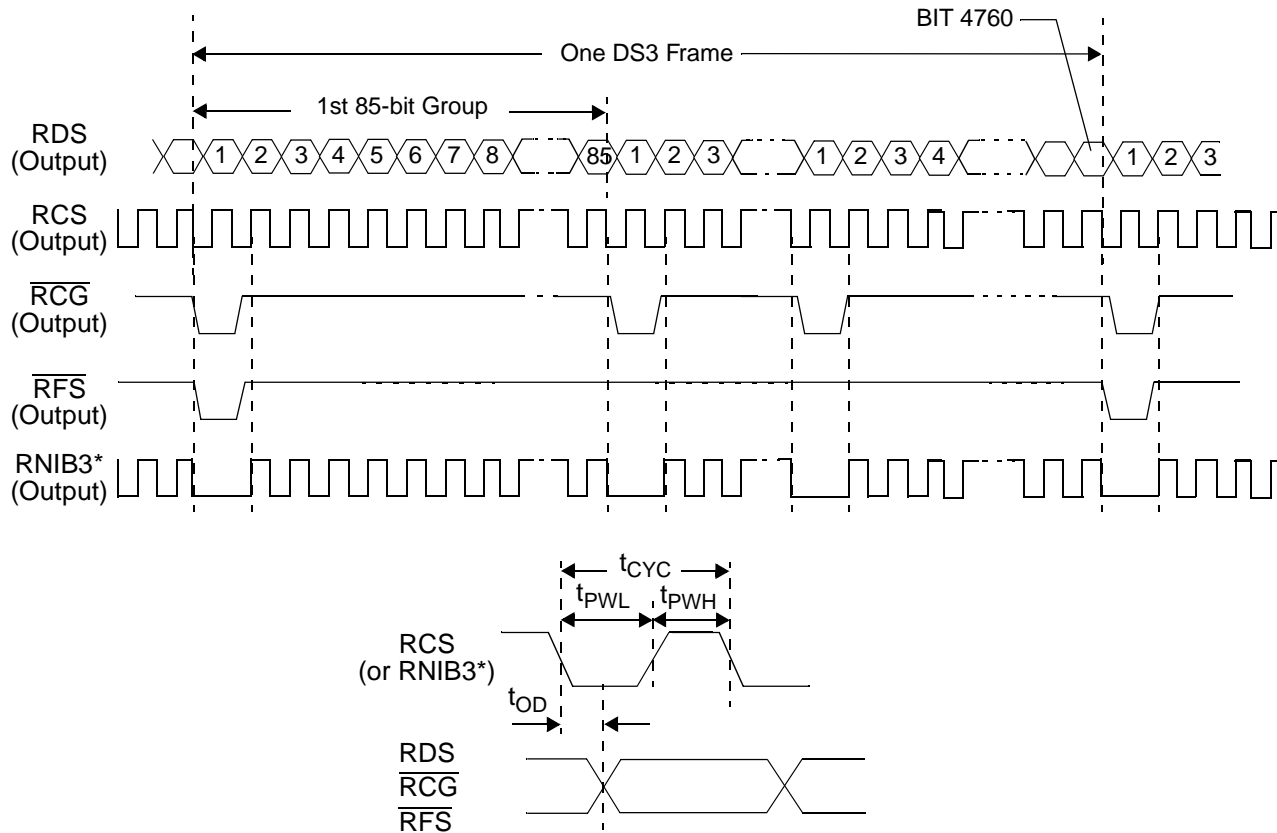
Figure 7. Terminal Side Transmit Nibble Input Timing



Parameter	Symbol	Min	Type	Max	Unit
XNC clock cycle	t_{CYC}	89.0	90.5	111	ns
XNC high time	t_{PWH}	40		63	ns
XNC low time	t_{PWL}	40		50	ns
XNIBn set-up time to XNC \uparrow	$t_{SU(1)}$	26			ns
XNIBn hold time after XNC \uparrow	$t_{H(1)}$	-14			ns
\overline{XFNO} output delay after XNC \uparrow	t_{OD}	0.0	2.0	8.0	ns

Note: XNIB data input is latched at the midpoint of XNC low.

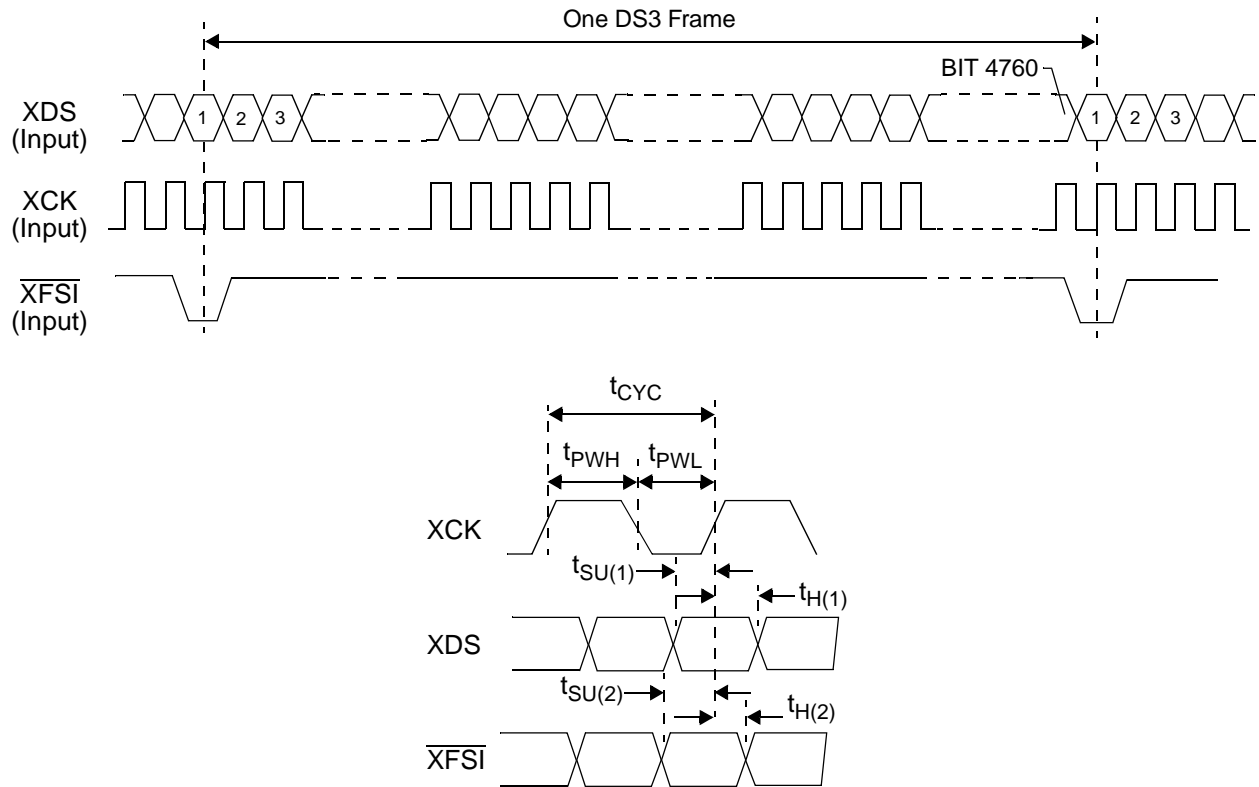
Figure 8. Terminal Side Receive Serial Output Timing



* Note: Waveform generated when control bits SER and RGCEN are both set to 1. The falling edge of RNIB3 substitutes for RCS \emptyset as a timing reference for RDS, RCG and RFS.

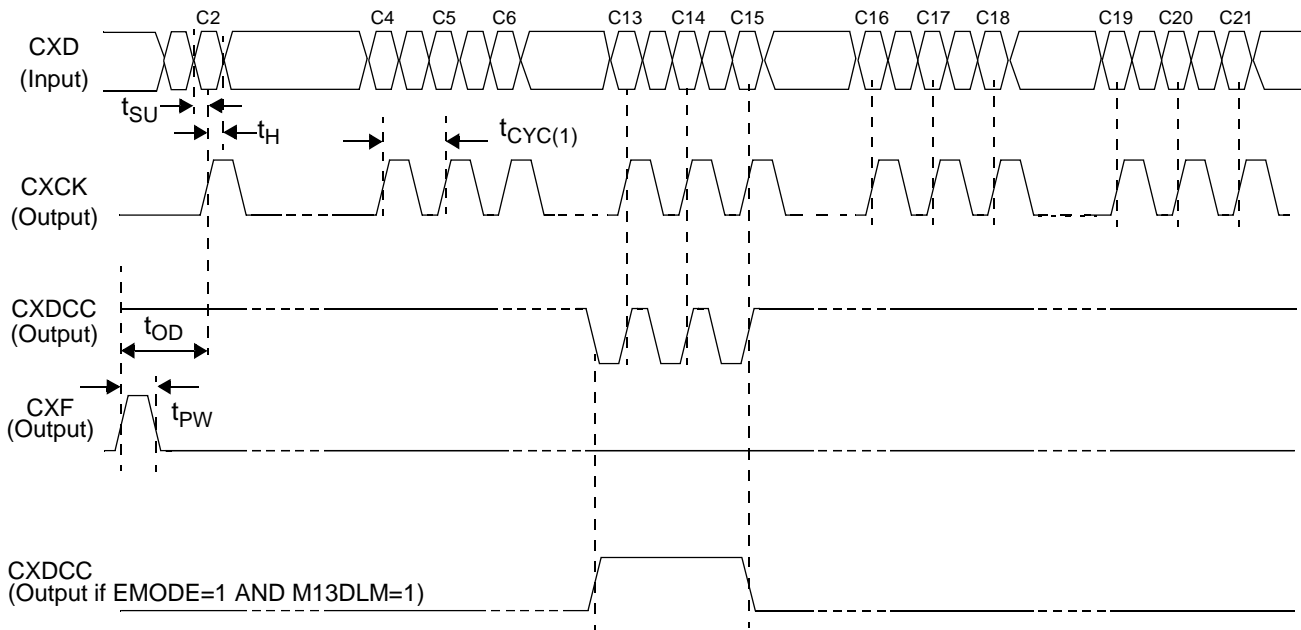
Parameter	Symbol	Min	Type	Max	Unit
RCS clock period	t_{CYC}	20	22.35		ns
RCS high time	t_{PWH}	8.0			ns
RCS low time	t_{PWL}	8.0			ns
RDS, \overline{RCG} , \overline{RFS} output delay after RCS \downarrow or RNIB3 \downarrow	t_{OD}	0.0	2.5	5.0	ns

Figure 9. Terminal Side Transmit Serial Input Timing



Parameter	Symbol	Min	Type	Max	Unit
XCK clock period	t_{CYC}	20	22.35		ns
XCK high time	t_{PWH}	8.0			ns
XCK low time	t_{PWL}	8.0			ns
XDS set-up time to XCK \uparrow	$t_{SU(1)}$	0.0			ns
XDS hold time after XCK \uparrow	$t_{H(1)}$	7.0			ns
\overline{XFSI} set-up time to XCK \uparrow	$t_{SU(2)}$	2.0			ns
\overline{XFSI} hold time after XCK \uparrow	$t_{H(2)}$	5.0			ns

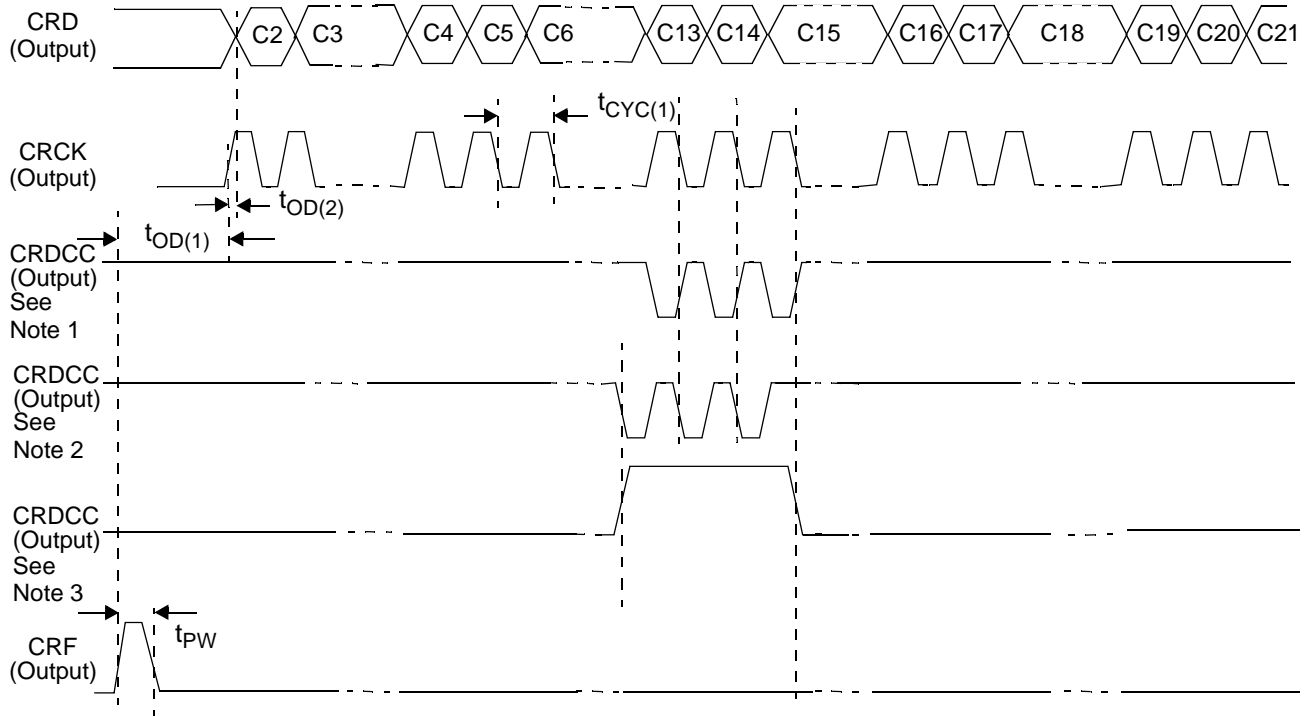
Figure 10. C-Bit Transmit Input Timing



Parameter	Symbol	Min	Type	Max	Unit
CXCK clock period	$t_{CYC(1)}$		$170 \times t_{CYC}$		ns
CXD set-up time to CXCK \uparrow	t_{SU}	20			ns
CXD hold time after CXCK \uparrow	t_H	40			ns
CXCK output delay after CXF \uparrow	t_{OD}		$170 \times t_{CYC}$		ns
CXF pulse width	t_{PW}		$85 \times t_{CYC}$		ns

Note: t_{CYC} is the D3TC clock period (see Figure 5).

Figure 11. C-Bit Receive Output Timing



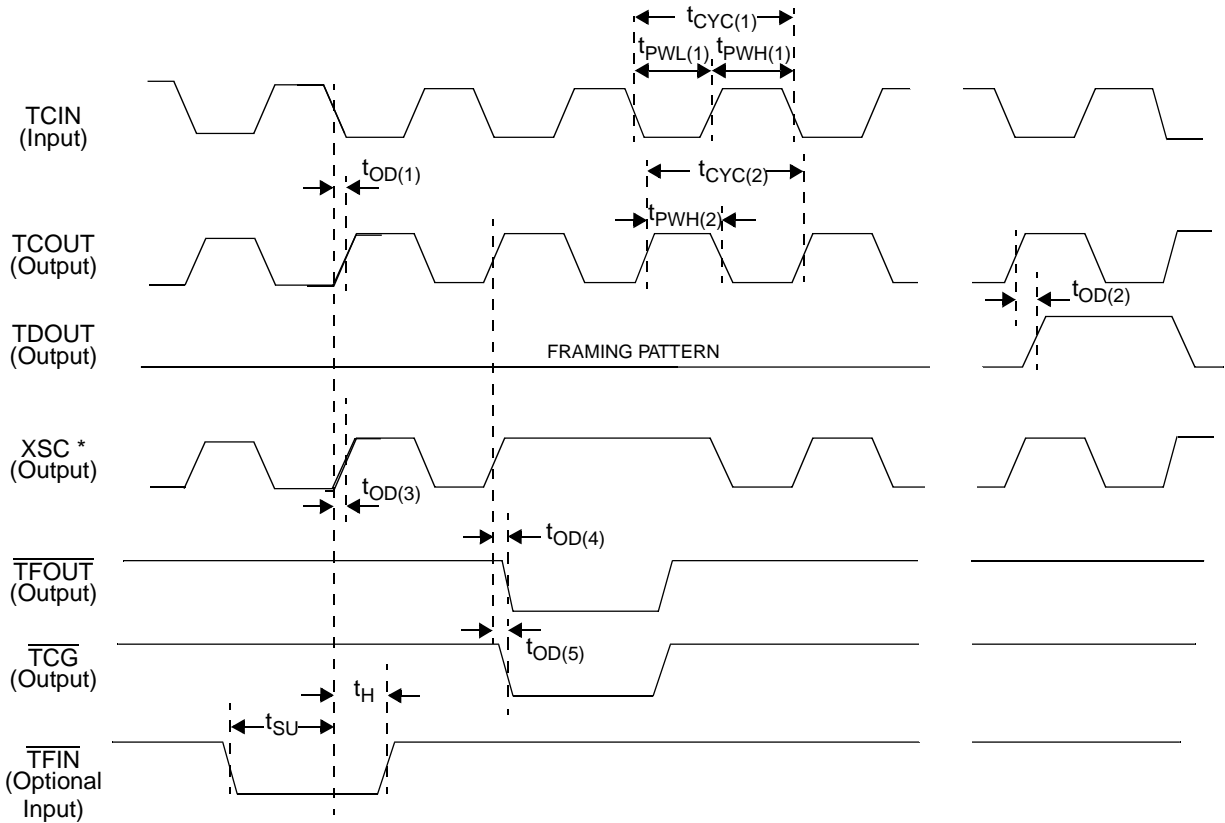
Notes:

1. Output for EMODE=0 or (EMODE=1, CRDCINV=0 and M13DLM=0)
2. Output for (EMODE=1, CRDCINV=1 and M13DLM=0)
3. Output for (EMODE=1, CRDCINV=X and M13DLM=1)

Parameter	Symbol	Min	Type	Max	Unit
CRCK clock period	$t_{CYC(1)}$		$170 \times t_{CYC}$		ns
CRCK output delay after CRF \uparrow	$t_{OD(1)}$		$170 \times t_{CYC}$		ns
CRD output delay after CRCK \uparrow	$t_{OD(2)}$	5.0		30	ns
CRF pulse width (high)	t_{PW}		$85 \times t_{CYC}$		ns

Note: t_{CYC} is the RCS clock period (see Figure 8).

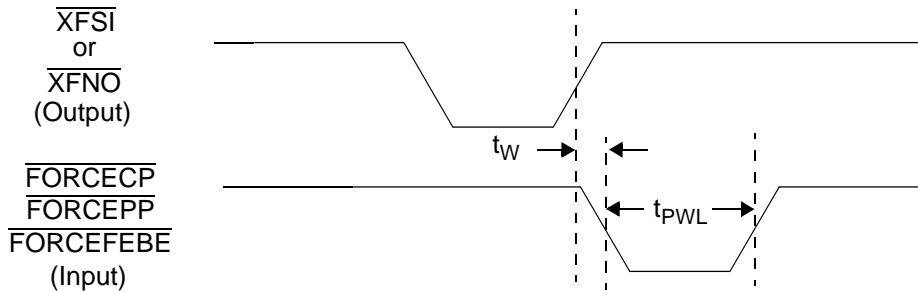
Figure 12. Transmit Reference Generator Timing



* Note: XSC signal occurs at pin 66/47 when control bits SER and TCGEN are both set to 1.

Parameter	Symbol	Min	Type	Max	Unit
TCIN clock period	$t_{CYC(1)}$	20	22.3		ns
TCIN high time	$t_{PWH(1)}$	10	$0.5 \times t_{CYC(1)}$		ns
TCIN low time	$t_{PWL(1)}$	10	$0.5 \times t_{CYC(1)}$		ns
TCIN duty cycle ($t_{PWH(1)}/t_{CYC(1)}$)	--	40	50	60	%
TCOU clock period	$t_{CYC(2)}$	$t_{CYC(1)}$	22.3		ns
TCOU high time	$t_{PWH(2)}$	$t_{PWH(1)}$	$0.5 \times t_{CYC(1)}$		ns
TCOU output delay after TCIN \downarrow	$t_{OD(1)}$	2.0	4.0	12	ns
TDOUT output delay after TCOU \uparrow	$t_{OD(2)}$	2.0	4.0	7.0	ns
XSC output delay after TCIN \downarrow	$t_{OD(3)}$	2.0	4.0	12	ns
TFOU output delay after TCOU \uparrow	$t_{OD(4)}$	2.0	4.0	7.0	ns
TCG output delay after TCOU \uparrow	$t_{OD(5)}$	2.0	4.0	7.0	ns
TFIN set-up time before TCIN \downarrow	t_{SU}	6.0			ns
TFIN hold time after TCIN \downarrow	t_H	2.0			ns

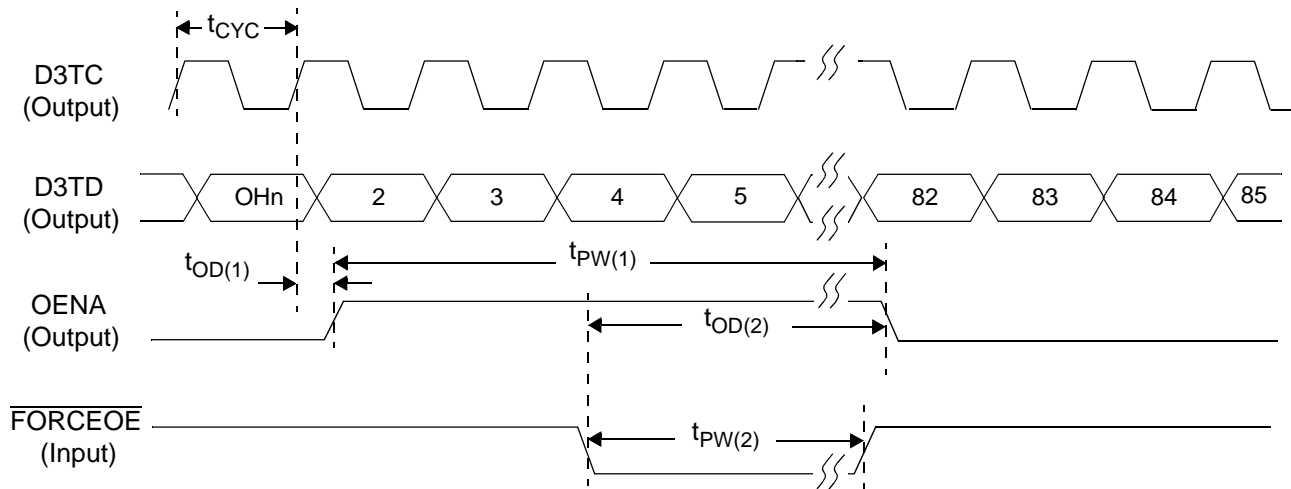
Figure 13. Force Error Timing (C-Bit Parity, P-Bit Parity, FEBE)



Parameter	Symbol	Min	Type	Max	Unit
Force error wait time after framing pulse	t_W			Note	ns
Force error low time	t_{PWL}	20	22		ns

Note: If the force error signal occurs during the first subframe of the DS3 frame (680 XCK clock cycles), then the error occurs during that frame. Otherwise, the error is transmitted in the next frame.

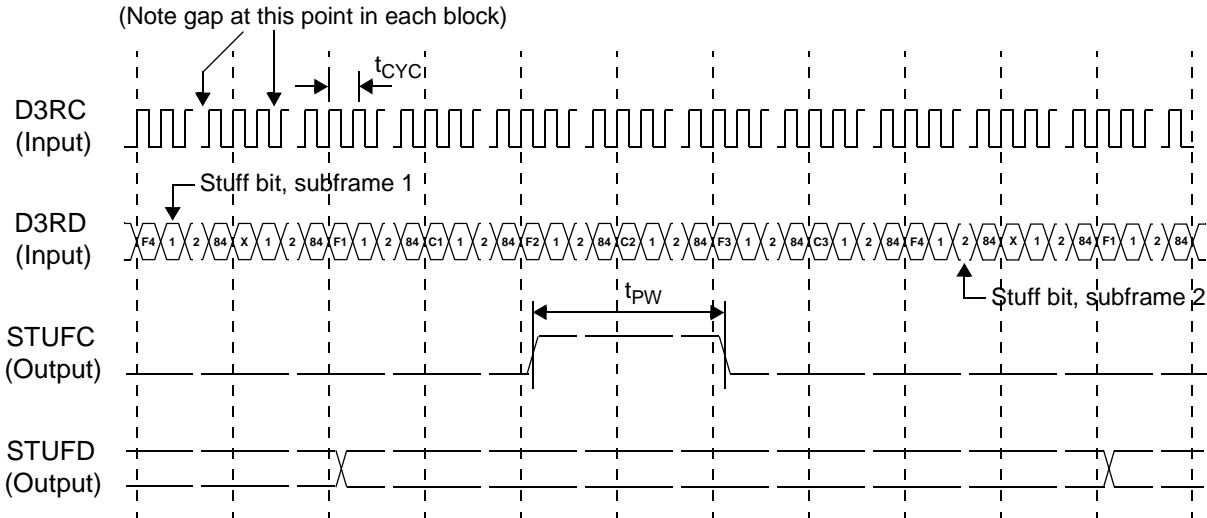
Figure 14. Force Overhead Bit Error Timing



Parameter	Symbol	Min	Type	Max	Unit
D3TC clock period	t_{CYC}	20	22.35		ns
OENA output delay after D3TC \uparrow	$t_{OD(1)}$	0.0		7.0	ns
OENA pulse width (high)	$t_{PW(1)}$	$9 \times t_{CYC}$		$80 \times t_{CYC}$	ns
FORCEOE pulse width (low)	$t_{PW(2)}$	$2 \times t_{CYC}$		$45 \times t_{CYC}$	ns
OENA \downarrow delay from FORCEOE \downarrow	$t_{OD(2)}$	0.0		$2 \times t_{CYC}$	ns

Note: FORCEOE \downarrow resets OENA.

Figure 15. Stuff Opportunity Bit Timing (M13 Mode)

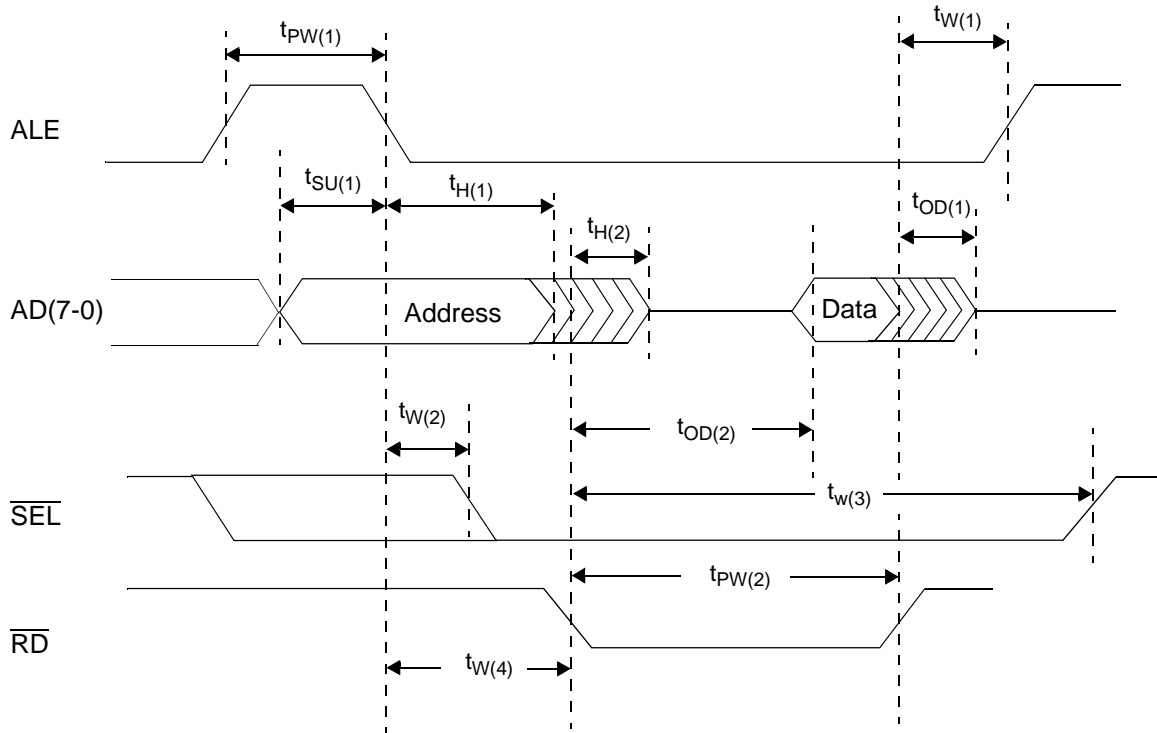


Parameter	Symbol	Min	Type	Max	Unit
D3RC clock period	t_{CYC}		22.35		ns
STUFC pulse width (high)	t_{PW}		3800		ns

Notes:

1. See Figure 4 for timing of the D3RC and D3RD signals.
2. Each block of 85 22.35 ns time slots is 1900 ns in duration.
3. The clock output STUFC is intended to be used to strobe the data output STUFD. It is a low frequency signal that repeats at 15.2 μ s intervals. STUFD has a 3.8 μ s set up time to STUFC \uparrow and a hold time of 11.4 μ s after STUFC \uparrow .

Figure 16. Microprocessor Read Cycle

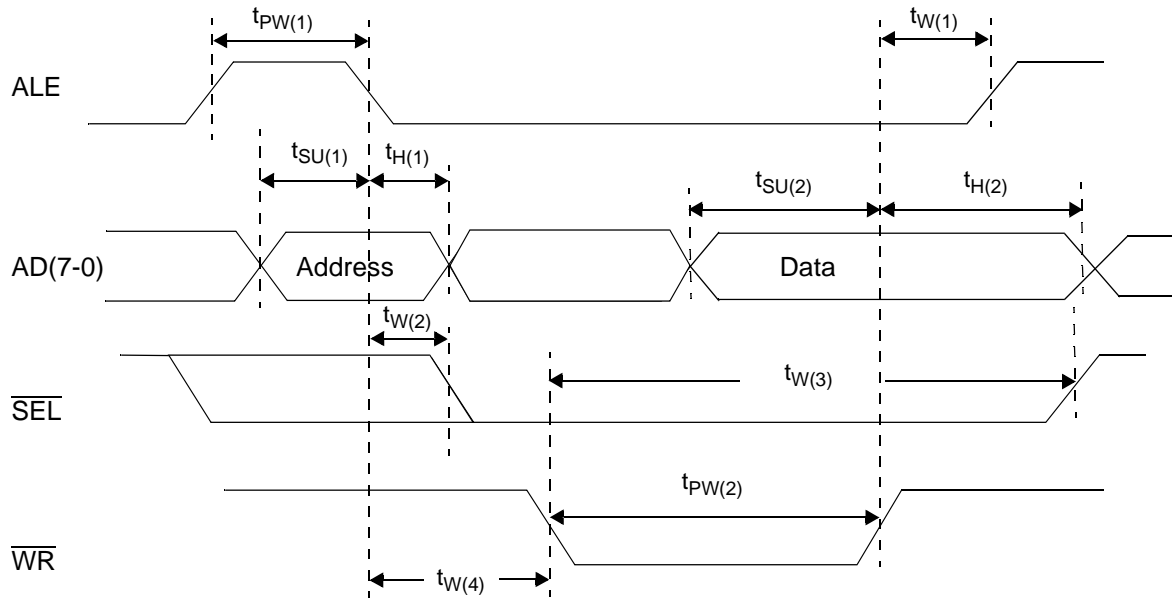


Parameter	Symbol	Min	Type	Max	Unit
ALE pulse width	$t_{PW(1)}$	30			ns
ALE wait after $\overline{RD} \uparrow$	$t_{W(1)}$	0.0			ns
Address set-up time to ALE \downarrow	$t_{SU(1)}$	20			ns
Address hold time after ALE \downarrow	$t_{H(1)}$	10			ns
Address hold time after $\overline{RD} \downarrow$	$t_{H(2)}$			50	ns
Data output delay (to tristate) after $\overline{RD} \uparrow$	$t_{OD(1)}$	10		20	ns
Data output delay after $\overline{RD} \downarrow$	$t_{OD(2)}$			80	ns
\overline{SEL} wait after ALE \downarrow	$t_{W(2)}$			40	ns
\overline{SEL} wait after $\overline{RD} \downarrow$	$t_{W(3)}$	40			ns
\overline{RD} pulse width	$t_{PW(2)}$	100			ns
\overline{RD} wait after ALE \downarrow	$t_{W(4)}$	10			ns

Notes:

1. The transmit clock (XCK) or receive clock (D3RC) must be present for the microprocessor bus interface to operate.
2. A minimum of 10 clock cycles must occur after power-up, before the read cycles are valid.

Figure 17. Microprocessor Write Cycle



Parameter	Symbol	Min	Type	Max	Unit
ALE pulse width	$t_{PW(1)}$	50			ns
ALE wait after $\overline{WR} \uparrow$	$t_{W(1)}$	0.0			ns
Address set-up time to ALE \downarrow	$t_{SU(1)}$	30			ns
Address hold time after ALE \downarrow	$t_{H(1)}$	10			ns
Data set-up time to $\overline{WR} \uparrow$	$t_{SU(2)}$	10			ns
Data hold time after $\overline{WR} \uparrow$	$t_{H(2)}$	20			ns
\overline{SEL} wait after ALE \downarrow	$t_{W(2)}$			40	ns
\overline{SEL} wait after $\overline{WR} \downarrow$	$t_{W(3)}$	70			ns
\overline{WR} pulse width	$t_{PW(2)}$	50			ns
\overline{WR} wait after ALE \downarrow	$t_{W(4)}$	10			ns

Notes:

1. The transmit clock (XCK) or receive clock (D3RC) must be present for the microprocessor bus interface to operate.
2. A minimum of 10 clock cycles must occur after power-up, before the write cycles are valid.

OPERATION

POWER, GROUND AND EXTERNAL COMPONENTS

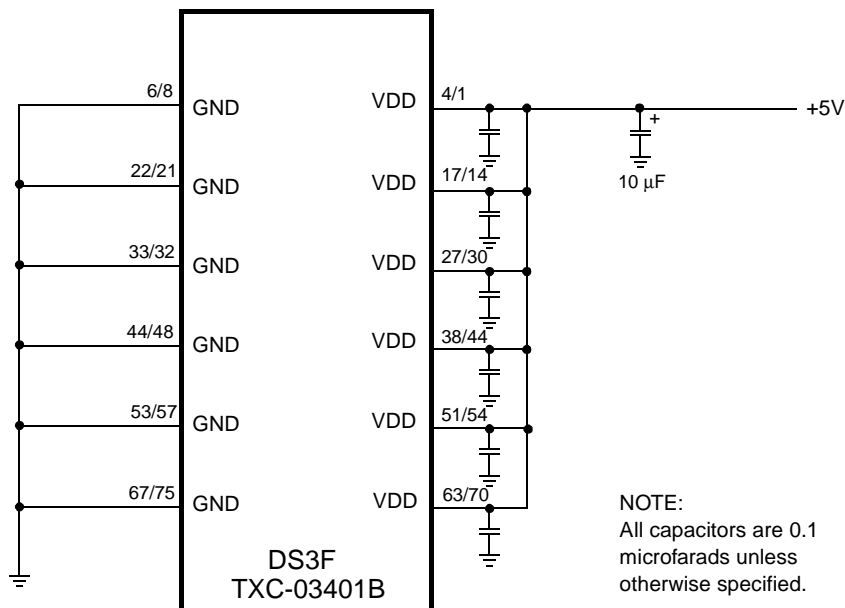


Figure 18. Power Supply Connections

Figure 18 shows the recommended power and ground connection method for the DS3F device. Separate planes should be employed for VDD and GND. Bypass networks consist of a 10 µF capacitor in parallel with 0.1 µF capacitors for each VDD pin, as shown. These 0.1 µF capacitors should be RF-quality and closely connected to each of the device’s VDD pins to decouple them to ground.

THROUGHPUT DELAYS

The DS3F throughput delays for the serial terminal interface are given below in terms of DS3 bit times (1 bit = 22.35 nsec nominal):

1. The throughput delay from the transmit terminal side input to the transmit line side output is 3 bit times.
2. The throughput delay from the receive line side input to the receive terminal side output is 2 bit times.



DATA SHEET

**DS3F
TXC-03401B**

MEMORY MAP

Note: At power-on, the Memory Map register contents are random and should be cleared by a register reset (See Memory Map Descriptions section for addresses affected by the RESET control bit at address 08H, bit 1).

Address (Hex)	Status*	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
00	R	RXLOS	RXOOF	RXAIS	RXIDL	RXLOC	TXLOC	XR2	XR1
01	R/W	NOFEBE	TXAIS	ENAI	TXIDL	M13MODE	SER	3LOOP	XTX
02	R	FEBE / Framing Bit Error Performance Counter (saturating counter, clears when read)							
03	R	C-Bit Parity Error Performance/Number of Frames Counter (saturating counter, clears when read)							
04	R	P-Bit Parity Error Performance Counter (saturating counter, clears when read)							
05	R/W	EMODE	START	FEAC Transmit Data					
06	R	FIDL	NEW	FEAC Receive Data					
07	R(L)	RXLOS	RXOOF	RXAIS	RXIDL	CERR	LOC	X2ERR	X1ERR
08 ***	R/W	FBEC	MBEC	TBLUE	OUTDIS	ITX2	ITX1	RESET	LPTIME
09 ***	R(L)	SEF	Unused**	RBLUE	Unused**	Unused**	Unused**	Unused**	STKOVFL
0A ***	R	F-Bit Error Counter (saturating counter, clears when read)							
0B ***	R	M-Bit Error Counter (saturating counter, clears when read)							
0C ***	R/W	RTPLLEN	RTPLOOP	TESTLOCK	M13DLM	DLCB1	C21	MCB1	CPARINV
0D ***	R/W	VER	DFEXEC	Double FEAC Transmit Data					
0E ***	R/W	FEAC10	Unused**	RGCEN	TGCEN	HINTINV	HINTEN	MOOFW	CRDCINV
0F ***	R	MOREFEAC	FEACVLID	RFEAC6	RFEAC5	RFEAC4	RFEAC3	RFEAC2	RFEAC1
10 ***	R(L)	RXLOS	RXOOF	RXAIS	RXIDL	NEWFEAC	RTLOC	SEF	XERR
11 ***	R/W	RXLOSEN	RXOOFEN	RXAISEN	RXIDLEN	NFEACIEN	RTLOCEN	SEFEN	XERREN
12 ***	R	Coding Violation / Excessive Zeros Counter, low order byte (saturating counter, clears when read)							
13 ***	R	Coding Violation / Excessive Zeros Counter, high order byte (saturating counter, clears when read)							
14 ***	R/W	STFREN	STFTGEN	FORCEFEBE	FORCEPP	FORCECP	TSTCNTR	EXZEN	CVEN

* Note: R = Read-only; R(L) = Read-only, latched (clears on read); R/W = Read/Write.

** Note: All unused read-only bits will contain 0. All unused read/write bits are to be set to 0 by the application software.

*** Note: Addresses 08H through 14H are enabled only when control bit EMODE at Address 05H, Bit 7 is set to 1.



MEMORY MAP DESCRIPTIONS

Address	Bit	Symbol	Description
00	7	RXLOS	Receive DS3 Loss of Signal: A receive LOS alarm occurs when the incoming DS3 data (D3RD) is stuck low for at least 2048 clock cycles (D3RC). Recovery occurs when two or more ones are detected in the incoming data bit stream.
	6	RXOOF	Receive DS3 Out of Frame: A receive OOF occurs when, in a sliding window of 16 F-bits, three F-bits are in error, or when there are M-bit errors in two frames of a window of three (MOOFW=1) or four (MOOFW=0) consecutive frames. Recovery occurs when 16 consecutive error-free F-bits are detected in the repeating 1001 F-bit framing pattern, followed by the M-bit pattern of 010 being detected for two consecutive frames. Recovery takes approximately 0.95 milliseconds, worst case. An OOF also inhibits the performance counters at Addresses 02H, 03H, 04H, 0AH and 0BH. The terminal output during an RXOOF condition is the received data.
	5	RXAIS	Receive DS3 Alarm Indication Signal (AIS): A Receive DS3 AIS condition is declared, and the RXAIS bit is set to 1, when RXOOF is 0 and all of the following events have occurred during a frame: the three C-bits in each subframe have been 0 for five consecutive frames, at least 95% of the payload of each subframe has contained a repeating 1010.... bit sequence which begins after each overhead bit for five consecutive frames, and the latest X-bit received is the sixteenth or higher to have arrived with a 1 value in the most recent nineteen X-bits received (i.e., sixteen or more 1 values have occurred since there was an accumulated total of four 0 values). Recovery to 0 occurs during the first subsequent subframe when one of these events could occur but does not. AIS detection conforms to the bit error rate requirement stated in Bellcore document TR-TSY-000191 (Issue 1, May 1986), "Alarm Indication Signal Requirements and Objectives."
	4	RXIDL	Receive DS3 Idle: A Receive DS3 Idle condition is declared, and the RXIDL bit is set to 1, when RXOOF is 0 and all of the following events have occurred during a frame: the C7, C8 and C9 bits in subframe 3 are 0, at least 95 per cent of the payload of each subframe contains a repeating 1100.... bit sequence which begins after each overhead bit for a period of one frame, and the latest X-bit received is the sixteenth or higher to have arrived with a 1 value in the most recent nineteen X-bits received (i.e., sixteen or more 1 values have occurred since there was an accumulated total of four 0 values). Recovery to 0 occurs at the end of the first subsequent frame during which not all of these events occur.
	3	RXLOC	Receive DS3 Loss of Clock: An alarm occurs when there are no transitions in the receive clock (D3RC) for seven or more XCK clock cycles. XCK clock must be present to count D3RC cycles. Recovery occurs on the first transition of D3RC.
	2	TXLOC	Transmit DS3 Loss of Clock: An alarm occurs when there are no transitions in the transmit clock (XCK) for seven or more D3RC receive clock cycles. D3RC clock must be present to count XCK cycles. A failure causes the receive clock to become the transmit clock. This permits the microprocessor interface and transmitter to continue to function. Recovery occurs on the first transition of XCK.



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
00 (cont.)	1	XR X2	Receive X-Bit Number 2: This bit position indicates the receive state of X2. This bit position is updated each frame.
	0	XR X1	Receive X-Bit Number 1: This bit position indicates the receive state of X1. This bit position is updated each frame.
01	7	NOFEBE	FEBE Transmission Disabled: A one written into this position disables the transmission of a FEBE when an F-bit or M-bit error or C-bit parity error occurs.
	6	TXAIS*	Transmit DS3 Alarm Indication Signal: A one written into this bit position causes the DS3F to transmit a DS3 AIS. A one must also be written (if not already written) into bit 0 (XTX) in this register location in order to satisfy the definition of DS3 AIS. TXAIS is not effective when input pin XFSI is active low while operating with a bit-serial terminal side interface.
	5	EN AIS	Enable Transmit DS3 Alarm Indication Signal Automatically: A one written into this bit position causes the DS3F to transmit DS3 AIS when the RXOOF bit (Register 00, bit 6) is set to 1.
	4	TXIDL*	Transmit DS3 Idle Signal: A one written into this bit position causes the DS3F to transmit a DS3 idle signal. A one must also be written (if not already written) into bit 0 (XTX) in this register location, in order to satisfy the definition of DS3 idle.
	3	M13MODE	M13 Operating Mode: A one enables the DS3F to operate in the M13 mode as specified in Bellcore TR-TSY-000009, and the ANSI T1.107-1995 standard. The M13 operating mode is available for the bit-serial terminal side interface only. A zero enables the DS3F to operate in the C-bit parity mode that is specified in the ANSI T1.107-1995 standard. The C-bit operating mode is available for either a serial or parallel terminal side interface.
	2	SER	Serial Interface Terminal Side: A one configures the DS3F terminal side to be a serial interface for both receive and transmit. A zero configures the terminal side to be a nibble interface. The serial interface is operational in either the M13 or C-bit parity mode. The nibble interface is operational for the C-bit parity mode only. In the M13 operating mode, the transmit C-bit interface is disabled and terminal side C-bits are transmitted as user data.
	1	3LOOP	DS3 Transmit-to-Receive Loopback: A one written into this bit position disables the receive input and causes the transmit output to be looped back as receive data. Transmit data is provided at the output (D3TD).
	0	XTX	Transmit X-Bits: The X-bits may be used to transmit a yellow alarm or as a low-speed signaling channel. A one written into this bit position causes the DS3F to transmit a one for both X1 and X2.



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
02	7-0	FBn	<p>FEBE / Framing Bit Error Performance Counter: This is a read-only 8-bit saturating counter that stops at a count of 255 and is automatically cleared to zero when it is read by the microprocessor. The integrity of the count is partially protected when the microprocessor reads the counter or the DS3F is in process of incrementing the counter. If an incoming count indication is received during one of these times, the indication is held and the counter is incremented once after completion of the read or increment cycle (i.e., any multiple indications received are recorded as a single increment).</p> <p>When the DS3F is operating in the C-bit parity mode, this counter counts the FEBE indications received. A FEBE indication occurs for a received DS3 frame if any one or more of the C10, C11, or C12 bits in the frame is zero.</p> <p>When the DS3F is operating in the M13 mode, this counter counts framing bit error indications. An error indication occurs for each F-bit in a received DS3 frame that has a value different from the expected framing pattern. In the M13 mode, the counter is frozen during a DS3 loss of signal or an out of frame condition.</p>
03	7-0	CPn	<p>C-Bit Parity Error Performance / Number of Frames Counter: This is a read-only 8-bit saturating counter that stops at a count of 255 and is automatically cleared to zero when it is read by the microprocessor. The integrity of the count is partially protected when the microprocessor reads the counter or the DS3F is in process of incrementing the counter. If an incoming count indication is received during one of these times, the indication is held and the counter is incremented once after completion of the read or increment cycle (i.e., any multiple indications received are recorded as a single increment).</p> <p>When the DS3F is operating in the C-bit parity mode, this counter counts C-bit parity error indications. An error indication occurs for each received DS3 frame in which the majority (i.e., two or more) of the C7, C8 and C9 parity bits differ from the parity bit which was calculated by the DS3F over all 4704 received payload data bits of the preceding frame. For each such indication, the DS3F also provides a FEBE indication in the transmit line output, unless control bit NOFEBE is 1.</p> <p>When the DS3F is operating in the M13 mode, this counter counts DS3 frames. It takes approximately 27 milliseconds to count 255 frames. The application's software may use this DS3 frame count in conjunction with the count contained in the framing bit error counter (Address 02H) to determine an approximate bit error rate (BER). In the M13 mode, the counter is frozen during a DS3 loss of signal or an out of frame condition.</p>



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
04	7-0	PPn	<p>P-Bit Parity Error Performance Counter: This is a read-only 8-bit saturating counter that stops at a count of 255 and is automatically cleared to zero when it is read by the microprocessor. The integrity of the count is partially protected when the microprocessor reads the counter or the DS3F is in process of incrementing the counter. If an incoming count indication is received during one of these times, the indication is held and the counter is incremented once after completion of the read or increment cycle (i.e., any multiple indications received are recorded as a single increment).</p> <p>This counter counts P-bit parity error indications in either C-bit parity or M13 operating mode. An error indication occurs for each received DS3 frame during which one or both of the P1 and P2 bits differ from the parity bit calculated by the DS3F over all 4704 of the received payload data bits of the preceding DS3 frame. The DS3F does not provide a FEBE indication in the transmit line output for each such indication. The counter is frozen during a DS3 loss of signal or an out of frame condition.</p>
05	7	EMODE	<p>Extended-features Mode Control Bit: When this bit is set to 1, the Extended-features mode of the DS3F is activated; control bit positions in memory map addresses above 07H are enabled. When this bit is set to 0, the Normal mode of the DS3F is activated; control bit positions in memory map addresses above 07H are disabled.</p>
	6	START	<p>Start FEAC Message: When START is set to 1, the DS3F starts to send repetitively the 16-bit FEAC code word, including the XXXXXX bits in bit positions 5-0, using the third C-bit (C3). If FEAC10 (Address 0EH, bit 7) has been set to 1, the FEAC word is sent exactly 10 times and START is automatically reset to 0. If FEAC10 has been set to 0, the transmission of FEAC words is continuous until START is set back to 0, when the 16-bit code word is sent 10 more times before the message is terminated. The FEAC channel is then disabled and a 1 is subsequently sent in the third C-bit. (See also FEAC10 at Address 0EH, bit 7.)</p>
	5-0	FEAC Transmit Data	<p>Transmit FEAC Message: The third C-bit (C3) is used as a far end alarm and control (FEAC) channel. The FEAC channel uses a 16-bit code word that has the form 0XXXXXX0 11111111 to convey information, where the XXXXXX bits are the FEAC message. Bit 0 corresponds to the right-most bit in the FEAC message. The FEAC word is inserted for the X's and the DS3F inserts the necessary 0's and trailing 1's to complete the 16-bit word. Specific words that are transmitted for alarm or status conditions must be sent for the duration of the condition or a minimum of 10 code repetitions. When the FEAC channel is used for control purposes, the two-word control codes are repeated 10 times. For example, to activate or deactivate a loopback, the first loopback control code word must be transmitted 10 times, followed by 10 repetitions of the second DS3 (or DS1) line code word. (See also DFEXEC at Address 0DH, bit 6.)</p>

Address	Bit	Symbol	Description																						
06	7	FIDL	<p>Receive Single FEAC Word: Bit 7 (FIDL) is the FEAC idle channel indication. It clears whenever a zero C3 bit is received framing the six-bit variable word. Bit 7 cannot be reset by a microprocessor read cycle. Bit 6 (NEW) indicates when a new FEAC word has been detected. NEW is set when the DS3F receives a FEAC message for five consecutive FEAC message intervals (5 x 16 = 80 frames). It clears when the register is read. Bits 5-0 (FEAC receive data) constitute the variable (XXXXXX) field in the FEAC word. A FEAC word is read in the field in the same order of being received as shown below:</p> <div style="text-align: center;"> <p>16-Bit FEAC Word</p> <table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">0</td> <td style="padding: 2px;">X X X X X X</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1 1 1 1 1 1 1 1</td> </tr> </table> <p style="margin: 10px 0;">Bit 7</p> <table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;">X X X X X X</td> <td style="padding: 2px;">06H</td> </tr> </table> </div> <p>The following table lists possible FEAC combinations:</p> <table style="margin: 10px auto;"> <thead> <tr> <th style="text-align: center;">FIDL</th> <th style="text-align: center;">NEW</th> <th style="text-align: center;">Status</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td>FEAC channel busy - No message received since last read cycle</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td>FEAC channel idle - No message received since last read cycle</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td>New message received - FEAC channel busy</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td>New message received - FEAC channel idle</td> </tr> </tbody> </table> <p>Note: There is no buffering for the received FEAC message. The latest, validated FEAC message is provided and bit 6 (NEW) is set to one even if the previous message is not read.</p>	0	X X X X X X	0	1 1 1 1 1 1 1 1		X X X X X X	06H	FIDL	NEW	Status	0	0	FEAC channel busy - No message received since last read cycle	1	0	FEAC channel idle - No message received since last read cycle	0	1	New message received - FEAC channel busy	1	1	New message received - FEAC channel idle
	0	X X X X X X		0	1 1 1 1 1 1 1 1																				
		X X X X X X		06H																					
FIDL	NEW	Status																							
0	0	FEAC channel busy - No message received since last read cycle																							
1	0	FEAC channel idle - No message received since last read cycle																							
0	1	New message received - FEAC channel busy																							
1	1	New message received - FEAC channel idle																							
	6	NEW																							
	5-0	FEAC Receive Data																							
07	7-0	RXLOS RXOOF RXAIS RXIDL CERR LOC X2ERR X1ERR	<p>Latched-Bit Register: Bits 7-4 in this location are the latched values of the corresponding bits in location 00H. All of the bits in this register latch and are cleared on a read cycle, but RXAIS maintains its value when the DS3F is in TR loopback or no TX terminal input is present. Bit 3 (CERR) latches when the DS3F receives a C1 bit equal to zero. Bit 2 (LOC) latches when either an RXLOC (bit 3 - 00H) or an TXLOC (bit 2 - 00H) occurs. The X2ERR and X1ERR bits (bits 1 and 0) are latched at the inverse of the XRX2 and XRX1 values (normally 1), so they are normally 0, and a value of 1 indicates an error in the corresponding received X-bit.</p>																						



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
08	7	FBEC	Control F-bit Error Counter: When this bit is set to 1, the error counter in register 0AH will count only F-bit errors. When this bit is set to 0, the error counter will count both F-bit and M-bit errors. The integrity of the count is partially protected when the microprocessor reads the counter or the DS3F is in process of incrementing the counter. If an incoming count indication is received during one of these times, the indication is held and the counter is incremented once after completion of the read or increment cycle (i.e., any multiple indications received are recorded as a single increment).
	6	MBEC	Control M-bit Error Counter: When this bit is set to 0, the error counter in register 0BH will count only M-bit errors. When this bit is set to 1, the error counter will count both M-bit and F-bit errors. The integrity of the count is partially protected when the microprocessor reads the counter or the DS3F is in process of incrementing the counter. If an incoming count indication is received during one of these times, the indication is held and the counter is incremented once after completion of the read or increment cycle (i.e., any multiple indications received are recorded as a single increment).
	5	TBLUE	Transmit Blue code AIS condition: When this bit is set to 1, the device will transmit all 1's.
	4	OUTDIS	Output Disable: When set to 1, this control bit disables all DS3F output pins except the microprocessor interface address/data bus.
	3	ITX2	Invert Transmit X2: When set to 1, the X2 bit is inverted from the state specified by the XTX bit (Address 01H, bit 0), which is 1 for XTX=1 and 0 for XTX=0.
	2	ITX1	Invert Transmit X1: When set to 1, the X1 bit is inverted from the state specified by the XTX bit (Address 01H, bit 0), which is 1 for XTX=1 and 0 for XTX=0.
	1	RESET	Reset: When set to 1, the transmit frame counter is reset. If left set to 1 for longer than one frame, then a register reset also occurs and this bit is cleared. When a register reset occurs, all bits in registers 02H - 04H and 08H - 14H, and bit 6 of register 05H, will be cleared. If this bit is set from 1 back to 0 before a frame has elapsed then no register reset will occur. If this bit is set to 1 when pin XFSI is low then a register reset occurs immediately. At power-on, the Memory Map register contents are random and RESET should be used to clear to zero the bits it controls.
	0	LPTIME	Receive Loop Timing: When set to 1, this control bit disables the transmit clock input (XCK) and causes the DS3 receive clock (D3RC) to become the DS3 transmit clock. XNC also becomes the DS3 receive clock. Since the Transmit Reference Generator does not switch to the DS3 receive clock, the LPTIME bit is invalid for serial mode applications. If the DS3 receive clock fails in this mode, the DS3F switches over to the transmit clock.



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
09	7	SEF	Severely Errored Frame Indication: A 1 indicates that a Severely Errored Frame condition (SEF) has been detected. An SEF is defined as 3 out of 16 F-bits in error, utilizing a sliding window of 16 bits. This is a latched bit, and it clears on a microprocessor read cycle. This bit will then relatch if the condition that causes this bit to latch is still present.
	6	Unused	This bit is internally set to 0.
	5	RBLUE	Receive Blue code AIS condition: When this bit is set to 1, the device has detected all 1's. This is a latched bit, and it clears on a microprocessor read cycle. This bit will then relatch if the condition that causes this bit to latch is still present.
	4-1	Unused	These four bits are internally set to 0.
	0	STKOVFL	Stack Overflow indicator for register OFH receive FEAC FIFO: This bit is set to 1 when the receive FEAC circuit has detected and stored in its stack more than four FEAC words since the last read of register OFH. This is a latched bit, and it clears on a microprocessor read cycle.
0A	7-0		Counter for errored DS3 F-bits (and M-bits): An 8-bit saturating counter that counts the number of F-bits that are in error since the last read cycle, if FBEC at Address 08H, bit 7 is set to 1. If FBEC is set to 0, this counter will count both F-bit and M-bit errors. The counter is cleared on a microprocessor read cycle.
0B	7-0		Counter for errored DS3 M-bits (and F-bits): An 8-bit saturating counter that counts the number of M-bits that are in error since the last read cycle, if MBEC at Address 08H, bit 6 is set to 0. If MBEC is set to 1, this counter will count both M-bit and F-bit errors. The counter is cleared on a microprocessor read cycle.
0C	7	RTPLEN	Receive-to-Transmit Payload Loopback Lock Enable: To activate receive-to-transmit payload loopback, this bit must first be set to 1 for at least one frame after RTPLOOP (bit 6) has been set to 1 and then be set to 0. This resets the transmit frame counter so that the data will be synchronized to the overhead bits when using the loopback. The loopback commences on the transition to 0 and terminates when RTPLOOP is cleared to 0.
	6	RTPLOOP	Receive-to-Transmit Payload Loopback: This bit must be set to 1 to permit RTPLEN (bit 7) to activate receive-to-transmit payload loopback. This loopback causes the receive output data (payload only) to be internally connected to the transmit side data input, as shown in Figure 1. The loopback condition is terminated by clearing this bit to 0. The XFSI input pulse must not be applied while RTPLOOP is set to 1.
	5	TESTLOCK	Test Lock: Test bit to reset the transmit frame counter at a different time with respect to the receive. For test purposes only. Normally set to 0.



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
0C (cont.)	4	M13DLM	M13 Data Link Mode: When this control bit is set to 0, the C-Bit Transmit Data Link Clocks (CXDCC and CRDCC) are gapped clocks provided for clocking in the three data link bits (C13, C14, and C15). When set to 1, then the outputs CXDCC and CRDCC become pulses that identify the location of the three data link C-bits (the same as in the M13 device). See Figures 9 and 10.
	3	DLCB1	Data Link C-bits Off: When set to 1, the C-bits used for the data link (C13, C14 and C15) will be set to 1. When set to 0, the values for these bits will be taken from the input pin CXD.
	2	C21	C2 Off: When this bit is set to 1, the C2 bit will be 1. When this bit is set to 0, the C2 bit value will be taken from the input pin CXD.
	1	MCB1	Most C-bits Off: When set to 1, the C-bits C4 - C6, and C16 - C21 for the data link will all be set to 1. When set to 0, the data for these bits is taken from the input pin CXD.
	0	CPARINV	Parity and FEBE C-bits Off: When this control bit is set to 1, the C-bits used for parity (C7, C8, and C9) and the C-bits used for FEBE (C10, C11 and C12) will all be set to the inverse of the state that is calculated for the parity and FEBE. When set to 0, the data for these bits is taken from the calculations for parity and FEBE.
0D	7	VER	Version Identifier: This is a read-only bit with a fixed value of 0.
	6	DFEXEC	Execute Double FEAC Transmission: When set to 1, this control bit causes the DS3F to transmit 10 repetitions of the 16-bit FEAC codeword using data from the Double FEAC Transmit Data field in bits 5-0, followed by 10 repetitions of the 16-bit FEAC codeword using data from the FEAC Transmit Data field in Address 05H, bits 5-0. This bit is cleared upon completion of the transmission.
	5-0		Double FEAC Transmit FEAC Message: The third C-bit (C3) is used as a far end alarm and control (FEAC) channel. The FEAC channel uses a 16-bit code word that has the form 0XXXXXX0 11111111 to convey information, where the XXXXXX bits are the FEAC message. Bit 0 corresponds to the right-most bit in the FEAC message. The FEAC word is inserted for the X's and the DS3F inserts the necessary 0's and trailing 1's to complete the 16-bit word. Specific words that are transmitted for alarm or status conditions must be sent for the duration of the condition or a minimum of 10 code repetitions. When the FEAC channel is used for control purposes, the two-word control codes are repeated 10 times. This field is used for the XXXXXX content of the first word of a double word message. Both FEAC words are sent ten times automatically when DFEXEC is set to 1.



Address	Bit	Symbol	Description
0E	7	FEAC10	Transmit FEAC Word 10 Times: When set to 1, the duration of the single FEAC transmission (started by setting to 1 the control bit START in bit 6 of Address 05H) is exactly 10 FEAC word times. The START bit is automatically reset to 0 at the end of the transmission. When set to 0, the single FEAC transmission is continuous. A continuous FEAC transmission cannot be terminated by setting this bit to 1. To terminate a continuous FEAC transmission, the START bit should be set to 0. (See also START at Address 05H, bit 6.)
	6	Unused	This bit is to be set to 0 by the application software.
	5	RGCEN	Receive Gapped Clock Output Enable: When set to 1 while the SER (Serial) bit is set to 1, a gapped clock signal is generated by the receive circuitry and sent as output on the RNIB3 pin (pin 39/15).
	4	TGCEN	Timing Generator Gapped Clock Output Enable: When set to 1 while the SER (Serial) bit is set to 1, a gapped clock signal sent as output on the XSC/XNC pin (pin 66/47). This signal is synchronous with bit 1 in each 85-bit group (56 overhead bits) of the DS3 frame.
	3	HINTINV	Hardware Interrupt Invert: When set to 1, this control bit inverts the HINT output so that it becomes active low.
	2	HINTEN	Hardware Interrupt Enable: When set to 1, this control bit enables the STUFD/HINT output (pin 15/67) to generate a hardware interrupt to the microprocessor based on the existence of alarm conditions and the state of the interrupt mask register bits at Address 11H.
	1	MOOFW	M-bit Out Of Frame Window: When set to 1, this control bit changes from 4 frames to 3 frames the duration of the window for M-bit errors that will cause the Out Of Frame condition to be reported.
	0	CRDCINV	CRDCC Extended-feature Inversion: When set to 1 while control bit M13DLM=0, this control bit advances the timing of the three CRDCC pulses by one-half a cycle of CRCK (see Figure 11).
0F	7	MOREFEAC	MORE Valid FEAC words remain in the stack: A 1 indicates that there is at least one more valid FEAC word in the stack (bits 5-0).
	6	FEACVLID	FEAC Word Valid: A 1 indicates that the FEAC word in bits 5-0 is valid.
	5-0	RFEAC6 RFEAC1	Receive FEAC Stack: This field provides access to the top word of a four-word deep push-down FIFO stack (maintained internally) that holds the received FEAC words. If more than four FEAC words have been received since the last read of this register then the STKOVFL bit (Address 09H, bit 0) will be set to 1. The stack will retain the 4 most recent FEAC words.



DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
10	7	RXLOS	Receive DS3 Loss Of Signal Interrupt: This latched bit is set to 1 when RXLOS is detected. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	6	RXOOF	Receive DS3 Out Of Frame Interrupt: This latched bit is set to 1 when RXOOF is detected. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	5	RXAIS	Receive DS3 Alarm Interrupt: This latched bit is set to 1 when RXAIS is detected. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	4	RXIDL	Receive DS3 Idle Interrupt: This latched bit is set to 1 when RXIDL is detected. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	3	NEWFEAC	New FEAC Receive Interrupt: This latched bit is set to 1 when a new FEAC word has been received 5 times consecutively. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	2	RTLOC	Receive or Transmit DS3 Clock Failure Interrupt: This latched bit is set to 1 when either RXLOC or TXLOC occurs. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	1	SEF	Severely Errored Frame Indication Interrupt: This latched bit is set to 1 when SEF occurs. This bit is cleared when Address 10H is read, but will then relatch if the condition that causes it to latch is still present.
	0	XERR	Receive X-Bit Error Interrupt: This latched bit is set to 1 when X1 or X2 is 0. This bit is cleared when address 10H is read, but it will relatch if a condition that causes it to latch is still present.
11	7	RXLOSEN	Alarm Interrupt Enable Mask Bits: If any of the eight bits in this register is set to 1, a hardware interrupt will be generated at the STUFD/HINT output pin (pin 15/67) when the corresponding latched alarm bit is set to 1 in the register at Address 10H, provided that the HINTEN bit at Address 0EH, bit 2 is set to 1.
	6	RXOOFEN	
	5	RXAISEN	
	4	RXIDLEN	
	3	NFEACIEN	
	2	RTLOCEN	
	1	SEFEN	
	0	XERREN	



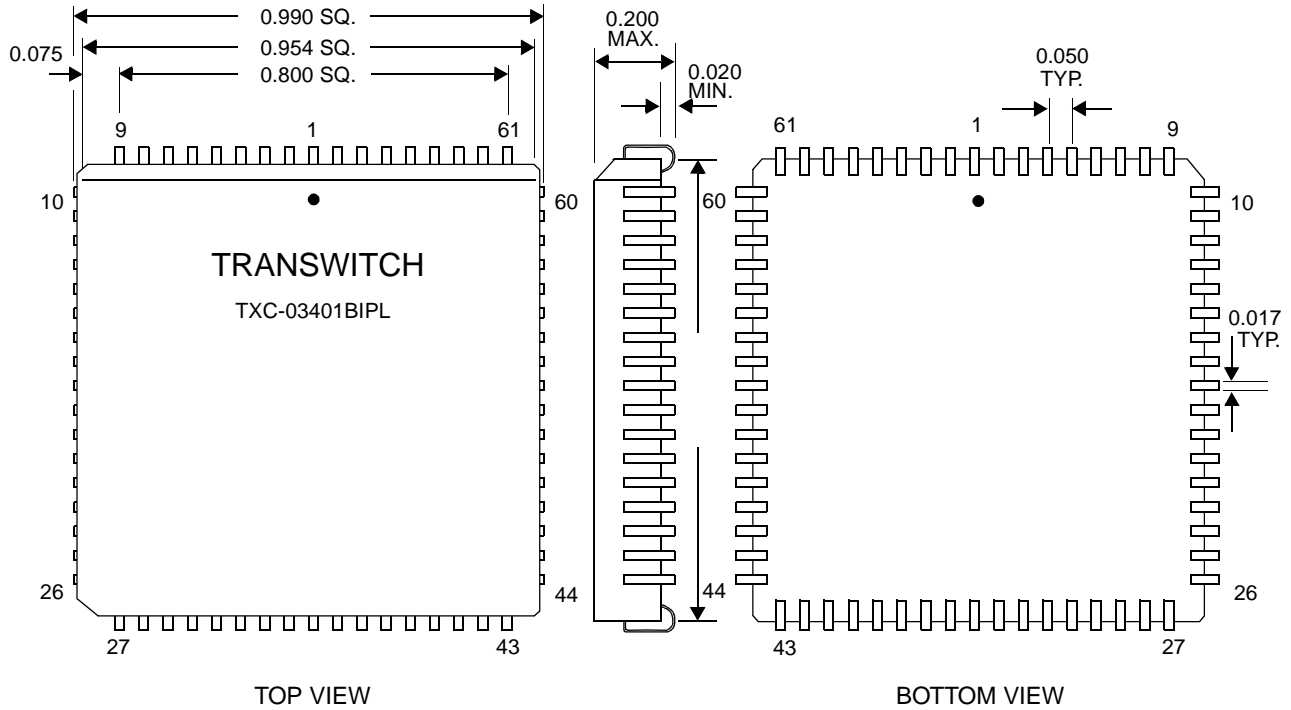
DATA SHEET

DS3F
TXC-03401B

Address	Bit	Symbol	Description
12	7-0	CVEXZ7- CVEXZ0	Coding Violation 16-Bit Counter, low order byte: A 16-bit saturating counter that counts the D3RC cycles for which CVCNT is high (and those for which EXZCNT is low, if EXZEN is set to 1). These signals are outputs from the ART (CV only) and ARTE devices and they are expected to be related to the rising edge of D3RC. There are actually two counters, so that when one counter is being read, the other counter is counting. A read cycle for this register causes this switch to toggle, and the current count data for the low order byte to be provided as output. Note: The counter switch will toggle whenever ALE goes low while this address is selected, so care should be taken if multiple DS3F devices are on the μ proc. I/O bus.
13	7-0	CVEXZ15- CVEXZ8	Coding Violation 16-Bit Counter, high order byte: A read cycle for this register causes the high order count byte which corresponds to the most recently read low order count byte from the register at Address 12H to be provided as output and then this counter (all 16 bits) is cleared to 0000H. It is therefore important to read the register at Address 12H first, followed by a read of this register, to insure that a correct count is obtained.
14	7	STFREN	Stuff Receive Enable: When set to 1, the $\overline{\text{RCG}}$ output of the receive data circuitry will include the stuff bit locations if 2 out of 3 C-bits in that sub-frame are set to 1, when operating in M13 mode and Serial mode.
	6	STFTGEN	Stuff Timing Generator Enable: When set to 1, the $\overline{\text{TCG}}$ output of the timing generator will include the stuff bit locations when operating in M13 mode and Serial mode.
	5	FORCEFEBE	Force FEBE Error: When the CVEN bit is set to 1, setting this bit to 1 will generate and transmit a far end block error (FEBE) by setting C10, C11, C12 to 0 in the next available DS3 frame when operating in the C-bit parity mode. To send an additional error, the microprocessor must first set this bit to 0 before again setting it to 1.
	4	FORCEPP	Force P-Bit Parity Error: When the CVEN bit is set to 1, setting this bit to 1 will generate and transmit a P-bit error by inverting both P-bits in the next available DS3 frame. To send an additional error, the microprocessor must first set this bit to 0 before again setting it to 1.
	3	FORCECP	Force C-Bit Parity Error: When the CVEN bit is set to 1, setting this bit to 1 will generate and transmit a C-bit parity error (C7, C8 and C9 inverted) in the next available DS3 frame when operating in the C-bit parity mode. To send an additional error, the microprocessor must first set this bit to 0 before again setting it to 1.
	2	TSTCNTR	Test Counter: This bit should be set to 0.
	1	EXZEN	Excessive Zeros Enable: When set to 1, the $\overline{\text{EXZ}}$ events are counted in the CVEXZ counter.
	0	CVEN	Coding Violation Counter Enable: Setting this bit to 1 disables the FORCECP, FORCEPP and FORCEFEBE input pins from performing their original force error functions and allows these functions to be performed instead by setting to 1 bits 3, 4 and 5 of this register. The FORCECP input pin is then defined as the CVCNT (coding violation) input pin and the FORCEPP input pin as the EXZCNT (excessive zeros) input pin to the CVEXZ 16-bit counter in the registers at Addresses 12H and 13H.

PACKAGE INFORMATION

The DS3F device is packaged in a 68-pin plastic led chip carrier (PLCC) suitable for socket or surface mounting, as shown in Figure 19, or as an 80-pin Thin Profile Plastic Quad Flat Package suitable for surface mounting, as shown in Figure 20.



Note: All dimensions are shown in inches and are nominal unless otherwise indicated.

Figure 19. DS3F TXC-03401B 68-Pin Plastic Led Chip Carrier

The DS3F device is also available as an 80-pin Thin Profile Plastic Quad Flat Package suitable for surface mounting, as illustrated in Figure 20 (the PLCC version is shown in Figure 19).

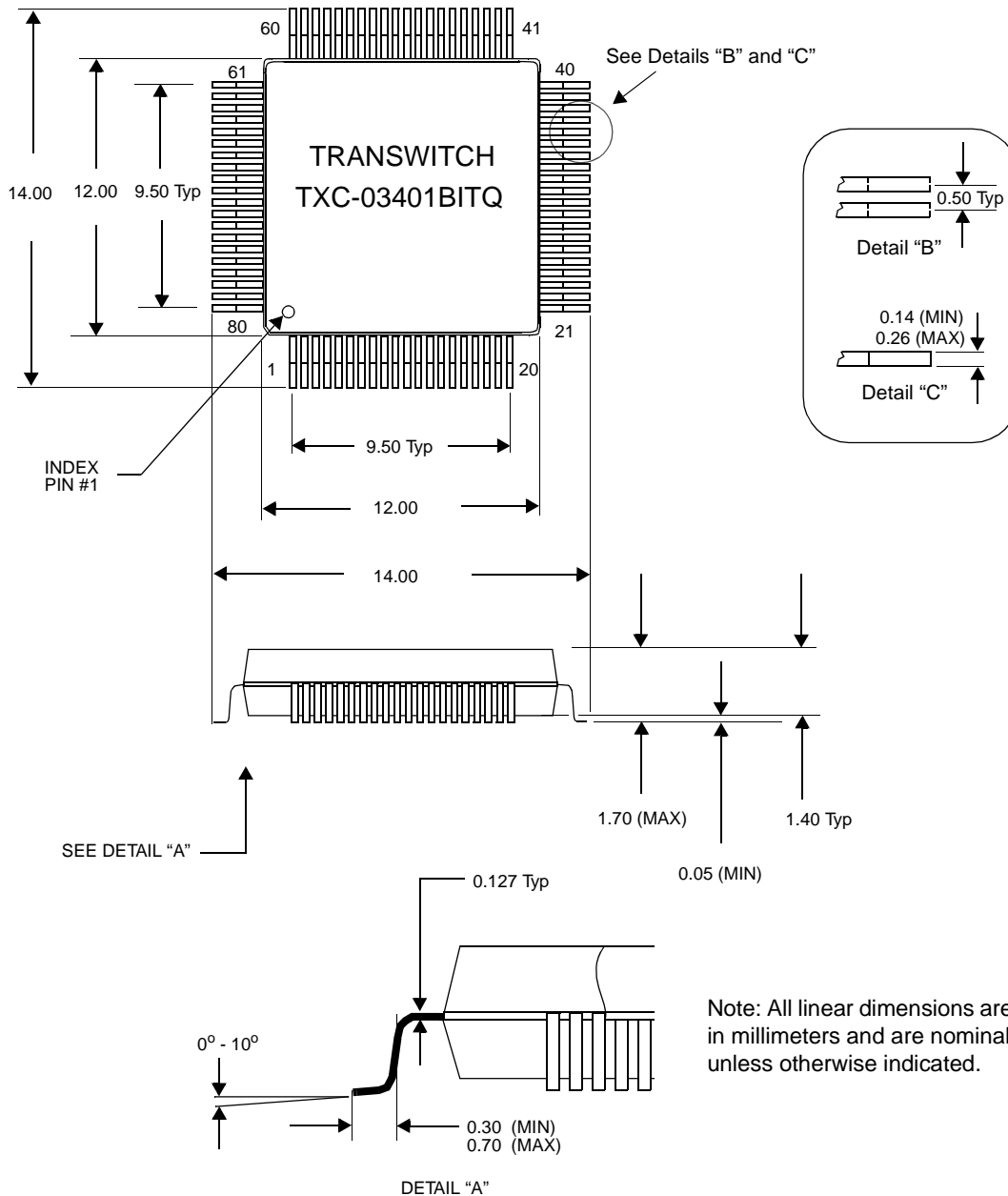


Figure 20. DS3F TXC-03401B 80-Pin Thin Profile Plastic Quad Flat Package



ORDERING INFORMATION

Part Number:	TXC-03401BIPL	68-pin plastic leaded chip carrier
Part Number:	TXC-03401BITQ	80-pin thin plastic quad flat package

RELATED PRODUCTS

TXC-02020 (02021), ART (ARTE) VLSI Device (Advanced DS3/STS-1 Receiver/Transmitter). Performs the receive and transmit line interface functions required for transmission of DS3 (44.736 Mbit/s) or STS-1 (51.840 Mbit/s) signals across a coaxial interface. The ARTE is an extended-feature version of the ART, in a larger package.

TXC-02030, DART VLSI Device (Advanced E3/DS3 Receiver/Transmitter). DART performs the transmit and receive line interface functions required for transmission of E3 (34.368 Mbit/s) and DS3 (44.736 Mbit/s) signals across a coaxial interface.

TXC-03303, M13E VLSI Device (DS3/DS1 Mux/Demux, Extended features). This single-chip multiplex/demultiplex device provides the complete interfacing function between a single DS3 signal and 28 independent DS1 signals.

TXC-03305, M13X VLSI Device (DS3/DS1 Mux/Demux). This single-chip device provides the functions needed to multiplex and demultiplex 28 independent DS1 signals to and from a DS3 signal with either an M13 or C-bit frame format. It includes some enhanced features relative to the M13E device.

TXC-03452B, L3M VLSI Device (Level 3 Mapper). The L3M maps a E3/DS3 line signal into a STM-1 TUG-3 or STS-3/STS-1 SPE or STS-1 SPE SDH/SONET signal.

TXC-03453, TL3M VLSI Device (Triple Level 3 Mapper). The TL3M maps up to 3 independent E3/DS3 line signals into an STM-1 TUG-3 or STS-3 STS-1 SPE SDH/SONET signal.

TXC-06125, XBERT VLSI Device (Bit Error Rate Generator/Receiver). Programmable multi-rate test pattern generator and receiver in a single chip with serial, nibble, or byte interface capability.

TXC-21005, DS3F/XBERT Evaluation Board. A complete, ready-to-use test system that demonstrates the functions and features of the DS3F VLSI device. Includes on-board micro-processor, RS-232 interface, XBERT, and MS-DOS compatible PC software for control and monitor.

STANDARDS DOCUMENTATION SOURCES

Telecommunication technical standards and reference documentation may be obtained from the following organizations:

ANSI (U.S.A.):

American National Standards Institute
11 West 42nd Street
New York, New York 10036

Tel: (212) 642-4900
Fax: (212) 302-1286
Web: www.ansi.org

The ATM Forum (U.S.A., Europe, Asia):

2570 West El Camino Real
Suite 304
Mountain View, CA 94040

Tel: (650) 949-6700
Fax: (650) 949-6705
Web: www.atmforum.com

ATM Forum Europe Office

Av. De Tervueren 402
1150 Brussels
Belgium

Tel: 2 761 66 77
Fax: 2 761 66 79

ATM Forum Asia-Pacific Office

Hamamatsu-cho Suzuki Building 3F
1-2-11, Hamamatsu-cho, Minato-ku
Tokyo 105-0013, Japan

Tel: 3 3438 3694
Fax: 3 3438 3698

Bellcore (See Telcordia)

CCITT (See ITU-T)

EIA (U.S.A.):

Electronic Industries Association
Global Engineering Documents
7730 Carondelet Avenue, Suite 407
Clayton, MO 63105-3329

Tel: (800) 854-7179 (within U.S.A.)
Tel: (314) 726-0444 (outside U.S.A.)
Fax: (314) 726-6418
Web: www.global.ihs.com

ETSI (Europe):

European Telecommunications Standards Institute
650 route des Lucioles
06921 Sophia Antipolis Cedex
France

Tel: 4 92 94 42 22
Fax: 4 92 94 43 33
Web: www.etsi.org



GO-MVIP (U.S.A.):

The Global Organization for Multi-Vendor Integration
Protocol (GO-MVIP)

3220 N Street NW, Suite 360
Washington, DC 20007

Tel: (800) 669-6857 (within U.S.A.)
Tel: (903) 769-3717 (outside U.S.A.)
Fax: (508) 650-1375
Web: www.mvip.org

ITU-T (International):

Publication Services of International Telecommunication
Union

Telecommunication Standardization Sector
Place des Nations, CH 1211
Geneve 20, Switzerland

Tel: 22 730 5111
Fax: 22 733 7256
Web: www.itu.int

MIL-STD (U.S.A.):

DODSSP Standardization Documents Ordering Desk
Building 4 / Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094

Tel: (215) 697-2179
Fax: (215) 697-1462
Web: www.dodssp.daps.mil

PCI SIG (U.S.A.):

PCI Special Interest Group
2575 NE Kathryn Street #17
Hillsboro, OR 97124

Tel: (800) 433-5177 (within U.S.A.)
Tel: (503) 693-6232 (outside U.S.A.)
Fax: (503) 693-8344
Web: www.pcisig.com

Telcordia (U.S.A.):

Telcordia Technologies, Inc.
Attention - Customer Service
8 Corporate Place
Piscataway, NJ 08854

Tel: (800) 521-CORE (within U.S.A.)
Tel: (908) 699-5800 (outside U.S.A.)
Fax: (908) 336-2559
Web: www.telcordia.com

TTC (Japan):

TTC Standard Publishing Group of the
Telecommunications Technology Committee
2nd Floor, Hamamatsu-cho Suzuki Building,
1 2-11, Hamamatsu-cho, Minato-ku, Tokyo

Tel: 3 3432 1551
Fax: 3 3432 1553
Web: www.ttc.or.jp

LIST OF DATA SHEET CHANGES

This change list identifies those areas within this updated DS3F Data Sheet that have significant differences relative to the previous and now superseded DS3F TXC-03401B Data Sheet:

Updated DS3F Data Sheet:	Edition 6, June 2001
Previous DS3F Data Sheet:	Edition 5, March 1998

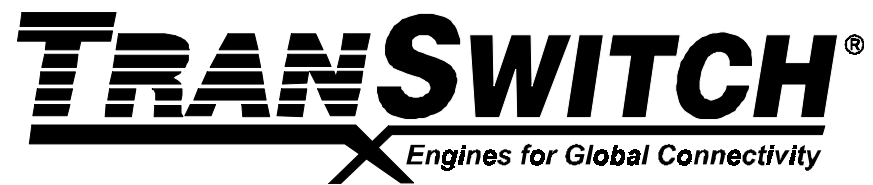
The page numbers indicated below of this updated Data Sheet include changes relative to the previous Data Sheet.

<u>Page Number of Updated Data Sheet</u>	<u>Summary of the Change</u>
All	Changed edition number and date.
1	Added 80-pin TQFP package option to last feature bullet item.
2	Updated Table of Contents and List of Figures for effects of adding Figures 3 and 20, and adding the TQFP pin column to the tables in the Pin Descriptions section. Added second sentence to the note.
3	Added arrow from Transmit Frame Reference generator block to input block in Figure 1.
7	Changed title of Figure 2 and added Figure 3, 80-pin TQFP pin diagram.
8-16	Added 80-Pin TQFP Pin No. column in Pin Descriptions tables. Added Spare pins on page 8 for TQFP.
11	Changed description for Symbol XSC/XNC to state that clock signal is derived from TCIN.
17	In first table, deleted Component Temperature x Time row and modified ESD row, adding Note 3. In second table, added thermal characteristics for TQFP package.
27	In Table of Figure 12, added max time for Symbol $t_{OD(3)}$.
31	In Figure 17, added Symbol $t_{SU(2)}$ and clarified $t_{W(2)}$. Changed Min value for Symbol $t_{W(3)}$ in table.
33	Added note at beginning of Memory Map Descriptions section.
39	Added last sentence to Description for symbol RESET.
41	Deleted Description for Symbol VER after first sentence.
27, 32, 42, 43	Added location of corresponding pin on TQFP package to existing location of pin on PLCC package in note about XSC signal in Figure 12, for VDD and GND leads in Figure 18, and in Description columns for Symbols RGCEN, TGCEN, HINTEN and Address 11H.
44	Added note to Description for symbols CVEXZ7-CVEXZ0.
46	Added Figure 20 to provide TQFP to package information.
47	Added 80-pin TQFP package option to Ordering Information section.
47	Changed Related Products section.
48	Replaced Standards Documentation Sources section.
50	Replaced List of Data Sheet Changes section.



- NOTES -

TranSwitch reserves the right to make changes to the product(s) or circuit(s) described herein without notice. No liability is assumed as a result of their use or application. TranSwitch assumes no liability for TranSwitch applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TranSwitch warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TranSwitch covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.





DOCUMENTATION UPDATE REGISTRATION FORM

If you would like to receive updated documentation for selected devices as it becomes available, please provide the information requested below (print clearly or type) then tear out this page, fold and mail it to the Marketing Communications Department at TranSwitch. Marketing Communications will ensure that the relevant Product Information Sheets, Data Sheets, Application Notes, Technical Bulletins and other publications are sent to you. You may also choose to provide the same information by fax **(203.926.9453)**, or by e-mail **(info@txc.com)**, or by telephone **(203.929.8810)**. Most of these documents will also be made immediately available for direct download as Adobe PDF files from the TranSwitch World Wide Web Site **(www.transwitch.com)**.

Name: _____

Company: _____ Title: _____

Dept./Mailstop: _____

Street: _____

City/State/Zip: _____

If located outside U.S.A., please add - Country: _____ Postal Code: _____

Telephone: _____ Ext.: _____ Fax: _____

E-mail: _____

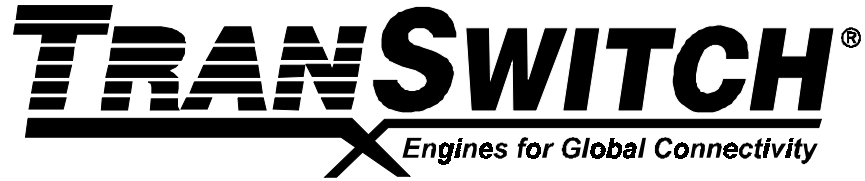
Please provide the following details for the managers in charge of the following departments at your company location.

<u>Department</u>	<u>Title</u>	<u>Name</u>
Company/Division	_____	_____
Engineering	_____	_____
Marketing	_____	_____

Please describe briefly your intended application(s) and indicate whether you would like to have a TranSwitch applications engineer contact you to provide further assistance:

If you are also interested in receiving updated documentation for other TranSwitch device types, please list them below rather than submitting separate registration forms:

Please fold, tape and mail this page (see other side) or fax it to Marketing Communications at 203.926.9453.



(Fold back on this line second, then tape closed, stamp and mail.)



3 Enterprise Drive
Shelton, CT 06484-4694
U.S.A.

First
Class
Postage
Required

TranSwitch Corporation

Attention: Marketing Communications Dept.
3 Enterprise Drive
Shelton, CT 06484-4694
U.S.A.

(Fold back on this line first.)

Please complete the registration form on this back cover sheet, and fax or mail it, if you wish to receive updated documentation on this TranSwitch product as it becomes available.