

FCC Registered DAA Module with DTMF Transmitter/Decoder

Description

The XE0068DT is an FCC registered telephone line interface which includes a DTMF transmitter, DTMF decoder and call progress monitor.

FCC rules limit the signal level that equipment can place on the telephone line. The XE0068DT incorporates an Automatic Gain Control (AGC) circuit to control the output signal level. The AGC optimizes the output level over a wide variety of input levels without introducing signal distortion.

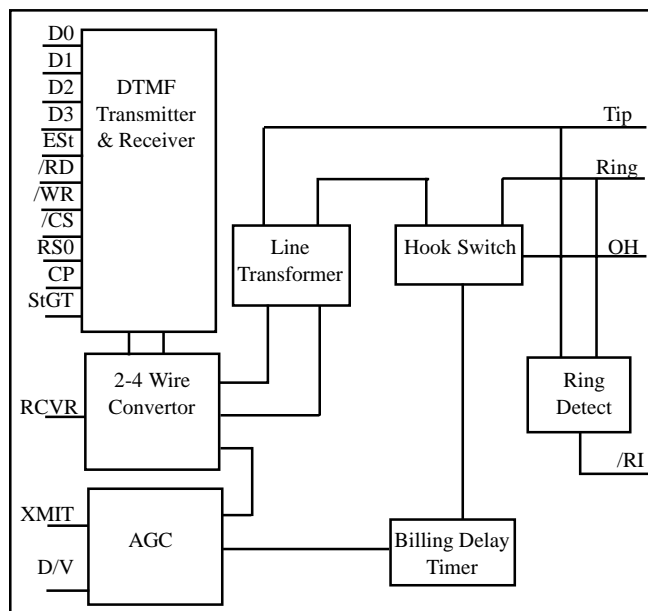
FCC rules also dictate a 2-second delay at the start of each call. This billing delay prevents information transmission during the billing period. The XE0068DT includes this billing delay.

The integrated DTMF transceiver, call progress monitor and FCC registration make the XE0068DT ideal for network signalling applications.

Features

- * Small Size - 2.28" x 1.08" x 0.42"
- * FCC Part 68 Registered
- * Ring Detection and Hookswitch Control
- * 1500 Volt Isolation;
- * 800 Volt Surge Protection;
- * An Integral 2-Second Billing Delay
- * Automatic Gain Control optimizes transmit level for most any input level.
- * Integral DTMF transmitter and decoder
- * Call progress Monitor

XE0068DT Block Diagram

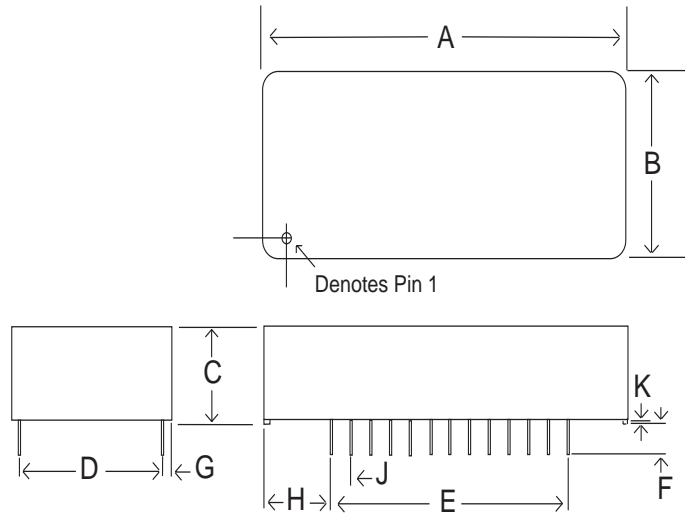


XE0068DT Pin Configuration

| | | | |
|-----|------|------|------|
| VCC | o 1 | 26 o | Tip |
| D3 | o 2 | | |
| D2 | o 3 | 24 o | Ring |
| D1 | o 4 | | |
| D0 | o 5 | 22 o | /RI |
| /WR | o 6 | 21 o | OH |
| /RD | o 7 | 20 o | N/C |
| /CS | o 8 | 19 o | RCVR |
| RS0 | o 9 | 18 o | XMIT |
| N/C | o 10 | 17 o | StGT |
| N/C | o 11 | 16 o | ESt |
| N/C | o 12 | 15 o | CP |
| D/V | o 13 | 14 o | GND |

XE0068DT Mechanical Specifications

| Dim | Inches | | Metric(MM) | |
|-----|--------|-------|------------|-------|
| | Min | Max | Min | Max |
| A | 2.270 | 2.290 | 57.66 | 58.17 |
| B | 1.065 | 1.095 | 27.05 | 27.81 |
| C | 0.420 | 0.430 | 12.32 | 13.08 |
| D | 0.890 | 0.910 | 22.61 | 23.11 |
| E | 1.190 | 1.210 | 30.23 | 30.73 |
| F | 0.125 | 0.200 | 3.18 | 5.08 |
| G | 0.080 | 0.100 | 2.03 | 2.54 |
| H | 0.530 | 0.550 | 13.46 | 13.97 |
| J | 0.090 | 0.110 | 2.29 | 2.79 |
| K | 0.020 | 0.025 | 0.51 | 0.64 |

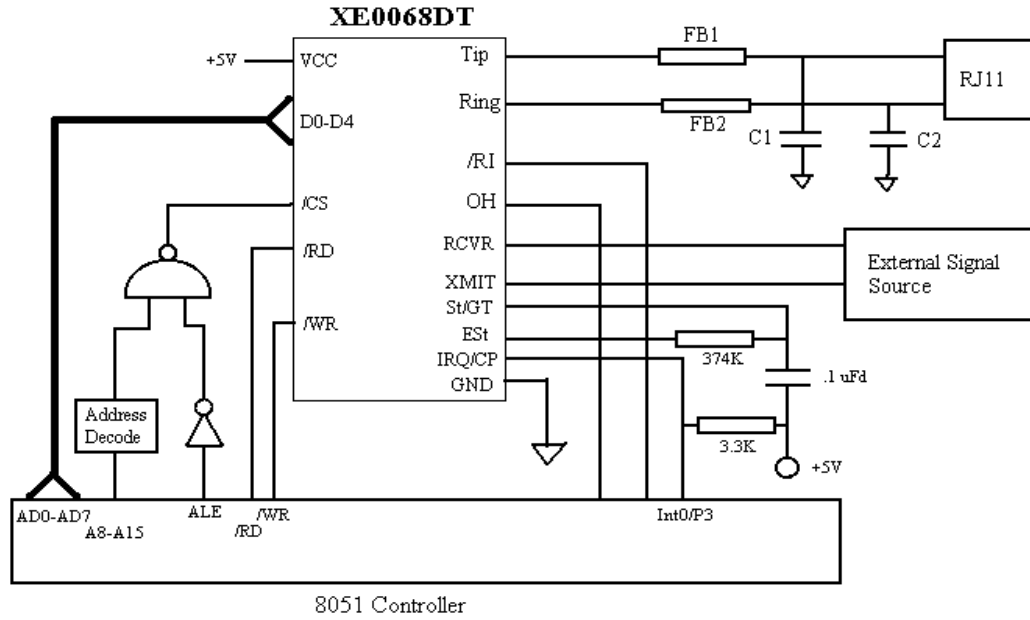


XE0068DT ABSOLUTE MAXIMUM RATINGS

| | |
|--------------------------------------|--------------------|
| Storage Temperature | -25° C to +85° C |
| Operating Temperature Range * | 0° C to +70° C |
| Maximum Solder Temperature | 220° C |
| Maximum Time Above Eutectic (183° C) | 90 seconds |
| Preheat Dwell Time | 120 to 180 seconds |

* The XEV90 can be ordered with an Operating Temperature of -40° C to +85° C at extra cost.
Specify Industrial Temperature Range (ITR).

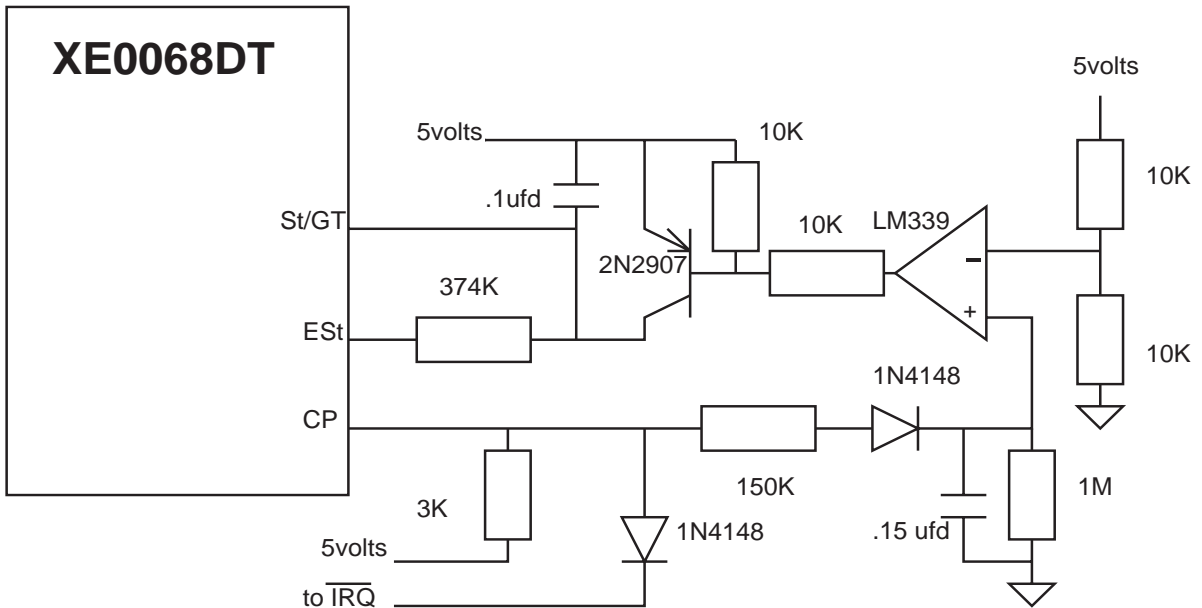
XE0068DT Typical Connection Diagram



Recommended Parts

| Designation | Description |
|-------------|---|
| C1, C2 | 47 picoFarad, 3000 Volts (Sprague part Number 30GA-T47) |
| FB1, FB2 | Ferrite Beads (TDK part Number CB30-453215B) |

XE0068DT Call Progress Detection Circuit



XE0068DT Pin Descriptions

| PIN | NAME | I/O | DESCRIPTION |
|-----|-----------------|-----|---|
| 1 | VCC | --- | +5 Volts |
| 2-5 | D0-D3 | I/O | These signals represent the 4-bit data bus which carries the DTMF information per the chart below. |
| 6 | WR | I | Read and Write determine the direction of DTMF data. A low on WR with RD high allows the processor to write to the XE0068DT. |
| 7 | RD | I | Read and Write determine the direction of DTMF data. A low on RD with WR low allows the processor to read from the XE0068DT. |
| 8 | CS | I | A low on Chip Select, selects the XE0068 DTMF data bus. |
| 9 | RS0 | I | This input selects the register to be used. A low selects the data register. |
| 13 | D/V | I | A low on Voice/Data selects a transmit level of 0 dBm for voice or DTMF; a high sets a -9 dbm transmit level for data transfer. |
| 14 | GND | --- | Ground |
| 15 | CP | O | In DTMF mode CP acts as an interrupt. CP goes low when a valid DTMF Tone is transmitted or received. In CallProgress Mode CP provides a square wave representation of the call progress signal on the phone line. |
| 16 | ES _t | O | Goes high to indicate that a valid tone pair has been detected. A momentary loss of signal causes ES _t to go low. |
| 17 | St/GT | I/O | As an input, ST/GT latches the DTMF code into the Receive Data Register when the threshold voltage is reached. As an output, St/GT goes high to disable the guard timer after the threshold voltage is reached. |
| 18 | XMIT | I | Analog input signal to the line interface, input impedance on XMIT is typically 10 Kohms at 1800 Hz. Signals from -15 to +5 dBm will be placed on the line at -10dBm ± 1 dBm. |
| 19 | RCVR | O | Analog output signal from the 2-4 wire converter, the output impedance of RCVR is typically 10 ohms at 1800 hz. |
| 21 | OH | I | Hookswitch control. A high closes the internal relay to connect the equipment to the phone line. |
| 22 | RI | O | Ring Indicate, output, active low, TTL, indicates the modem is receiving a ring signal. |
| 24 | Ring | --- | Ring connection to the phone line (RJ11 Pin 4). |
| 26 | Tip | --- | Tip Connection to the phone line (RJ11 Pin 3) |

XE0068DT Register Selection

Table 1 below shows the combination of RS0, /WR, and /RD to select each register.

| Table 1 | RS0 | /WR | /RD | Function |
|---------|-----|-----|-----|----------------------------------|
| | 0 | 0 | 1 | Write to Transmit Data Register |
| | 0 | 1 | 0 | Read from Receive Data Register |
| | 1 | 0 | 1 | Write to Control Register A or B |
| | 1 | 1 | 0 | Read from Status Register |

DTMF Codes

Table 2 below shows the 4-bit codes applied to D0-D3 to represent each DTMF Digit.

| Table 1 | DTMF Digit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | * | # | A | B | C | D |
|---------|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | D1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| | D2 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| | D3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |

XE0068DT Status Register

Table 3 below defines the bit codess which can be read from the status register.

| Table 3 | Bit | Indicator | Status Set | Status Cleared |
|---------|-----|------------------------------|--|--|
| | 0 | IRQ | An interrupt has occurred | Interupt Active |
| | 1 | Transmit Data Register Empty | Transmitter Ready for New Data | Status has been read or is in non-burst mode |
| | 2 | Receive Data Register Full | ReceiveData Register contains valid data | Status Register has been Read |
| | 3 | Delayed Steering | Set upon detection of the absence of a DTMF signal | Cleared upon detection of a vailid DTMF signal |

XE0068DT Control Register A

Table 4 below defines the XE0068DT operations set by the bits in Control Register A.

| Table 4 | Bit | Signal | Function |
|---------|-----|---------|---|
| | 0 | TOUT | Tone Output Control: This bit controls the tone transmit functions. A high enables the tone output; a low turns tone output off. |
| | 1 | CP/DTMF | Call Progress or DTMF Mode: A logic high enables the XE0068DT to detect call progress tones. A low enables DTMF send and receive mode. In call progress mode a square wave representation of the incoming signal will be presented on the CP output, IRQ enabled. DTMF tones cannot be decoded in call progress mode. |
| | 2 | IRQ | Interrupt Enable: A logic high enables the interrupt function. When IRQ and DTMF mode are disabled, the CP output will go low when either a valid DTMF signal is received or the transmitter is ready for more data. |
| | 3 | RSEL | Register Select. A logic high on bit 3 sets the XE0068DT to select Control Register B for the next write cycle. After writing to Control Register B, the next control register write cycle will be directed to Control Register A. |

XE0068DT Control Register B

Table 5 below defines the XE0068DT operations set by the bits in Control Register B.

| Table 4 | Bit | Signal | Function |
|---------|-----|--------|---|
| | 0 | Burst | Burst Mode: A logic low enables burst mode. When Burst Mode is activated, DTMF tones can be transmitted by writing the correct code to the Transmit Register. The XE0068DT transmits a tone burst of 51 milliseconds on and 51 milliseconds off. In call progress mode the duration of the tone burst and pause after the tone burst are doubled to 102 milliseconds. When not in Burst Mode the XE0068DT transmits the tone as long as TOUT, Status Register A, is active. |
| | 1 | Test | Test Mode: A logic high enables the Test Mode in the XE0068DT. When the Test and DTMF modes are selected, the signal on CP reflects the state of the delayed steering bit of the status register. |
| | 2 | S/D | Single or Dual Tone Generation: A logic high sets the XE0068DT to generate a single tone rather than the transmitting two tones. |
| | 3 | C/R | Column or Row: Control Register B bit 3 determines if the row or column tone is transmitted when single tone operation is selected. A logic high selects the row tone output |

XE0068DT Operational Modes

Burst Mode Burst mode is used to transmit DTMF signals of specific duration. The XE0068DT transmitter sends symmetric tone bursts which are on for 51 milliseconds and off for 51 milliseconds. This is a standard interval for central office switching. When call progress mode is also selected extended bursts of 102 milliseconds can be sent.

Single Tone Generation Single tones, rather than tone pairs, may also be generated. Control Register B regulates single tone transmission.

Call Progress Mode Call Progress Mode allows detection of the various tones used to identify the status of a call. They include Ring Back, Busy Tone Dial Tone, etc. In call Progress Mode the XE0068DT provides a square wave representation of these signals on the CP pin. The system host can decode the incoming call progress tones.

Initialization Procedure

| Description | Control Lines | | | Data Bits | | | |
|---------------------------|---------------|----|----|-----------|----|----|----|
| | RS0 | WR | RD | B3 | B2 | B1 | B0 |
| Read Status Register | 1 | 1 | 0 | X | X | X | X |
| Write to Control Register | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Write to Control Register | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| Write to Control Register | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Write to Control Register | 1 | 0 | 1 | 0 | 0 | 0 | 0 |

* Performs a software reset on the XE0068DT

Call Progress Tone Definitions

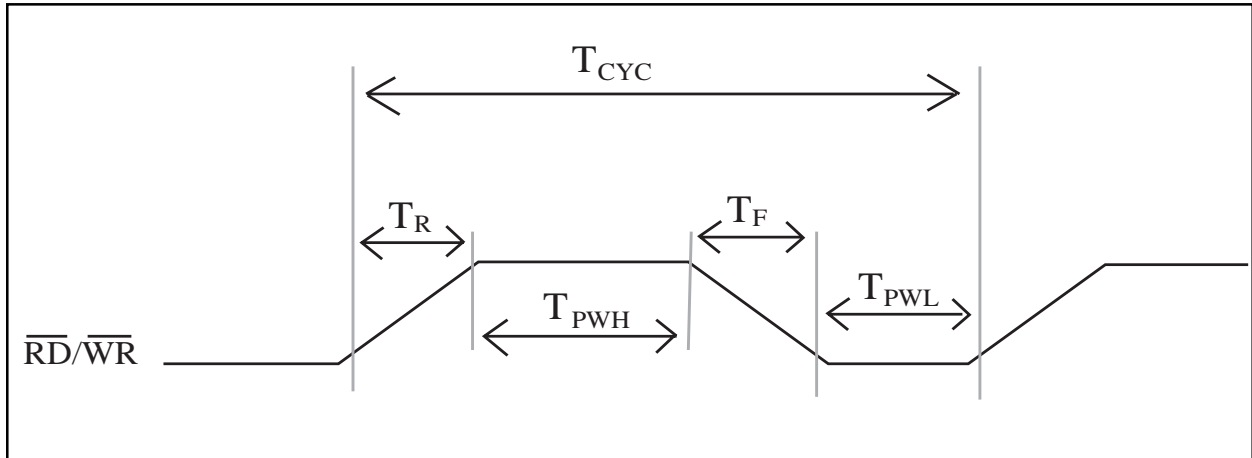
The chart below shows the signal characteristics for the most common call progress tones in the United States. Check the frequency and cadence on the CP line to identify signals in Call Progress mode.

| Tone | Frequency (Hz) | Cadence | Level | Description |
|-------------------|----------------|----------------------------|---------|--|
| Dial Tone | 350 + 400 | Steady | -13 dBm | Indicates the network is ready to receive dialing signals |
| Ringback | 440 + 480 | 2 sec. On 4 sec. Off | -19 dBm | Indicates the called line is ringing |
| Busy Tone | 480 + 620 | .5 sec. On .5 sec Off | -24 dBm | Indicates the called line has been reached but is currently in use. |
| Reorder | 480 + 620 | .25 sec. On .25 sec Off | -24 dBm | Indicates the switching path is busy |
| Partial Dial Tone | 480 | Steady | -17 dBm | Notifies the calling party that dialing has not begun in the allotted time or that not enough digits have been dialed. |

XE0068DT Electrical Specifications *(V_{cc} = +5 Volts \pm 5%, T_a = 70 deg C.)*

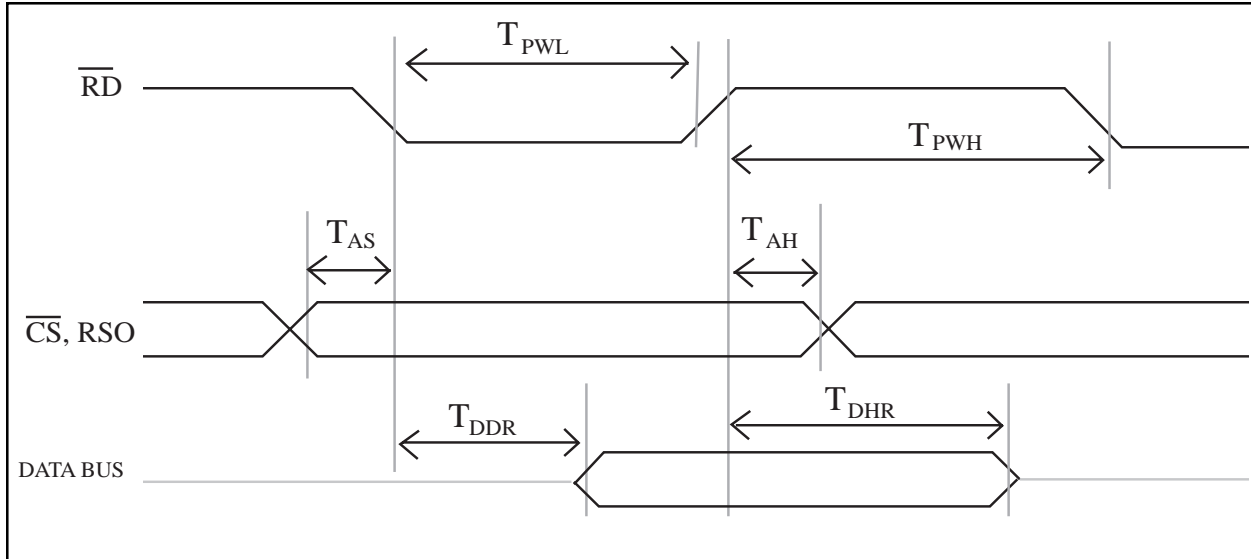
| Parameter | Conditions | Min | Typ | Max | Units |
|-------------------------------------|---|------|--|-----|------------------|
| Power Supply Current | Ring Indicate Active | | 20 | | mA |
| Coupler Match | Output impedance of external | 531 | 536 | 541 | ohms |
| AGC Input Range | Maintaining steady output level | -40 | | 0 | dBm |
| AGC Output Level | D/V held high | -20 | | -9 | dBm |
| AGC Output Level | D/V held low | -11 | | 0 | dBm |
| Billing Delay | OH activated | 2.0 | 2.3 | | seconds |
| Transhybrid Loss | at 1000 Hz | | 34 | | dBm |
| Receive Loss | at 1000 Hz | -1.0 | 0 | 1.0 | dB |
| Ring Detect Sensitivity | Min. AC voltage between Tip & Ring Type B ringer | 38 | | | v _{rms} |
| Ring Indicate Output Voltage | Ring Voltage present on Tip & Ring | | 0.2 | 0.5 | volts |
| Loop Current Switch control voltage | ON: (off-hook) Control Voltage | 2.0 | 3.0 | | volts |
| | OFF: (on-hook) | | 0.2 | 0.5 | volts |
| Loop Current Switch | Off-hook Control Current | | 0.1 | 2.0 | mA |
| Loop Current | OFF-Hook current draw from Telephone Line | 0 | 20 | 100 | mA |
| Data Bus, | Low Level Input Voltage | | | 0.8 | volts |
| | High Level Input Voltage | 2.0 | | | volts |
| Receive Sensitivity | DTMF tones | -37 | | | dBm |
| | Call Progress Tones | -30 | | | dBm |
| Tone Duration to Detect | | | | 40 | msec |
| Tone Frequencies | DTMF Transmission, | | 697 770 852 941 1209 1336 | | hz |

XE0068DT Read/Write Clock Pulse Timing



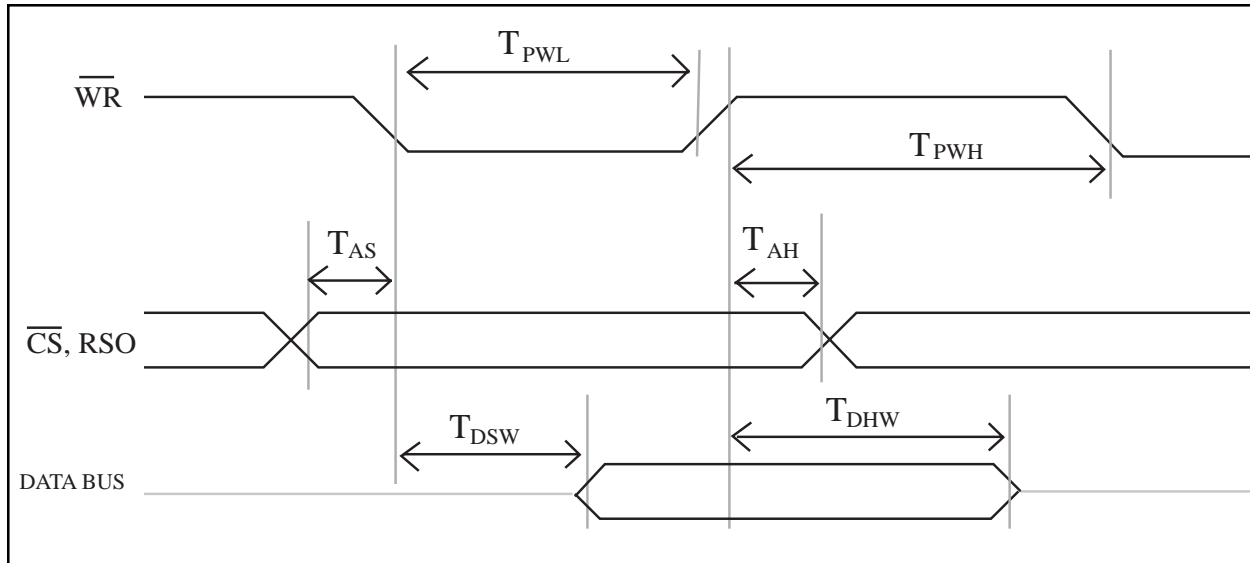
| Signal | Definition | Min | Typ | Max | Units |
|--------|-----------------------------|-----|-----|-----|-------------|
| TR | Read/Write Rise Time | | | 20 | nanoseconds |
| TF | Read/Write Fall Time | | | 20 | nanoseconds |
| TCYC | Read/Write Cycle period | | 250 | | nanoseconds |
| TRWH | Read/Write pulse width high | | 100 | | nanoseconds |
| TPWL | Read/Write pulse width low | 150 | | | nanoseconds |

XE0068DT Read Timing



| Signal | Definition | Min | Typ | Max | Units |
|--------|-----------------------|-----|-----|-----|-------------|
| TAS | Address Setup Time | 23 | | | nanoseconds |
| TAH | Address Hold Time | 26 | | | nanoseconds |
| TPWH | Read Pulse Width High | | 100 | | nanoseconds |
| TPWL | Read Pulse Width Low | 150 | | | nanoseconds |
| TDDR | Read to Valid Data | | | 100 | nanoseconds |
| TDHR | Data Hold Time (Read) | | 22 | | nanoseconds |

XE0068DT Write Timing



| Signal | Definition | Min | Typ | Max | Units |
|--------|-------------------------|-----|-----|-----|-------------|
| TAS | Address Setup Time | 23 | | | nanoseconds |
| TAH | Address Hold Time | 26 | | | nanoseconds |
| TPWH | Write Pulse Width High | | 100 | | nanoseconds |
| TPWL | Write Pulse Width Low | 150 | | | nanoseconds |
| TDDR | Data Setup Time (Write) | 45 | | | nanoseconds |
| TDHR | Data Hold Time (Write) | | | | nanoseconds |

This product complies with Part 68 of the FCC Rules and Regulations. With each device shipped, there is a label which contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this product. You must, upon request, give this information to your telephone company.

Mounting this device in the final assembly must be made in such a manner as to preserve the high voltage protection between the TIP/RING connection and the rest of the system. Typically, this may be accomplished by maintaining a minimum spacing .100 mils between the TIP/RING trace to the RJ-11C Jack and low voltage portion of the system. No additional circuitry may be attached between TIP/RING and the telephone line connection unless specifically allowed in the rules.

The REN is useful to determine the quantity of devices you may connect to the telephone line and still have all of these devices ring when the number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to the line, as determined by the REN, you should contact the local telephone company to determine the maximum REN for your calling area.

If your system causes harm to the telephone network, the telephone company may discontinue service temporarily. If possible, they will notify you in advance. If advance notification is not practical, you will be notified as soon as possible.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted service.

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If you experience trouble with the device, please contact XECOM at (408) 945-6640 for information on obtaining service or repairs. The telephone company may ask you to disconnect this device from the network until the problem has been corrected or until you are sure that the device is not malfunctioning.

There are no repairs that can be made by the customer to the XE0068.

The device may not be used on coin service lines provided by the telephone company (this does not apply to private coin telephone applications which use standard telephone lines). Connection to party lines is subject to state tariffs.

| | |
|-------------------------|-------------------|
| FCC Registration Number | DWEUSA-75283-DP-W |
| Ringer Equivalence | 0.5B |
| Telephone Jack | RJ11C |

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