

CML Semiconductor Products

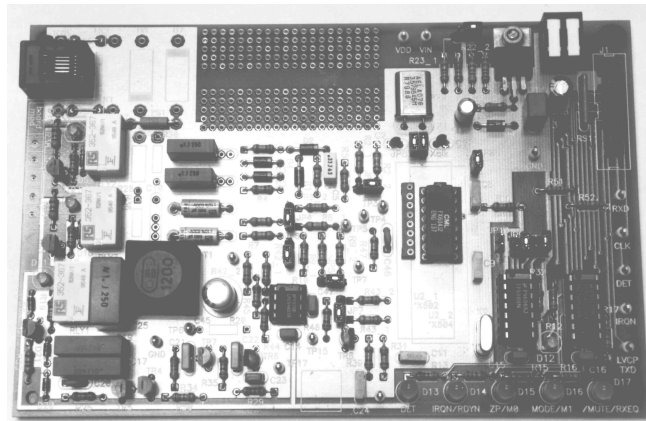
Evaluation Kit User Manual **EV6040**

UM6040/3 December 1996

Advance Information

1.0 Features

- For FX604 Product Evaluation
- Reconfigurable Board with Interface to Optional μ C Board
- Parallel Phone Detector
- Easy Access to Test Points
- User's Prototyping Area
- Space for Optional and Telco-Specific Components
- Single Power Supply Operation
- On-Board Regulator



1.1 Brief Description

The EV6040 Evaluation Kit comprises a single board containing an FX604 and its associated line interface components. It communicates with the CML μ C board (EV6000), or the user's own μ C board, demonstrating the use of an FX604 in modem applications, when user programmed. The EV6040 board is powered from a single 8 - 35V dc power supply; an on-board regulator sets 3.3V or 5.0V operation. LEDs indicate data, control and interrupt line status (DET, RDYN, RXEQ, M0 and M1) and the FX604 may be driven from an external clock, or from its own crystal oscillator. Important signals can be monitored by test points. The FX604 is socketed for easy replacement; a ZIF socket may also be fitted. The FX614 may be substituted for Bell 202 modem applications.

On-board relays may be used to implement a wetting pulse, to place an ac or dc load on the line, and to interface the line to a transformer/op-amp hybrid for modem communications. A mutable voice input and a μ C controllable or pre-settable DTMF generator are provided; operation of both these and the relays are indicated by LEDs. The parallel phone detector may be used in adjunct box emulation. The FX604 supply current may be measured by removing a jumper. Where components are telco-specific (line impedance, line protection, ac-load, wetting pulse, etc.) space is provided for the user to add appropriate components. A user prototyping area is provided.

Finally, with a different jumper configuration, an FX602 and appropriate μ C firmware, the EV6040 board may be used for evaluating the FX602. The EV6020 manual is enclosed on disk.

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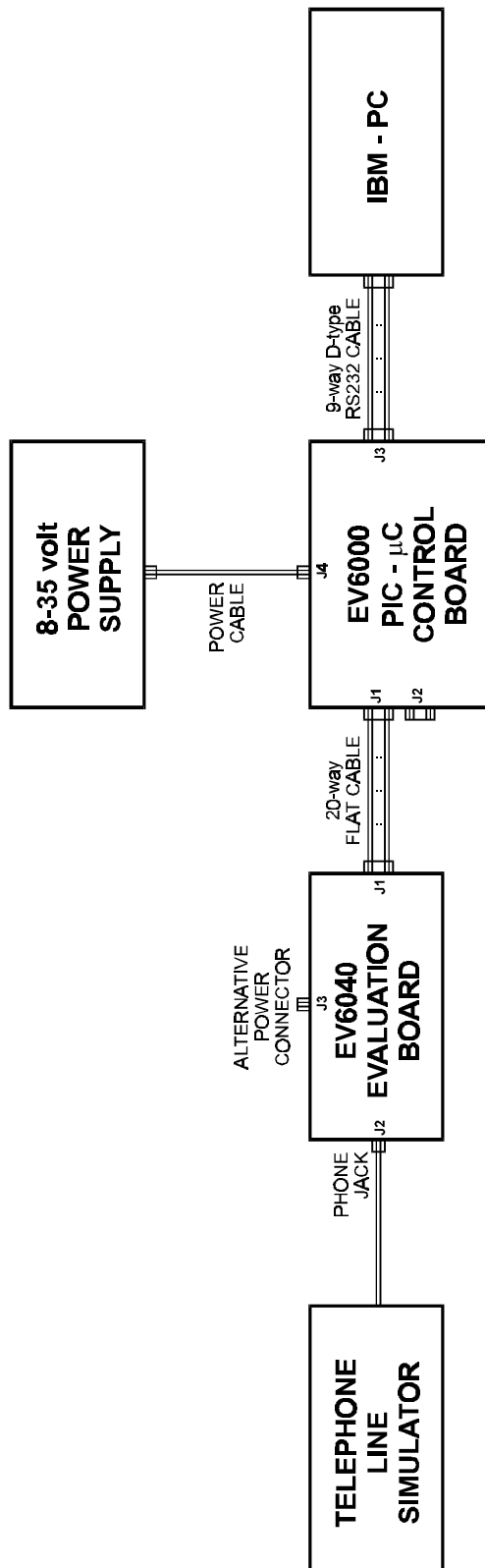


Figure 1 Block Diagram

1.2 Preliminary Information

1.2.1 Laboratory Equipment

The following laboratory equipment is needed to use this evaluation kit:

1.2.1.1 8 - 35V DC Power Supply.

1.2.1.2 Telephone Line Simulator and Line Signal Generator.

1.2.1.3 A μC control board (such as a CML EV6000, which contains the PIC 16LC74JW (or similar) μC), together with firmware and a user interface.

1.2.2 Handling Precautions

Like most evaluation kits, this product is designed for use in office and laboratory environments. The following practices will help ensure its proper operation.

1.2.2.1 Static Protection

This product uses low power CMOS circuits which may be damaged by electrostatic discharge. Partially damaged circuits may function erroneously, leading to misleading results. Observe ESD precautions at all times when handling this product.

1.2.2.2 Contents - Unpacking

Please ensure that you have received all of the items listed on the separate information sheet (EK6040) and notify CML within 7 working days if the delivery is incomplete.

1.2.3 Telephone Line Connection

This Evaluation Kit is not approved for direct or indirect connection to any public telecommunication system. Users are advised to observe local statutory requirements which may apply to this product.

1.3 Quick Start

This section provides instructions for users who wish to experiment immediately with the evaluation kit. A fuller description of the kit and its use appears later in this document.

1.3.1 Setting-Up

THE EV6040 COMES PRE-CONFIGURED WITH AN FX604, SET FOR OPERATION AT 5.0V.

The board should be interconnected to a suitable μC control board with a 20-way flat cable, as shown in the Block Diagram of Figure 1. If the EV6000 μC board is not used, then power will need to be applied separately to the EV6040 evaluation kit through connector J3. An RJ11 (US style) phone jack is provided for telephone line simulator connection. No board adjustments are required by the user, although a ($\approx 600\Omega$) line termination will need to be fitted to R20 before the EV6040 kit can be used. Other, telco-specific, components may be added, as required.

BEFORE APPLYING POWER, PLEASE CHECK THE FOLLOWING:

When using the EV6040 board with the EV6000 μC board, it will be noted that each board has connections for a single 8 - 35V dc power supply. Only one board needs to be connected as power is supplied to the other board over the flat cable. Each board has its own power supply regulator chip, with a jumper to select 3.3V or 5.0V (default) operation.

MAKE SURE BOTH BOARDS HAVE THIS JUMPER SET TO THE SAME VOLTAGE. DAMAGE MAY RESULT IF THIS STEP IS NOT OBSERVED. DO NOT OPERATE EITHER BOARD WITH ITS VOLTAGE SELECTION JUMPER REMOVED.

Ensure the component value jumpers on the evaluation board are correctly set for 3.3V or 5.0V operation. Please refer to Section 1.6.1.5 for further details.

1.3.2 Operation

This evaluation kit has no inherent functionality without a μC control board and appropriate firmware. The evaluation board may be used independently of the μC board, if the user wishes to interface to a different type of μC .

1.4 Signal Lists

CONNECTOR PINOUT - EVALUATION BOARD					
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description	
J1	1, 2	VIN	Power	+ve power from external power supply.	
	3, 4	VSS	Power	0V power from external power supply.	
	5	TX-DTMF	I/P	Enables Tx from the DTMF generator.	
	6	AC-LOAD	I/P	Controls the relay which applies an ac load across the line.	
	7	WETTING PULSE	I/P	Controls the relay which applies a wetting pulse across the line.	
	8	TX-LINE	I/P	Controls the relay which connects the transformer across the line.	
	9	D3	I/P	Control Line "D3" to the DTMF generator.	
	10	D2	I/P	Control Line "D2" to the DTMF generator.	
	11	D1	I/P	Control Line "D1" to the DTMF generator.	
	12	D0	I/P	Control Line "D0" to the DTMF generator.	
	13	604-M0	I/P	FX604: Mode Select pin (M0)	
	14	604-M1	I/P	FX604: Mode Select pin (M1)	
	15	604-RDYN	O/P	FX604: μ C Interrupt (Data Ready)	
	16	604-DET	O/P	FX604: Detect pin	
	17	604-CLK	I/P	FX604: Rx Data Clock pin	
	18	604-RXD	O/P	FX604: Rx Data pin	
	19	604-TXD	I/P	FX604: Tx Data pin	
	20	604-RXEQ	I/P	Control Line to unmute the Local Voice input (TP18) & Select FX604 Equalisation	
	J2	1, 2	-	-	Not Used. No connection needed.
		3	A	BI	Bidirectional 'phone line (A = TIP)
4		B	BI	Bidirectional 'phone line (B = RING)	
5, 6		-	-	Not Used. No connection needed.	
J3	1	VSS	Power	0V power from external power supply.	
	2	VIN	Power	+ve power from external power supply.	

Notes:

I/P = Input

O/P = Output

BI = Bidirectional

TEST POINTS - EVALUATION BOARD		
Test Point Ref.	Default Measurement	Description
TP1	0V	VSS connection.
TP2	0V	VSS connection.
TP3	-	FX602 RD input, pin 3. Not used on EV6040 evaluation board.
TP4	-	FX602 RT signal, pin 4. Not used on EV6040 evaluation board.
TP5	-	FX602 AOP signal, pin 5. Not used on EV6040 evaluation board.
TP6	V _{DD} /2	Line signal after transformer.
TP7	-	FX604 RXFB signal, pin 6.
TP8	-	FX604 RXD output, pin 13.
TP9	-	FX604 CLK input, pin 12.
TP10	-	FX604 DET output, pin 14.
TP11	-	FX604 RDYN output, pin 15. Pull-up resistor R11 is included on-board.
TP12	-	FX604 TXD input, pin 11.
TP13	3.3V or 5.0V	V _{DD} connection.
TP14	8 - 35V	V _{IN} connection.
TP15	V _{DD} /2	Hybrid transmit output (Local Voice).
TP16	V _{DD} /2	Hybrid receive output (Remote Voice).
TP17	V _{DD}	Parallel Phone Detector output.
TP18	-	Hybrid transmit input. Used as a mutable Local Voice input.

JUMPERS - EVALUATION BOARD			
Link Ref.	Positions	Default Position	Description
JP1	1-2 or 2-3	2-3	Sets R2 value for line reversal (default) or ring detect usage
JP2	1-2	1-2	Disconnect to measure I _{DD} of evaluation device.
JP3	1-2 or 2-3	2-3	Sets V _{DD} = 3.3V (1-2) or V _{DD} = 5.0V (2-3)
JP4	1-2 or 2-3	2-3	Sets FX602 input sensitivity for 3.3V or 5.0V operation.
JP5	1-2 or 2-3	2-3	Sets FX602 input sensitivity for 3.3V or 5.0V operation.
JP6	1-2 or 2-3	2-3	Sets FX604 input sensitivity for 3.3V or 5.0V operation.
JP7	1-2 or 2-3	2-3	Sets FX604 output drive level for 3.3V or 5.0V operation.
JP8_1,2	1-2	1-2	Disconnect to supply an external clock to JP8_1 (2).
JP9_1,2, JP9_3,4	1-2 1-2	all o/c	User selectable DTMF answerback code. (Default = "C").
JP10	1-2	o/c	Links the Parallel Phone Detector to connector J1:19.

1.5 Circuit Schematics and Board Layouts

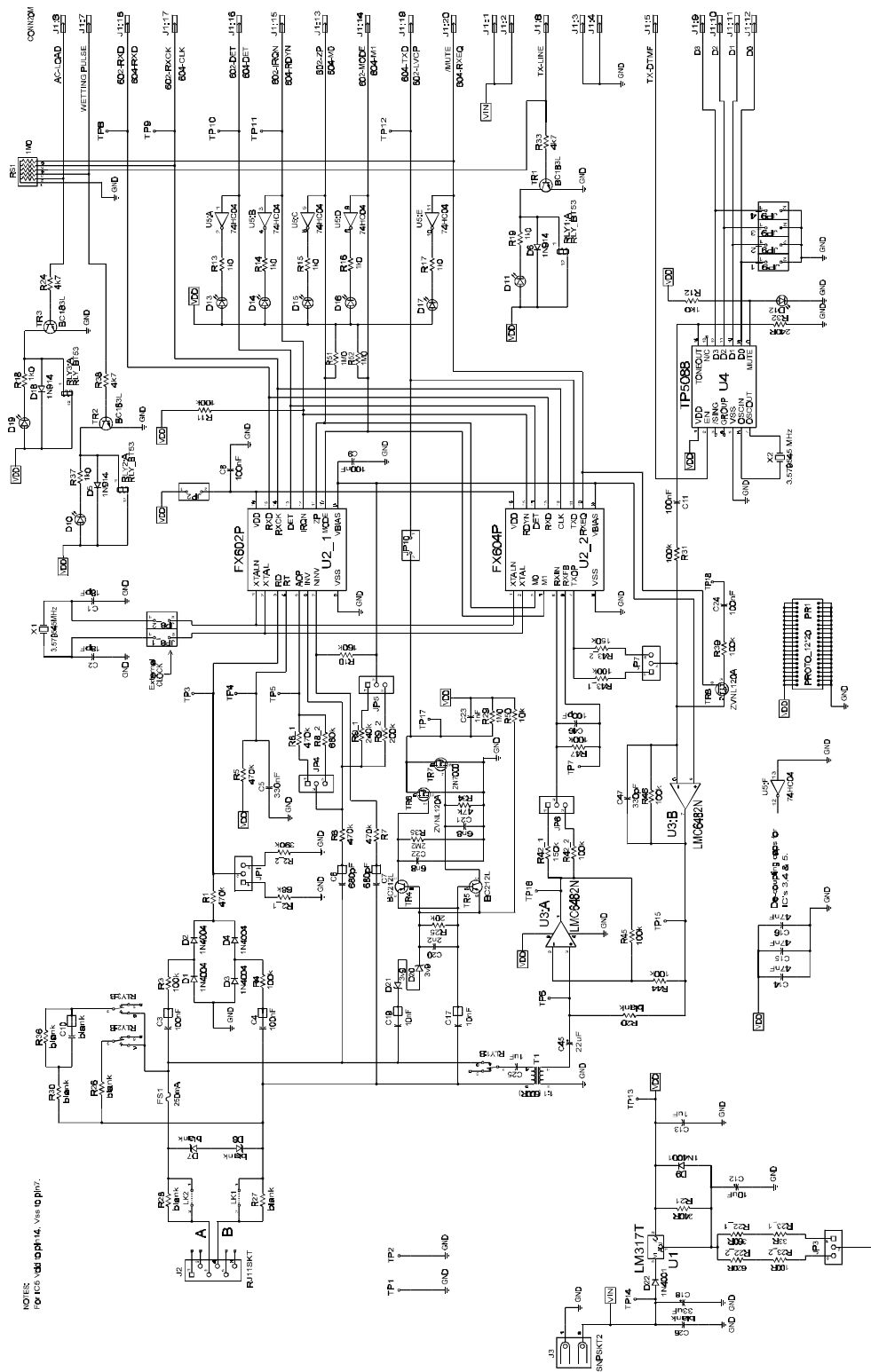


Figure 2 Evaluation Board - Circuit Schematic

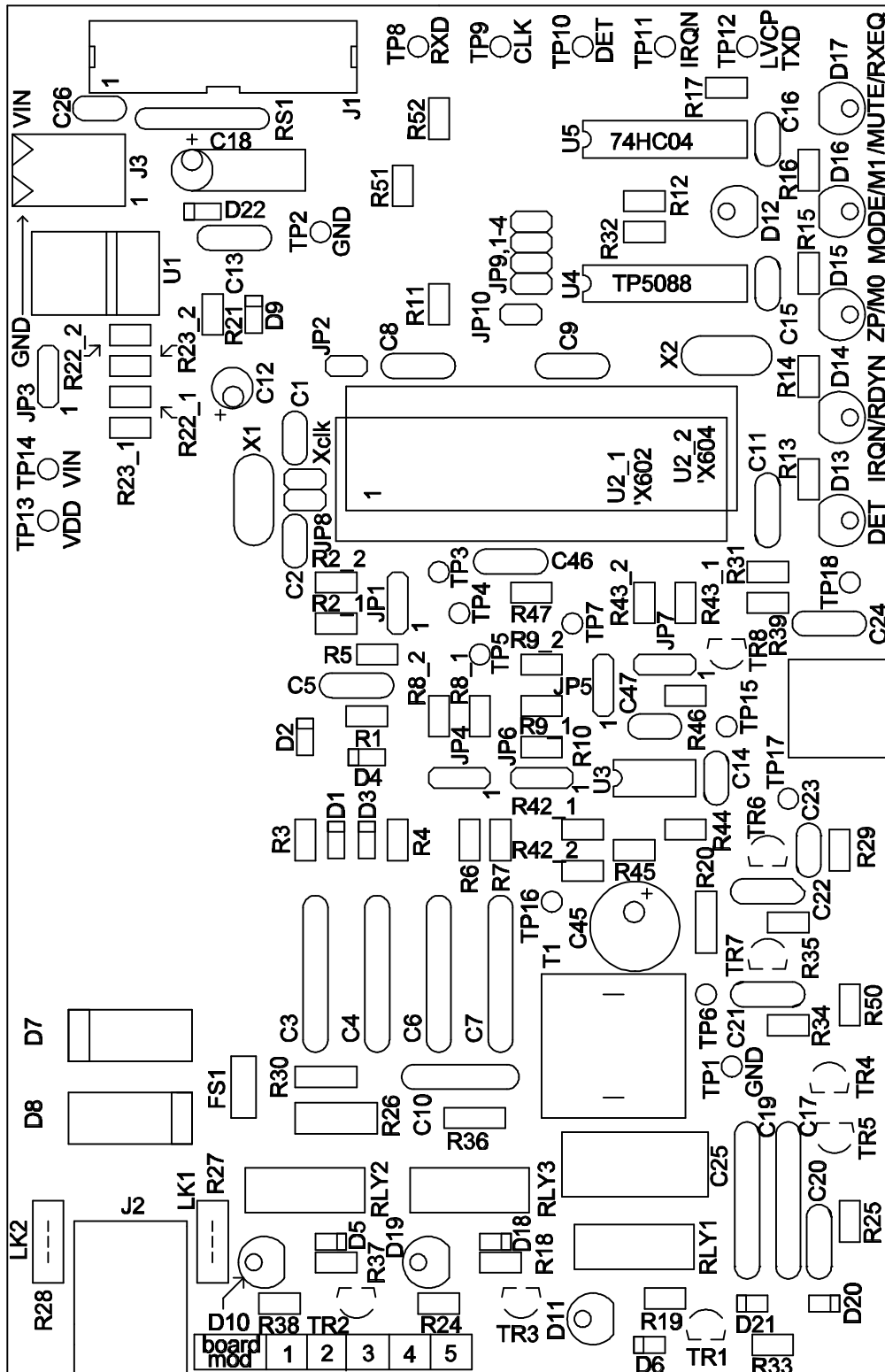


Figure 3 Evaluation Board - Layout

1.6 Detailed Description

1.6.1 Hardware Description - Evaluation Board

1.6.1.1 Line Protection

Line protection is provided by R27 (47 Ω), R28 (47 Ω), D7 and D8 (both TISP4180 or TISP5180 or TPA150A12 or TPA150B12). These components are not fitted, but suitable values for UK applications are suggested in brackets. Wire links which bypass R27 and R28 will need to be cut if these resistors are fitted.

1.6.1.2 AC or DC Load

An ac or dc load is provided by R30 (827 Ω), R36 (1386 Ω) and C10 (139nF). These components are not fitted, but suitable values for UK applications are suggested in brackets. This load is controlled by relay RLY3. A logic '1' on AC-LOAD (J1 pin 6) connects this load and illuminates the LED.

1.6.1.3 Wetting Pulse

A wetting pulse load is provided by R26, which is not fitted. For UK applications, a suitable value may be in the region of 240 Ω to 350 Ω . The wetting pulse is controlled by relay RLY2. A logic '1' on WETTING PULSE (J1 pin 7) connects the wetting pulse load and illuminates the LED.

1.6.1.4 Transformer and Op-Amp Hybrid

The transformer and op-amp hybrid are connected to the phone jack by relay RLY1. A logic '1' on TX-LINE (J1 pin 8) connects the transformer to the phone jack and illuminates the LED.

1.6.1.5 Operating Voltage

The selection of operating voltage ($V_{DD} = 3.3V$ or $5.0V$) by jumper JP3 affects the choice of component values around the evaluation device. The following jumpers should be used to select appropriate component values: JP1, JP4, JP5, JP6 and JP7. All jumpers must be set the same way: use position 1-2 for $V_{DD} = 3.3V$ and position 2-3 for $V_{DD} = 5.0V$ operation.

1.6.1.6 Clock/Oscillator

The evaluation device may use either an external clock or its own xtal oscillator. A 3.58MHz xtal is provided on-board for the latter method. Two jumpers JP8, which are normally fitted, select the xtal oscillator. An external clock may be supplied to JP8_1 (2) once the jumpers have been removed. The DTMF generator uses its own 3.58MHz xtal because the xtal oscillator is only operational when the generator is active and the evaluation device has a 'zero-power' mode (in which its xtal oscillator is disabled) preventing it from supplying a clock to the DTMF generator.

1.6.1.7 Ring/Line Reversal Detection

Ring/line reversal detection is provided by components C3, C4, R1-R4 and D1-D4. The response time constant is set by components R5 and C5. The evaluation board has been fitted with suitable components for UK applications. See FX602 data sheet for further details. This function is not used on the FX604.

1.6.1.8 Parallel Phone Detection

Parallel phone detection is provided by components C17, C19-C23, R25, R29, R34, R35, R50, D20, D21 and TR4-TR7. It only communicates with a μC control board if jumper JP10 is fitted (however, this is not possible when a FX604 is used). A $>2ms$ negative-going pulse on TP17 signifies a phone line voltage drop of $\approx 4.5V$; a $1ms$ negative-going pulse signifies a phone line voltage rise of $\approx 4.5V$.

1.6.1.9 I_{DD} Measurement

The evaluation device I_{DD} may be measured by removing jumper JP2 and replacing it with a multimeter.

1.6.1.10 DTMF Answerback Code

The DTMF answerback code may be selected by an appropriate choice of the four jumpers JP9. Fitting a jumper sets that input to logic '0'. If not fitted, the input is pulled-up on-chip to logic '1'. Alternatively, all of the JP9 jumpers may be omitted and the DTMF generator may be driven from a μ C. A logic '1' on TX-DTMF (J1 pin 5) enables the generator and illuminates the LED.

DTMF GENERATOR DECODE TABLE				DTMF CODE
J1:9 (D3)	J1:10 (D2)	J1:11 (D1)	J1:12 (D0)	
0	0	0	0	D
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	0
1	0	1	1	*
1	1	0	0	#
1	1	0	1	A
1	1	1	0	B
1	1	1	1	C

1.6.1.11 Line Impedance Matching

Line impedance matching is provided by R20, which is not fitted. A resistor (value $\approx 600\Omega$) is required for the evaluation board to operate correctly.

1.6.1.12 Voice Mute

A mutable local voice input is provided on test point TP18. A logic '1' on 604-RXEQ (J1 pin 20) unmutes the voice input, selects the FX604 equalisation and illuminates the LED. Access to voice signals is provided as follows:

The hybrid receive output (Rx = remote voice) is located on test point TP16.

The hybrid transmit output (Tx = local voice) is located on test point TP15.

If a voice input is not required, test point TP18 should be connected to ground.

1.6.1.13 Evaluation Device FX602/FX604/FX614

If the evaluation device is an FX602 it should be fitted in socket U2 position 1 and jumper JP10 should be fitted. If the evaluation device is an FX604 or FX614 it should be fitted in socket U2 position 2 and jumper JP10 should be removed, thus disabling the parallel phone detector output. This output is still available on test point TP17.

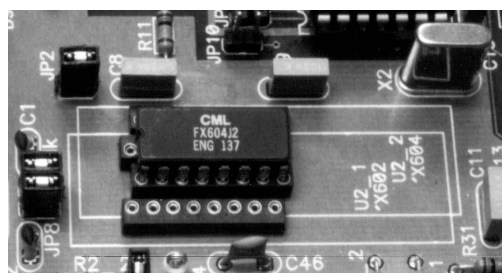


Figure 4 FX604 Configuration

1.7 Performance Specification

1.7.1 Electrical Performance

Absolute Maximum Ratings

Exceeding these maximum ratings can result in damage to the Evaluation Kit.

	Min.	Max.	Units
Supply ($V_{IN} - V_{SS}$)	-0.3	40.0	V
Supply ($V_{DD} - V_{SS}$)	-0.3	7.0	V
Voltage on any connector pin to V_{SS} (excluding J2 pins 3 and 4)	-0.3	$V_{DD} + 0.3$	V
Current into or out of V_{IN} and V_{SS} pins	0	+1.5	A
Current into or out of J2 pins 3 and 4	-250	+250	mA
Current into or out of any other connector pin	-20	+20	mA
Storage Temperature	-10	+70	°C
Operating Temperature	+10	+35	°C

Operating Limits

Correct operation of the Evaluation Kit outside these limits is not implied.

	Notes	Min.	Max.	Units
Supply ($V_{IN} - V_{SS}$)		8.0	35.0	V
Supply ($V_{DD} - V_{SS}$)		3.0	5.5	V
Operating Temperature		+10	+35	°C
External Clock Frequency		3.575965	3.583125	MHz

Operating Characteristics

For the following conditions unless otherwise specified:

Evaluation Device and DTMF Generator Xtal Frequency = 3.579545MHz,

$V_{DD} = 3.3V$ or $5.0V$, $T_{amb} = +25^{\circ}C$.

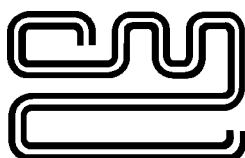
	Notes	Min.	Typ.	Max.	Units
DC Parameters					
I_{DD}	1	-	-	200	mA
AC Parameters					
Xtal/Clock Input to Evaluation Device					
'High' pulse width	2	100	-	-	ns
'Low' pulse width	2	100	-	-	ns
μC Interface (Connector J1)					
Input logic "1" level	3	80%	-	-	V_{DD}
Input logic "0" level	3	-	-	20%	V_{DD}
Input leakage current ($V_{in} = 0$ to V_{DD})	3	-5.0	-	+5.0	μA
Input capacitance	3	-	10	-	pF
Output logic "1" level ($I_{OH} = 120\mu A$)	4	90%	-	-	V_{DD}
Output logic "0" level ($I_{OL} = 360\mu A$)	4	-	-	10%	V_{DD}

- Notes:**
1. Not including any current drawn from the board connector pins by external circuitry.
 2. Timing for an external input to the XTAL/CLOCK pin.
 3. When μ C pin is configured as an input.
 4. When μ C pin is configured as an output.

Operating Characteristics - Timing Diagrams

For FX602/FX604/FX614 timing information and operating characteristics, refer to CML Data Sheets.

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CONSUMER MICROCIRCUITS LIMITED

1 WHEATON ROAD
WITHAM - ESSEX
CM8 3TD - ENGLAND

Telephone: +44 1376 513833
Telefax: +44 1376 518247
e-mail: sales@cmlmicro.co.uk
<http://www.cmlmicro.co.uk>