Low-Voltage PCM Repeater

GENERAL DESCRIPTION

The XR-C277 is a monolithic repeater circuit for Pulse-Code Modulated (PCM) telephone systems. It is designed to operate as a regenerative repeater at 1.544 Megabits per second (Mbps) data rate on T1-type PCM lines. It is packaged in a hermetic 16-Pin CERDIP package and is designed to operate over a temperature range of -40°C to +85°C. It contains all the basic functional blocks of a regenerative repeater system, including Automatic Line Build-Out (ALBO) and equalization, and is insensitive to reflections caused by cable discontinuities.

The key feature of the XR-C277 is its ability to operate with low supply voltage (6.3 volts and 4.3 volts) with a supply current of less than 13 mA. Compared to conventional repeater designs using discrete components, the XR-C277 monolithic repeater IC offers greatly improved reliability and performance, along with significant savings in power consumption and system cost.

The XR-C277-5F is an improved version of XR-C277 with an internal feedback that improved the phase gain margin which enables the system to be more stable and less sensitive to PC board layouts.

Other versions of the XR-C277-5F are XR-C277-F and XR-C277-FL. XR-C277-F is an AC tested device of XR-C277-5F at 2Mbit while XR-C277-FL is the equivalen at 1.544 Mbit.

FEATURES

Contains all the Active Components of a PCM Repeater
Low-Voltage Operation (6.3 volts)
Low-Power Dissipation (13 mA)
On-Chip ALBO Port
High-Current Output Drivers
Increased Reliability over Discrete Designs
2 Megabit Operation Capability
Pin-Compatible with XR-C240

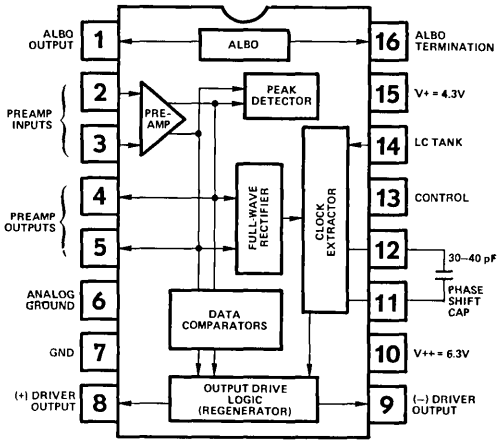
ABSOLUTE MAXIMUM RATINGS

Storage Temperature	-65°C to +150°C
Operating Temperature	-40°C to +85°C
Supply Voltage	-0.5 to +10 V
Input Voltage (Except Pin 1,16)	-0.5 to +7 V
Input Voltage (Pin 1,16)	-0.5 to +0.5 V
Data Output Voltage (Pin 8,9)	20 V
Voltage Surge (Pin 2,3,8,9) (10 msec only)	50 V

SYSTEM DESCRIPTION

The XR-C277 contains all the active circuits required to build one side of a T1 or 2 M bit/s PCM repeater. T1 is the most widely used PCM transmission system, operating at 1.544 M bit/s. It can operate on either pulp or plastic insulated twisted pair cables. Although the cable gauge may vary the total cable loss should not exceed 36 dB at 772 kHz. For a 22 gauge pulp insulated cable and a bit error rate (BER) of less than 10-6 the max allowable repeater to repeater spacing is about 6300 feet.

FUNCTIONAL BLOCK DIAGRAM



Bipolar PCM signal is attenuated and dispersed in time as it travels along a transmission cable. This signal, when received, is amplified and reconstructed by the preamplifier automatic line build out (ALBO), clock and data threshold detector circuits contained within the XR-C277. Amplitude equalization and frequency spectrum shaping is achieved through the variable impedance of the ALBO port and its associated ALBO network.

Incoming pulse stream is full wave rectified and timing information is extracted by the clock threshold detector. Clock recovery is then achieved by pulsing a tank circuit tuned to 1.544 MHz. Either injection locking or pulsed tank type clock extraction are possible with the XR-C277. By grounding Pin 13, the circuit works in the injection lock mode. Floating (open) Pin 13 switches the XR-C277 to an pulse tank mode. The oscillator's sinusoidal waveform is amplified and phase shifted by 90 degrees with the help of a capacitor between Pins 11 and 12.

Data is sampled and stored in the output data latches by an internally generated sampling pulse. Buffer drivers are then enabled to produce precisely timed output pulses whose width and time of occurence are controlled by the regenerated clock signal.

ELECTRICAL CHARACTERISTICS

Test Conditions: +25°C, V++ = 6.3V ±5%, V+ = 4.4V ±5%, unless specified otherwise.

PARAMETERS	LIMITS			UNITS	CONDITIONS
	MIN.	TYP.	MAX.		
Supply Current					
I_A		3.5		mA	Measured at Pin 10
I_B		7.5		mA	Measured at Pin 15
Total Current	8	11	13	mA	(I_C + I_B)
Preamplifier					
Input Offset Voltage		1.5	15	mV	Measured at Pins 2 and 3
Input Bias Current		0.3	4	µA	Measured at Pins 2 and 3
Voltage Gain	44	48	51	dB	Single-ended Gain
Preamp Output Swing					Measured at Pins 4 and 5
High Swing	3.45	3.6	3.75	V	Maximum Voltage Swing
Low Swing	1.25	1.4	1.55	V	Minimum Voltage Swing
Output DC Level	2.47	2.55	2.72	V	
ALBO Section					
ALBO "Off" Voltage		10	75	mV	Measured from Pin 1 and 16 to Ground
ALBO "On" Voltage	0.6	0.87	1.1	V	Measured at Pin 1
ALBO "On Voltage	1.2	1.5	2.1	V	Measured at Pin 16
ALBO Threshold	1.35	1.50	1.65	V	Measured Differentially Across Pins 4 and 5
Differential Threshold	-75		+75	mV	Threshold Difference for Polarity Reversal at Pins 4 and 5
ALBO "On" Impedance		5	10	Ω	Measured at Pin 1
ALBO "Off" Impedance	20	50		kΩ	Measured at Pin 1
Comparator Thresholds					
Clock Threshold	68	73	78	%	% of ALBO Threshold
Data Threshold	47	50	53	%	% of ALBO Threshold
Clock Extractor					
Oscillator Current	10	14	20	µA	
Tank Drive Impedance		50		kΩ	
Recommended OSC. Q	100				
$I_{injection}/I_{OSC.}$	6.0	7	7.5		Ratio of Current Q_{1B} to Current in Q_{1A}
Output Driver					
Low Output Voltage	0.65	0.75	0.95	V	Measured at Pins 8 and 9 I_L = 15 mA
Output "Off" Current		5	100	µA	V_{out} = 20V
Output Pulse					
Max. Pulse Width Error			±30	n sec	
Rise Time			80	n sec	
Full Time			80	n sec	

APPLICATIONS

PCM Repeater for T1 Systems
PCM Repeater for 2 M Bit/s Systems

ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-C277	Ceramic	-40°C to +85°C
XR-C277-5F	Ceramic	-40°C to +85°C
XR-C277-F	Ceramic	-40°C to +85°C
XR-C277-FL	Ceramic	-40°C to +85°C