Base Band Signal

A

Definition: Signal transmitted near zero frequency range without frequency modulation.

$a_{K=3.3\ V}$

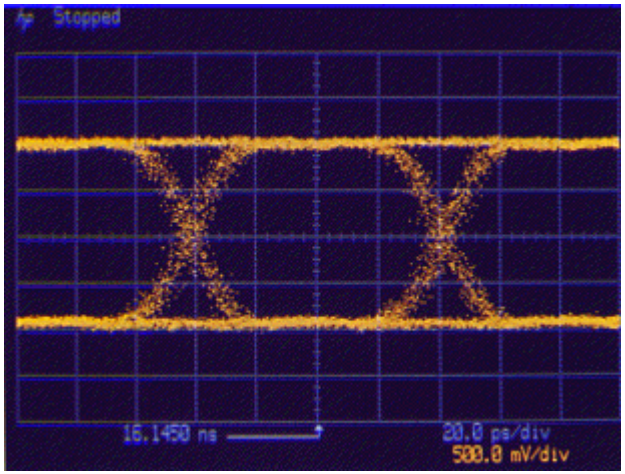
Time domain

B

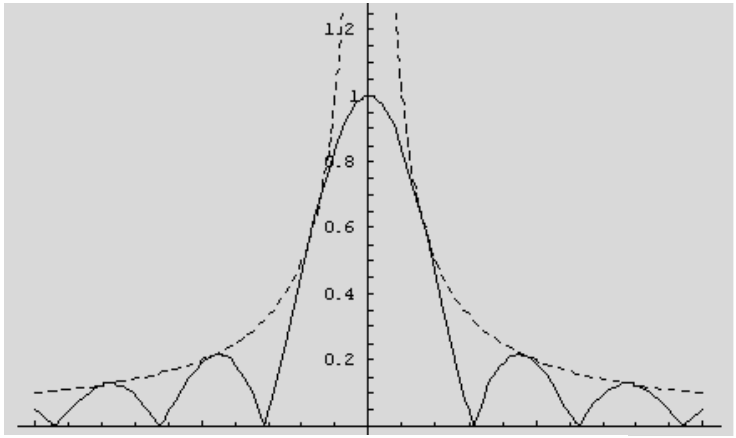
t

3×10^{-6}

Mathematical Description of Base Band Signal, see lecture notes.



Frequency domain



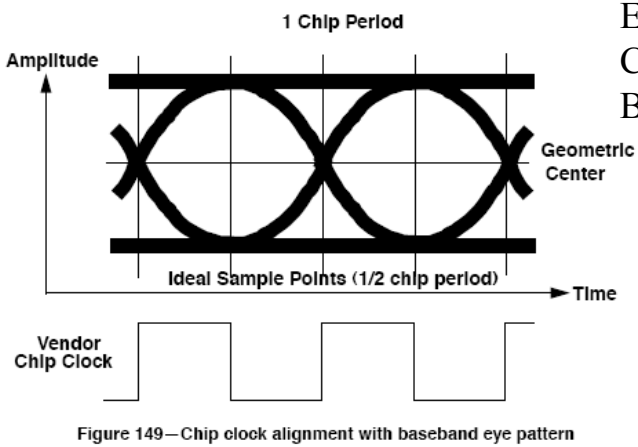


Figure 149—Chip clock alignment with baseband eye pattern

Eye Pattern: Characterization of Base Band Signal

IEEE 802.11b Standard pp. 56

Eye Patterns of Base Band Signals

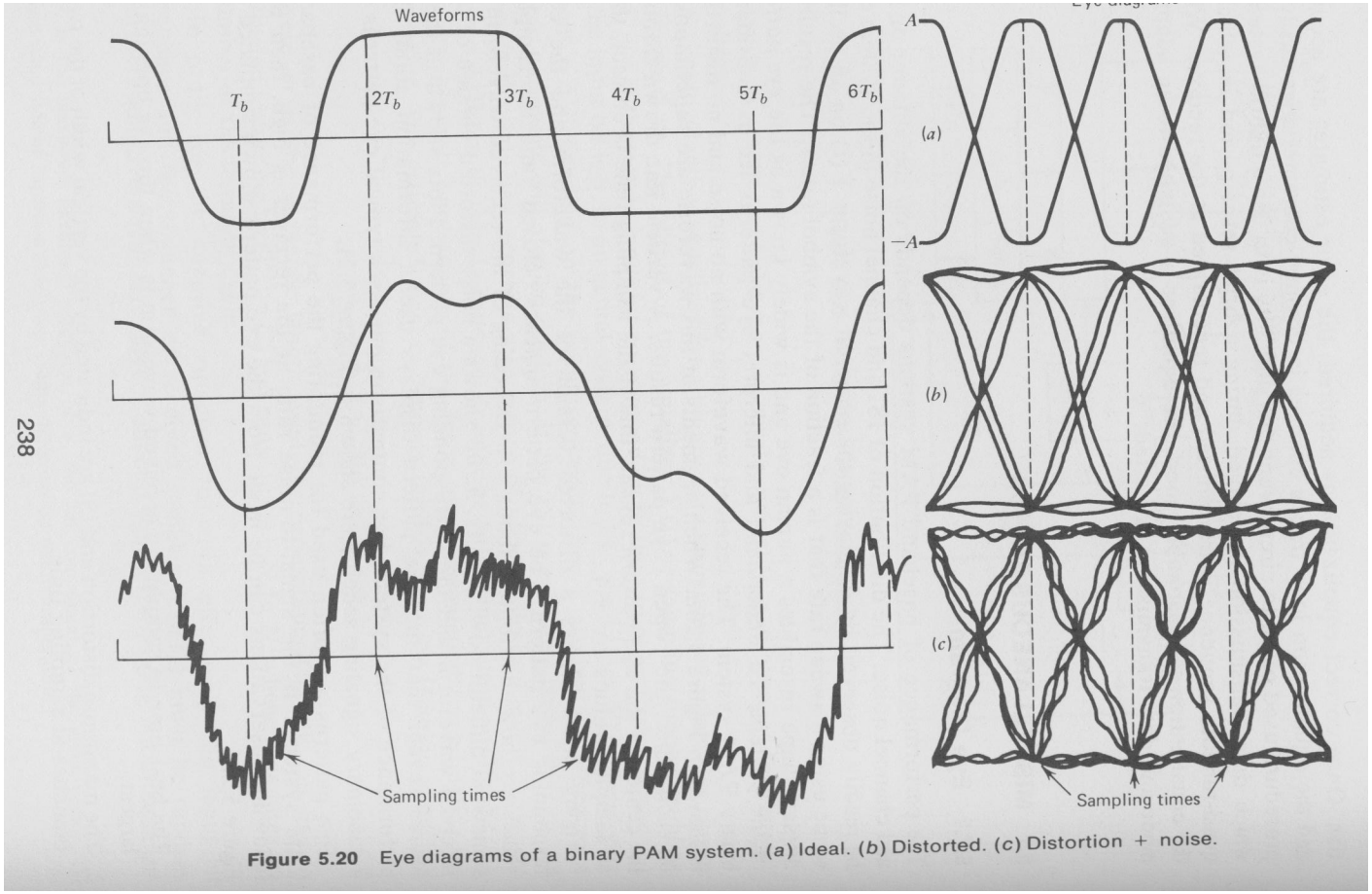
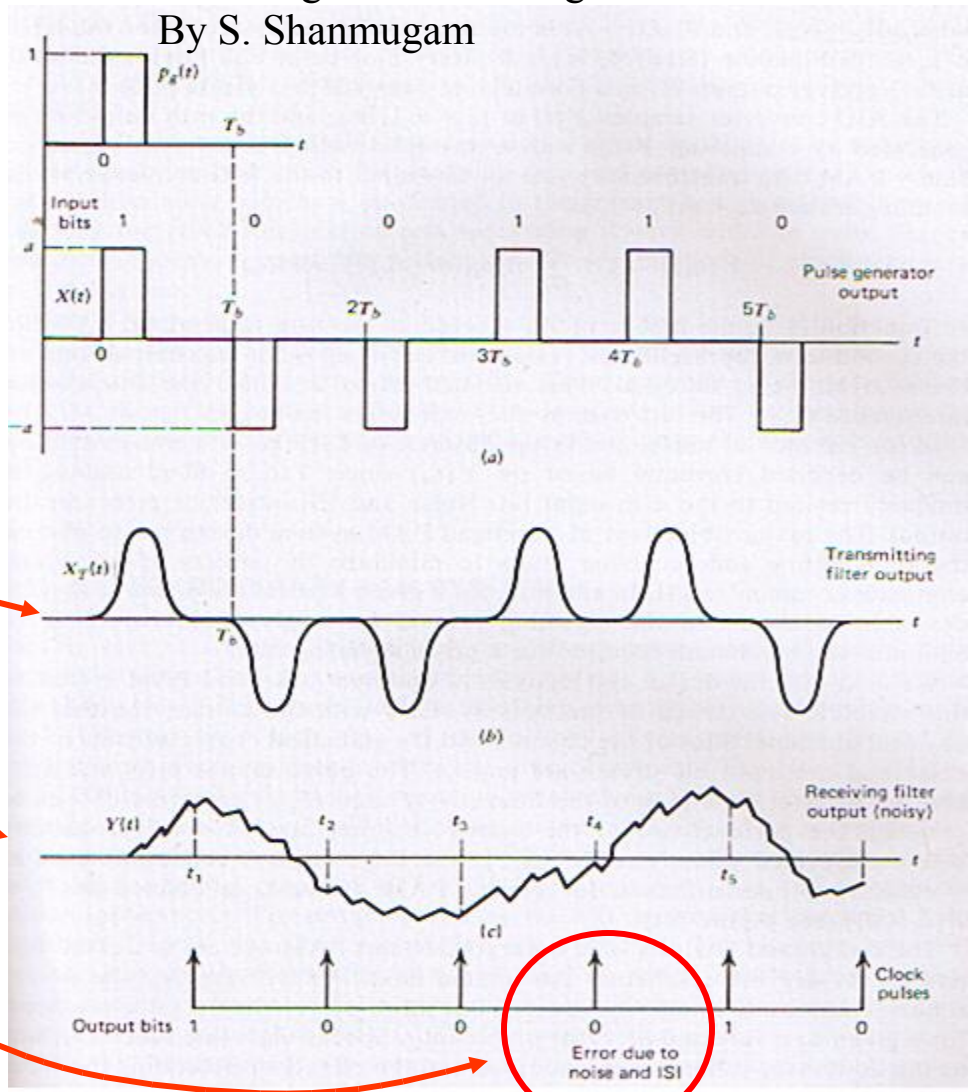


Figure 5.20 Eye diagrams of a binary PAM system. (*a*) Ideal. (*b*) Distorted. (*c*) Distortion + noise.

Reference: Digital and Analog Communication Systems, by K. Sam Shanmugam

Based Band Signal w/o Modulation

From Digital and Analog Communications
By S. Shanmugam

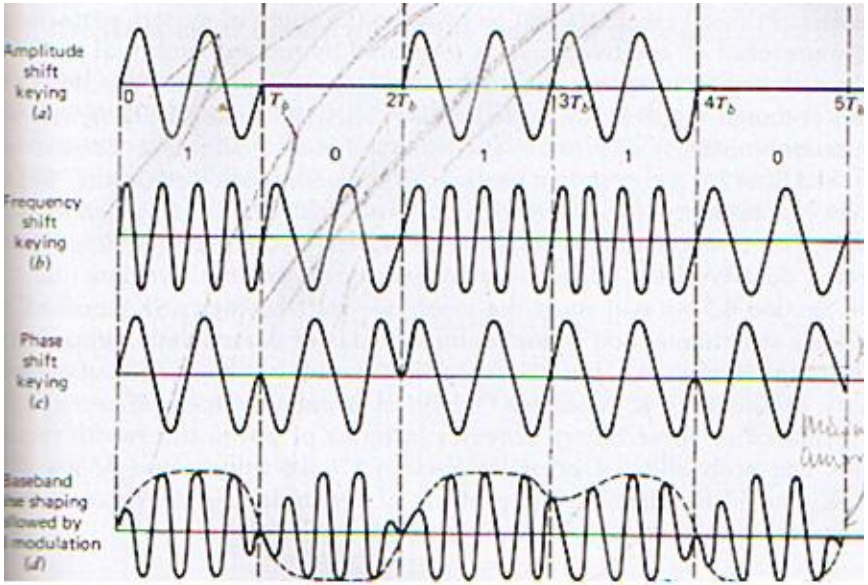


Transmitting Filter Output

Receiving Filter Output

Error

ASK, FSK, PSK



ASK

FSK

PSK

Base Band Shaping + Analog Modulation (DSB)

Review

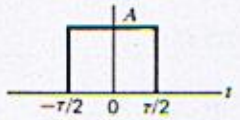
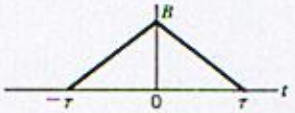
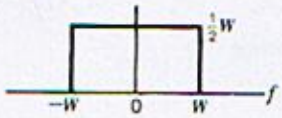
$$X(f) = \int_{-\infty}^{\infty} x(t) \exp(-j2\pi ft)\, dt$$

$$x(t) = \int_{-\infty}^{\infty} X(f) \exp(j2\pi ft)\, df$$

$$\int_{-\infty}^{\infty} |x(t)|^2\, dt = \int_{-\infty}^{\infty} |X(f)|^2\, df$$

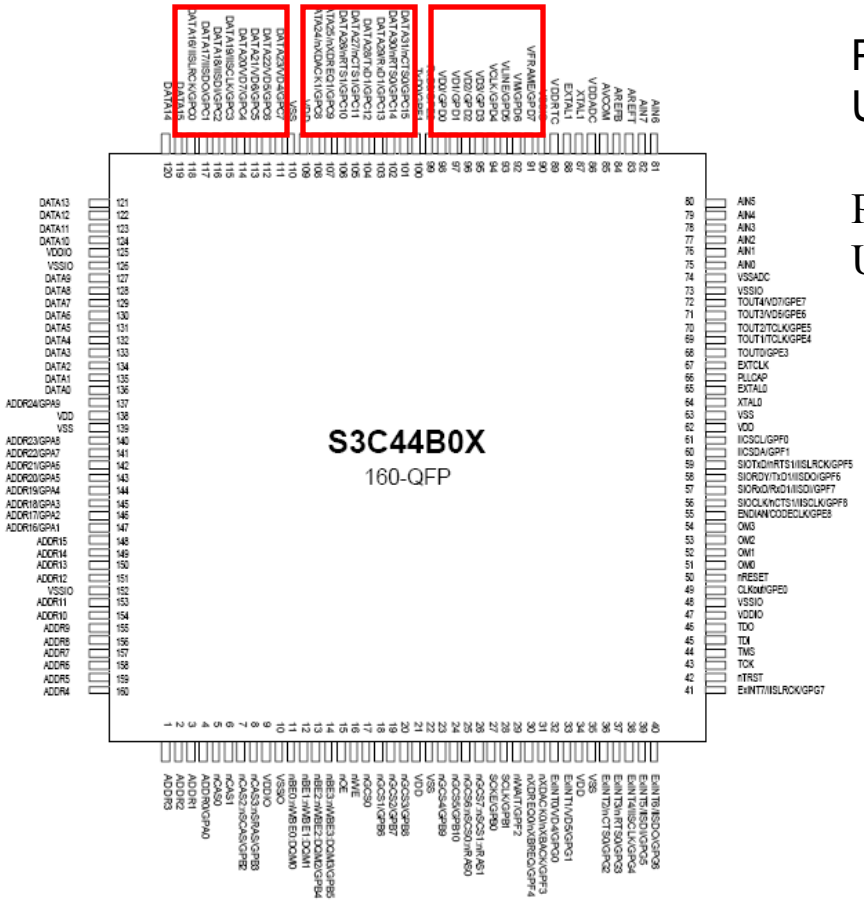
Table C.1. Transform theorems.

Name of theorem	Signal	Fourier transform
(1) Superposition	$a_1x_1(t) + a_2x_2(t)$	$a_1X_1(f) + a_2X_2(f)$
(2) Time delay	$x(t - t_0)$	$X(f) \exp(-j2\pi ft_0)$
(3) Scale change	$x(at)$	$\lvert a\rvert^{-1}X(f/a)$
(4) Frequency translation	$x(t) \exp(j2\pi f_0t)$	$X(f - f_0)$
(5) Modulation	$x(t) \cos 2\pi f_0t$	$\frac{1}{2}X(f - f_0) + \frac{1}{2}X(f + f_0)$
(6) Differentiation	$\frac{d^nx(t)}{dt^n}$	$(j2\pi f)^nX(f)$
(7) Integration	$\int_{-\infty}^{t} x(t')\, dt'$	$(j2\pi f)^{-1}X(f) + \frac{1}{2}X(0)\delta(f)$
(8) Convolution	$\int_{-\infty}^{\infty} x_1(t - t')x_2(t')\, dt'$ $= \int_{-\infty}^{\infty} x_1(t')x_2(t - t')\, dt'$	$X_1(f)X_2(f)$
(9) Multiplication	$x_1(t)x_2(t)$	$\int_{-\infty}^{\infty} X_1(f - f')X_2(f')\, df'$ $= \int_{-\infty}^{\infty} X_1(f')X_2(f - f')\, df'$

(1)		$A\tau \frac{\sin \pi f\tau}{\pi f\tau} \triangleq A\tau \operatorname{sinc} f\tau$
(2)		$B\tau \frac{\sin^2 \pi f\tau}{(\pi f\tau)^2} \triangleq B\tau \operatorname{sinc}^2 f\tau$
(3)	$e^{-\alpha t}u(t)$	$\frac{1}{\alpha + j2\pi f}$
(4)	$\exp(-\lvert t\rvert/\tau)$	$\frac{2\tau}{1 + (2\pi f\tau)^2}$
(5)	$\exp[-\pi(t/\tau)^2]$	$\tau \exp[-\pi(f\tau)^2]$
(6)	$\frac{\sin 2\pi Wt}{2\pi Wt} \triangleq \operatorname{sinc} 2Wt$	
(7)	$\exp[j(2\pi f_ct + \phi)]$	$\exp(j\phi)\delta(f - f_c)$
(8)	$\cos(2\pi f_ct + \phi)$	$\frac{1}{2}\delta(f - f_c)\exp(j\phi) + \frac{1}{2}\delta(f + f_c)\exp(-j\phi)$
(9)	$\delta(t - t_0)$	$\exp(-j2\pi ft_0)$
(10)	$\sum_{n=-\infty}^{\infty} \delta(t - nT_s)$	$\frac{1}{T_s}\sum_{n=-\infty}^{\infty} \delta\left(f - \frac{n}{T_s}\right)$
(11)	$\operatorname{sgn} t = \begin{cases} +1, & t > 0 \\ -1, & t < 0 \end{cases}$	$-\frac{j}{\pi f}$
(12)	$u(t) = \begin{cases} 1, & t > 0 \\ \end{cases}$	$\frac{1}{2}\delta(f) + \frac{1}{\quad}$

From Digital and Analog Communications, By S. Shanmugam, John Weiley and Sons

GPP Port Interface

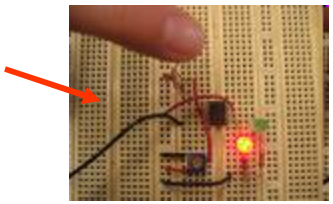


Port C: 16-bit input/output port.
Use: GPC0 –GPC7

Port D: 8-bit input/output port.
Use: GPD0-GPD7

Step 1: Testing RS232 I/F with ARM board

Write	"1"	LED ON
	"0"	LED OFF
Read	"1"	Switch On
	"0"	Switch Off



Testing Write

Step 2: Testing RS232 I/F with ARM board

Testing Timing	Use hyper-terminal or mini-com (Linux)