

Table 6.1 Values of Q-function

$x$	$Q(x)$	$x$	$Q(x)$	$x$	$Q(x)$	$x$	$Q(x)$
0.00	0.5	2.30	0.010724	4.55	$2.6823 \times 10^{-6}$	6.80	$5.231 \times 10^{-12}$
0.05	0.48006	2.35	0.0093867	4.60	$2.1125 \times 10^{-6}$	6.85	$3.6925 \times 10^{-12}$
0.10	0.46017	2.40	0.0081975	4.65	$1.6597 \times 10^{-6}$	6.90	$2.6001 \times 10^{-12}$
0.15	0.44038	2.45	0.0071428	4.70	$1.3008 \times 10^{-6}$	6.95	$1.8264 \times 10^{-12}$
0.20	0.42074	2.50	0.0062097	4.75	$1.0171 \times 10^{-6}$	7.00	$1.2798 \times 10^{-12}$
0.25	0.40129	2.55	0.0053861	4.80	$7.9333 \times 10^{-7}$	7.05	$8.9459 \times 10^{-13}$
0.30	0.38209	2.60	0.0046612	4.85	$6.1731 \times 10^{-7}$	7.10	$6.2378 \times 10^{-13}$
0.35	0.36317	2.65	0.0040246	4.90	$4.7918 \times 10^{-7}$	7.15	$4.3389 \times 10^{-13}$
0.40	0.34458	2.70	0.003467	4.95	$3.7107 \times 10^{-7}$	7.20	$3.0106 \times 10^{-13}$
0.45	0.32636	2.75	0.0029798	5.00	$2.8665 \times 10^{-7}$	7.25	$2.0839 \times 10^{-13}$
0.50	0.30854	2.80	0.0025551	5.05	$2.2091 \times 10^{-7}$	7.30	$1.4388 \times 10^{-13}$
0.55	0.29116	2.85	0.002186	5.10	$1.6983 \times 10^{-7}$	7.35	$9.9103 \times 10^{-14}$
0.60	0.27425	2.90	0.0018658	5.15	$1.3024 \times 10^{-7}$	7.40	$6.8092 \times 10^{-14}$
0.65	0.25785	2.95	0.0015889	5.20	$9.9644 \times 10^{-8}$	7.45	$4.667 \times 10^{-14}$
0.70	0.24196	3.00	0.0013499	5.25	$7.605 \times 10^{-8}$	7.50	$3.1909 \times 10^{-14}$
0.75	0.22663	3.05	0.0011442	5.30	$5.7901 \times 10^{-8}$	7.55	$2.1763 \times 10^{-14}$
0.80	0.21186	3.10	0.0009676	5.35	$4.3977 \times 10^{-8}$	7.60	$1.4807 \times 10^{-14}$
0.85	0.19766	3.15	0.00081635	5.40	$3.332 \times 10^{-8}$	7.65	$1.0049 \times 10^{-14}$
0.90	0.18406	3.20	0.00068714	5.45	$2.5185 \times 10^{-8}$	7.70	$6.8033 \times 10^{-15}$
0.95	0.17106	3.25	0.00057703	5.50	$1.899 \times 10^{-8}$	7.75	$4.5946 \times 10^{-15}$
1.00	0.15866	3.30	0.00048342	5.55	$1.4283 \times 10^{-8}$	7.80	$3.0954 \times 10^{-15}$
1.05	0.14686	3.35	0.00040406	5.60	$1.0718 \times 10^{-8}$	7.85	$2.0802 \times 10^{-15}$
1.10	0.13567	3.40	0.00033693	5.65	$8.0224 \times 10^{-9}$	7.90	$1.3945 \times 10^{-15}$
1.15	0.12507	3.45	0.00028029	5.70	$5.9904 \times 10^{-9}$	7.95	$9.3256 \times 10^{-16}$
1.20	0.11507	3.50	0.00023263	5.75	$4.4622 \times 10^{-9}$	8.00	$6.221 \times 10^{-16}$
1.25	0.10565	3.55	0.00019262	5.80	$3.3157 \times 10^{-9}$	8.05	$4.1397 \times 10^{-16}$

Function	Time Waveform $w(t)$	Spectrum $W(f)$
Rectangular	$\Pi\left(\frac{t}{T}\right)$	$T[\text{Sa}(\pi fT)]$ <span style="float: right;">T is the pulse width</span>
Triangular	$\Lambda\left(\frac{t}{T}\right)$	$T^2[\text{Sa}(\pi fT)]^2$
Unit step	$u(t) \triangleq \begin{cases} +1, & t > 0 \\ 0, & t < 0 \end{cases}$	$\frac{1}{j} \delta(f) + \frac{1}{j2\pi f}$
Signum	$\text{sgn}(t) \triangleq \begin{cases} +1, & t > 0 \\ -1, & t < 0 \end{cases}$	$\frac{1}{j\pi f}$
Constant	1	$\delta(f)$
Impulse at $t = t_0$	$\delta(t - t_0)$	$e^{-j2\pi f t_0}$
Sin c	$\text{Sa}(2\pi Wt)$	$\frac{1}{2W} \Pi\left(\frac{f}{2W}\right)$ <span style="float: right;">2W is the pulse width</span>
Phasor	$e^{j(\omega_0 t + \varphi)}$	$e^{j\varphi} \delta(f - f_0)$
Sinusoid	$\cos(\omega_c t + \varphi)$	$\frac{1}{2} e^{j\varphi} \delta(f - f_c) + \frac{1}{2} e^{-j\varphi} \delta(f + f_c)$
Gaussian	$e^{-\pi(t/t_0)^2}$	$t_0 e^{-\pi(f/f_0)^2}$
Exponential, one-sided	$\begin{cases} e^{-t/T}, & t > 0 \\ 0, & t < 0 \end{cases}$	$\frac{1}{1 + j2\pi fT}$

Performance of various Binary signaling system assuming optim. detection (using matched filter detection)

signaling	BER *	$E_b$ (*)	$\sigma^2$ variance noise
unipolar NRZ ON-OFF signaling	$Q\left(\sqrt{\frac{E_b}{N_0}}\right)$	$\frac{A^2 T_b}{2}$	
Polar NRZ Antipolar NRZ	$Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$	$\frac{A^2 T_b}{1}$	
Bipolar NRZ	$\frac{3}{2} Q\left(\sqrt{\frac{E_b}{N_0}}\right)$	$\frac{A^2 T_b}{2}$	$\frac{N_0 A^2 T_b}{2}$
BASK	$Q\left(\sqrt{\frac{E_b}{N_0}}\right)$	$\frac{A_c^2 T_b}{4}$	
BPSK	$Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$	$\frac{A_c^2 T_b}{2}$	
BFSK	$Q\left(\sqrt{\frac{E_b}{N_0}}\right)$	$\frac{A_c^2 T_b}{2}$	$2N_0 T_b$
Non-coherent BFSK	$\frac{1}{2} e^{-E_b/N_0}$	$\frac{A_c^2 T_b}{2}$	
Non-coherent BASK	$\frac{1}{2} e^{-\frac{E_b}{2N_0}}$	$\frac{A_c^2 T_b}{4}$	

\* Note  $E_b/N_0$  is also called SNR/bit

remember SNR  $\equiv$  peak signal to RMS noise power ratio.

(\*) Energy per bit