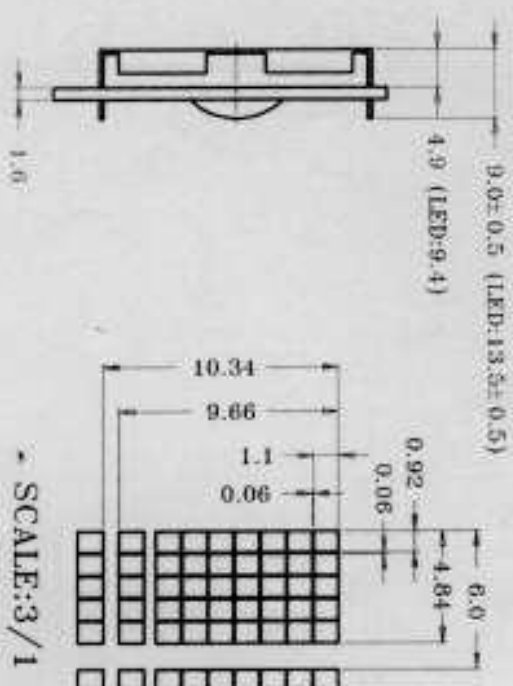
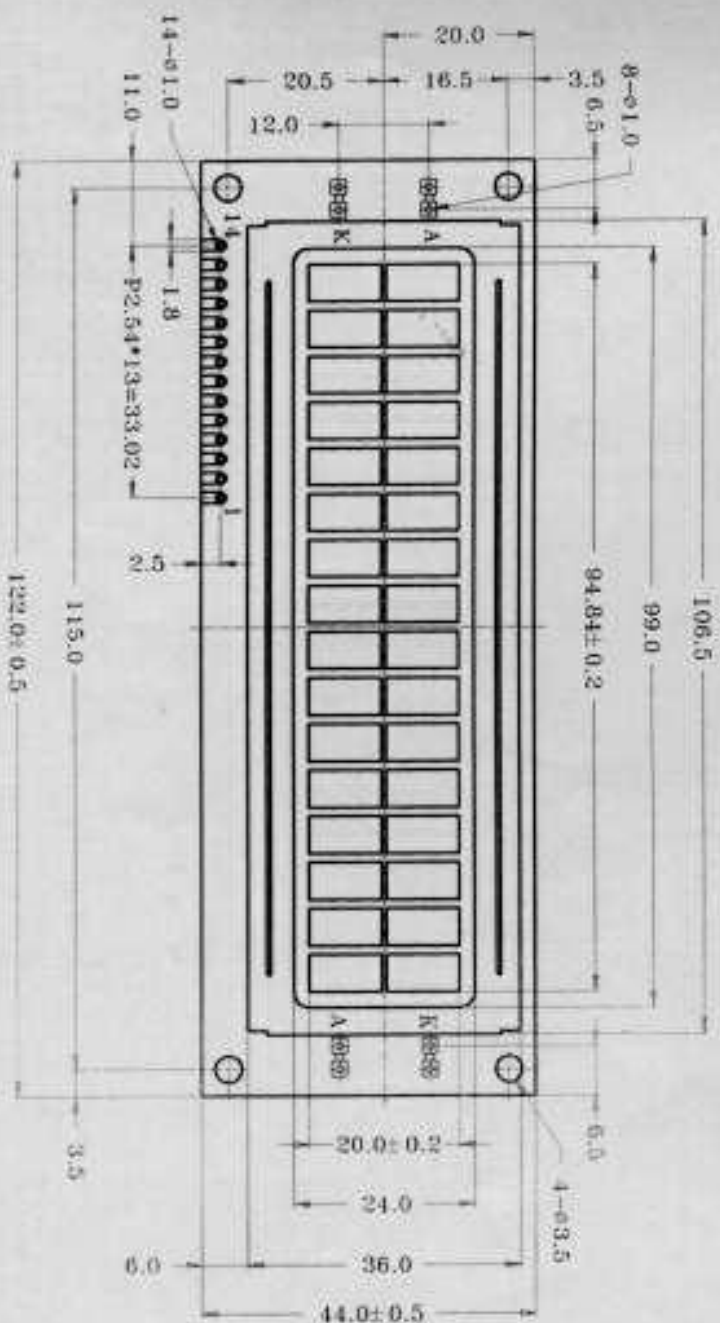
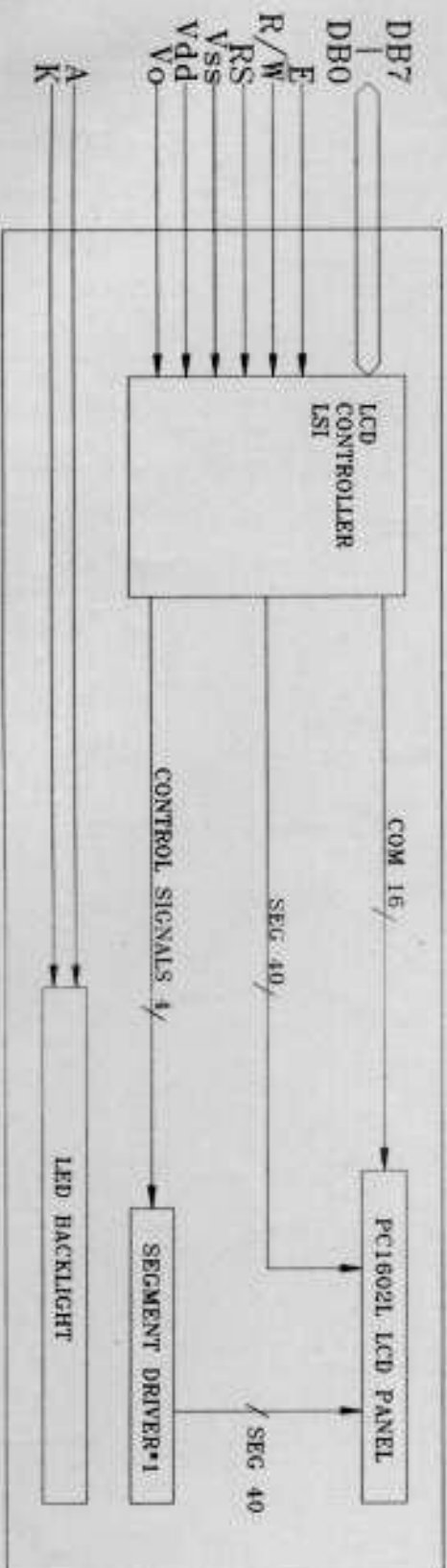




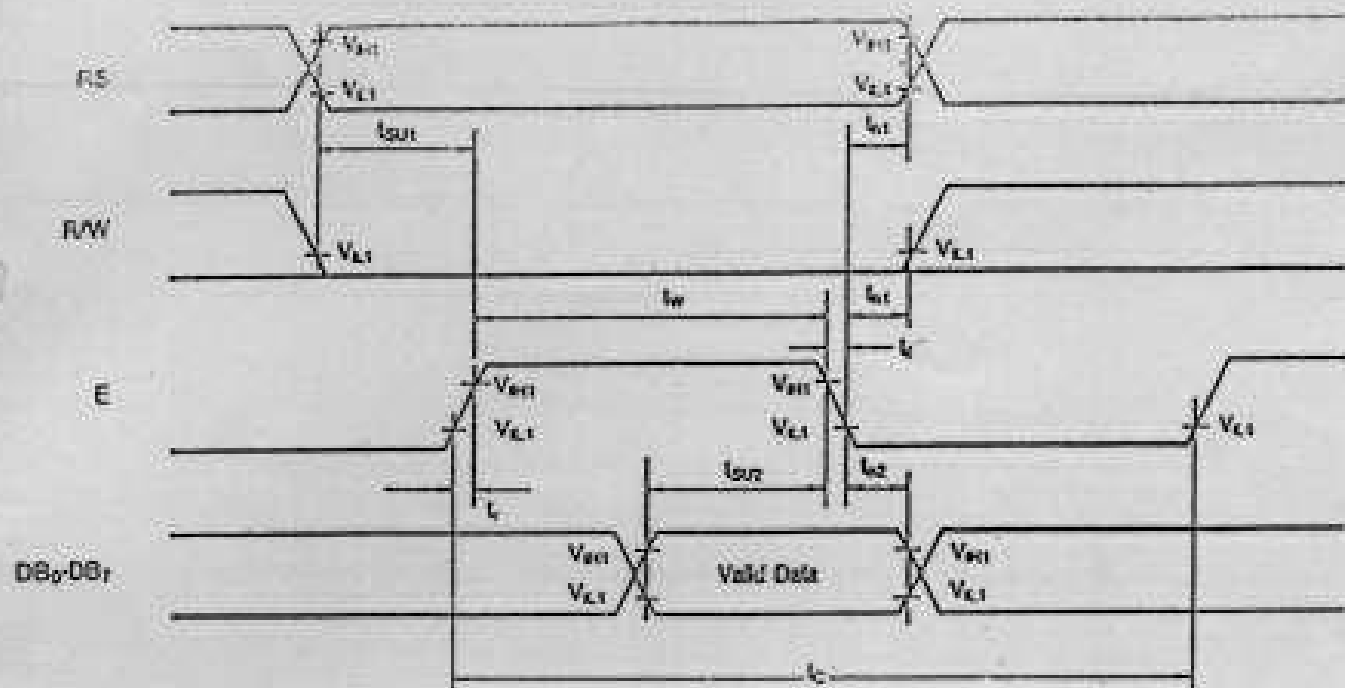
SCALE:3/1



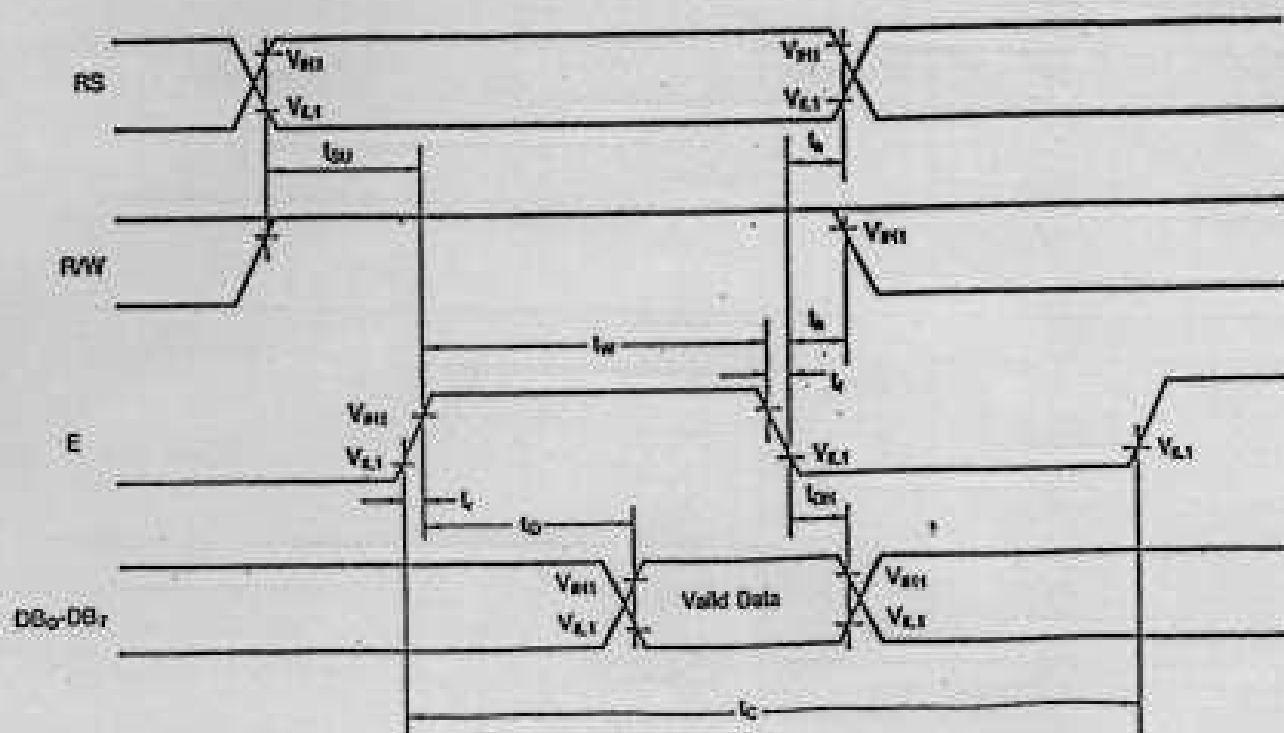
PIN NO.	SIGNAL
1	V _{SS}
2	V _{DD}
3	V _O
4	R _S
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7

Timing Characteristics

(1) Write mode



(2) Read mode



■ DISPLAY COMMAND

■ DISPLAY COMMAND											
Parameter	RS	R/V	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DESCRIPTION
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	+	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	SH	DB1=1: Increment DB1=0: Decrement DB0=1: The display is shifted DB0=0: The display is not shifted
DISPLAY ON/OFF	0	0	0	0	0	0	1	0	C	B	DB2=1: Display on DB2=0: Display off DB1=1: Cursor on DB1=0: Cursor off DB0=1: Blinking on DB0=0: Blinking off
CURSOR/DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	=	=	DB3=1: Shifts display one character DB2=1: Right shift DB2=0: Left shift
FUNCTION SET	0	0	0	0	1	DL	H	F	=	=	DB4=1: 8 bits DB4=0: 4 bits DB3=1: 2 lines display (1/16 duty) DB3=0: 1 line display (DB2=1: 5×10 dots, 1/11 duty DB2=0: 5×7 dots, 1/8 duty)
SET CORAM ADDRESS	0	0	0	1	AC0						The address length that can be set is 10 addresses
SET DDRAM ADDRESS	0	0	1	ADD						The address length that can be set is 80 addresses	
READ BUSY FLAG/ ADDRESS COUNTER	0	1	BF	AC						DB7=1: Busy (instruction not accepted) DB7=0: Ready (instruction accepted)	
WRITE DATA	1	0	Write Data								
READ DATA	1	1	Read Data								

NOTE: = Don't care.

ELECTRAL CHARACTERISTICS

DC Characteristics (Vdd=+5V±10%, Vss=0V, Ta=25℃)

Parameter	Symbol	Condition	Applicable PIN	Min.	Typ	Max.	Unit
H level input voltage(1)	Vih1	—	DB0 ~ DB7	2.2	—	Vdd	V
L level input voltage(1)	Vil1	—	RS,R/VE	-0.3	—	0.6	V
H level input voltage(2)	Vih2	—	OSC1	Vdd-1.0	—	Vdd	V
L level input voltage(2)	Vil2	—		-0.2	—	1.0	V
H level output voltage(1)	Voh1	Ioh=-0.205mA	DB0 ~ DB7	2.4	—	—	V
L level output voltage(1)	Vol1	Iol=1.2mA		—	—	0.4	V
H level output voltage(2)	Voh2	Ioh=40μA	XSC LP D0	0.9Vdd	—	—	V
L level output voltage(2)	Vol2	Iol=40μA		—	—	0.1Vdd	V
I/o leakage current	Iil	Vin=0 to Vdd		-1	—	1	μA
Pull-UP Mos Current	-Ip	Vdd=5V		50	125	250	μA
Supply current	Iop	Rf oscillation from external clock Vdd=5v fosc=270kHz	Vdd	—	0.35	0.6	mA

Internal clock operation (Rf oscillation)

Oscillation frequency	fosc	Rf=91kΩ±2%	OSC1 OSC2	180	270	350	kHz
Oscillation frequency	fosc	Ceramic filter	OSC1 OSC2	245	250	255	kHz
LCD driving voltage	Vled	Vdd-V5	V1~V5	3.0	—	11.0	V

AC Characteristics (V_{dd}=5V±10%, V_{ss}=0V, T_a=25°C)
Read Cycle

Parameter	Symbol	Min	Typ	Max	Unit	TEST PIN
Enable cycle time	t _c	500	—	—	ns	E
Enable "H" level pulse width	t _w	220	—	—	ns	E
Enable rise/fall time	t _{r,tf}	—	—	25	ns	E
RS,R/W setup time	t _{su}	40	—	—	ns	R/W,RS
RS,R/W address hold time	t _h	10	—	—	ns	R/W,RS
Read data output delay	t _d	60	—	120	ns	DB0~DB7
Read data hold time	t _{dh}	20	—	—	ns	DB0~DB7

Write Cycle

Parameter	Symbol	Min	Typ	Max	Unit	TEST PIN
Enable Cycle time	t _c	500	—	—	ns	E
Enable H level pulse width	t _w	220	—	—	ns	E
Enable rise/fall time	t _{r,tf}	—	—	25	ns	E
RS,R/W setup time	t _{su1}	40	—	—	ns	R/W,RS
RS,R/W address hold time	t _{h1}	10	—	—	ns	R/W,RS
Data setup time	t _{su2}	60	—	—	ns	DB0~DB7
Write data hold time	t _{h2}	10	—	—	ns	DB0~DB7

Optical Characteristics

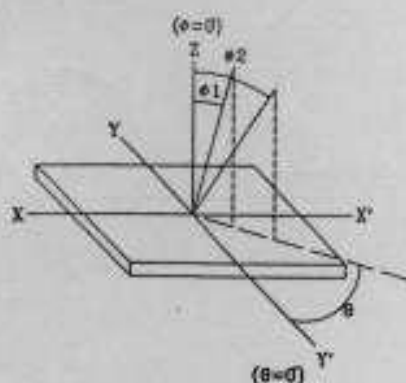
1. STN TYPE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	$\phi 2 - \phi 1$	$K=1.4$	40	—	—	deg.	#1, #2
Contrast Ratio	K	$\phi = 10^\circ$ $\theta = 0^\circ$	—	3	—	—	#3
Response Time(Rise)	tr	$\phi = 10^\circ$ $\theta = 0^\circ$	—	150	250	ns	#4
Response Time(Fall)	tf	$\phi = 10^\circ$ $\theta = 0^\circ$	—	200	300	ns	#4

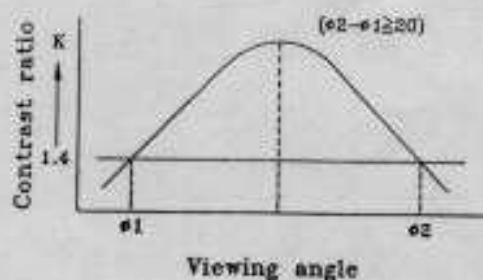
2. TN TYPE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	$\phi 2 - \phi 1$	$K=1.4$	60	—	—	deg.	#1, #2
Contrast Ratio	K	$\phi = 25^\circ$ $\theta = 0^\circ$	—	3	—	—	#3
Response Time(Rise)	tr	$\phi = 25^\circ$ $\theta = 0^\circ$	—	80	120	ns	#4
Response Time(Fall)	tf	$\phi = 25^\circ$ $\theta = 0^\circ$	—	60	90	ns	#4

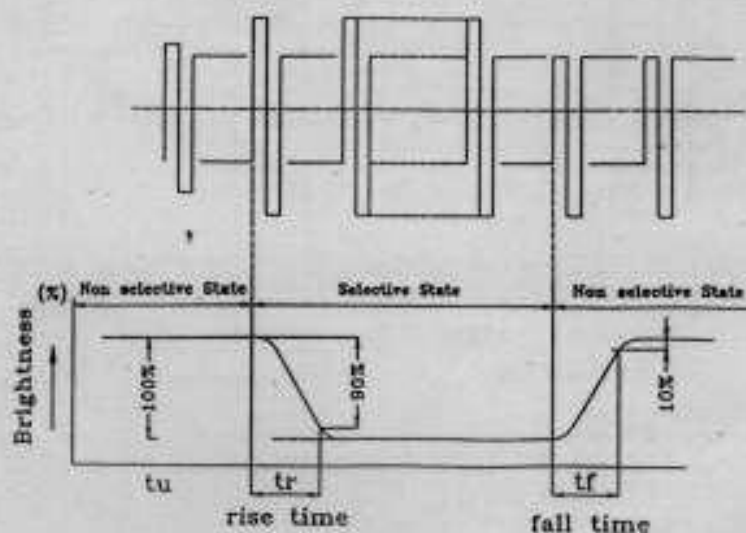
*1. Definition of Q AND ϕ



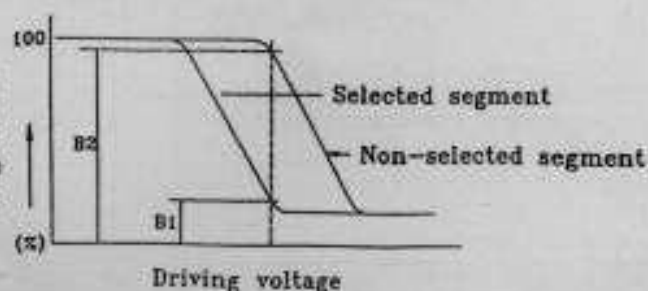
*2. Contrast vs viewing angle



*4. Definition of optical response



*3. definition of contrast ratio



$$K = \frac{\text{Brightness of non-selected segment}(B2)}{\text{Brightness of selected segment}(B1)}$$

■ LED BACKLIGHT

Long life, low power consumption and simple power supply. Three different color of red, green and orange are available, or color can be changed alternatively. 2 back light methods are available, beneath illumination and side illumination.

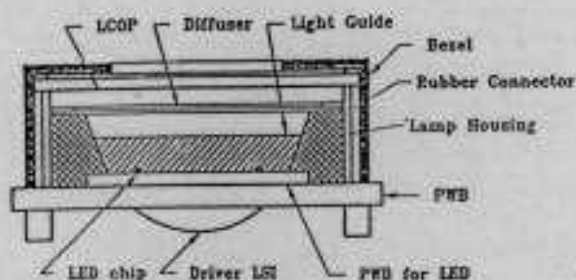
Features

- Low voltage deiving(DC) is available.
- Long life time 100,000 hours (average).
- No noise occurrence.

- Various color of red, green and orange etc.
(multi-color by alternative switch is also available)
- Operating characteristics
EX:PC 2002-A series is $IF=210mA$,
 $IV=250\text{ cd/m}^2$.

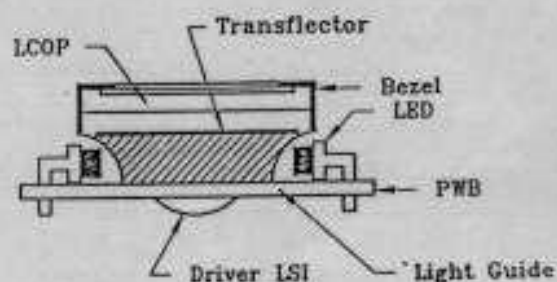
■ Beneath Illumination

Less quantity of chip even illumination.



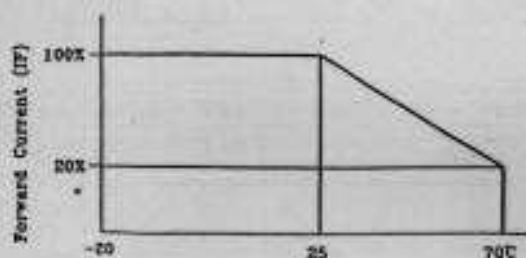
■ Side Illumination

Combination LED with light guide offers thin structure type of illumination.

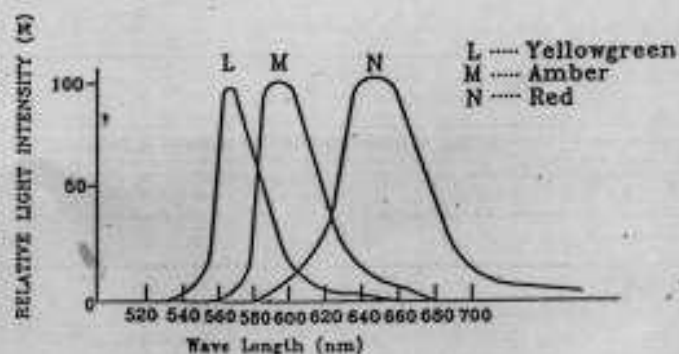


Electrical Characteristics (Reference Date)

- Forward current
Derating Curve



- Wave Length vs Relative Light Intensity



ROMAN (LAT)	MSB	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
00000000	00		0000	0001	0010	0011	0100	0101	0110	0111				1000	1001	1010	1011
00000001	01	!	1	A	Q	a	q							—	2	3	0
00000010	02	"	2	B	R	b	r							7	8	4	9
00000011	03	#	3	C	S	c	s							1	5	6	7
00000100	04	\$	4	D	T	d	t							\	E	T	*
00000101	05	%	5	E	U	e	u							=	F	U	+
00000110	06	&	6	F	V	f	v							7	U	2	3
00000111	07	'	7	G	W	g	w							7	8	9	0
00001000	08	(	8	H	X	h	x							4	5	6	7
00001001	09	)	9	I	Y	i	y							4	5	6	7
00001010	0A	*	*	J	Z	j	z							1	2	3	4
00001011	0B	+	+	K	L	k	l							7	8	9	0
00001100	0C	,	,	L	M	l	m							7	8	9	0
00001101	0D	-	-	N	O	n	o							1	2	3	4
00001110	0E	.	.	>	N	n	*							5	6	7	8
00001111	0F	/	/	O	P	o	p							5	6	7	8