DISCRETE LED INDICATORS

NTE Type No.	Description and Application	Diag. No.	Qty Per Bag	Ind Pkg Size	Typical Viewing Angle (°)	Viewed Color	Typical Luminous Intensity (mcd) I_V	Typical Forward Voltage Drop (Volts) V_F	Maximum Reverse Breakdown Voltage (Volts) V_R	Maximum DC Forward Current (mA) I_F	Maximum Power Dissipation (mW) P_D
3130	Blinking LED, Pulse rate 3Hz	383	1	T–1 3/4	30	Yellow Blinking	3	5.25 Max	0.4	20	–
3131	Blinking LED, Pulse rate 3Hz	383	1	T–1 3/4	30	Green Blinking	2	5.25 Max	0.4	20	–
3160	Rectangular LED's designed for Level meter displays, Bar graph displays, Instrumentation and general purpose applications	166	5	–	50	Diffused Red	0.4	1.9	3	25	70
3161		166	5	–	50	Diffused Green	0.7	2.1	3	25	70
3162		166	5	–	50	Diffused Yellow	2	2.1	3	25	70
3163		167	5	–	50	Diffused Red	0.4	1.9	3	25	70
3164		167	5	–	50	Diffused Green	0.7	2.1	3	25	70
3165		167	5	–	50	Diffused Yellow	1	2.1	3	25	70
3166		168	5	–	50	Diffused Red	0.4	1.9	3	25	70
3167		168	5	–	50	Diffused Green	0.8	2.1	3	25	70
3168		168	5	–	50	Diffused Yellow	2	2.1	3	25	70
3169	Square LED lamp suitable for Segment Display Elements	407	5	–	150	Dif Bright Red	0.5	2.8 Max	5	15	45
3170	Square LED lamp suitable for Segment Display Elements	407	5	–	150	Diffused Green	1.8	2.8 Max	5	30	100
3171	Square LED lamp suitable for Segment Display Elements	407	5	–	150	Diffused Yellow	1.4	2.8 Max	5	20	65
3180	Universal Rectangular Bar (Surface Mount)	417	2	–	100	High–Eff Red	9.8	2.1	5	25	75
3181	Universal Rectangular Bar (Surface Mount)	417	2	–	100	Diffused Green	9.8	2.1	5	25	75
3182	Universal Rectangular Bar (Surface Mount)	417	2	–	100	Diffused Yellow	9.0	2.1	5	25	75

DISCRETE LED SELECTING MADE EASIER

THEORY

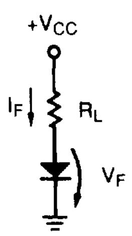
Although light emission from a semiconductor junction had long been speculated, the first commercial devices did not become available until about 1963. This light emission phenomenon can be explained in terms of Semiconductor Energy–Band Theory. An external voltage applied to forward–bias a PN junction excites the majority carriers (electrons), causing them to move from the N–side Conduction Band to the P–side Valence Band. In making this transition the electrons cross the Energy Gap, E_g, that separates the two Bands, and so have to give up energy in the form of heat (phonons) and light (photons).

ELECTRICAL CONSIDERATIONS

Most incandescents are rated in terms of voltage; LED's, on the other hand, are current–dependent devices since they are basically diodes. When operating from constant–voltage sources, protection should be provided by incorporating a current–limiting resistor with each LED.

Basic DC Circuit

For the simple circuit shown below the resistor value can be calculated from



$$R_L = \frac{V_{CC} - V_F}{I_F}$$

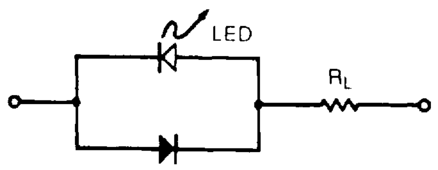
where V_F and I_F are taken from an LED Data Sheet. The power rating required for the resistor should also be kept in mind.

See Diagrams, beginning on Page 1–116

DISCRETE LED INDICATORS

AC Operation

LED's should be operated in the forward direction only. Therefore, the LED circuit must provide reverse–voltage protection if applied voltage is expected to exceed the V_R maximum rating of the LED. The example below shows a circuit having an ordinary silicon diode (e.g., NTE519) placed "back–to–back" with the LED.



OPTICAL CONSIDERATIONS

Lens Effects

Lenses of the earliest LED's were designed to pass maximum light in the forward direction, i.e., perpendicular to the mounting surface. Later LED's produced more light and their lenses were designed to spread light over a wider area, thus permitting broader observer viewing angles. Still later, as higher light output LED's became available, a variety of red–colored, epoxy lenses came into use. These lenses act to diffuse light into a broader apparent emitting area. LED lenses that produce a broad, evenly–diffused light are generally assumed to be more pleasing to the eye than the lenses that produce a highly–intense point of light.

Colors

LED's are now available in various colors. In some applications the designer may be called upon to develop circuits in which LED's of different colors are to produce equal Brightness. Since light output from an LED is basically a function of current flow through the PN junction, equal Brightness can be achieved by adjustments of current flow.

Infrared LED Sources

Visible–emitting LED's, the vital link in the man–machine interface, are characterized in terms of Photometric quantities. On the other hand, infrared–emitting LED's (whose invisible light is of wavelengths longer than 750 nanometers) are characterized in terms of Radiometric quantities. Also, applications requirements for infrared LED sources are different from those for visible–emitting LED's. Whereas for visible–emitting LED's a wide viewing angle is normally important, for infrared sources a narrow beam width and high on–axis intensity are normally important.

5–LAMP LED ARRAYS

NTE Type Number	Diagram Number	Viewed Color	Electrical Characteristics Per Lamp					
			Typical Forward Voltage (Volts)	Maximum Reverse Voltage (Volts)	Maximum Forward Current (mA)	Typical Luminous Intensity (mcd)	Peak Emission Wavelength (nm)	Power Dissipation (Watts)
			V_F	V_R	I_F	I_V	λp	P_D
3150	164	Diffused Red	1.9	3	25	0.4	700	70
3151	164	Diffused Green	2.1	3	25	0.7	565	70
3152	164	Diffused Yellow	2.1	3	25	1.5	585	70
3153	165	Diffused Red	1.9	3	25	0.4	700	70
3154	165	Diffused Green	2.1	3	25	0.7	565	70
3155	165	Diffused Yellow	2.1	3	25	1.5	585	70

See Diagrams, beginning on Page 1–116