

# 6-Pin DIP Optoisolators Transistor Output

The 4N25, 4N26, 4N27 and 4N28 devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Most Economical Optoisolator Choice for Medium Speed, Switching Applications
- Meets or Exceeds All JEDEC Registered Specifications

## Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- I/O Interfacing
- Solid State Relays

## MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
--------	--------	-------	------

### INPUT LED

Reverse Voltage	$V_R$	3	Volts
Forward Current – Continuous	$I_F$	60	mA
LED Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Output Detector Derate above $25^\circ\text{C}$	$P_D$	120	mW
		1.41	mW/ $^\circ\text{C}$

### OUTPUT TRANSISTOR

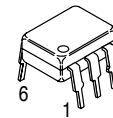
Collector–Emitter Voltage	$V_{CEO}$	30	Volts
Emitter–Collector Voltage	$V_{ECO}$	7	Volts
Collector–Base Voltage	$V_{CBO}$	70	Volts
Collector Current – Continuous	$I_C$	150	mA
Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ with Negligible Power in Input LED Derate above $25^\circ\text{C}$	$P_D$	150	mW
		1.76	mW/ $^\circ\text{C}$

### TOTAL DEVICE

Isolation Surge Voltage <sup>(1)</sup> (Peak ac Voltage, 60 Hz, 1 sec Duration)	$V_{ISO}$	7500	Vac(pk)
Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250 2.94	mW mW/ $^\circ\text{C}$
Ambient Operating Temperature Range	$T_A$	-55 to +100	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Soldering Temperature (10 sec, 1/16" from case)	$T_L$	260	$^\circ\text{C}$

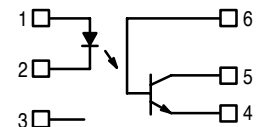
1. Isolation surge voltage is an internal device dielectric breakdown rating.  
For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.

**4N25**  
**4N26**  
**4N27**  
**4N28**



STANDARD THRU HOLE

## SCHEMATIC



- PIN 1. LED ANODE  
2. LED CATHODE  
3. N.C.  
4. EMITTER  
5. COLLECTOR  
6. BASE

# 4N25 4N26 4N27 4N28

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)<sup>(1)</sup>

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
----------------	--------	-----	--------------------	-----	------

### INPUT LED

Forward Voltage ( $I_F = 10\text{ mA}$ )	$T_A = 25^\circ\text{C}$	$V_F$	—	1.15	1.5	Volts
	$T_A = -55^\circ\text{C}$			1.3	—	
	$T_A = 100^\circ\text{C}$			1.05	—	
Reverse Leakage Current ( $V_R = 3\text{ V}$ )		$I_R$	—	—	100	$\mu\text{A}$
Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ )		$C_J$	—	18	—	$\text{pF}$

### OUTPUT TRANSISTOR

Collector–Emitter Dark Current ( $V_{CE} = 10\text{ V}$ , $T_A = 25^\circ\text{C}$ )	4N25,26,27	$I_{CEO}$	—	1	50	$\text{nA}$
	4N28			1	100	
( $V_{CE} = 10\text{ V}$ , $T_A = 100^\circ\text{C}$ )	All Devices	$I_{CEO}$	—	1	—	$\mu\text{A}$
Collector–Base Dark Current ( $V_{CB} = 10\text{ V}$ )		$I_{CBO}$	—	0.2	—	$\text{nA}$
Collector–Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )		$V_{(BR)CEO}$	30	45	—	Volts
Collector–Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{A}$ )		$V_{(BR)CBO}$	70	100	—	Volts
Emitter–Collector Breakdown Voltage ( $I_E = 100\text{ }\mu\text{A}$ )		$V_{(BR)ECO}$	7	7.8	—	Volts
DC Current Gain ( $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ )		$h_{FE}$	—	500	—	—
Collector–Emitter Capacitance ( $f = 1\text{ MHz}$ , $V_{CE} = 0$ )		$C_{CE}$	—	7	—	$\text{pF}$
Collector–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{CB} = 0$ )		$C_{CB}$	—	19	—	$\text{pF}$
Emitter–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{EB} = 0$ )		$C_{EB}$	—	9	—	$\text{pF}$

### COUPLED

Output Collector Current ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ )	4N25,26 4N27,28	$I_C$ (CTR) <sup>(2)</sup>	2 (20)	7 (70)	—	$\text{mA} (\%)$
			1 (10)	5 (50)		
Collector–Emitter Saturation Voltage ( $I_C = 2\text{ mA}$ , $I_F = 50\text{ mA}$ )		$V_{CE(sat)}$	—	0.15	0.5	Volts
Turn–On Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>		$t_{on}$	—	2.8	—	$\mu\text{s}$
Turn–Off Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>		$t_{off}$	—	4.5	—	$\mu\text{s}$
Rise Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>		$t_r$	—	1.2	—	$\mu\text{s}$
Fall Time ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\text{ }\Omega$ ) <sup>(3)</sup>		$t_f$	—	1.3	—	$\mu\text{s}$
Isolation Voltage ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ ) <sup>(4)</sup>		$V_{ISO}$	7500	—	—	$\text{Vac(pk)}$
Isolation Resistance ( $V = 500\text{ V}$ ) <sup>(4)</sup>		$R_{ISO}$	$10^{11}$	—	—	$\Omega$
Isolation Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ ) <sup>(4)</sup>		$C_{ISO}$	—	0.2	—	$\text{pF}$

1. Always design to the specified minimum/maximum electrical limits (where applicable).

2. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .

3. For test circuit setup and waveforms, refer to Figure 11.

4. For this test, Pins 1 and 2 are common, and Pins 4, 5 and 6 are common.

TYPICAL CHARACTERISTICS

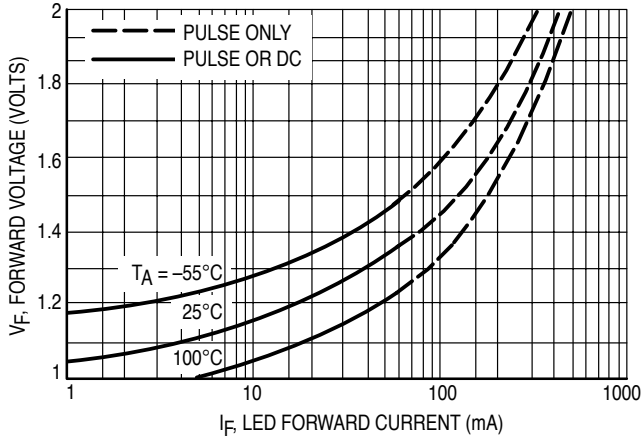


Figure 1. LED Forward Voltage versus Forward Current

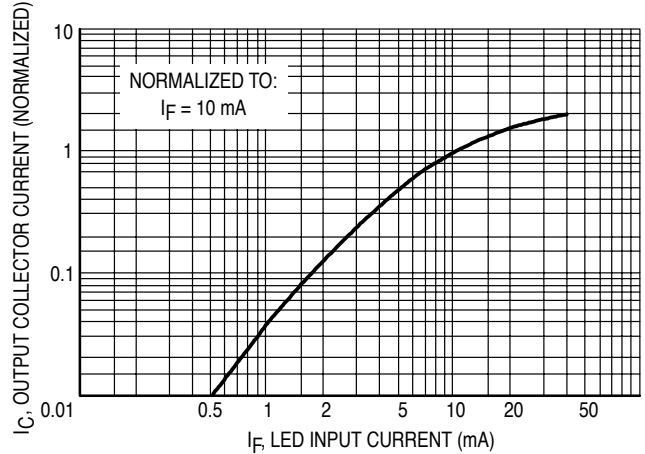


Figure 2. Output Current versus Input Current

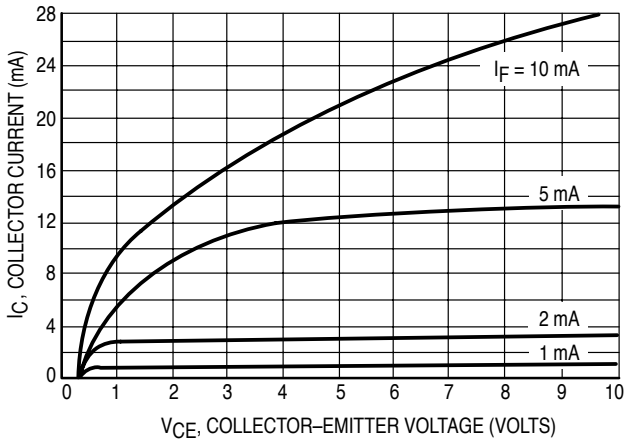


Figure 3. Collector Current versus Collector-Emitter Voltage

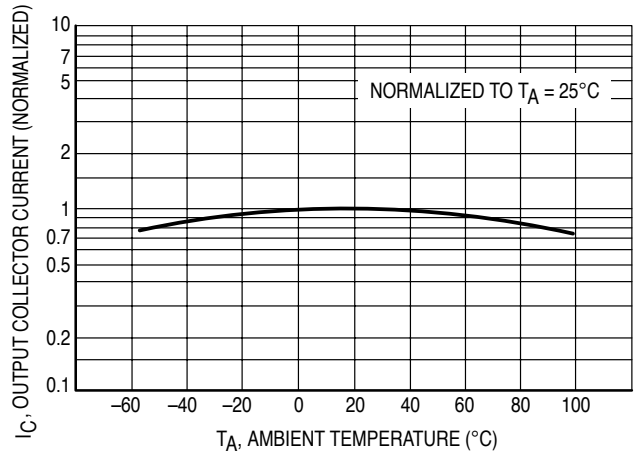


Figure 4. Output Current versus Ambient Temperature

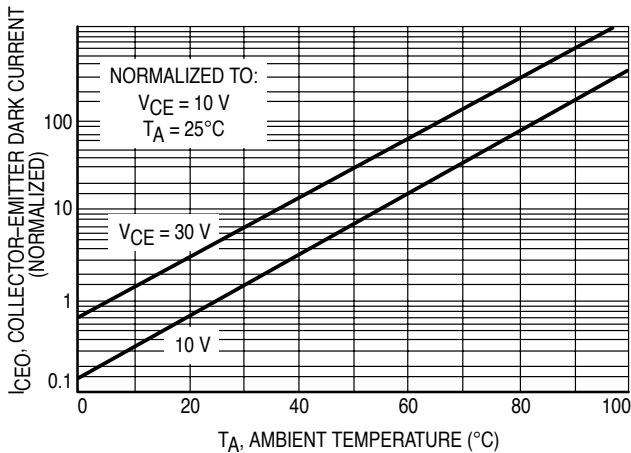


Figure 5. Dark Current versus Ambient Temperature

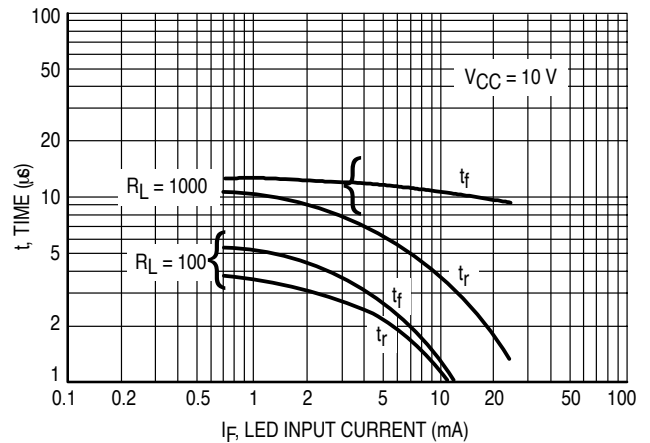


Figure 6. Rise and Fall Times (Typical Values)

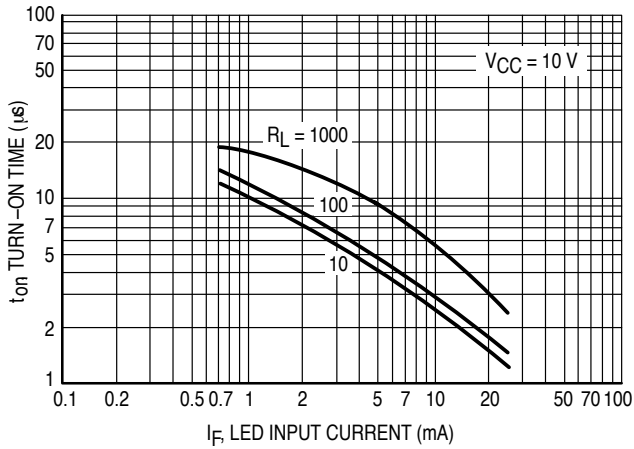


Figure 7. Turn-On Switching Times (Typical Values)

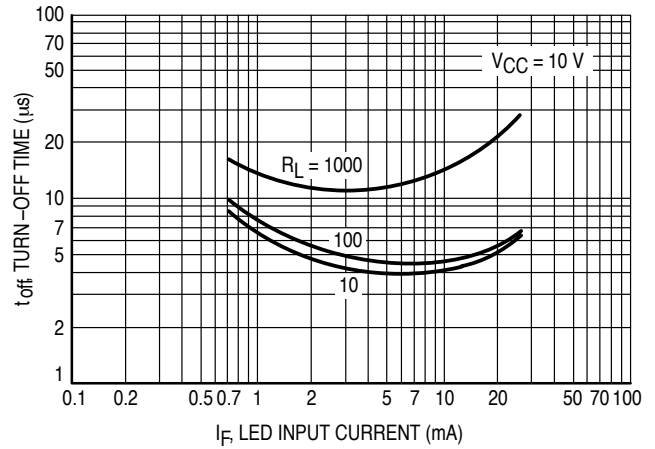


Figure 8. Turn-Off Switching Times (Typical Values)

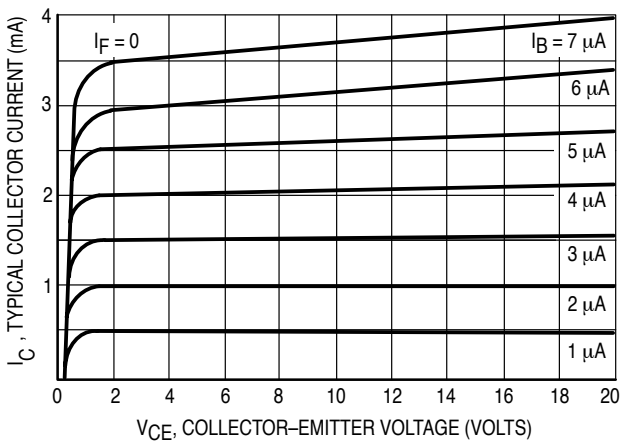


Figure 9. DC Current Gain (Detector Only)

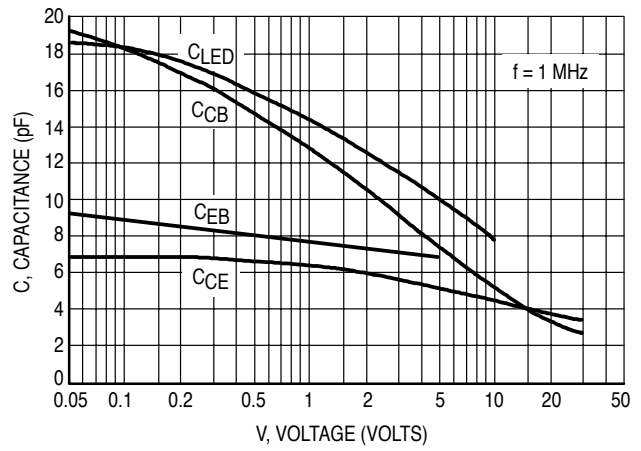


Figure 10. Capacitances versus Voltage

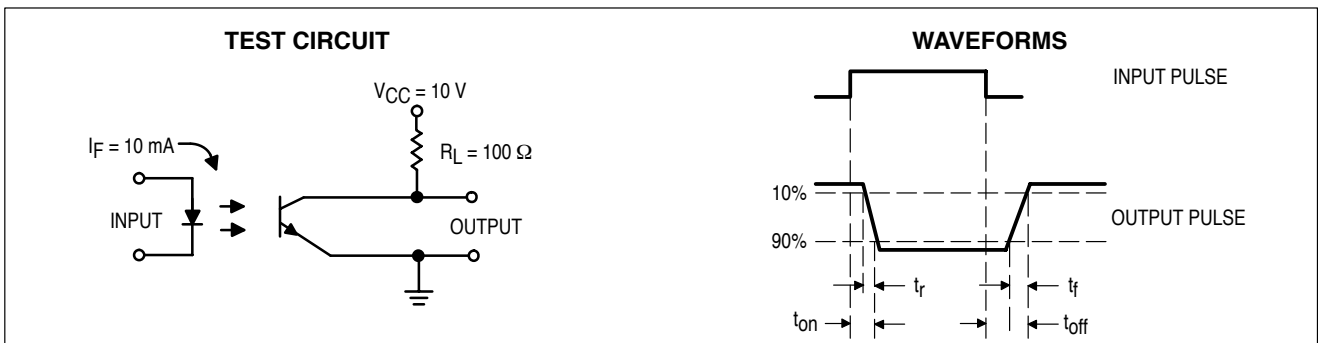
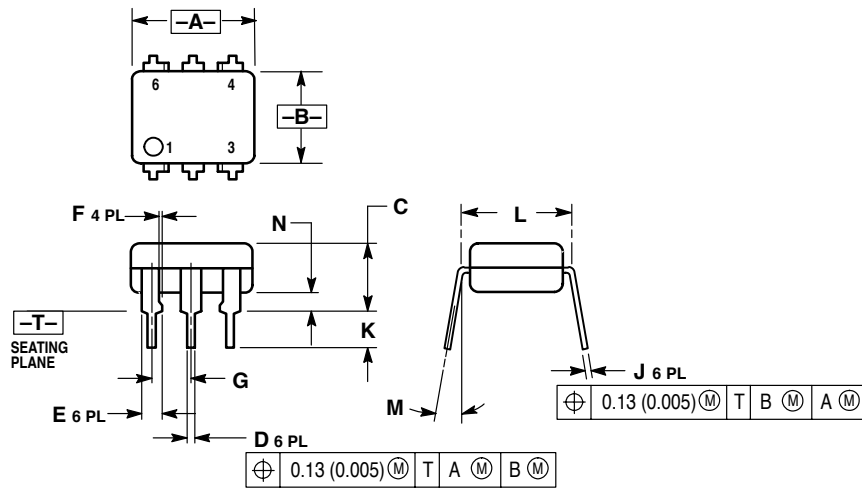


Figure 11. Switching Time Test Circuit and Waveforms

# 4N25 4N26 4N27 4N28

## PACKAGE DIMENSIONS

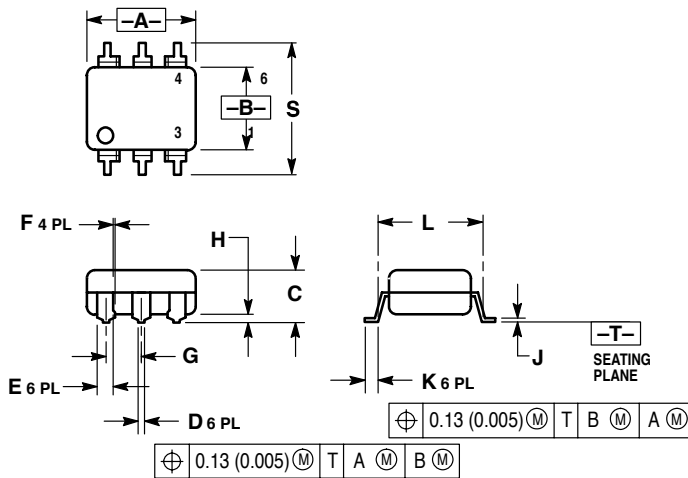


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
J	0.008	0.012	0.21	0.30
K	0.100	0.150	2.54	3.81
L	0.300 BSC		7.62 BSC	
M	0° 15°		0° 15°	
N	0.015	0.100	0.38	2.54

- STYLE 1:
- PIN 1. ANODE
  - CATHODE
  - NC
  - EMITTER
  - COLLECTOR
  - BASE

### THRU HOLE

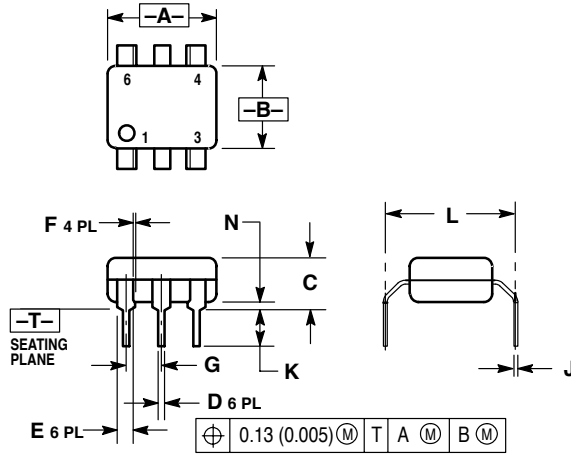


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
H	0.020	0.025	0.51	0.63
J	0.008	0.012	0.20	0.30
K	0.006	0.035	0.16	0.88
L	0.320 BSC		8.13 BSC	
S	0.332	0.390	8.43	9.90

### SURFACE MOUNT

# 4N25 4N26 4N27 4N28



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.350	8.13	8.89
B	0.240	0.260	6.10	6.60
C	0.115	0.200	2.93	5.08
D	0.016	0.020	0.41	0.50
E	0.040	0.070	1.02	1.77
F	0.010	0.014	0.25	0.36
G	0.100 BSC		2.54 BSC	
J	0.008	0.012	0.21	0.30
K	0.100	0.150	2.54	3.81
L	0.400	0.425	10.16	10.80
N	0.015	0.040	0.38	1.02

**0.4" LEAD SPACING**