



## 6-Pin DIP Optoisolators Transistor Output

The 4N35, 4N36 and 4N37 devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector.

- Current Transfer Ratio — 100% Minimum @ Specified Conditions
- Guaranteed Switching Speeds
- Meets or Exceeds all JEDEC Registered Specifications
- **To order devices that are tested and marked per VDE 0884 requirements, the suffix "V" must be included at end of part number. VDE 0884 is a test option.**

### Applications

- General Purpose Switching Circuits
- Interfacing and coupling systems of different potentials and impedances
- Regulation Feedback Circuits
- Monitor & Detection Circuits
- Solid State Relays

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

Rating	Symbol	Value	Unit
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#### INPUT LED

Reverse Voltage	$V_R$	6	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 1.41	mW mW/ $^\circ\text{C}$

#### OUTPUT TRANSISTOR

Collector-Emitter Voltage	$V_{CEO}$	30	Volts
Emitter-Base Voltage	$V_{EBO}$	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 1.76	mW mW/ $^\circ\text{C}$

#### TOTAL DEVICE

Isolation Source 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 <sup>(2)</sup>	$T_A$	-55 to +100	$^\circ\text{C}$
Storage Temperature Range <sup>(2)</sup>	$T_{stg}$	-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.
2. Refer to Quality and Reliability Section in Opto Data Book for information on test conditions.

**Preferred** devices are Motorola recommended choices for future use and best overall value.

GlobalOptoisolator is a trademark of Motorola, Inc.

**4N35\***

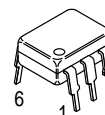
**4N36**

**4N37**

[CTR = 100% Min]

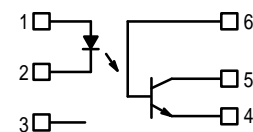
\*Motorola Preferred Device

### STYLE 1 PLASTIC



STANDARD THRU HOLE  
CASE 730A-04

### SCHEMATIC



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

## 4N35 4N36 4N37

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

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
<b>INPUT LED</b>					
Forward Voltage ( $I_F = 10\text{ mA}$ ) $T_A = 25^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$V_F$	0.8 0.9 0.7	1.15 1.3 1.05	1.5 1.7 1.4	V
Reverse Leakage Current ( $V_R = 6\text{ V}$ )	$I_R$	—	—	10	$\mu\text{A}$
Capacitance ( $V = 0\text{ V}$ , $f = 1\text{ MHz}$ )	$C_J$	—	18	—	pF
<b>OUTPUT TRANSISTOR</b>					
Collector–Emitter Dark Current ( $V_{CE} = 10\text{ V}$ , $T_A = 25^\circ\text{C}$ ) ( $V_{CE} = 30\text{ V}$ , $T_A = 100^\circ\text{C}$ )	$I_{CEO}$	— —	1 —	50 500	nA $\mu\text{A}$
Collector–Base Dark Current ( $V_{CB} = 10\text{ V}$ ) $T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$I_{CBO}$	—	0.2 100	20 —	nA
Collector–Emitter Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$V_{(BR)CEO}$	30	45	—	V
Collector–Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{A}$ )	$V_{(BR)CBO}$	70	100	—	V
Emitter–Base Breakdown Voltage ( $I_E = 100\text{ }\mu\text{A}$ )	$V_{(BR)EBO}$	7	7.8	—	V
DC Current Gain ( $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ )	$h_{FE}$	—	400	—	—
Collector–Emitter Capacitance ( $f = 1\text{ MHz}$ , $V_{CE} = 0$ )	$C_{CE}$	—	7	—	pF
Collector–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{CB} = 0$ )	$C_{CB}$	—	19	—	pF
Emitter–Base Capacitance ( $f = 1\text{ MHz}$ , $V_{EB} = 0$ )	$C_{EB}$	—	9	—	pF
<b>COUPLED</b>					
Output Collector Current ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ ) $T_A = 25^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_A = 100^\circ\text{C}$	$I_C$ (CTR) <sup>(2)</sup>	10 (100) 4 (40) 4 (40)	30 (300) — —	— — —	mA (%)
Collector–Emitter Saturation Voltage ( $I_C = 0.5\text{ mA}$ , $I_F = 10\text{ mA}$ )	$V_{CE(sat)}$	—	0.14	0.3	V
Turn-On Time	$t_{on}$	—	7.5	10	$\mu\text{s}$
Turn-Off Time	$t_{off}$	—	5.7	10	
Rise Time	$t_r$	—	3.2	—	
Fall Time	$t_f$	—	4.7	—	
Isolation Voltage ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ )	$V_{ISO}$	7500	—	—	Vac(pk)
Isolation Current <sup>(4)</sup> ( $V_{I-O} = 3550\text{ Vpk}$ ) ( $V_{I-O} = 2500\text{ Vpk}$ ) ( $V_{I-O} = 1500\text{ Vpk}$ )	$I_{ISO}$	— — —	— — 8	100 100 100	$\mu\text{A}$
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	2	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

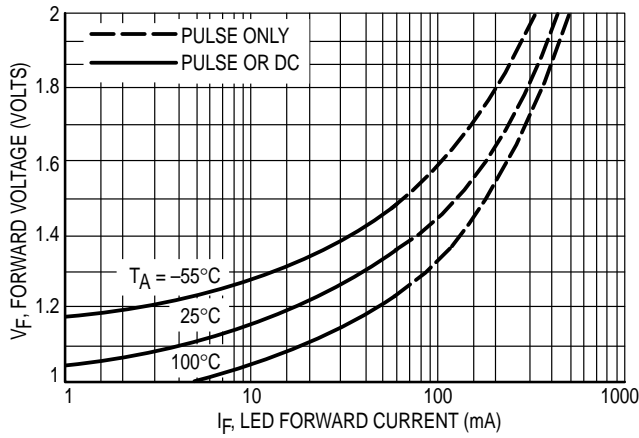


Figure 1. LED Forward Voltage versus Forward Current

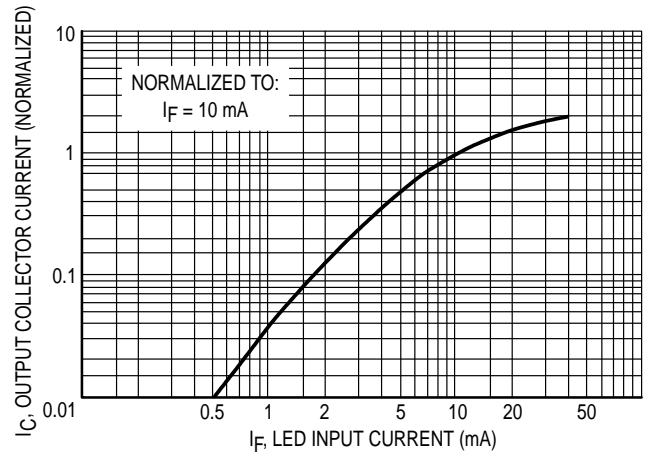


Figure 2. Output Current versus Input Current

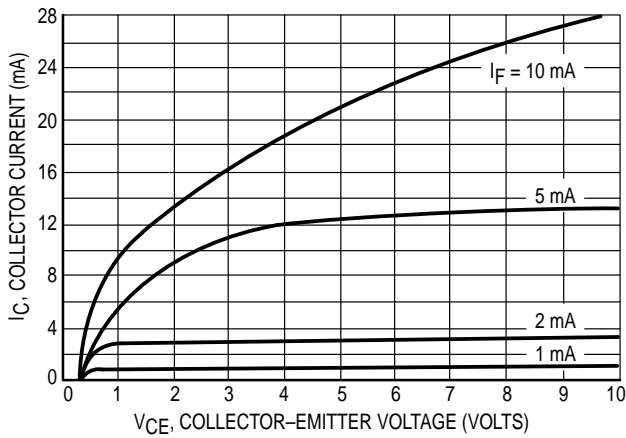


Figure 3. Collector Current versus Collector-Emitter Voltage

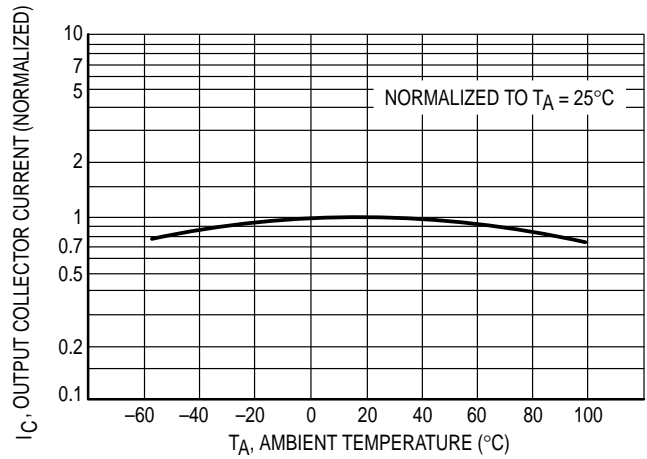


Figure 4. Output Current versus Ambient Temperature

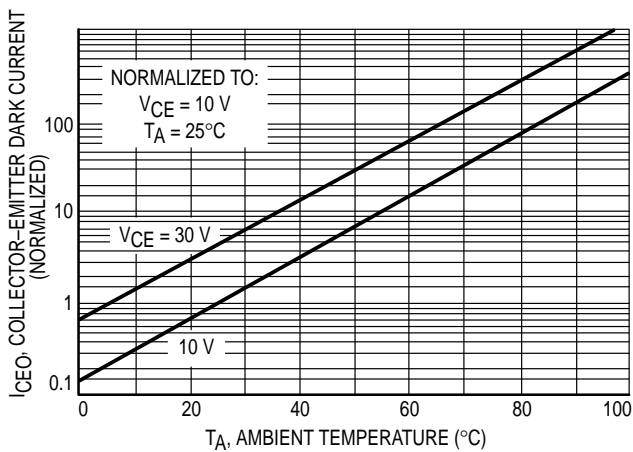


Figure 5. Dark Current versus Ambient Temperature

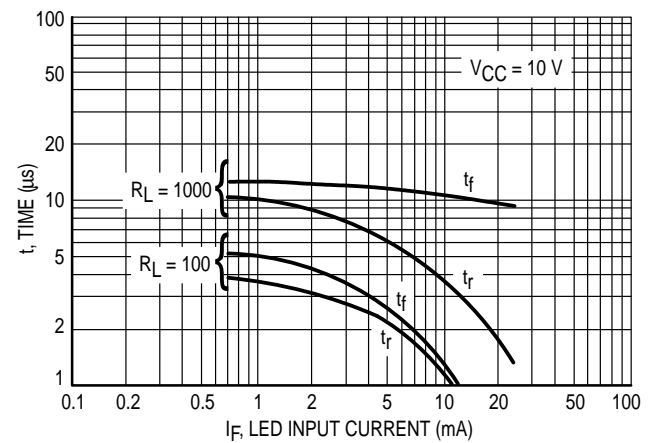


Figure 6. Rise and Fall Times (Typical Values)

# 4N35 4N36 4N37

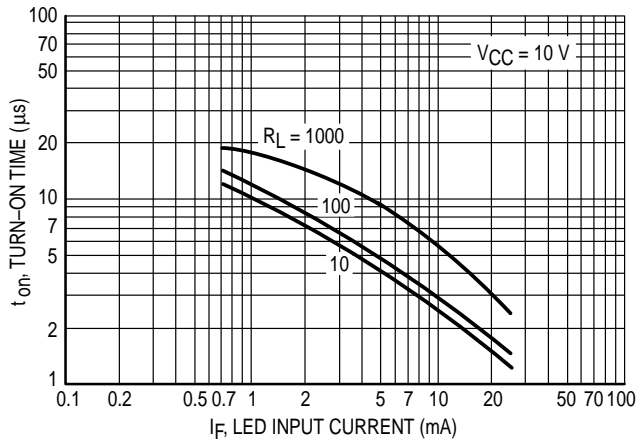


Figure 7. Turn-On Switching Times

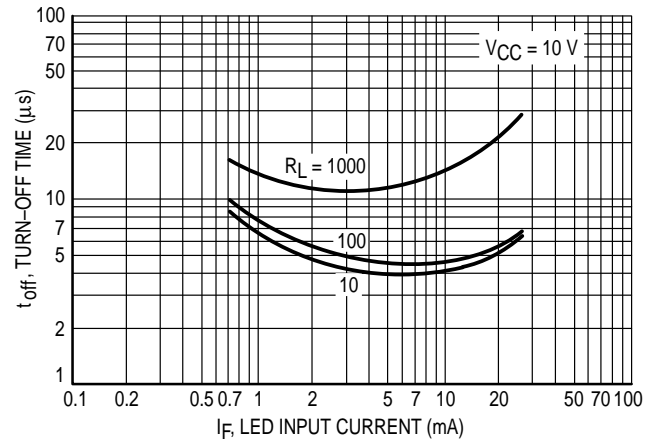


Figure 8. Turn-Off Switching Times

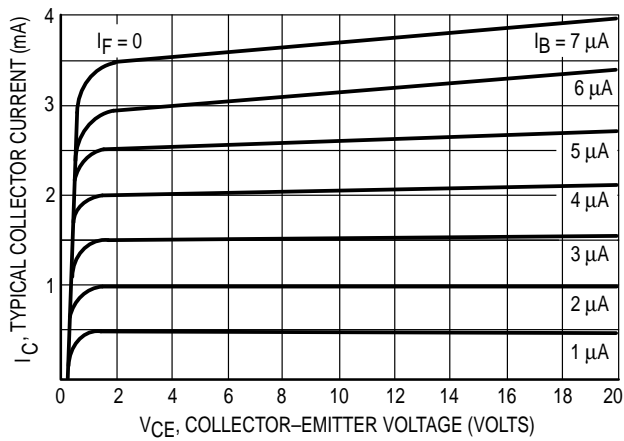


Figure 9. DC Current Gain (Detector Only)

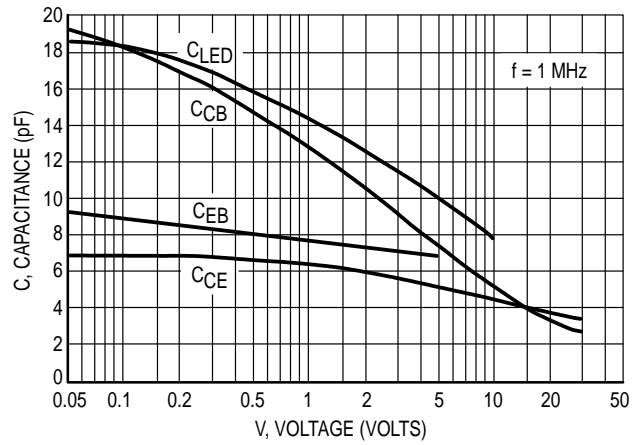


Figure 10. Capacitances versus Voltage

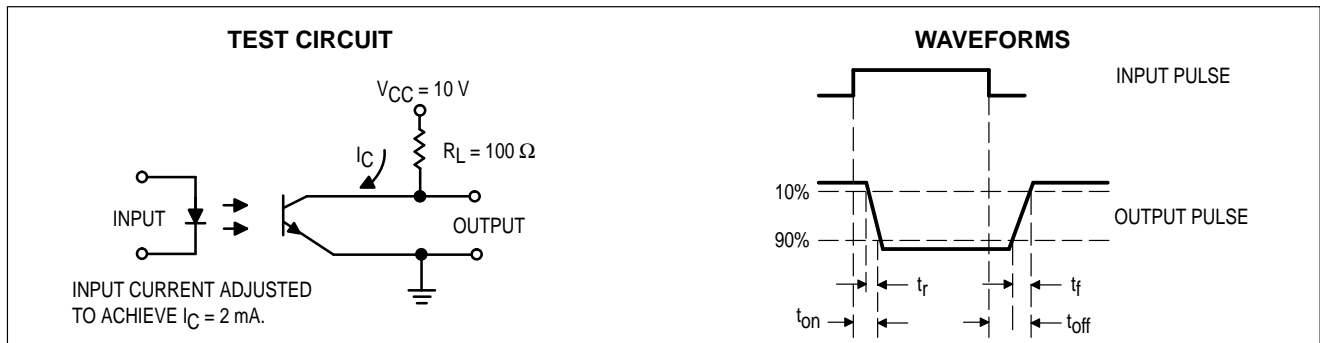
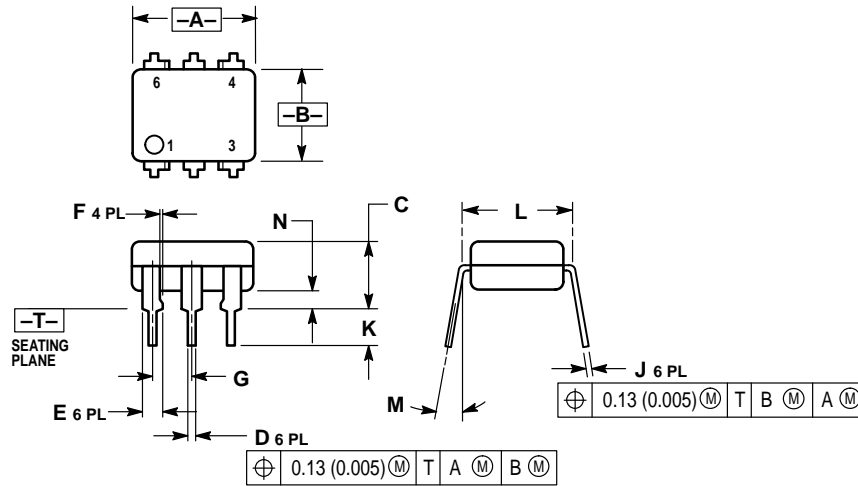


Figure 11. Switching Time Test Circuit and Waveforms

PACKAGE DIMENSIONS

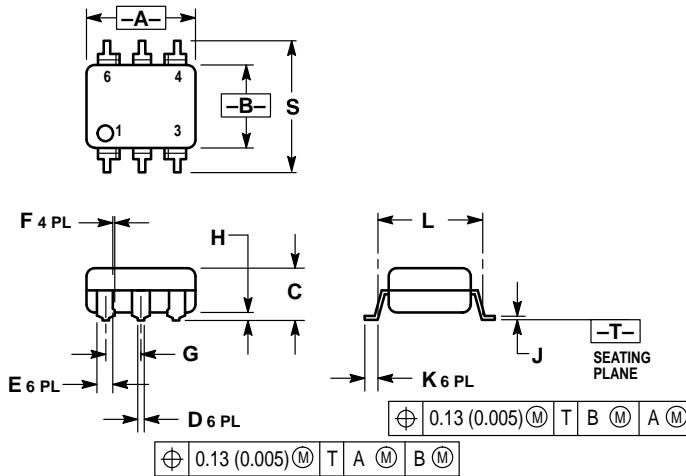


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

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	
H	0.008	0.012	0.21	0.30
I	0.100	0.150	2.54	3.81
J	0.300 BSC		7.62 BSC	
K	0°	15°	0°	15°
L	0.015	0.100	0.38	2.54

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

CASE 730A-04  
ISSUE G



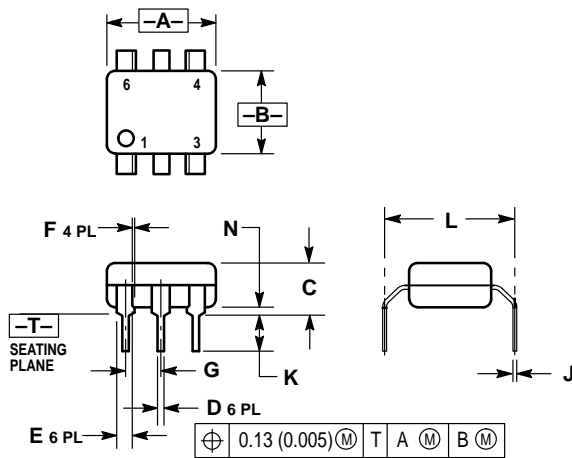
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  2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
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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
I	0.008	0.012	0.20	0.30
J	0.006	0.035	0.16	0.88
K	0.320 BSC		8.13 BSC	
L	0.332	0.390	8.43	9.90

\*Consult factory for leadform option availability

CASE 730C-04  
ISSUE D

4N35 4N36 4N37




- NOTES:
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  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

**\*Consult factory for leadform option availability**

**CASE 730D-05  
ISSUE D**

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4N35/D

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Datasheets for electronics components.