

6-Pin DIP Optoisolators Darlington Output

The 4N29/A, 4N30, 4N31, 4N32⁽¹⁾ and 4N33⁽¹⁾ devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon photodarlington detector.

This series is designed for use in applications requiring high collector output currents at lower input currents.

- Higher Sensitivity to Low Input Drive Current
- 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

- Low Power Logic Circuits
- Interfacing and coupling systems of different potentials and impedances
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays

MAXIMUM RATINGS (T_A = 25°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°C Derate above 25°C | P _D | 120 1.41 | mW mW/°C |
| OUTPUT DETECTOR | | | |
| Collector-Emitter Voltage | V _{CEO} | 30 | Volts |
| Emitter-Collector Voltage | V _{ECO} | 5 | Volts |
| Collector-Base Voltage | V _{CBO} | 30 | Volts |
| Collector Current — Continuous | I _C | 150 | mA |
| Detector Power Dissipation @ T _A = 25°C Derate above 25°C | P _D | 150 1.76 | mW mW/°C |
| TOTAL DEVICE | | | |
| Isolation Surge Voltage ⁽²⁾ (Peak ac Voltage, 60 Hz, 1 sec Duration) | V _{ISO} | 7500 | Vac(pk) |
| Total Device Power Dissipation @ T _A = 25°C Derate above 25°C | P _D | 250 2.94 | mW mW/°C |
| Ambient Operating Temperature Range ⁽³⁾ | T _A | -55 to +100 | °C |
| Storage Temperature Range ⁽³⁾ | T _{stg} | -55 to +150 | °C |
| Soldering Temperature (10 sec, 1/16" from case) | T _L | 260 | °C |

1. Difference in 4N32 and 4N33 is JEDEC Registration for VISO only. All Motorola 6-Pin devices exceed JEDEC specification and are 7500 Vac(pk). The same applies for 4N29 and 4N30.
2. 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.
3. 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.
Global Optoisolator is a trademark of Motorola, Inc.

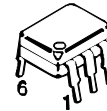
REV 4

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4N29
4N29A
4N30*
[CTR = 100% Min]
4N31
[CTR = 50% Min]
4N32*
4N33*
[CTR = 500% Min]

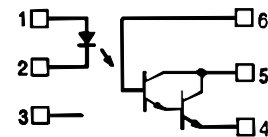
*Motorola Preferred Devices

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



MOTOROLA

151

4N29 4N29A 4N30 4N31 4N32 4N33

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)⁽¹⁾

| Characteristic | Symbol | Min | Typ ⁽¹⁾ | Max | Unit |
|----------------|--------|-----|--------------------|-----|------|
|----------------|--------|-----|--------------------|-----|------|

INPUT LED

| | | | | | |
|---|-------|---|------|-----|---------------|
| *Reverse Leakage Current ($V_R = 3\text{ V}$, $R_L = 1\text{ M ohms}$) | I_R | — | 0.05 | 100 | μA |
| *Forward Voltage ($I_F = 10\text{ mA}$) | V_F | — | 1.34 | 1.5 | Volts |
| Capacitance ($V_R = 0\text{ V}$, $f = 1\text{ MHz}$) | C | — | 1.8 | — | pF |

OUTPUT DETECTOR ($T_A = 25^\circ\text{C}$ and $I_F = 0$, unless otherwise noted)

| | | | | | |
|---|---------------|----|-----|-----|-------|
| *Collector–Emitter Dark Current ($V_{CE} = 10\text{ V}$, Base Open) | I_{CEO} | — | — | 100 | nA |
| *Collector–Base Breakdown Voltage ($I_C = 100\ \mu\text{A}$, $I_E = 0$) | $V_{(BR)CBO}$ | 30 | — | — | Volts |
| *Collector–Emitter Breakdown Voltage ($I_C = 100\ \mu\text{A}$, $I_B = 0$) | $V_{(BR)CEO}$ | 30 | — | — | Volts |
| *Emitter–Collector Breakdown Voltage ($I_E = 100\ \mu\text{A}$, $I_B = 0$) | $V_{(BR)ECO}$ | 5 | — | — | Volts |
| DC Current Gain ($V_{CE} = 5\text{ V}$, $I_C = 500\ \mu\text{A}$) | h_{FE} | — | 16K | — | — |

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

| | | | | | | |
|---|--|----------------------------|--------------------------------|-------------|-------------|---------------|
| *Collector Output Current ⁽³⁾ ($V_{CE} = 10\text{ V}$, $I_F = 10\text{ mA}$) | 4N32, 4N33 4N29, 4N30 4N31 | I_C (CTR) ⁽²⁾ | 50 (500) 10 (100) 5 (50) | — — — | — — — | mA (%) |
| Isolation Surge Voltage ^(4,5) (60 Hz ac Peak, 1 Second) | 4N29/A, 4N30, 31, 32, 33 *4N29, 4N32 *4N30, 4N31, 4N33 | V_{ISO} | 7500 2500 1500 | — — — | — — — | Vac(pk) |
| Isolation Resistance ⁽⁴⁾ ($V = 500\text{ V}$) | | R_{ISO} | — | 10^{11} | — | Ohms |
| *Collector–Emitter Saturation Voltage ⁽³⁾ ($I_C = 2\text{ mA}$, $I_F = 8\text{ mA}$) | 4N31 4N29, 4N30, 4N32, 4N33 | $V_{CE(sat)}$ | — — | — — | 1.2 1 | Volts |
| Isolation Capacitance ⁽⁴⁾ ($V = 0\text{ V}$, $f = 1\text{ MHz}$) | | C_{ISO} | — | 0.2 | — | pF |
| Turn-On Time ⁽⁶⁾ ($I_C = 50\text{ mA}$, $I_F = 200\text{ mA}$, $V_{CC} = 10\text{ V}$) | | t_{on} | — | 0.6 | 5 | μs |
| Turn-Off Time ⁽⁶⁾ ($I_C = 50\text{ mA}$, $I_F = 200\text{ mA}$, $V_{CC} = 10\text{ V}$) | 4N29, 30, 31 4N32, 33 | t_{off} | — — | 17 45 | 40 100 | μs |

* Indicates JEDEC Registered Data. All Motorola 6-pin devices have V_{ISO} rating of 7500 Vac(pk).

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = $I_C/I_F \times 100\%$.
3. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2\%$.
4. For this test, Pins 1 and 2 are common and Pins 4, 5 and 6 are common.
5. Isolation Surge Voltage, V_{ISO} , is an internal device dielectric breakdown rating.
6. For test circuit setup and waveforms, refer to Figure 11.

TYPICAL CHARACTERISTICS

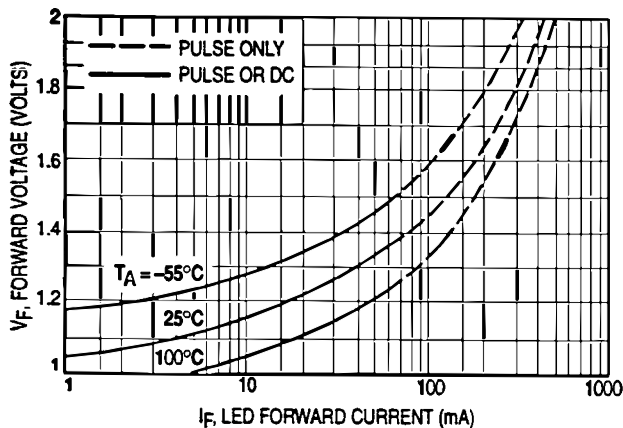


Figure 1. LED Forward Voltage versus Forward Current

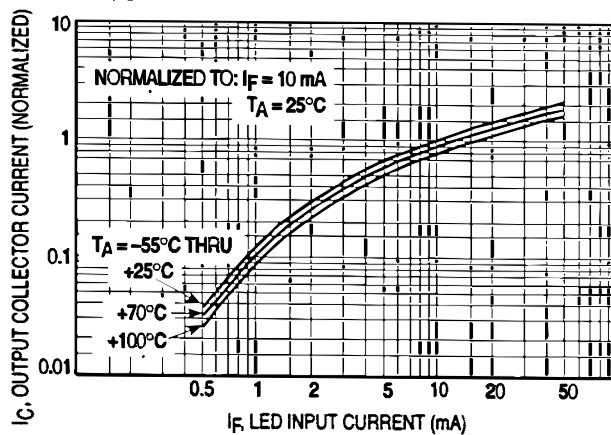


Figure 2. Output Current versus Input Current

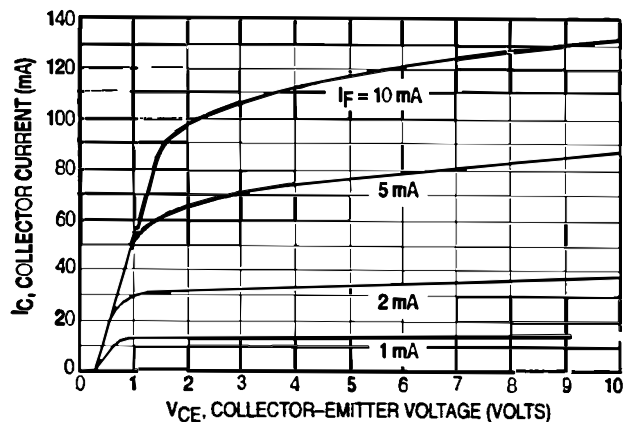


Figure 3. Collector Current versus Collector-Emitter Voltage

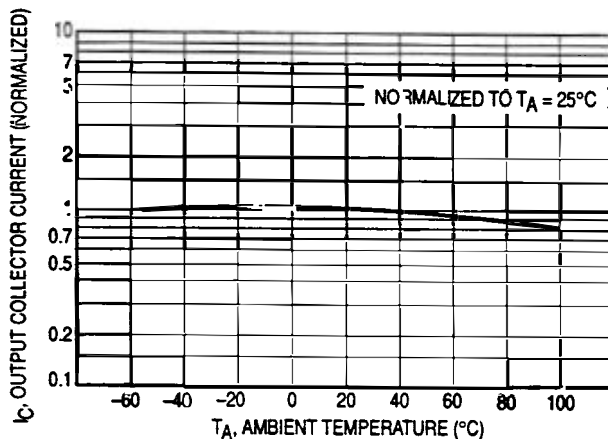


Figure 4. Output Current versus Ambient Temperature

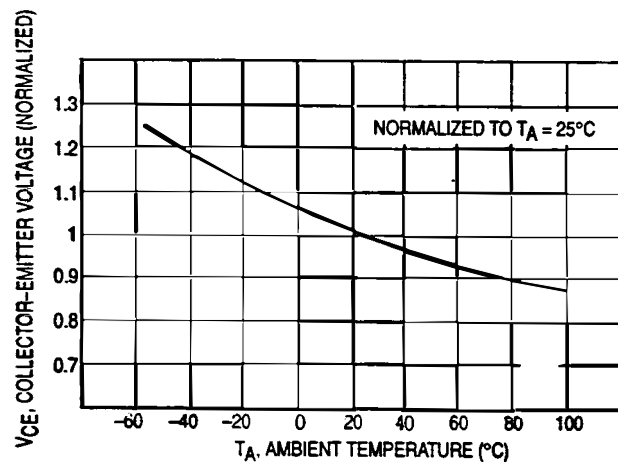


Figure 5. Collector-Emitter Voltage versus Ambient Temperature

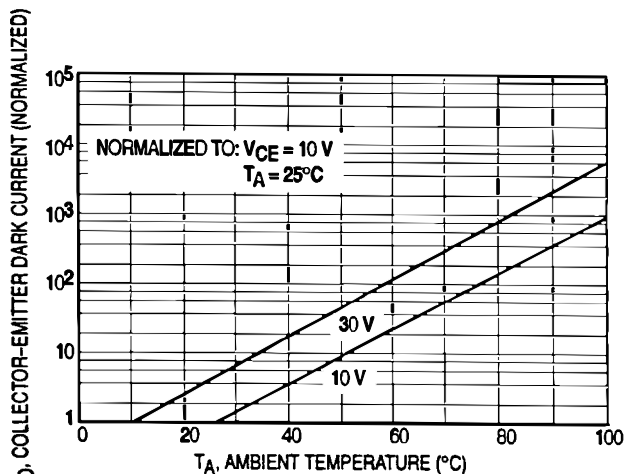


Figure 6. Collector-Emitter Dark Current versus Ambient Temperature

4N29 4N29A 4N30 4N31 4N32 4N33

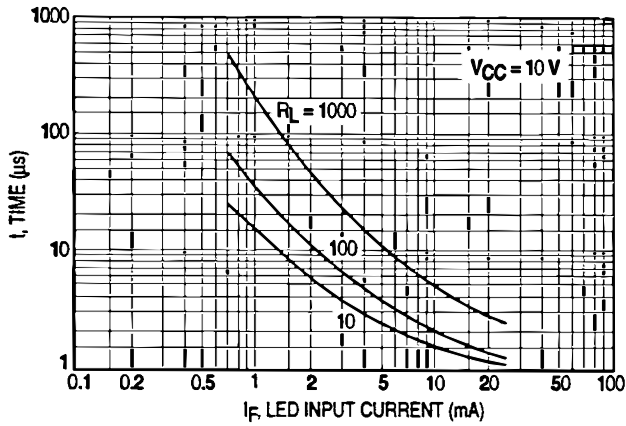


Figure 7. Turn-On Switching Times

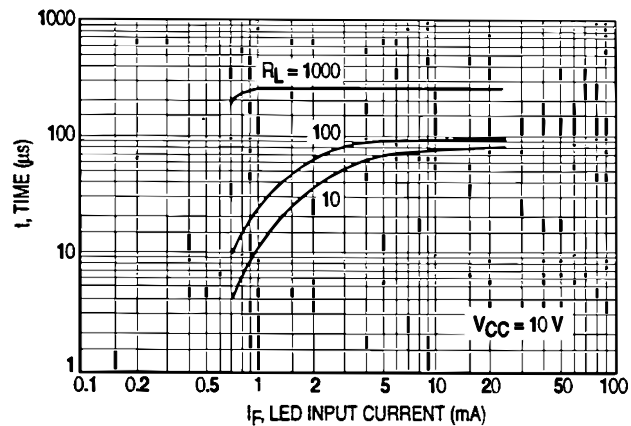


Figure 8. Turn-Off Switching Times

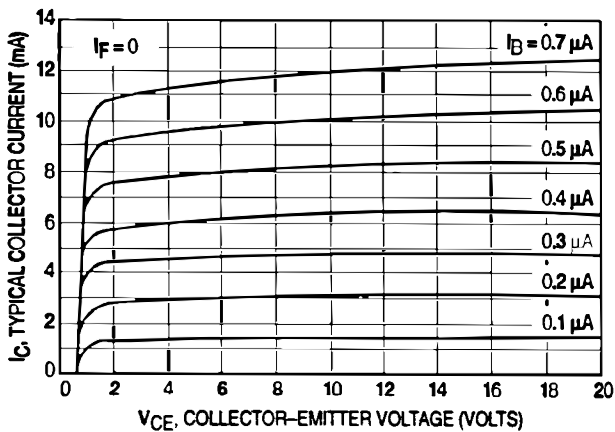


Figure 9. DC Current Gain (Detector Only)

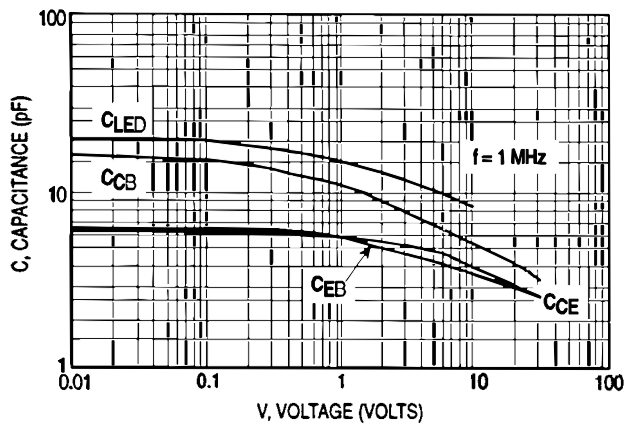


Figure 10. Capacitances versus Voltage

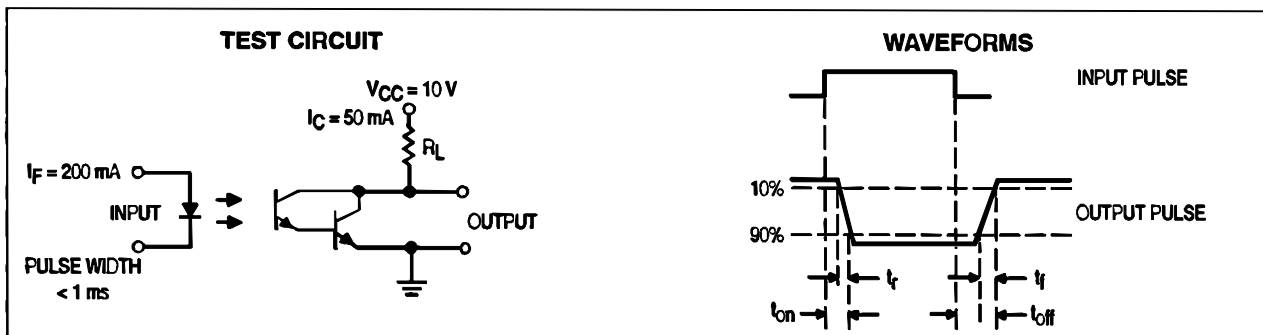
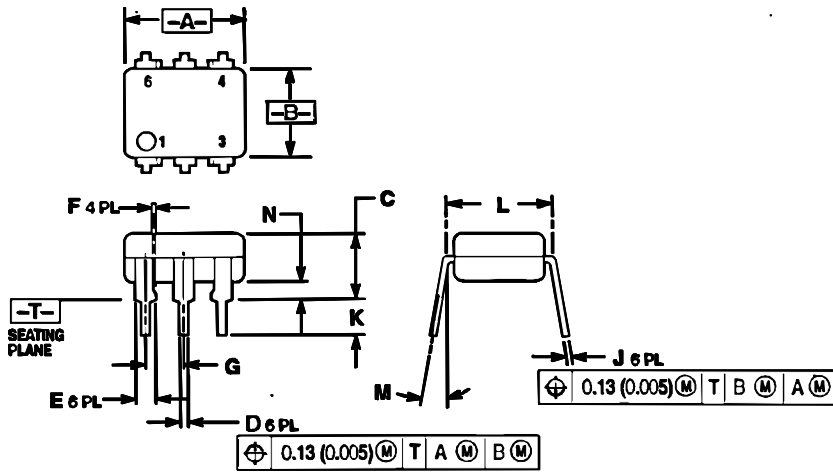


Figure 11. Switching Time Test Circuit and Waveforms

4N29 4N29A 4N30 4N31 4N32 4N33

PACKAGE DIMENSIONS

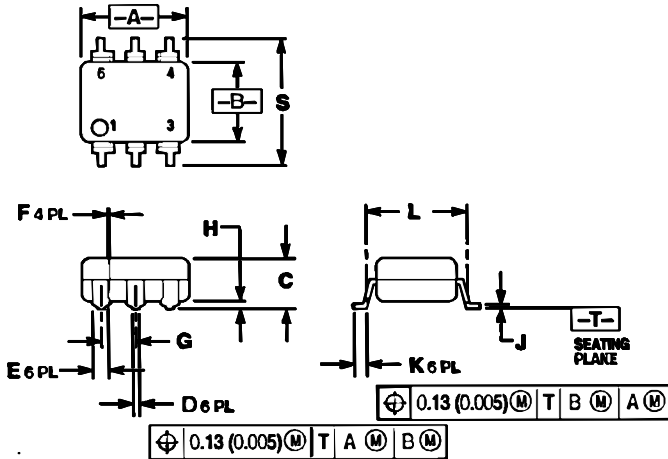


- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.

| 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
 2. CATHODE
 3. NC
 4. EMITTER
 5. COLLECTOR
 6. BASE

**CASE 730A-04
 ISSUE G**



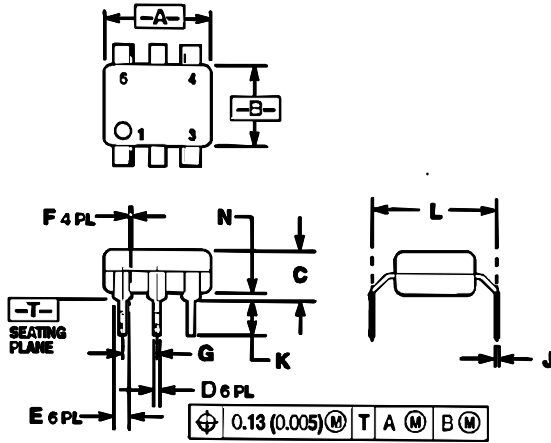
- NOTES:
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 2. CONTROLLING DIMENSION: INCH.

| 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 | 0.005 | 0.035 | 0.16 | 0.89 |
| L | 0.320 BSC | | 8.13 BSC | |
| S | 0.332 | 0.390 | 8.43 | 9.90 |

***Consult factory for leadform
 option availability**

**CASE 730C-04
 ISSUE D**

4N29 4N29A 4N30 4N31 4N32 4N33



- 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 | 0.003 | 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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