



## 6-Pin DIP Optoisolators Darlington Output

The 4N29/A, 4N30, 4N31, 4N32<sup>(1)</sup> and 4N33<sup>(1)</sup> 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<sub>A</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
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#### INPUT LED

Reverse Voltage	V <sub>R</sub>	3	Volts
Forward Current — Continuous	I <sub>F</sub>	60	mA
LED Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	120 1.41	mW mW/°C

#### OUTPUT DETECTOR

Collector–Emitter Voltage	V <sub>CEO</sub>	30	Volts
Emitter–Collector Voltage	V <sub>ECO</sub>	5	Volts
Collector–Base Voltage	V <sub>CB0</sub>	30	Volts
Collector Current — Continuous	I <sub>C</sub>	150	mA
Detector Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	150 1.76	mW mW/°C

#### TOTAL DEVICE

Isolation Surge Voltage <sup>(2)</sup> (Peak ac Voltage, 60 Hz, 1 sec Duration)	V <sub>ISO</sub>	7500	Vac(pk)
Total Device Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	250 2.94	mW mW/°C
Ambient Operating Temperature Range <sup>(3)</sup>	T <sub>A</sub>	–55 to +100	°C
Storage Temperature Range <sup>(3)</sup>	T <sub>stg</sub>	–55 to +150	°C
Soldering Temperature (10 sec, 1/16" from case)	T <sub>L</sub>	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.

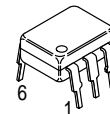
**Preferred** devices are Motorola recommended choices for future use and best overall value.

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

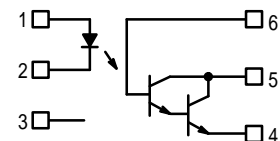
\*Motorola Preferred Devices

### 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

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

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)<sup>(1)</sup>

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit	
<b>INPUT LED</b>						
*Reverse Leakage Current (V <sub>R</sub> = 3 V, R <sub>L</sub> = 1 M ohms)	I <sub>R</sub>	—	0.05	100	μA	
*Forward Voltage (I <sub>F</sub> = 10 mA)	V <sub>F</sub>	—	1.34	1.5	Volts	
Capacitance (V <sub>R</sub> = 0 V, f = 1 MHz)	C	—	1.8	—	pF	
<b>OUTPUT DETECTOR (T<sub>A</sub> = 25°C and I<sub>F</sub> = 0, unless otherwise noted)</b>						
*Collector–Emitter Dark Current (V <sub>CE</sub> = 10 V, Base Open)	I <sub>CEO</sub>	—	—	100	nA	
*Collector–Base Breakdown Voltage (I <sub>C</sub> = 100 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	30	—	—	Volts	
*Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 100 μA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	30	—	—	Volts	
*Emitter–Collector Breakdown Voltage (I <sub>E</sub> = 100 μA, I <sub>B</sub> = 0)	V <sub>(BR)ECO</sub>	5	—	—	Volts	
DC Current Gain (V <sub>CE</sub> = 5 V, I <sub>C</sub> = 500 μA)	h <sub>FE</sub>	—	16K	—	—	
<b>COUPLED (T<sub>A</sub> = 25°C unless otherwise noted)</b>						
*Collector Output Current <sup>(3)</sup> (V <sub>CE</sub> = 10 V, I <sub>F</sub> = 10 mA)	4N32, 4N33 4N29, 4N30 4N31	I <sub>C</sub> (CTR) <sup>(2)</sup>	50 (500) 10 (100) 5 (50)	— — —	— — —	mA (%)
Isolation Surge Voltage <sup>(4,5)</sup> (60 Hz ac Peak, 1 Second)	4N29/A, 4N30, 31, 32, 33 *4N29, 4N32 *4N30, 4N31, 4N33	V <sub>ISO</sub>	7500 2500 1500	— — —	— — —	Vac(pk)
Isolation Resistance <sup>(4)</sup> (V = 500 V)		R <sub>ISO</sub>	—	10 <sup>11</sup>	—	Ohms
*Collector–Emitter Saturation Voltage <sup>(3)</sup> (I <sub>C</sub> = 2 mA, I <sub>F</sub> = 8 mA)	4N31 4N29, 4N30, 4N32, 4N33	V <sub>CE(sat)</sub>	— —	— —	1.2 1	Volts
Isolation Capacitance <sup>(4)</sup> (V = 0 V, f = 1 MHz)		C <sub>ISO</sub>	—	0.2	—	pF
Turn–On Time <sup>(6)</sup> (I <sub>C</sub> = 50 mA, I <sub>F</sub> = 200 mA, V <sub>CC</sub> = 10 V)		t <sub>on</sub>	—	0.6	5	μs
Turn–Off Time <sup>(6)</sup> (I <sub>C</sub> = 50 mA, I <sub>F</sub> = 200 mA, V <sub>CC</sub> = 10 V)	4N29, 30, 31 4N32, 33	t <sub>off</sub>	— —	17 45	40 100	μs

\* Indicates JEDEC Registered Data. All Motorola 6–pin devices have V<sub>ISO</sub> rating of 7500 Vac(pk).

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = I<sub>C</sub>/I<sub>F</sub> x 100%.
3. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.
4. For this test, Pins 1 and 2 are common and Pins 4, 5 and 6 are common.
5. Isolation Surge Voltage, V<sub>ISO</sub>, is an internal device dielectric breakdown rating.
6. For test circuit setup and waveforms, refer to Figure 11.

TYPICAL CHARACTERISTICS

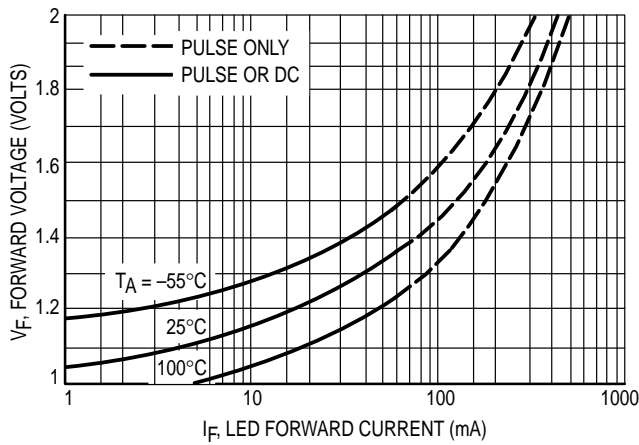


Figure 1. LED Forward Voltage versus Forward Current

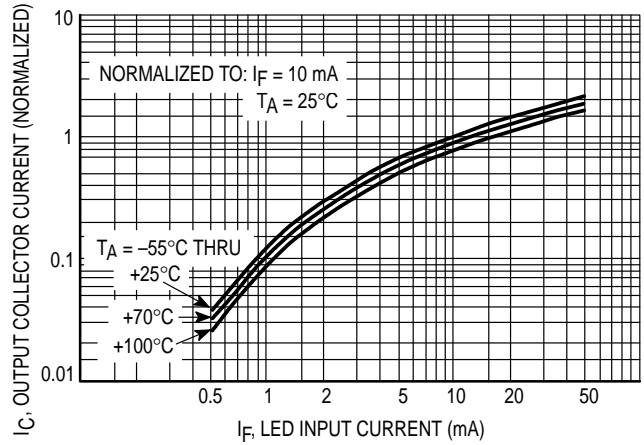


Figure 2. Output Current versus Input Current

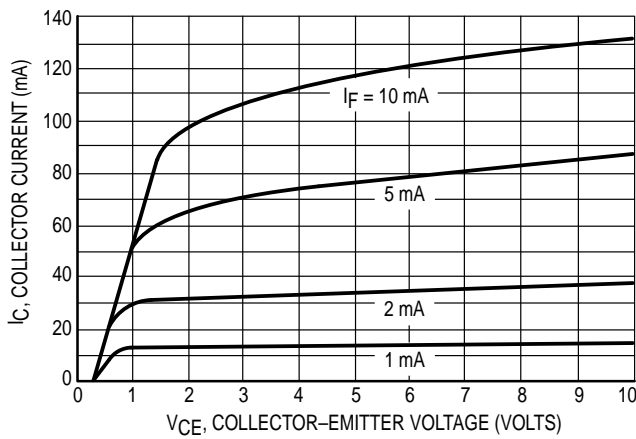


Figure 3. Collector Current versus Collector-Emitter Voltage

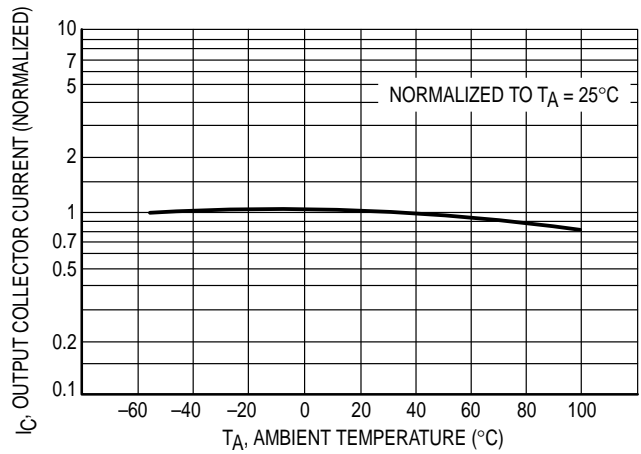


Figure 4. Output Current versus Ambient Temperature

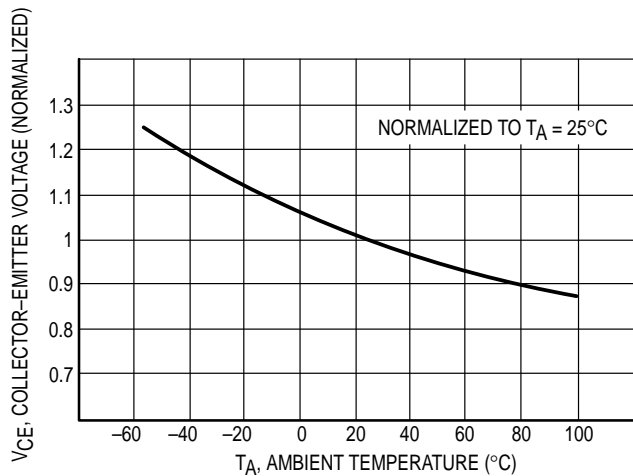


Figure 5. Collector-Emitter Voltage versus Ambient Temperature

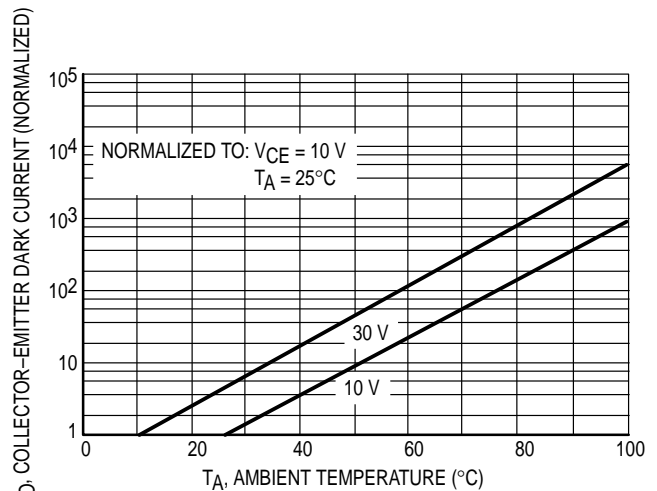
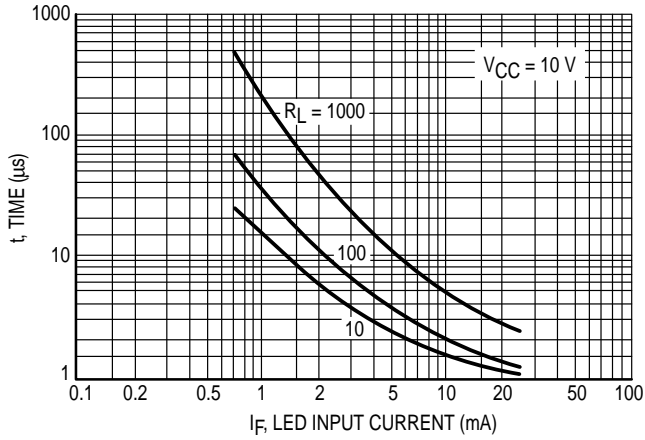
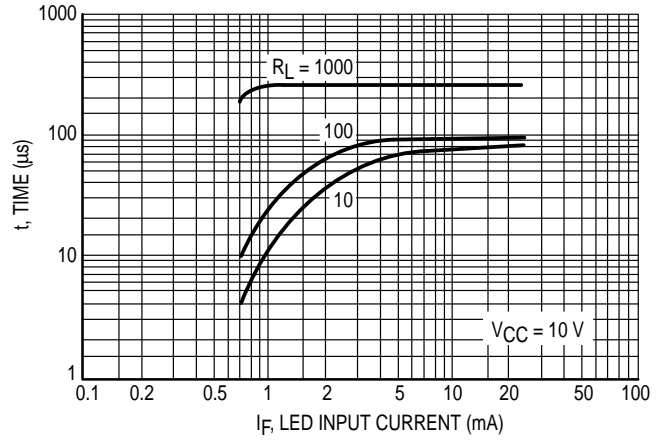


Figure 6. Collector-Emitter Dark Current versus Ambient Temperature

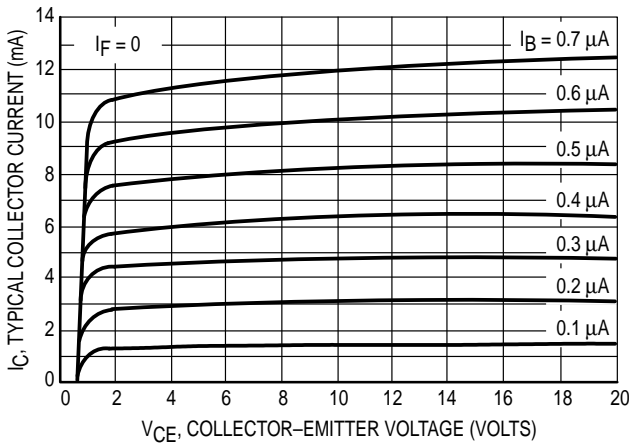
**4N29 4N29A 4N30 4N31 4N32 4N33**



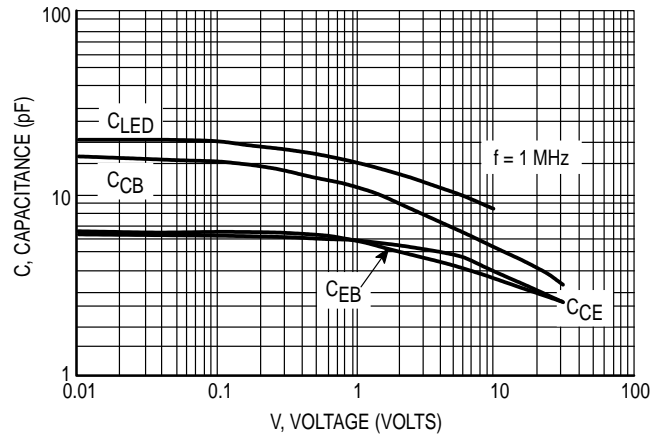
**Figure 7. Turn-On Switching Times**



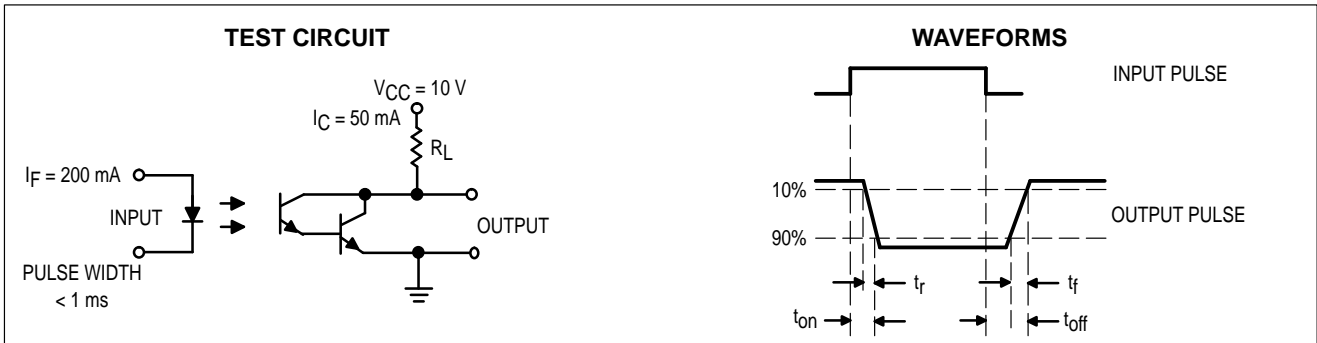
**Figure 8. Turn-Off Switching Times**



**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
- CATHODE
- NC
- EMITTER
- COLLECTOR
- BASE

**CASE 730A-04  
ISSUE G**

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

**\*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	0.008	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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**How to reach us:**

**USA / EUROPE:** Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

**MFAX:** RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244-6609  
**INTERNET:** http://Design-NET.com

**HONG KONG:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

