

## DESCRIPTION

The 4N29, 4N30, 4N31, 4N32, 4N33 have a gallium arsenide infrared emitter optically coupled to a silicon planar photodarlington.

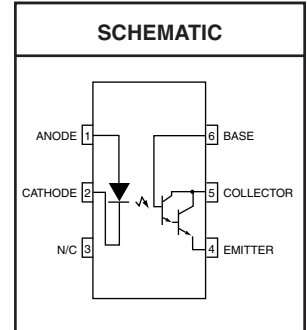
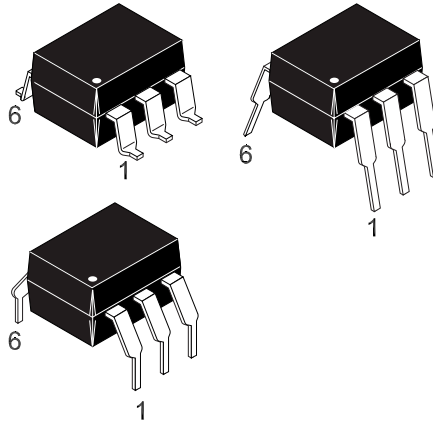
**4N29    4N30    4N31    4N32    4N33**

## FEATURES

- High sensitivity to low input drive current
- Meets or exceeds all JEDEC Registered Specifications
- VDE 0884 approval available as a test option  
-add option .300. (e.g., 4N29.300)

## APPLICATIONS

- Low power logic circuits
- Telecommunications equipment
- Portable electronics
- Solid state relays
- Interfacing coupling systems of different potentials and impedances.



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ Unless otherwise specified.) |                  |                |                      |
|---|------------------|----------------|----------------------|
| Parameter   | Symbol           | Value          | Units                |
| <b>TOTAL DEVICE</b>   |                  |                |                      |
| Storage Temperature   | $T_{STG}$        | -55 to +150    | $^\circ\text{C}$     |
| Operating Temperature   | $T_{OPR}$        | -55 to +100    | $^\circ\text{C}$     |
| Lead Solder Temperature   | $T_{SOL}$        | 260 for 10 sec | $^\circ\text{C}$     |
| Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$                               | $P_D$            | 250            | mW                   |
| Derate above $25^\circ\text{C}$   |                  | 3.3            | mW/ $^\circ\text{C}$ |
| <b>EMITTER</b>  |                  |                |                      |
| Continuous Forward Current  | $I_F$            | 80             | mA                   |
| Reverse Voltage   | $V_R$            | 3              | V                    |
| Forward Current - Peak (300 $\mu\text{s}$ , 2% Duty Cycle)                              | $I_F(\text{pk})$ | 3.0            | A                    |
| LED Power Dissipation @ $T_A = 25^\circ\text{C}$  | $P_D$            | 150            | mW                   |
| Derate above $25^\circ\text{C}$   |                  | 2.0            | mW/ $^\circ\text{C}$ |
| <b>DETECTOR</b>   |                  |                |                      |
| Collector-Emitter Breakdown Voltage   | $BV_{CEO}$       | 30             | V                    |
| Collector-Base Breakdown Voltage  | $BV_{CBO}$       | 30             | V                    |
| Emitter-Collector Breakdown Voltage   | $BV_{ECO}$       | 5              | V                    |
| Detector Power Dissipation @ $T_A = 25^\circ\text{C}$                                   | $P_D$            | 150            | mW                   |
| Derate above $25^\circ\text{C}$   |                  | 2.0            | mW/ $^\circ\text{C}$ |
| Continuous Collector Current  | $I_C$            | 150            | mA                   |

|             |             |             |             |             |
|-------------|-------------|-------------|-------------|-------------|
| <b>4N29</b> | <b>4N30</b> | <b>4N31</b> | <b>4N32</b> | <b>4N33</b> |
|-------------|-------------|-------------|-------------|-------------|

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

| Parameter                            | Test Conditions  | Symbol     | Min | Typ   | Max | Unit          |
|--------------------------------------|--|------------|-----|-------|-----|---------------|
| <b>EMITTER</b>                       |  |            |     |       |     |               |
| *Input Forward Voltage               | ( $I_F = 10\text{ mA}$ )                               | $V_F$      |     | 1.2   | 1.5 | V             |
| *Reverse Leakage Current             | ( $V_R = 3.0\text{ V}$ )                               | $I_R$      |     | 0.001 | 100 | $\mu\text{A}$ |
| *Capacitance                         | ( $V_F = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )          | C          |     | 150   |     | pF            |
| <b>DETECTOR</b>                      |  |            |     |       |     |               |
| *Collector-Emitter Breakdown Voltage | ( $I_C = 100\ \mu\text{A}$ , $I_B = 0$ )               | $BV_{CEO}$ | 30  | 60    |     |               |
| *Collector-Base Breakdown Voltage    | ( $I_C = 100\ \mu\text{A}$ , $I_E = 0$ )               | $BV_{CBO}$ | 30  | 100   |     | V             |
| *Emitter-Collector Breakdown Voltage | ( $I_E = 100\ \mu\text{A}$ , $I_B = 0$ )               | $BV_{ECO}$ | 5.0 | 8     |     | V             |
| *Collector-Emitter Dark Current      | ( $V_{CE} = 10\text{ V}$ , Base Open)                  | $I_{CEO}$  |     | 1     | 100 | nA            |
| DC Current Gain                      | ( $V_{CE} = 5.0\text{ V}$ , $I_C = 500\ \mu\text{A}$ ) | $h_{FE}$   |     | 5000  |     |               |

**TRANSFER CHARACTERISTICS**

| DC Characteristic   | Test Conditions   | Symbol        | Min      | Typ | Max | Units  |
|---|---|---------------|----------|-----|-----|--------|
| *Collector Output Current <sup>(1,2)</sup> (4N32, 4N33)     | ( $I_F = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $I_B = 0$ ) | $I_C$ (CTR)   | 50 (500) |     |     | mA (%) |
| (4N29, 4N30)  |   |               | 10 (100) |     |     |        |
| (4N31)  |   |               | 5 (50)   |     |     |        |
| *Saturation Voltage <sup>(2)</sup> (4N29, 4N30, 4N32, 4N33) | ( $I_F = 8.0\text{ mA}$ , $I_C = 2.0\text{ mA}$ )             | $V_{CE(sat)}$ |          |     | 1.0 | V      |
| (4N31)  |   |               |          |     | 1.2 |        |

**TRANSFER CHARACTERISTICS**

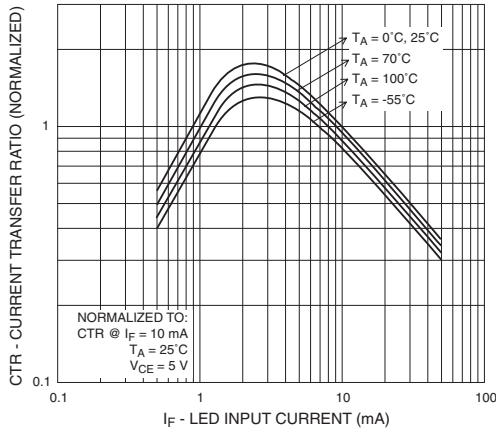
| AC Characteristic                         | Test Conditions  | Symbol   | Min | Typ | Max | Units         |
|---|--|----------|-----|-----|-----|---------------|
| Turn-on Time <sup>(3)</sup>               | ( $I_F = 200\text{ mA}$ , $I_C = 50\text{ mA}$ , $V_{CC} = 10\text{ V}$ )<br>(Fig.7) | $t_{on}$ |     |     | 5.0 | $\mu\text{s}$ |
| Turn-off Time <sup>(3)</sup> (4N32, 4N33) |  |          |     |     | 100 |               |
| (4N29, 4N30, 4N31)                        |  |          |     |     | 40  |               |
| Bandwidth <sup>(4,5)</sup>                |  | BW       |     | 30  |     | KHz           |

**ISOLATION CHARACTERISTICS**

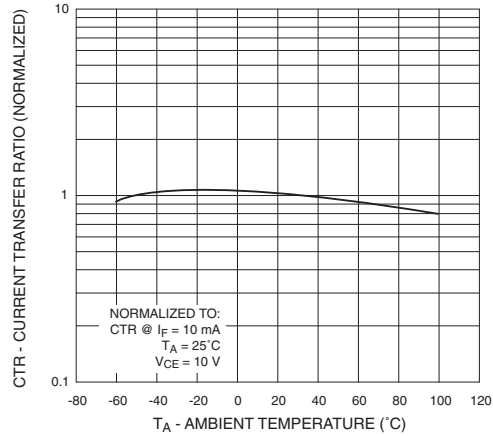
| Characteristic  | Test Conditions   | Symbol    | Min  | Typ       | Max | Units         |
|---|---|-----------|------|-----------|-----|---------------|
| Input-Output Isolation Voltage <sup>(6)</sup><br>(4N29, 4N30, 4N31, 4N32, 4N33) | ( $I_{I-O} \leq 1\ \mu\text{A}$ , $V_{rms}$ , $t = 1\text{ min.}$ ) | $V_{ISO}$ | 5300 |           |     | $V_{ac(rms)}$ |
| * (4N32)  |   |           | VDC  | 2500      |     | V             |
| * (4N33)  |   |           | VDC  | 1500      |     |               |
| Isolation Resistance <sup>(6)</sup>   | ( $V_{I-O} = 500\text{ VDC}$ )                                      | $R_{ISO}$ |      | $10^{11}$ |     | $\Omega$      |
| Isolation Capacitance <sup>(6)</sup>  | ( $V_{I-O} = \emptyset$ , $f = 1\text{ MHz}$ )                      | $C_{ISO}$ |      | 0.8       |     | pf            |

4N29    4N30    4N31    4N32    4N33

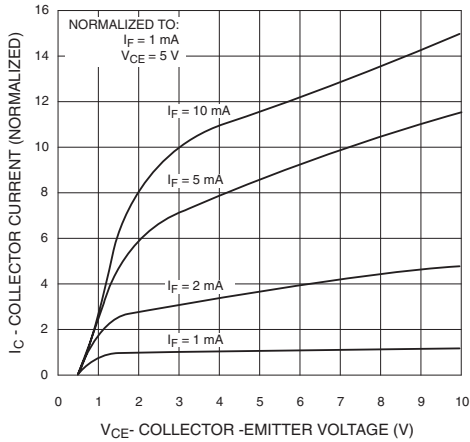
**Fig. 1 Output Current vs. Input Current**



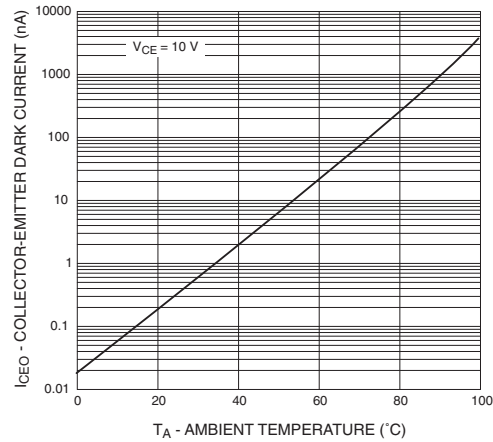
**Fig. 2 Current Transfer Ratio vs. Ambient Temperature**



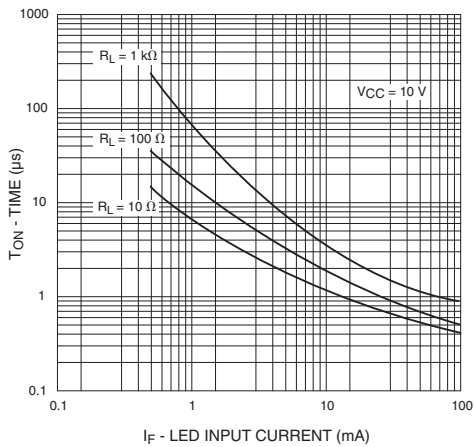
**Fig. 3 Collector Current vs. Collector-Emitter Voltage**



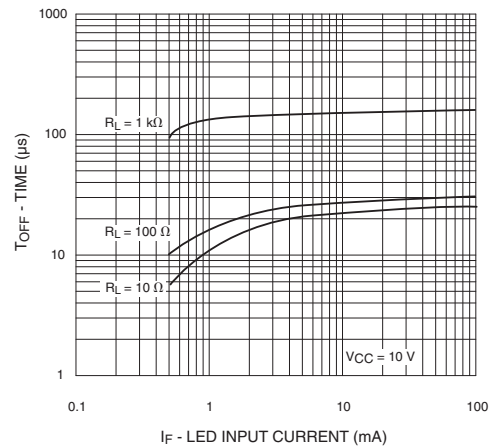
**Fig. 4 Dark Current vs. Ambient Temperature**



**Fig. 5 Turn-On Time vs. Input Current**



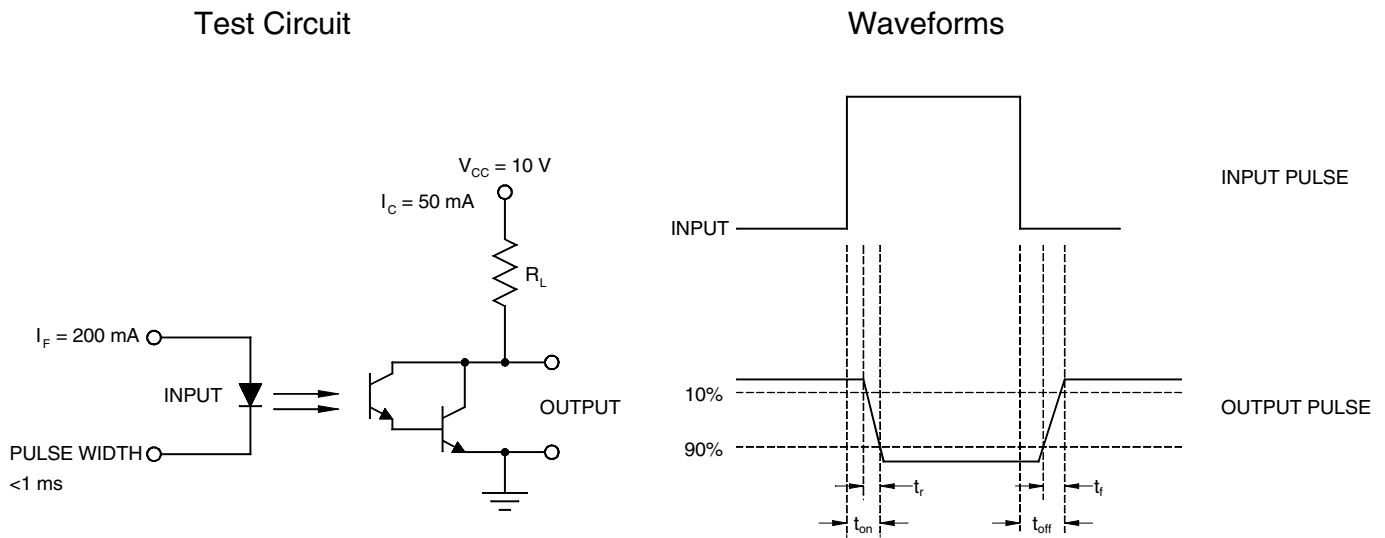
**Fig. 6 Turn-Off Time vs. Input Current**



4N29 4N30 4N31 4N32 4N33

**TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES**

(25°C Free air temperature unless otherwise specified) (Cont.)



**Fig. 7 Switching Time Test Circuit and Waveforms**

**Notes**

\* Indicates JEDEC registered data.

1. The current transfer ratio ( $I_C/I_F$ ) is the ratio of the detector collector current to the LED input current with  $V_{CE} @ 10 \text{ V}$ .
2. Pulse test: pulse width =  $300 \mu\text{s}$ , duty cycle  $\leq 2.0\%$ .
3. For test circuit setup and waveforms, refer to figure 7..
4.  $I_F$  adjusted to  $I_C = 2.0 \text{ mA}$  and  $I_C = 0.7 \text{ mA rms}$ .
5. The frequency at which  $I_C$  is 3dB down from the 1 KHz value.
6. For this test, LED pins 1 and 2 are common, and phototransistor pins 4,5 and 6 are common.

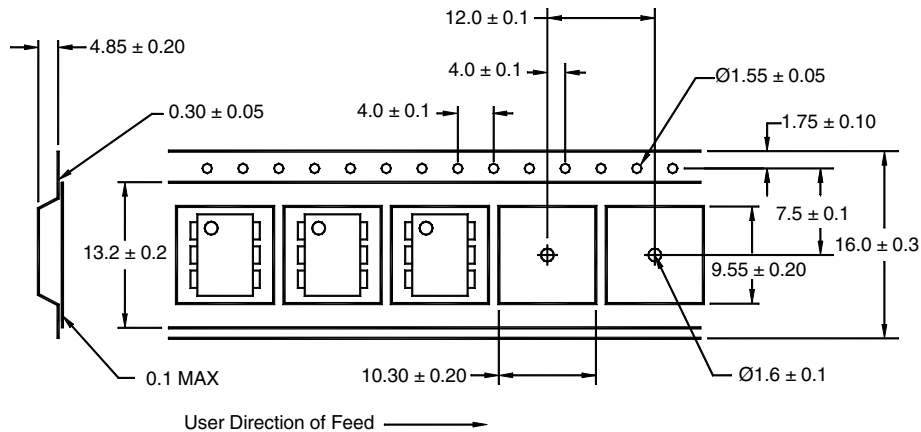


4N29 4N30 4N31 4N32 4N33

## ORDERING INFORMATION

| Option | Order Entry Identifier | Description                          |
|--------|------------------------|--------------------------------------|
| S      | .S                     | Surface Mount Lead Bend              |
| SD     | .SD                    | Surface Mount; Tape and reel         |
| W      | .W                     | 0.4" Lead Spacing                    |
| 300    | .300                   | VDE 0884                             |
| 300W   | .300W                  | VDE 0884, 0.4" Lead Spacing          |
| 3S     | .3S                    | VDE 0884, Surface Mount              |
| 3SD    | .3SD                   | VDE 0884, Surface Mount, Tape & Reel |

## QT Carrier Tape Specifications ("D" Taping Orientation)



## NOTE

All dimensions are in millimeters

**Call QT Optoelectronics for more information or the phone number of your nearest distributor.**

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