

## DESCRIPTION

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

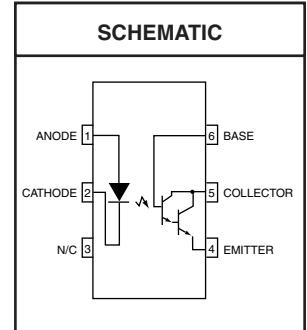
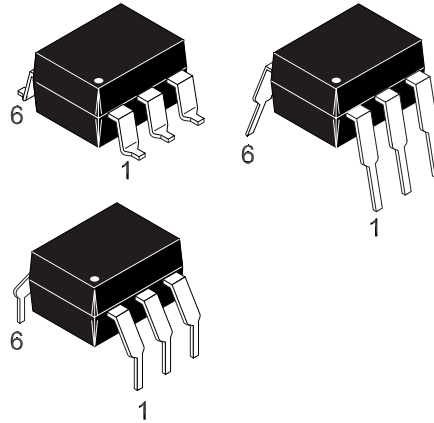
**4N29    4N30    4N31    4N32    4N33**

## 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.



## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C Unless otherwise specified.)

| Parameter  | Symbol             | Value          | Units |
|--|--------------------|----------------|-------|
| <b>TOTAL DEVICE</b>                                    |                    |                |       |
| Storage Temperature                                    | T <sub>STG</sub>   | -55 to +150    | °C    |
| Operating Temperature                                  | T <sub>OPR</sub>   | -55 to +100    | °C    |
| Lead Solder Temperature                                | T <sub>SOL</sub>   | 260 for 10 sec | °C    |
| Total Device Power Dissipation @ T <sub>A</sub> = 25°C | P <sub>D</sub>     | 250            | mW    |
| Derate above 25°C                                      |                    | 3.3            | mW/°C |
| <b>EMITTER</b>   |                    |                |       |
| Continuous Forward Current                             | I <sub>F</sub>     | 80             | mA    |
| Reverse Voltage  | V <sub>R</sub>     | 3              | V     |
| Forward Current - Peak (300 μs, 2% Duty Cycle)         | I <sub>F(pk)</sub> | 3.0            | A     |
| LED Power Dissipation @ T <sub>A</sub> = 25°C          | P <sub>D</sub>     | 150            | mW    |
| Derate above 25°C                                      |                    | 2.0            | mW/°C |
| <b>DETECTOR</b>  |                    |                |       |
| Collector-Emitter Breakdown Voltage                    | BV <sub>CEO</sub>  | 30             | V     |
| Collector-Base Breakdown Voltage                       | BV <sub>CBO</sub>  | 30             | V     |
| Emitter-Collector Breakdown Voltage                    | BV <sub>ECO</sub>  | 5              | V     |
| Detector Power Dissipation @ T <sub>A</sub> = 25°C     | P <sub>D</sub>     | 150            | mW    |
| Derate above 25°C                                      |                    | 2.0            | mW/°C |
| Continuous Collector Current                           | I <sub>C</sub>     | 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 <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V, I <sub>B</sub> = 0) | $I_C$ (CTR)   | 50 (500) |     |     | mA (%) |
| (4N29, 4N30)  |  |               | 10 (100) |     |     |        |
| (4N31)  |  |               | 5 (50)   |     |     |        |
| *Saturation Voltage <sup>(2)</sup> (4N29, 4N30, 4N32, 4N33) | (I <sub>F</sub> = 8.0 mA, I <sub>C</sub> = 2.0 mA)                   | $V_{CE(sat)}$ |          |     | 1.0 | V      |
| (4N31)  |  |               |          |     | 1.2 |        |

**TRANSFER CHARACTERISTICS**

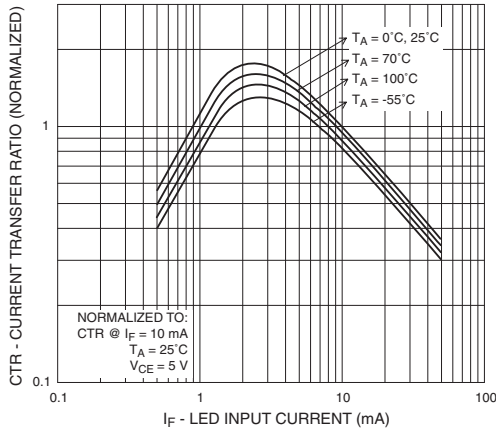
| AC Characteristic                         | Test Conditions  | Symbol   | Min | Typ | Max | Units         |
|---|--|----------|-----|-----|-----|---------------|
| Turn-on Time <sup>(3)</sup>               | (I <sub>F</sub> = 200 mA, I <sub>C</sub> = 50 mA, V <sub>CC</sub> = 10 V)<br>(Fig.7) | $t_{on}$ |     |     | 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**

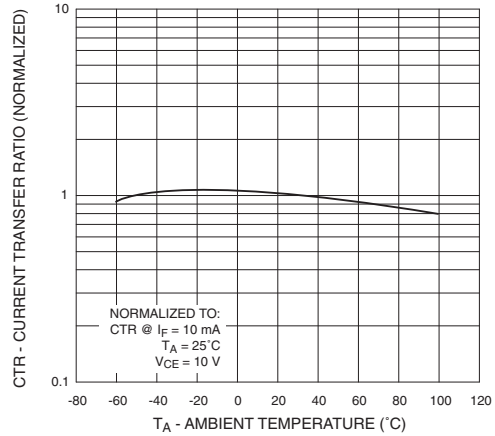
| Characteristic  | Test Conditions  | Symbol    | Min  | Typ              | Max | Units    |
|---|--|-----------|------|------------------|-----|----------|
| Input-Output Isolation Voltage <sup>(6)</sup><br>(4N29, 4N30, 4N31, 4N32, 4N33) | (I <sub>I-O</sub> ≤ 1 $\mu\text{A}$ , V <sub>rms</sub> , t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

4N29   4N30   4N31   4N32   4N33

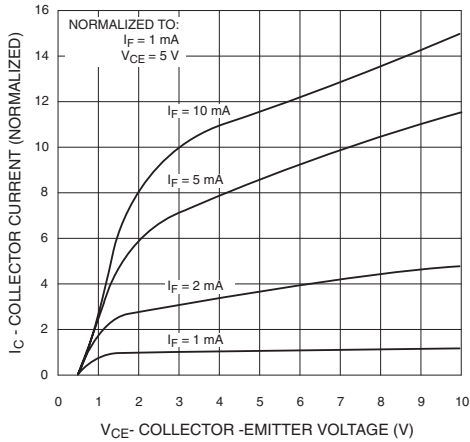
**Fig. 1 Output Current vs. Input Current**



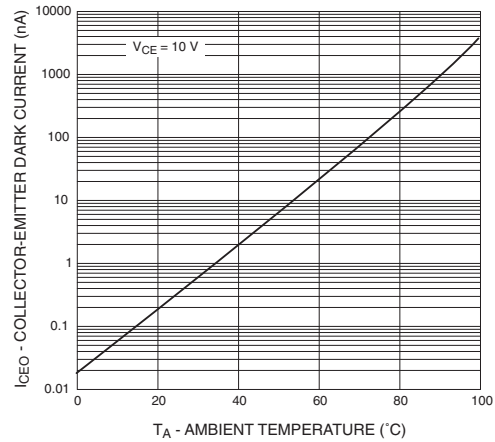
**Fig. 2 Current Transfer Ratio vs. Ambient Temperature**



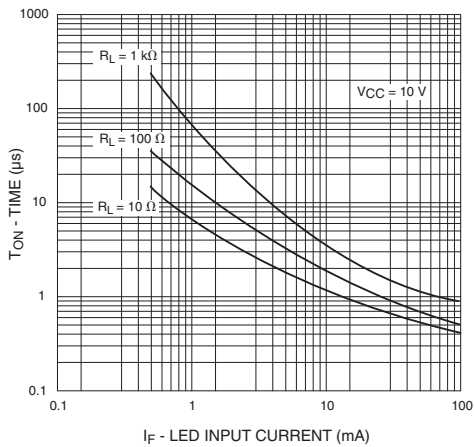
**Fig. 3 Collector Current vs. Collector-Emitter Voltage**



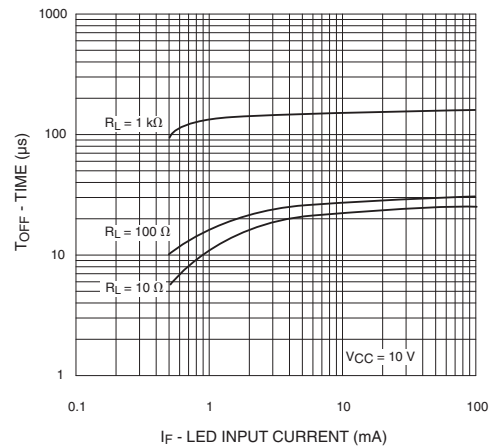
**Fig. 4 Dark Current vs. Ambient Temperature**



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



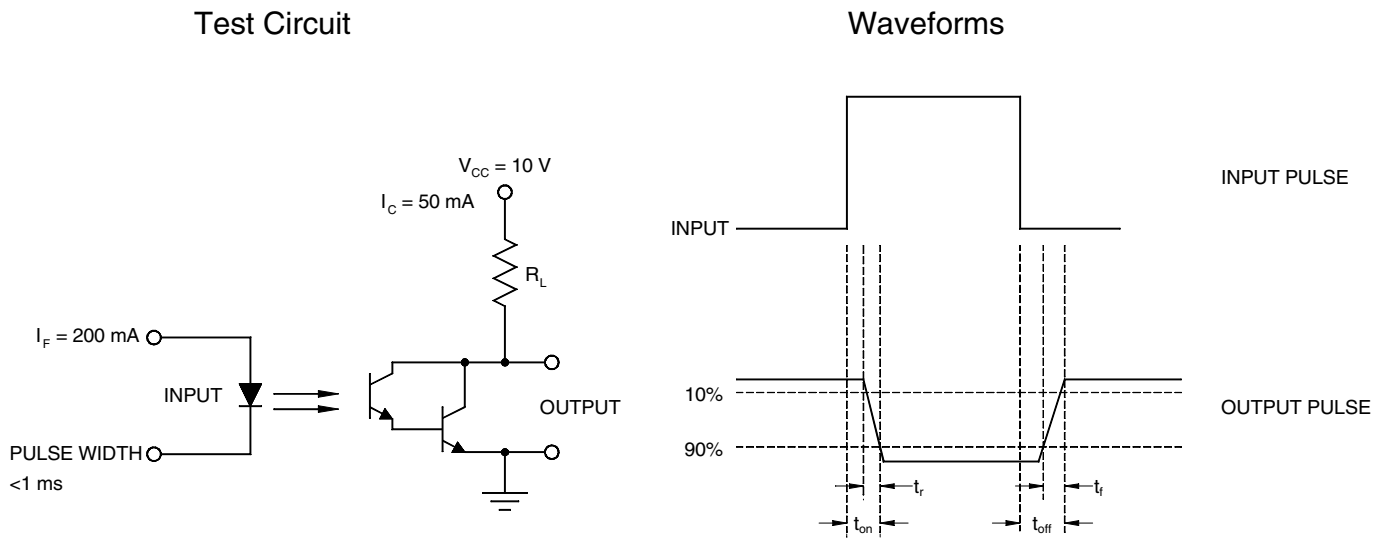
**Fig. 6 Turn-Off Time vs. Input Current**



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**

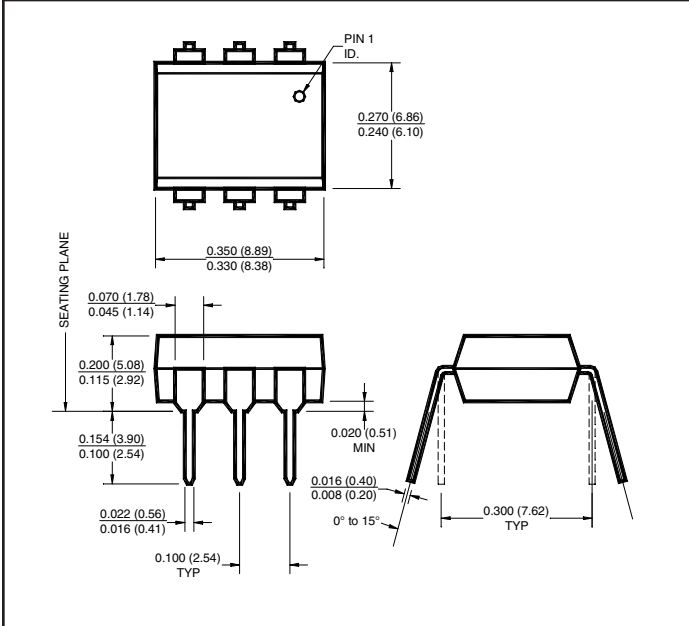
**Notes**

\* Indicates JEDEC registered data.

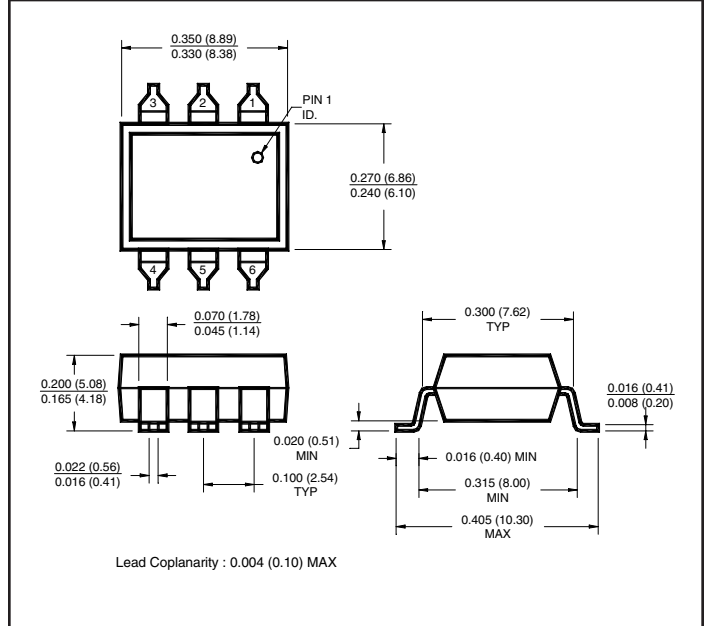
1. The current transfer ratio ( $I_C/I_F$ ) is the ratio of the detector collector current to the LED input current with  $V_{CE} @ 10 \text{ V}$ .
2. Pulse test: pulse width =  $300 \mu\text{s}$ , duty cycle  $\leq 2.0\%$ .
3. For test circuit setup and waveforms, refer to figure 7..
4.  $I_F$  adjusted 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

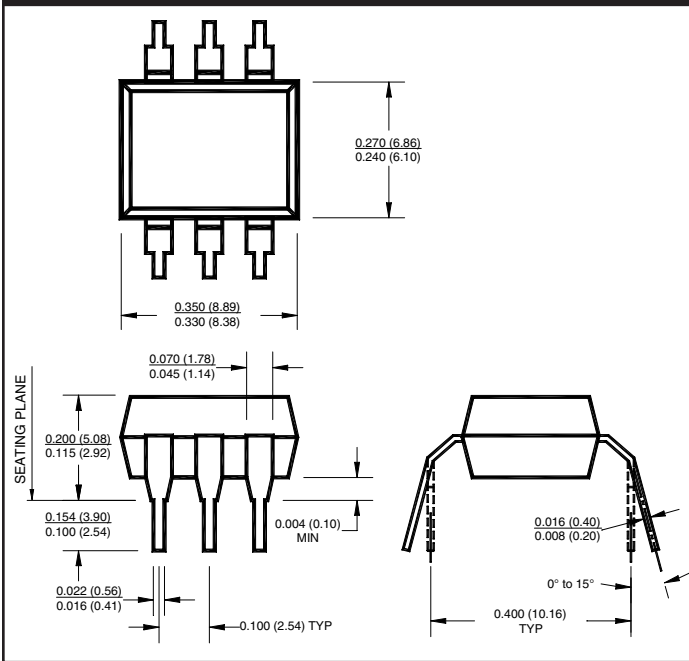
## Package Dimensions (Through Hole)



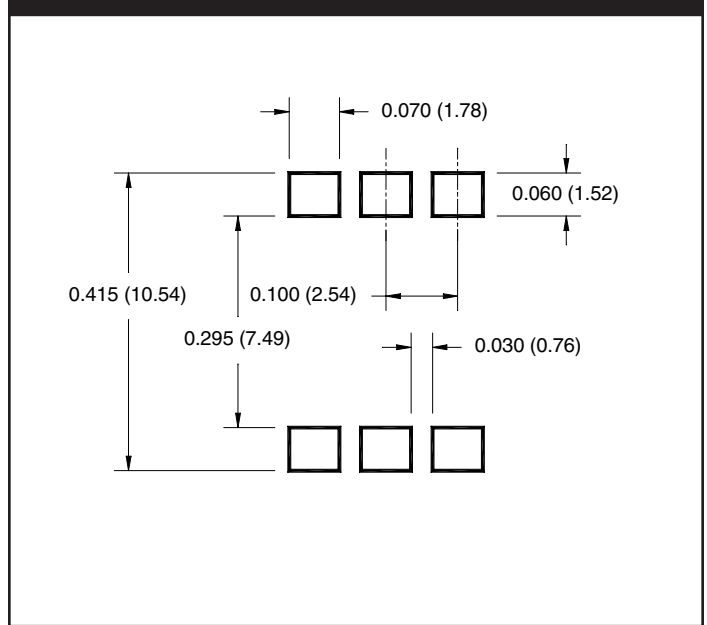
## Package Dimensions (Surface Mount)



## Package Dimensions (0.4" Lead Spacing)



## Recommended Pad Layout for Surface Mount Leadform



### NOTE

All dimensions are in inches (millimeters)

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

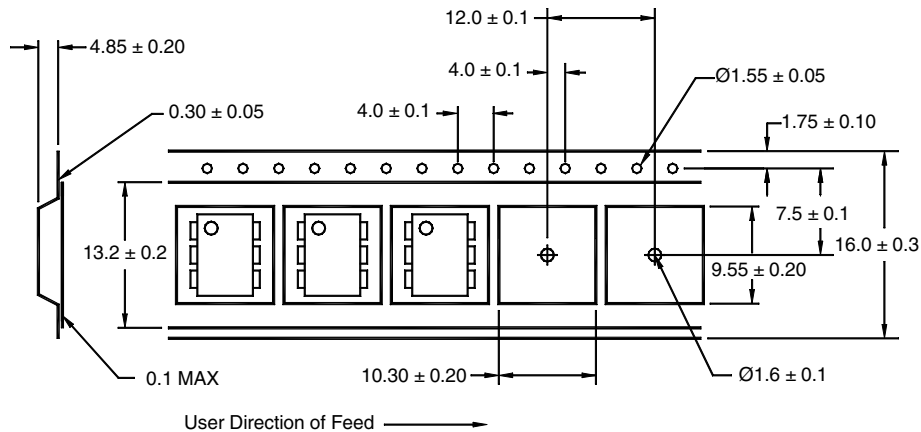
United States 800-533-6786 • France 33 [0] 1.45.18.78.78 • Germany 49 [0] 89/96.30.51 • United Kingdom 44 [0] 1296 394499 • Asia/Pacific 603-7248193

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

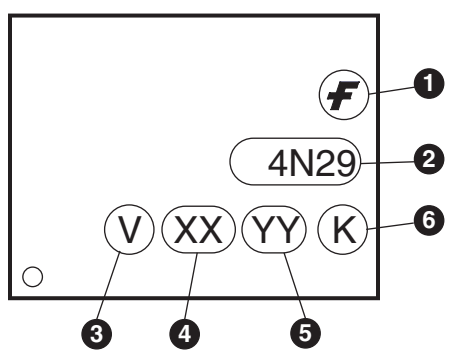
All dimensions are in millimeters

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

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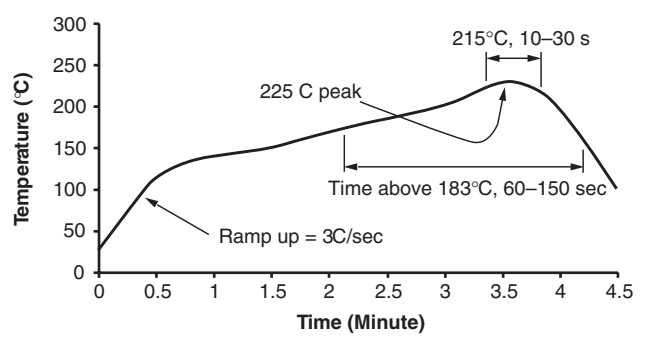
[www.qtopto.com](http://www.qtopto.com)

**MARKING INFORMATION**



| Definitions |  |
|-------------|--|
| 1           | Fairchild logo   |
| 2           | Device number  |
| 3           | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4           | Two digit year code, e.g., '03'  |
| 5           | Two digit work week ranging from '01' to '53'  |
| 6           | Assembly package code  |

**Reflow Profile (Black Package, No Suffix)**



- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60–150 seconds
- One time soldering reflow is recommended

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| ActiveArray™                         | FASTr™              | LittleFET™    | PowerEdge™          | SuperFET™       |
| Bottomless™                          | FPST™               | MICROCOUPLER™ | PowerSaver™         | SuperSOT™-3     |
| CoolFET™                             | FRFET™              | MicroFET™     | PowerTrench®        | SuperSOT™-6     |
| CROSSVOLT™                           | GlobalOptoisolator™ | MicroPak™     | QFET®               | SuperSOT™-8     |
| DOMET™                               | GTO™                | MICROWIRE™    | QS™                 | SyncFET™        |
| EcoSPARK™                            | HiSeC™              | MSX™          | QT Optoelectronics™ | TinyLogic®      |
| E <sup>2</sup> CMOS™                 | ꝑC™                 | MSXPro™       | Quiet Series™       | TINYOPTO™       |
| EnSigna™                             | i-Lo™               | OCX™          | RapidConfigure™     | TruTranslation™ |
| FACT™                                | ImpliedDisconnect™  | OCXPro™       | RapidConnect™       | UHC™            |
| FACT Quiet Series™                   |                     | OPTOLOGIC®    | µSerDes™            | UltraFET®       |
| Across the board. Around the world.™ |                     | OPTOPLANAR™   | SILENT SWITCHER®    | VCX™            |
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| Programmable Active Droop™           |                     | POP™          | SPM™                |                 |

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## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition  |
|--------------------------|------------------------|---|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.  |
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