

## DESCRIPTION

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

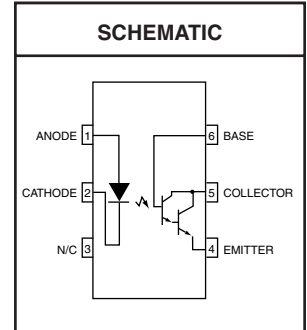
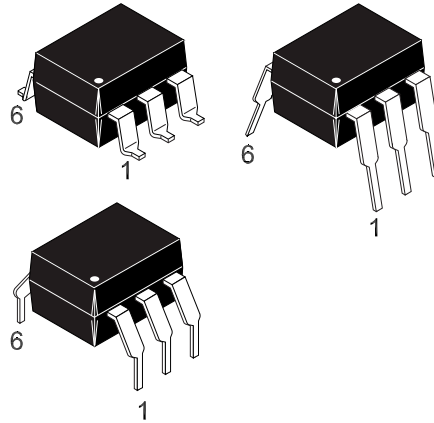
**4N29    4N30    4N31    4N32    4N33**

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

| Parameter                                              | Symbol             | Value          | Units |
|--------------------------------------------------------|--------------------|----------------|-------|
| TOTAL DEVICE                                           |                    |                |       |
| 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 |
| EMITTER                                                |                    |                |       |
| 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 |
| DETECTOR                                               |                    |                |       |
| 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<sub>A</sub> = 25°C Unless otherwise specified.)

### INDIVIDUAL COMPONENT CHARACTERISTICS

| Parameter                            | Test Conditions                                    | Symbol            | Min | Typ   | Max | Unit |
|--------------------------------------|----------------------------------------------------|-------------------|-----|-------|-----|------|
| <b>EMITTER</b>                       |                                                    |                   |     |       |     |      |
| *Input Forward Voltage               | (I <sub>F</sub> = 10 mA)                           | V <sub>F</sub>    |     | 1.2   | 1.5 | V    |
| *Reverse Leakage Current             | (V <sub>R</sub> = 3.0 V)                           | I <sub>R</sub>    |     | 0.001 | 100 | μA   |
| *Capacitance                         | (V <sub>F</sub> = 0 V, f = 1.0 MHz)                | C                 |     | 150   |     | pF   |
| <b>DETECTOR</b>                      |                                                    |                   |     |       |     |      |
| *Collector-Emitter Breakdown Voltage | (I <sub>C</sub> = 100 μA, I <sub>B</sub> = 0)      | BV <sub>CEO</sub> | 30  | 60    |     |      |
| *Collector-Base Breakdown Voltage    | (I <sub>C</sub> = 100 μA, I <sub>E</sub> = 0)      | BV <sub>CBO</sub> | 30  | 100   |     | V    |
| *Emitter-Collector Breakdown Voltage | (I <sub>E</sub> = 100 μA, I <sub>B</sub> = 0)      | BV <sub>ECO</sub> | 5.0 | 8     |     | V    |
| *Collector-Emitter Dark Current      | (V <sub>CE</sub> = 10 V, Base Open)                | I <sub>CEO</sub>  |     | 1     | 100 | nA   |
| DC Current Gain                      | (V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 500 μA) | h <sub>FE</sub>   |     | 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 <sub>C</sub> (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 <sub>CE(sat)</sub> |          |     | 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 <sub>on</sub>  |     |     | 5.0 | μs    |
| Turn-off Time <sup>(3)</sup> (4N32, 4N33) |                                                                                      | t <sub>off</sub> |     |     | 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 μA, V <sub>rms</sub> , t = 1 min.) | V <sub>ISO</sub> | 5300 |                  |     | Vac(rms) |
| * (4N32)                                                                        | VDC                                                      |                  | 2500 |                  |     | V        |
| * (4N33)                                                                        | VDC                                                      |                  | 1500 |                  |     |          |
| Isolation Resistance <sup>(6)</sup>                                             | (V <sub>I-O</sub> = 500 VDC)                             | R <sub>ISO</sub> |      | 10 <sup>11</sup> |     | Ω        |
| Isolation Capacitance <sup>(6)</sup>                                            | (V <sub>I-O</sub> = ∅, f = 1 MHz)                        | C <sub>ISO</sub> |      | 0.8              |     | pf       |

4N29 4N30 4N31 4N32 4N33

Fig. 1 Output Current vs. Input Current

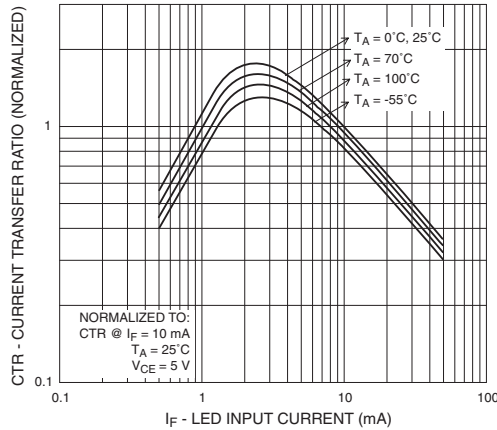


Fig. 2 Current Transfer Ratio vs. Ambient Temperature

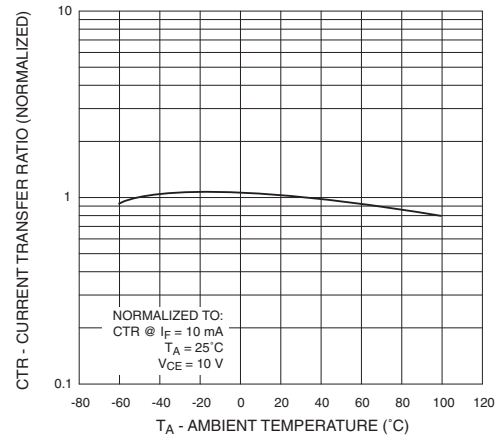


Fig. 3 Collector Current vs. Collector-Emitter Voltage

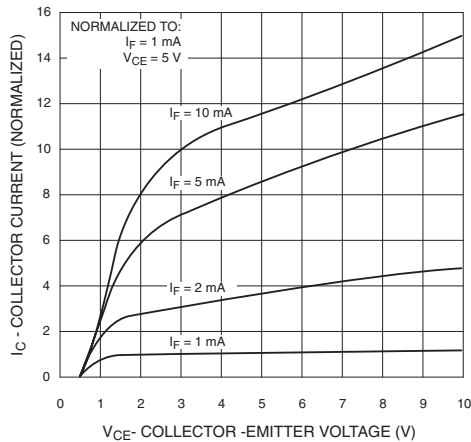


Fig. 4 Dark Current vs. Ambient Temperature

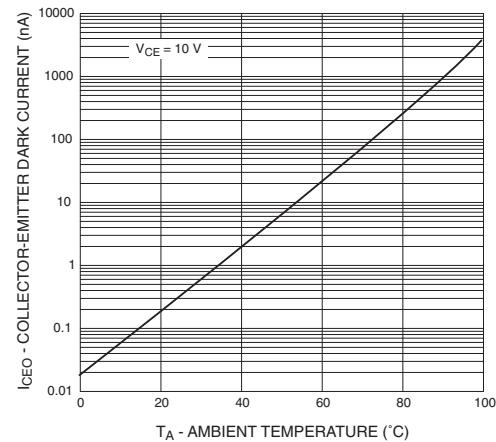


Fig. 5 Turn-On Time vs. Input Current

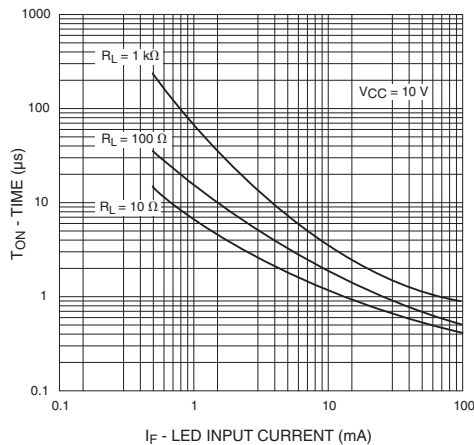
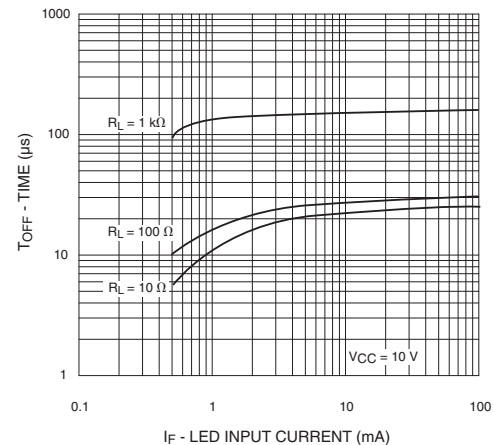


Fig. 6 Turn-Off Time vs. Input Current



4N29 4N30 4N31 4N32 4N33

## TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

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

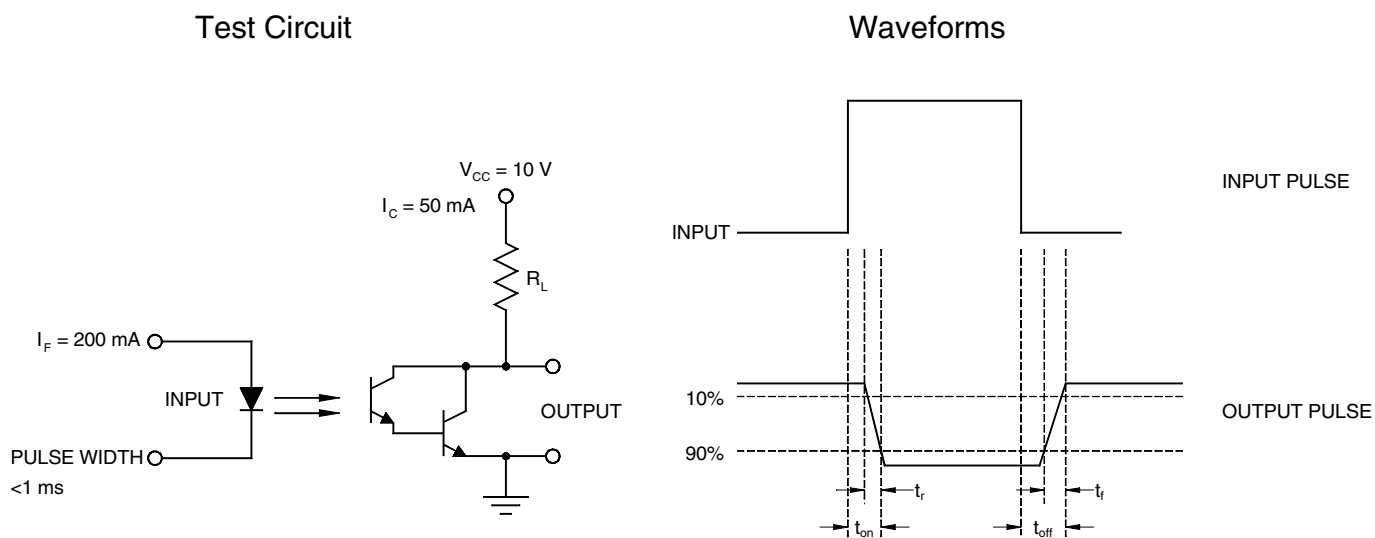


Fig. 7 Switching Time Test Circuit and Waveforms

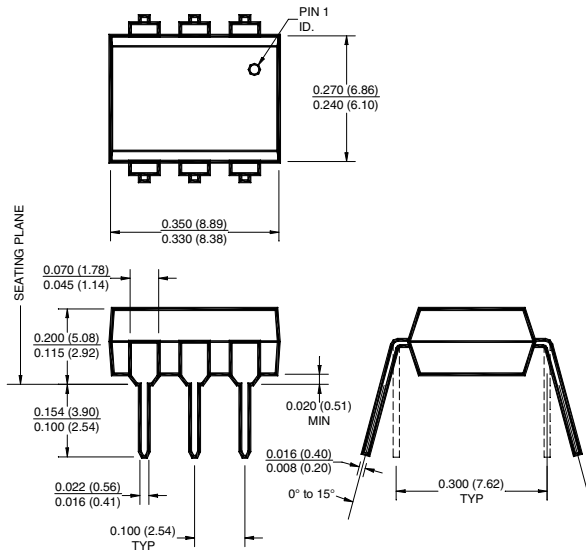
### Notes

\* Indicates JEDEC registered data.

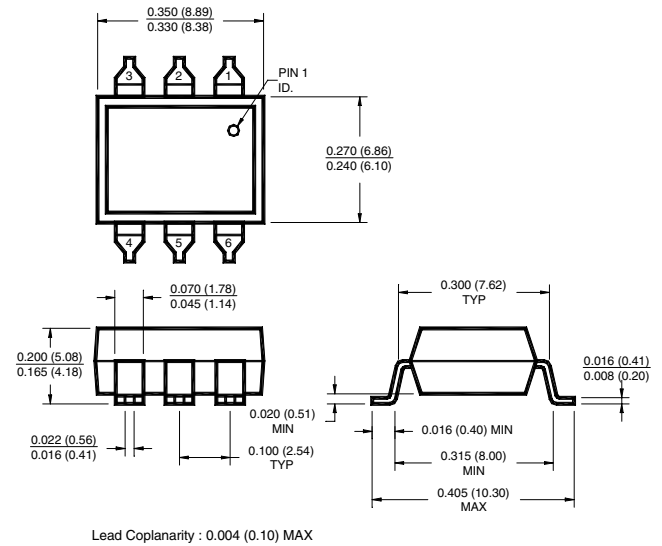
1. The current transfer ratio ( $I_C/I_F$ ) is the ratio of the detector collector current to the LED input current with  $V_{CE} @ 10 \text{ V}$ .
2. Pulse test: pulse width =  $300 \mu\text{s}$ , duty cycle  $\leq 2.0\%$ .
3. For test circuit setup and waveforms, refer to figure 7..
4.  $I_F$  adjusted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

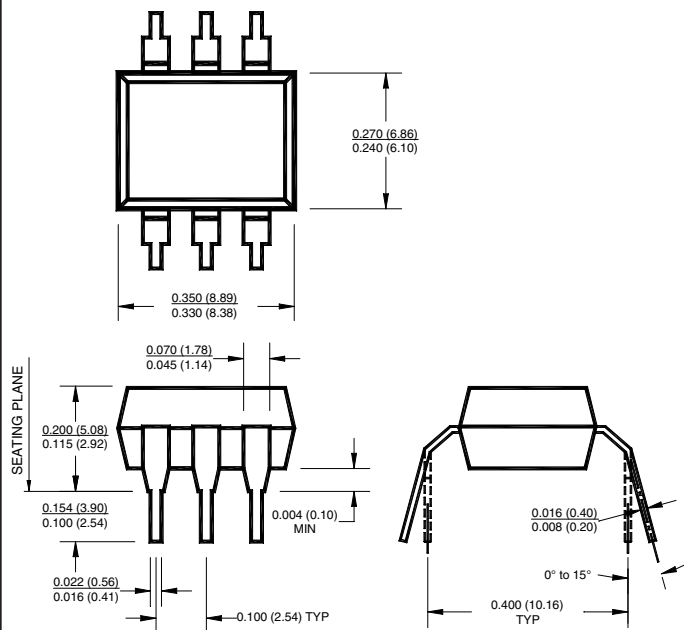
## Package Dimensions (Through Hole)



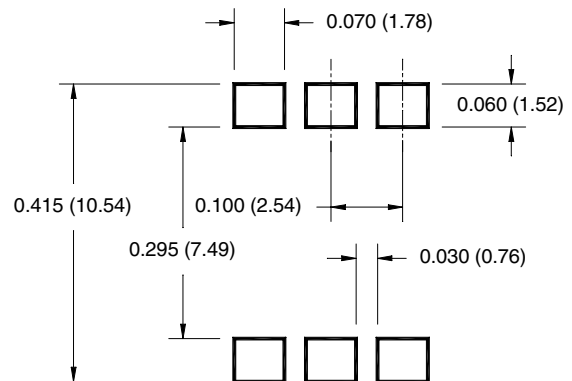
## Package Dimensions (Surface Mount)



## 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.

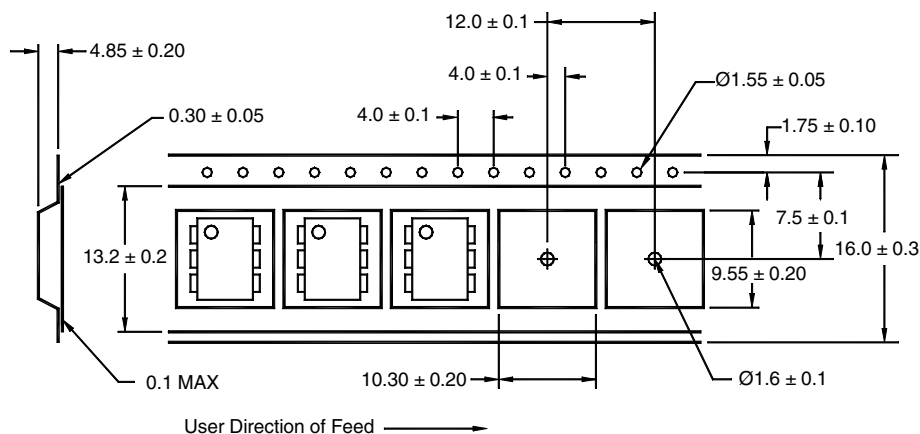
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4N29 4N30 4N31 4N32 4N33

## 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

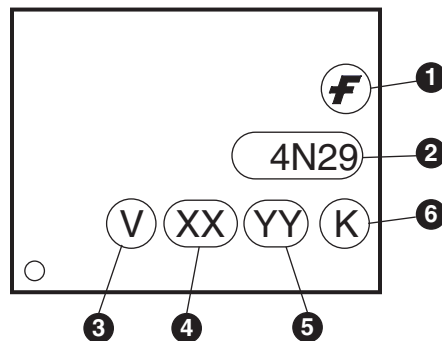
All dimensions are in millimeters

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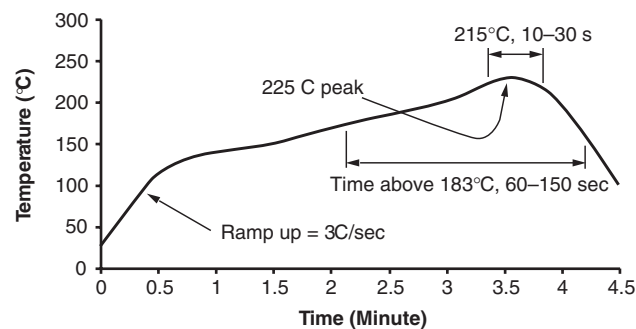
[www.qtopto.com](http://www.qtopto.com)

## 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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|                                      |                     |               |                     |                 |
|--------------------------------------|---------------------|---------------|---------------------|-----------------|
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| ActiveArray™                         | FASTr™              | LittleFET™    | PowerEdge™          | SuperFET™       |
| Bottomless™                          | FPS™                | MICROCOUPLER™ | PowerSaver™         | SuperSOT™-3     |
| CoolFET™                             | FRFET™              | MicroFET™     | PowerTrench®        | SuperSOT™-6     |
| CROSSVOLT™                           | GlobalOptoisolator™ | MicroPak™     | QFET®               | SuperSOT™-8     |
| DOME™                                | GTO™                | MICROWIRE™    | QS™                 | SyncFET™        |
| EcoSPARK™                            | HiSeC™              | MSX™          | QT Optoelectronics™ | TinyLogic®      |
| E <sup>2</sup> CMOS™                 | I <sup>2</sup> C™   | 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™            |
| The Power Franchise®                 |                     | PACMAN™       | SMART START™        |                 |
| Programmable Active Droop™           |                     | POP™          | SPM™                |                 |

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## 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.                                                                                    |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
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