



|                                  | ITC135P | Units |
|----------------------------------|---------|-------|
| Relay Load Voltage               | 350     | V     |
| Relay Load Current               | 120     | mA    |
| Relay Max R <sub>ON</sub>        | 15      | Ω     |
| Bridge Rectifier Reverse Voltage | 100     | V     |
| Darlington Collector Current     | 120     | mA    |
| Darlington Current Gain          | 10,000  | -     |

### Features

- Small 16 Pin SOIC Package (PCMCIA Compatible)
- Board Space and Cost Savings
- 2mW Hookswitch Drive Power (Logic Compatible)
- No Moving Parts
- 3750V<sub>RMS</sub> Input/Output Isolation
- FCC Compatible Part 68
- Full-Wave Bridge Rectifier
- Darlington Transistor for Electronic Inductor “Dry” Circuits
- Half Wave Current Detector for Ring Signal or Loop Current Detect
- Current Limiting and Tape & Reel Versions Available
- JEDEC Standard Pin Out
- Includes Zener Diodes

### Applications

- Data/Fax Modem
- Voice Mail Systems
- Telephone Sets
- Computer Telephony Integration
- Cable TV Modems

### Description

The Integrated Telecom Circuit combines a 1-Form-A solid state relay, bridge rectifier, Darlington transistor, optocoupler and zener diodes into one 16 pin SOIC package, consolidating designs and reducing component count in telecom applications. The ITC135P's optocoupler provides half wave ring detection.

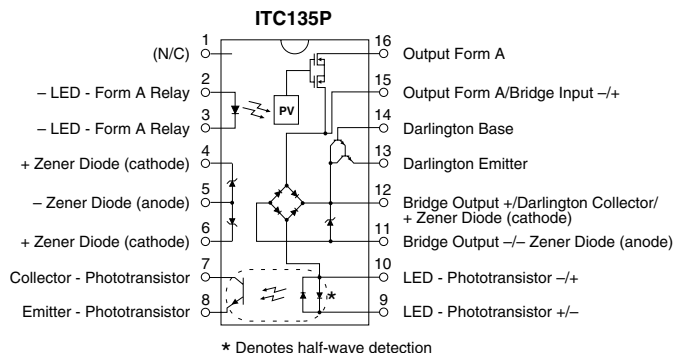
### Approvals

- UL Recognized: File Number E76270
- CSA Certified: File Number LR 43639-12
- BSI Certified:
  - BS EN 60950:1992 (BS7002:1992) Certificate #: 7969
  - BS EN 41003:1993 Certificate #: 7969

### Ordering Information

| Part #  | Description             |
|---------|-------------------------|
| ITC135P | 16 Pin SOIC (50/Tube)   |
| ITC135P | 16 Pin SOIC (1000/Reel) |

### Pin Configuration



### Absolute Maximum Ratings (@ 25° C)

| Parameter                                  | Min  | Typ | Max            | Units            |
|--|------|-----|----------------|------------------|
| Total Package Dissipation                  | -    | -   | 1 <sup>1</sup> | W                |
| Isolation Voltage                          |      |     |                |                  |
| Input to Output                            | 3750 | -   | -              | V <sub>RMS</sub> |
| Operational Temperature                    | -40  | -   | +85            | °C               |
| Storage Temperature                        | -40  | -   | +125           | °C               |
| Soldering Temperature<br>(10 Seconds Max.) | -    | -   | +220           | °C               |

<sup>1</sup> Above 25° derate linearly 8.33mw/°C

Total Power Dissipation (PD):

$$P_D = P_{\text{HOOKSWITCH}} + P_{\text{BRIDGE}} + P_{\text{DARLINGTON}} + P_{\text{LED}}$$

$$P_D = (R_{DS(on)})(I_L^2) + 2(V_F)(I_L) + (V_{CE})(I_L) + (V_{LED})(I_F)$$

WHERE:

$R_{DS(on)}$  = Maximum realy on resistance

$I_L$  = Maximum loop current

$V_F$  = Maximum diode forward voltage

$V_{CE}$  = Maximum voltage collector to emitter

$V_{LED}$  = Maximum LED forward voltage

$I_F$  = Maximum LED current

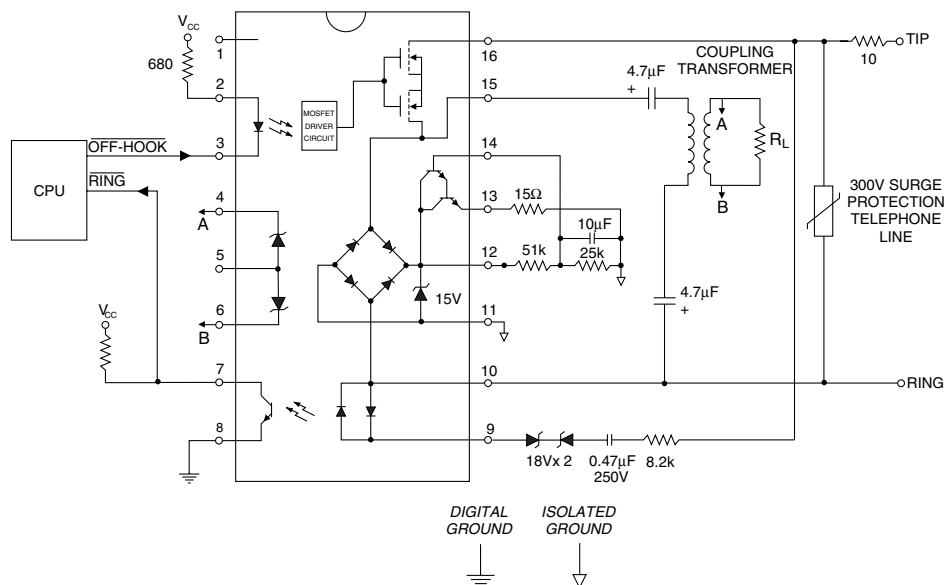
*Absolute Maximum Ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this data sheet is not implied. Exposure of the device to the absolute maximum ratings for an extended period may degrade the device and effect its reliability.*

### Electrical Characteristics

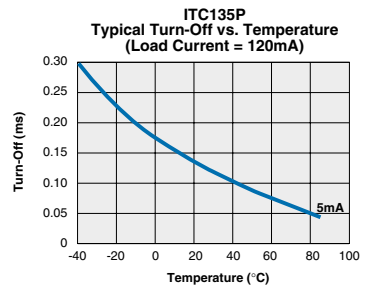
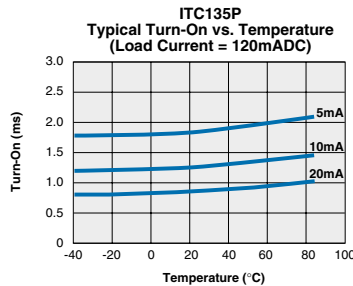
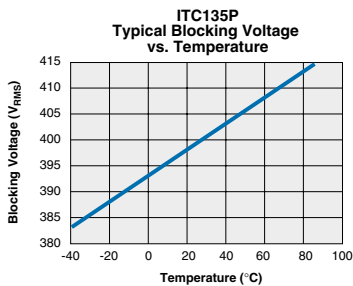
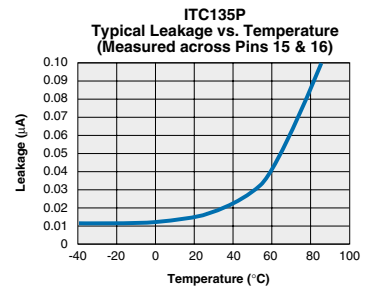
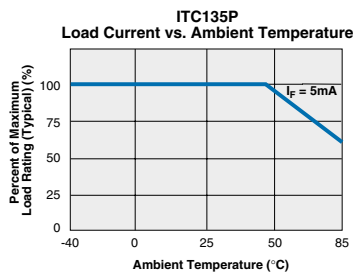
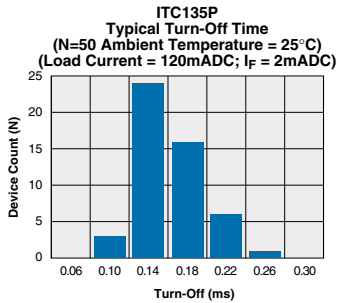
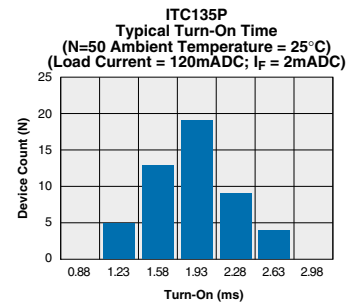
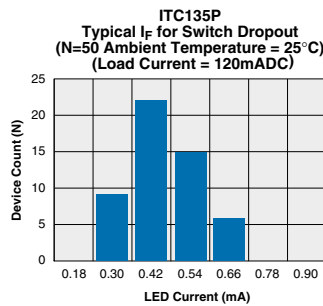
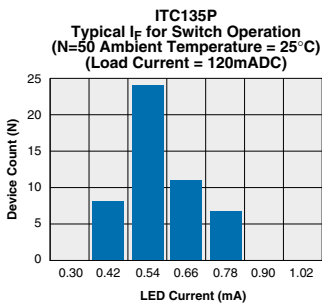
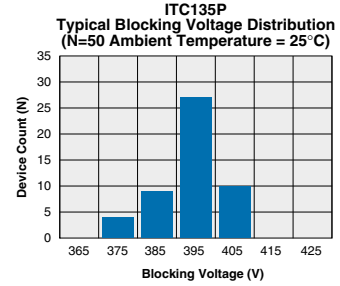
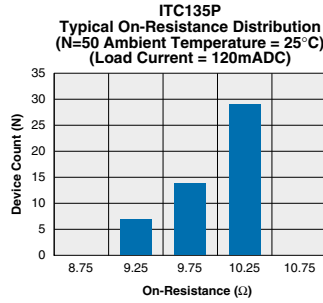
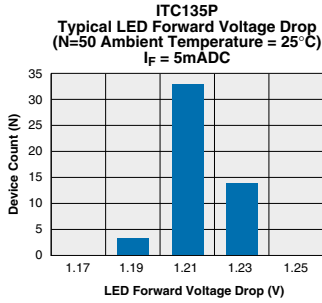
| Parameter                               | Conditions                           | Symbol     | Min | Typ | Max | Units         |
|---|--------------------------------------|------------|-----|-----|-----|---------------|
| <b>Relay Portion (Pins 15,16)</b>       |                                      |            |     |     |     |               |
| <b>Output Characteristics @ 25°C</b>    |                                      |            |     |     |     |               |
| Load Voltage, DC or Peak AC             | -                                    | $V_L$      | -   | -   | 350 | V             |
| Load Current (Continuous)               | -                                    | $I_L$      | -   | -   | 120 | mA            |
| On-Resistance                           | $I_L=120\text{mA}$                   | $R_{ON}$   | -   | -   | 15  | $\Omega$      |
| Off-State Leakage Current               | $V_L=350, T_J=25^\circ\text{C}$      | $I_{LEAK}$ | -   | -   | 1   | $\mu\text{A}$ |
| Switching Speeds                        |                                      |            |     |     |     |               |
| Turn-On                                 | $I_F=5\text{mA}, V_L=10\text{V}$     | $T_{ON}$   | -   | -   | 3   | ms            |
| Turn-Off                                | $I_F=5\text{mA}, V_L=10\text{V}$     | $T_{OFF}$  | -   | -   | 3   | ms            |
| Output Capacitance                      | 50V, f=1MHz                          | $C_{OUT}$  | -   | 25  | -   | pF            |
| <b>Relay Portion (Pins 2,3)</b>         |                                      |            |     |     |     |               |
| <b>Input Characteristics @ 25°C</b>     |                                      |            |     |     |     |               |
| Input Control Current                   | $I_L=120\text{mA}$                   | $I_F$      | 5   | -   | 50  | mA            |
| Input Voltage Drop                      | $I_F=5\text{mA}$                     | $V_F$      | 0.9 | 1.2 | 1.4 | V             |
| Reverse Input Voltage                   | -                                    | $V_R$      | -   | -   | 5   | V             |
| Reverse Input Current                   | $V_R=5\text{V}$                      | $I_R$      | -   | -   | 10  | $\mu\text{A}$ |
| <b>Detector Portion (Pins 7,8)</b>      |                                      |            |     |     |     |               |
| <b>Output Characteristics @ 25°C</b>    |                                      |            |     |     |     |               |
| Phototransistor Blocking Voltage        | $I_C=10\mu\text{A}$                  | $BV_{CEO}$ | 20  | 50  | -   | V             |
| Phototransistor Dark Current            | $V_{CE}=5\text{V}, I_F=0\text{mA}$   | $I_{CEO}$  | -   | 50  | 500 | A             |
| Saturation Voltage                      | $I_C=2\text{mA}, I_F=16\text{mA}$    | $V_{SAT}$  | -   | 0.3 | 0.5 | V             |
| Current Transfer Ratio                  | $I_F=6\text{mA}, V_{CE}=0.5\text{V}$ | CTR        | 33  | 400 | -   | %             |
| <b>Detector Portion (Pins 9,10)</b>     |                                      |            |     |     |     |               |
| <b>Input Characteristics @ 25°C</b>     |                                      |            |     |     |     |               |
| Input Control Current                   | $I_C=2\text{mA}, V_{CE}=0.5\text{V}$ | $I_F$      | 6   | 2   | 100 | mA            |
| Input Voltage Drop                      | $I_F=5\text{mA}$                     | $V_F$      | 0.9 | 1.2 | 1.4 | V             |
| Input Current<br>(Detector must be off) | $I_C=1\mu\text{A}, V_{CE}=5\text{V}$ | $I_F$      | 5   | 25  | -   | $\mu\text{A}$ |

**Electrical Characteristics**

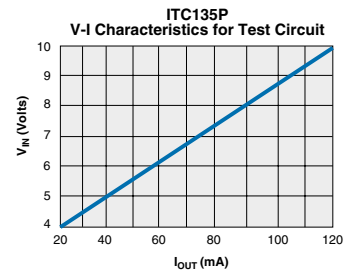
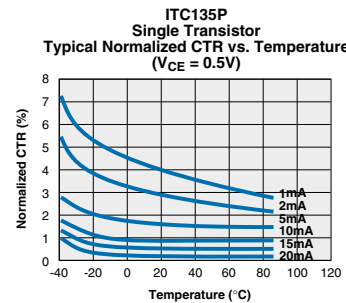
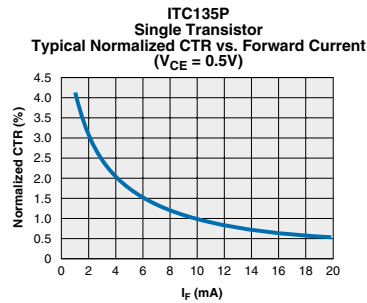
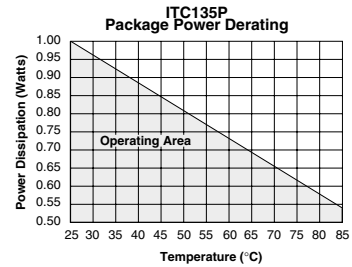
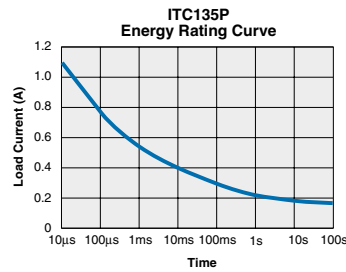
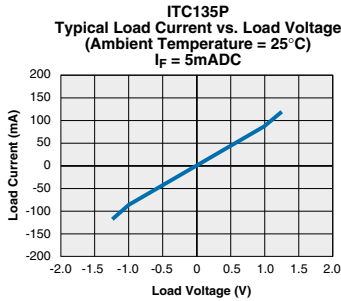
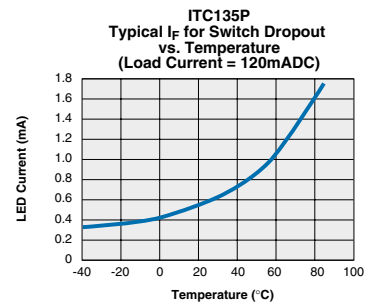
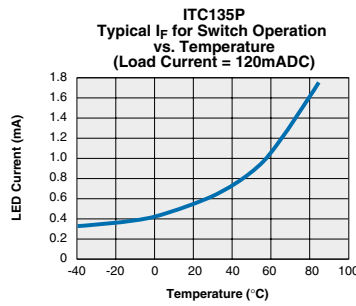
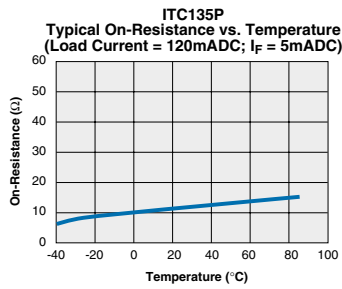
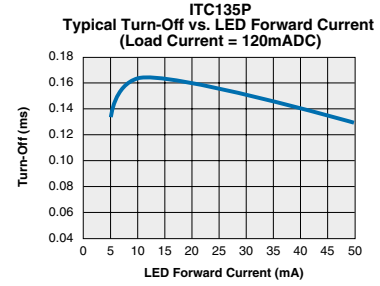
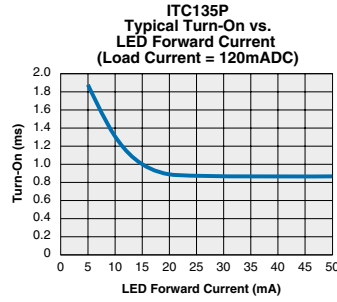
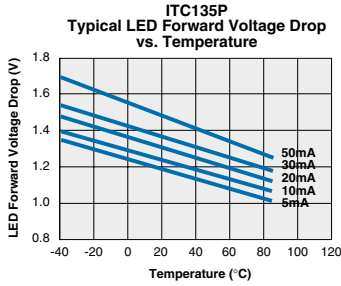
| Parameter   | Conditions  | Symbol        | Min    | Typ | Max      | Units                          |
|---|---|---------------|--------|-----|----------|--------------------------------|
| <b>Bridge Rectifier Electrical Ratings @ 25°C</b> |   |               |        |     |          |                                |
| Reverse Voltage                                   | -   | $V_{RD}$      | -      | -   | 100      | V                              |
| Forward Drop Voltage                              | $I_{FD}=120\text{mA}$   | $V_{FD}$      | -      | -   | 1.5      | V                              |
| Reverse Leakage Current                           | $T_J=25^\circ\text{C}, V_R=100\text{V}$<br>$T_J=85^\circ\text{C}$ | $I_{RD}$      | -      | -   | 10<br>50 | $\mu\text{A}$<br>$\mu\text{A}$ |
| Forward Current (Continuous)                      |   | $I_{FD}$      | -      | -   | 140      | mA                             |
| Forward Current (Peak)                            | $t=10\text{mS}$   | $I_{FD}$      | -      | -   | 0.5      | A                              |
| <b>Darlington Electrical Ratings @ 25°C</b>       |   |               |        |     |          |                                |
| Collector-Emitter Voltage                         | $I_C=10\text{mA DC}, I_B=0$                                       | $V_{CE0}$     | 40     | -   | -        | V                              |
| Collector-Current Continuous                      | $V_C=3.5\text{V}$   | $I_C$         | -      | -   | 120      | mA                             |
| Power Dissipation @ 25°C                          | -   | $P_d$         | -      | -   | 500      | mW                             |
| Off-State Collector Emitter Leakage Current       | $V_{CE}=10\text{V}; I_B=0\text{mA}$                               | $I_{CEX}$     | -      | -   | 1        | $\mu\text{A}$                  |
| DC Current Gain                                   | $I_C=120\text{mA}, V_{CE}=10\text{VDC}$                           | $h_{FE}$      | 10,000 | -   | -        |                                |
| Saturation Voltage                                | $I_C=120\text{mA}$  | $V_{CE(SAT)}$ | -      | -   | 1.5      | V                              |
| Total Harmonic Distortion                         | $f_o=300\text{Hz @ -10dBm}$<br>$I_C=40\text{mA}$                  | -             | -      | -   | -80      | dB                             |
| <b>Zener Characteristics @ 25°C</b>               |   |               |        |     |          |                                |
| Zener Voltage<br>(Between pins 4+5 and 6+5)       | $I_{ZT}=20\text{mA}$  | $V_Z$         | -      | 4.3 | -        | V                              |
| Zener Voltage<br>(Between pins 12+11)             | $I_{ZT}=20\text{mA}$  | $V_Z$         | -      | 15  | -        | V                              |
| Input to Output Capacitance                       | -   | $C_{I/O}$     | -      | 3   | -        | pF                             |
| Input to Output Isolation                         | -   | $V_{I/O}$     | 3750   | -   | -        | $V_{RMS}$                      |

**EXAMPLE CIRCUIT**


PERFORMANCE DATA\*

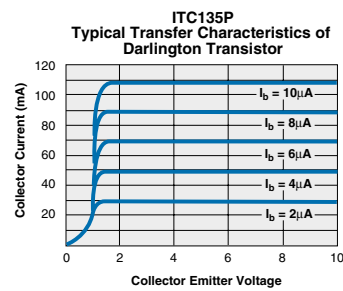
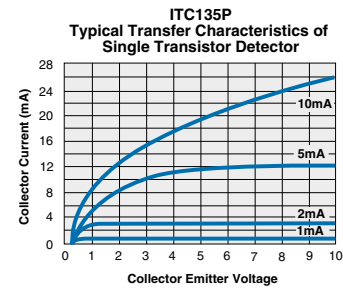
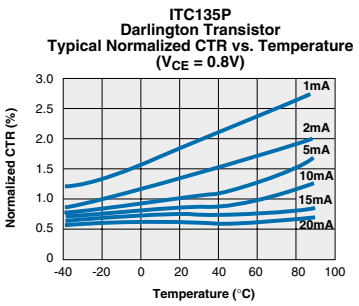
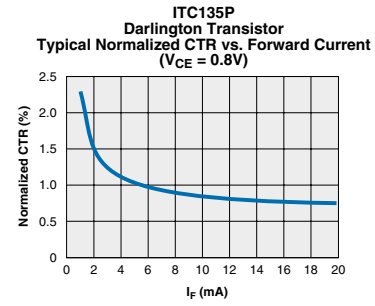
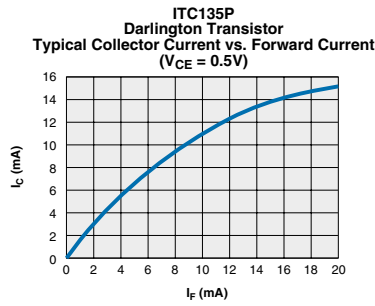
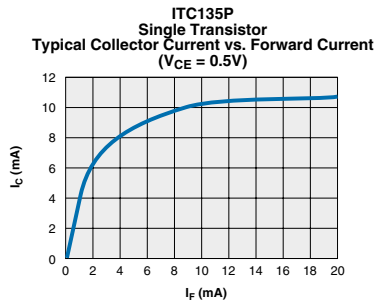


The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

**PERFORMANCE DATA\***


\*The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

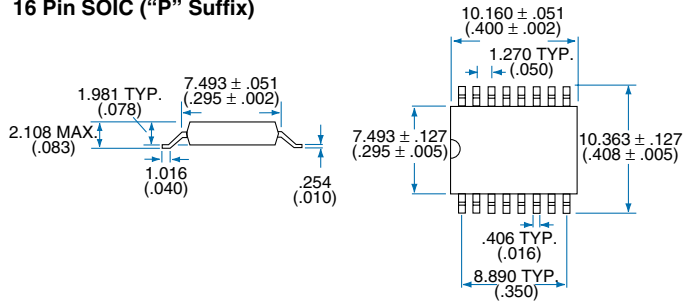
PERFORMANCE DATA\*



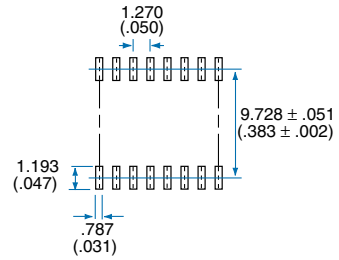
\*The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

Mechanical Dimensions

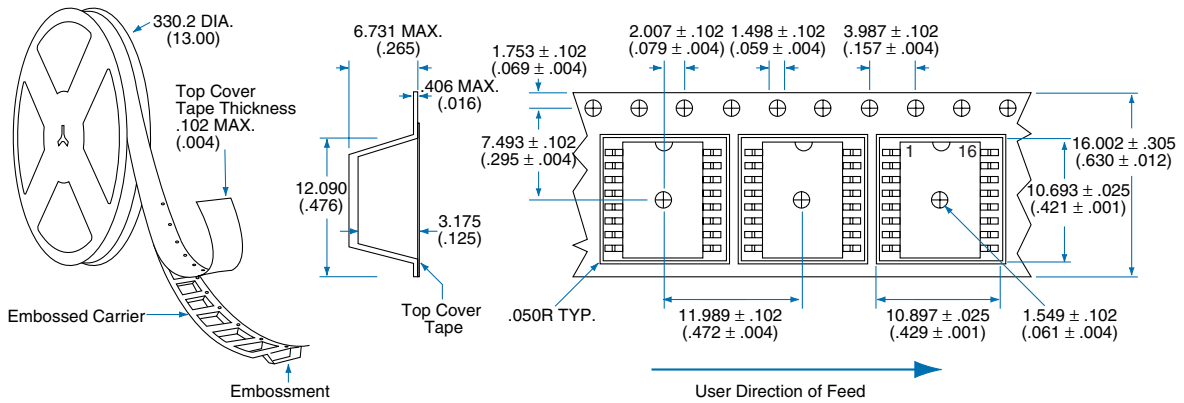
16 Pin SOIC ("P" Suffix)



PC Board Pattern (Top View)



Tape and Reel Packaging for 16 Pin SOIC Package



Dimensions  
mm  
(inches)

**CLARE LOCATIONS**

Clare Headquarters  
78 Cherry Hill Drive  
Beverly, MA 01915  
Tel: 1-978-524-6700  
Fax: 1-978-524-4900  
Toll Free: 1-800-27-CLARE

Clare Micronix Division  
145 Columbia  
Aliso Viejo, CA 92656-1490  
Tel: 1-949-831-4622  
Fax: 1-949-831-4628

**SALES OFFICES**

**AMERICAS**

**Americas Headquarters**

Clare  
78 Cherry Hill Drive  
Beverly, MA 01915  
Tel: 1-978-524-6700  
Fax: 1-978-524-4900  
Toll Free: 1-800-27-CLARE

**Eastern Region**

Clare  
P.O. Box 856  
Mahwah, NJ 07430  
Tel: 1-201-236-0101  
Fax: 1-201-236-8685  
Toll Free: 1-800-27-CLARE

**Central Region**

Clare Canada Ltd.  
3425 Harvester Road, Suite 202  
Burlington, Ontario L7N 3N1  
Tel: 1-905-333-9066  
Fax: 1-905-333-1824

**Western Region**

Clare  
1852 West 11th Street, #348  
Tracy, CA 95376  
Tel: 1-209-832-4367  
Fax: 1-209-832-4732  
Toll Free: 1-800-27-CLARE

**Canada**

Clare Canada Ltd.  
3425 Harvester Road, Suite 202  
Burlington, Ontario L7N 3N1  
Tel: 1-905-333-9066  
Fax: 1-905-333-1824

**EUROPE**

**European Headquarters**

CP Clare nv  
Bampslaan 17  
B-3500 Hasselt (Belgium)  
Tel: 32-11-300868  
Fax: 32-11-300890

**France**

Clare France Sales  
Lead Rep  
99 route de Versailles  
91160 Champlan  
France  
Tel: 33 1 69 79 93 50  
Fax: 33 1 69 79 93 59

**Germany**

Clare Germany Sales  
ActiveComp Electronic GmbH  
Mitterstrasse 12  
85077 Manching  
Germany  
Tel: 49 8459 3214 10  
Fax: 49 8459 3214 29

**Italy**

C.L.A.R.E.s.a.s.  
Via C. Colombo 10/A  
I-20066 Melzo (Milano)  
Tel: 39-02-95737160  
Fax: 39-02-95738829

**Sweden**

Clare Sales  
Comptronic AB  
Box 167  
S-16329 Spånga  
Tel: 46-862-10370  
Fax: 46-862-10371

**United Kingdom**

Clare UK Sales  
Marco Polo House  
Cook Way  
Bindon Road  
Taunton  
UK-Somerset TA2 6BG  
Tel: 44-1-823 352541  
Fax: 44-1-823 352797

**ASIA/PACIFIC**

**Asian Headquarters**

Clare  
Room N1016, Chia-Hsin, Bldg II,  
10F, No. 96, Sec. 2  
Chung Shan North Road  
Taipei, Taiwan R.O.C.  
Tel: 886-2-2523-6368  
Fax: 886-2-2523-6369

<http://www.clare.com>

---

*Clare cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in this Clare product. No circuit patent licenses nor indemnity are expressed or implied. Clare reserves the right to change the specification and circuitry, without notice at any time. The products described in this document are not intended for use in medical implantation or other direct life support applications where malfunction may result in direct physical harm, injury or death to a person.*

---