



|                                  | ITC135P | Units    |
|----------------------------------|---------|----------|
| Relay Load Voltage               | 350     | V        |
| Relay Load Current               | 120     | mA       |
| Relay Max $R_{ON}$               | 15      | $\Omega$ |
| Bridge Rectifier Reverse Voltage | 100     | V        |
| Darlington Collector Current     | 120     | mA       |
| Darlington Current Gain          | 10,000  | -        |

### 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 ITC137P's optocoupler provides for full wave detection of the ring signal.

### 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
- Full Wave Current Detector for Ring Signal or Loop Current Detect
- JEDEC Standard Pin Out
- Includes Zener Diodes

### 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

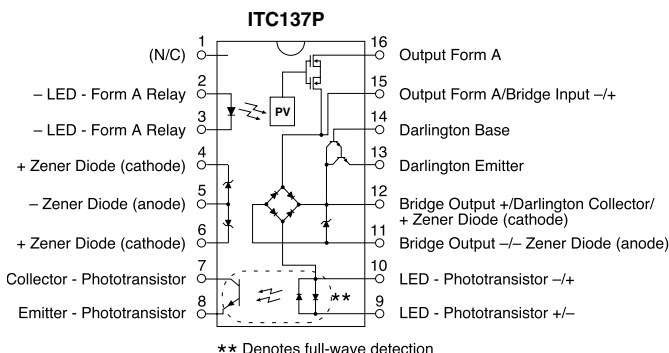
### Ordering Information

| Part #    | Description             |
|-----------|-------------------------|
| ITC137P   | 16 Pin SOIC (50/Tube)   |
| ITC137PTR | 16 Pin SOIC (1000/Reel) |

### Applications

- Data/Fax Modem
- Voice Mail Systems
- Telephone Sets
- Computer Telephony Integration
- Set Top Box Modems

### 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 reoly 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.*

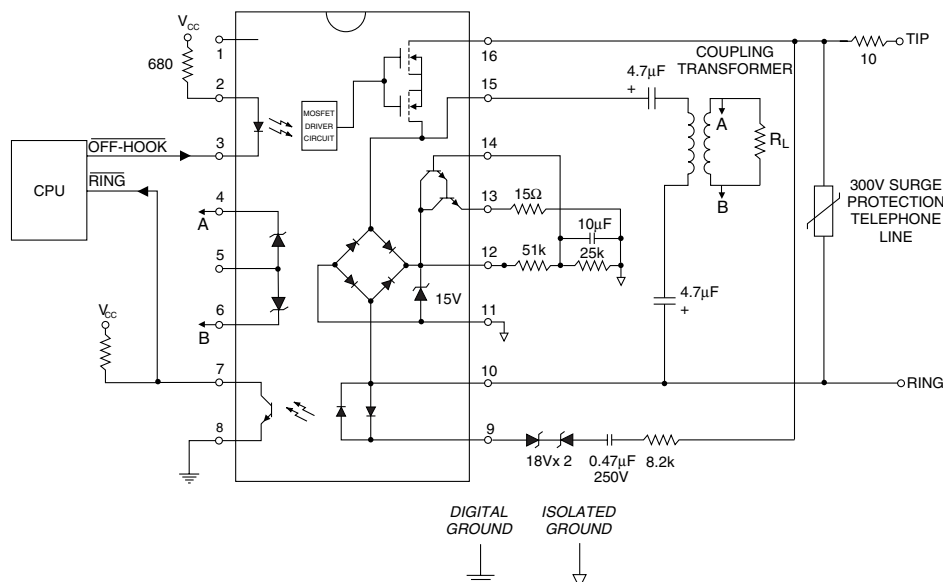
**Electrical Characteristics**

| 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  | -   | $\mu\text{A}$ |

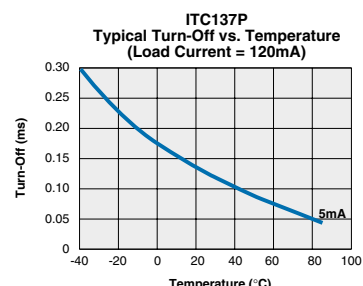
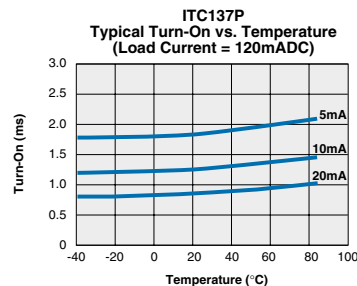
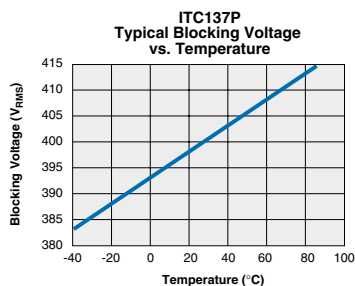
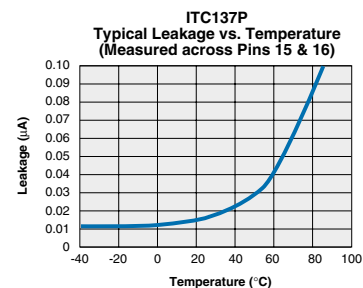
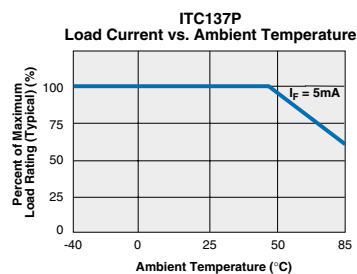
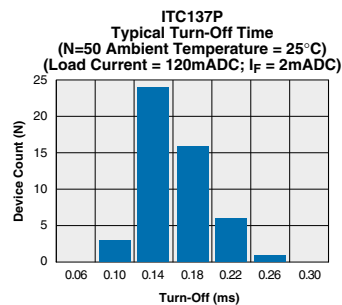
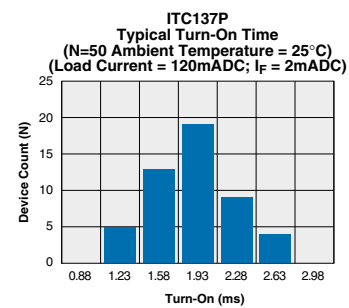
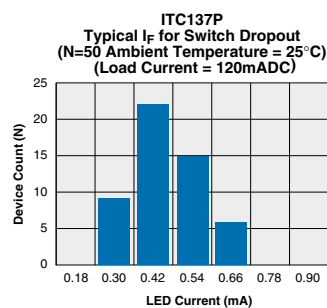
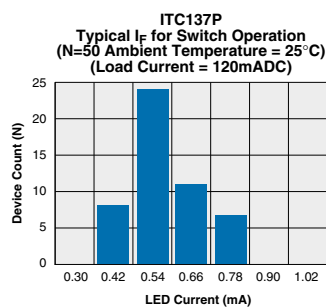
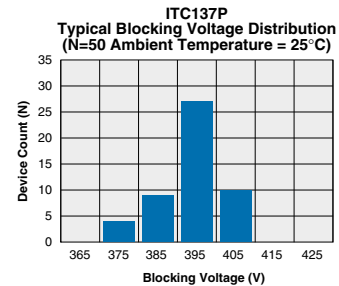
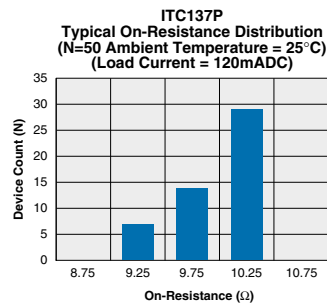
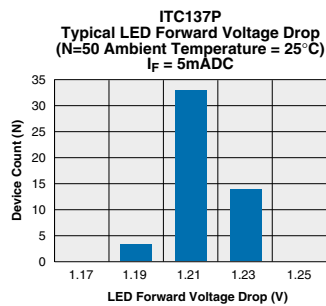
## Electrical Characteristics

| 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 (Between pins 4+5 and 6+5)          | $I_{ZT}=20\text{mA}$                                              | $V_Z$         | -      | 4.3 | -        | V                              |
| Zener Voltage (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   | -   | -        | $V_{RMS}$                      |

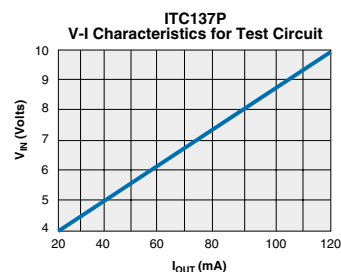
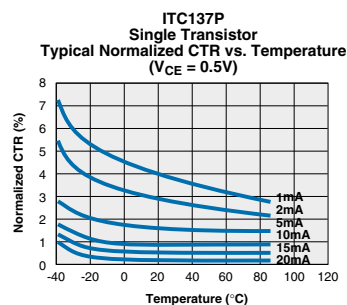
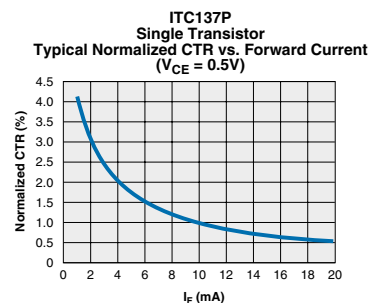
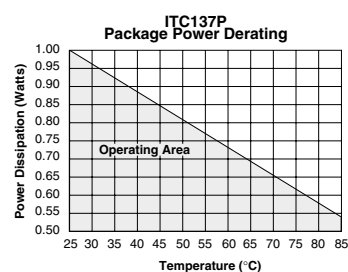
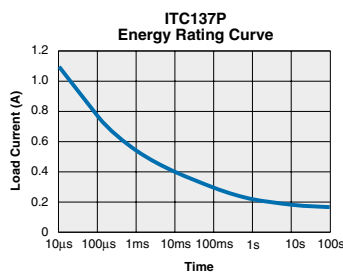
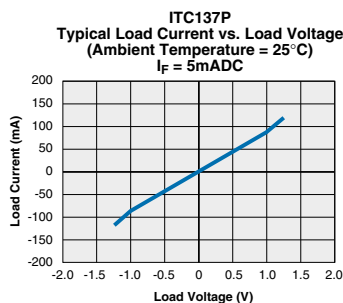
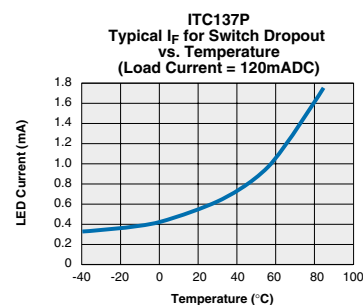
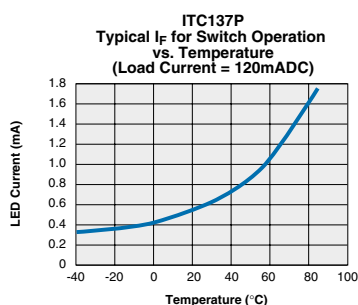
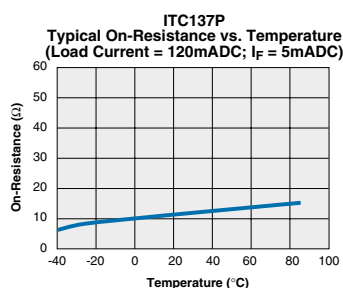
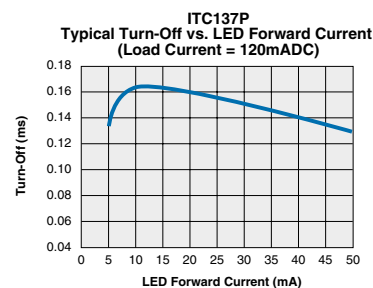
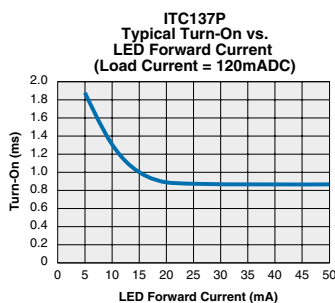
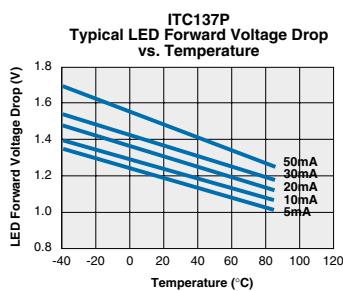
## EXAMPLE CIRCUIT



## PERFORMANCE DATA\*

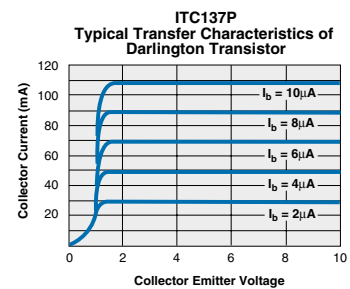
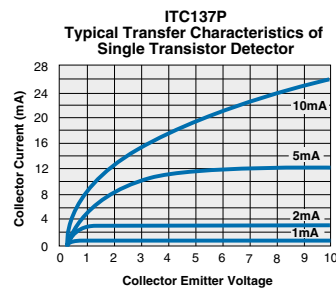
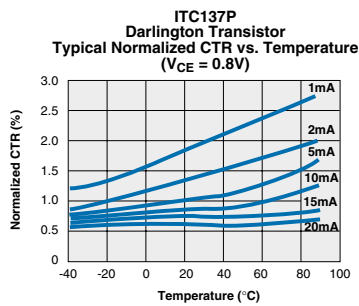
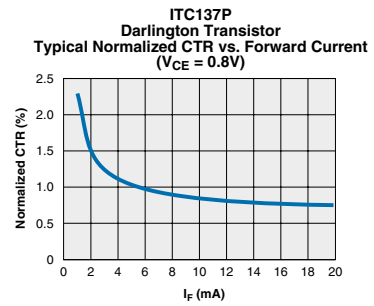
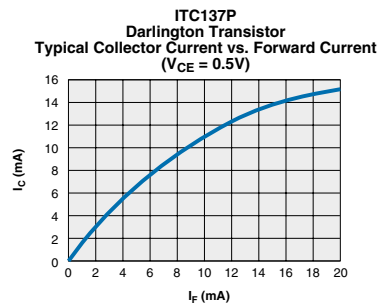
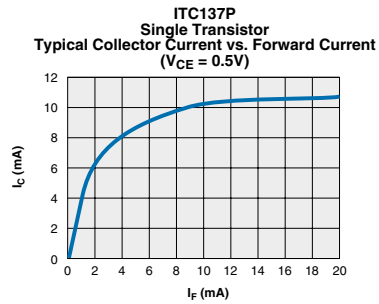


The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

**PERFORMANCE DATA\***


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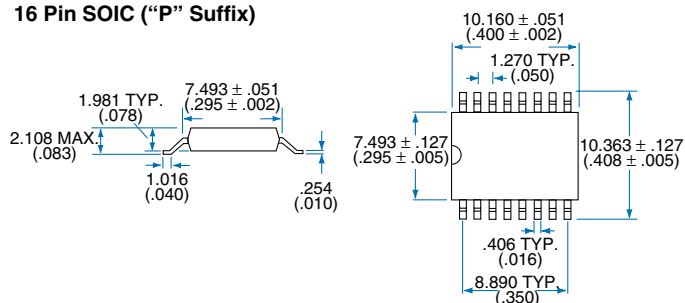
## PERFORMANCE DATA\*



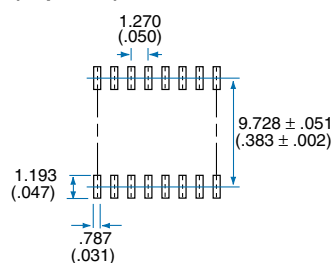
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## Mechanical Dimensions

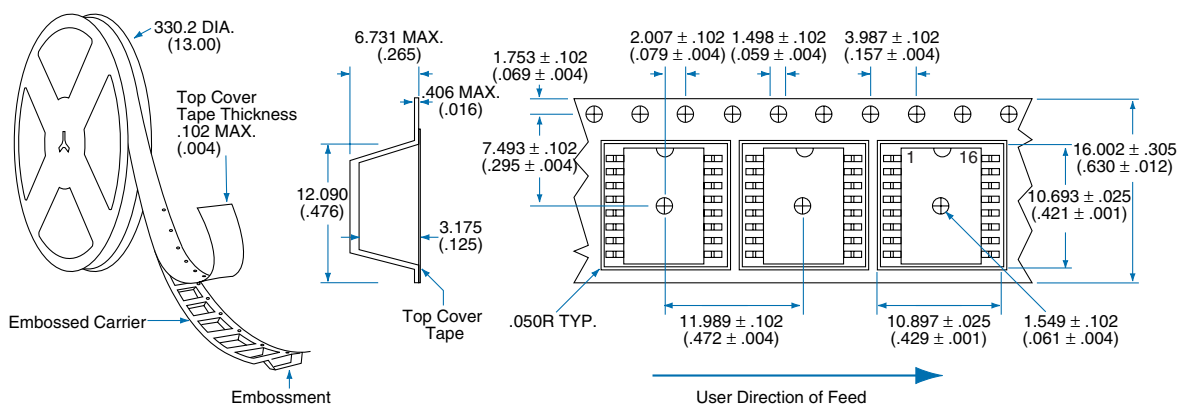
### 16 Pin SOIC ("P" Suffix)



### PC Board Pattern (Top View)



### Tape and Reel Packaging for 16 Pin SOIC Package



Dimensions  
mm  
(inches)

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