



|                     | TS190L | Units |
|---------------------|--------|-------|
| Load Voltage        | 400    | V     |
| Load Current        | 150    | mA    |
| Max R <sub>ON</sub> | 22     | Ω     |

### Features

- Small 8 Pin DIP Package
- Low Drive Power Requirements (TTL/CMOS Compatible)
- No Moving Parts
- High Reliability
- Arc-Free With No Snubbing Circuits
- 3750V<sub>RMS</sub> Input/Output Isolation
- FCC Compatible
- VDE Compatible
- No EMI/RFI Generation
- Machine Insertable, Wave Solderable
- Current Limiting Surface Mount and Tape & Reel Versions Available

### Applications

- Telecommunications
  - Telecom Switching
  - Tip/Ring Circuits
  - Modem Switching (Laptop, Notebook, Pocket Size)
  - Hookswitch
  - Dial Pulsing
  - Ground Start
  - Ringer Injection
- Instrumentation
  - Multiplexers
  - Data Acquisition
  - Electronic Switching
  - I/O Subsystems
  - Meters (Watt-Hour, Water, Gas)
- Medical Equipment-Patient/Equipment Isolation
- Security
- Aerospace
- Industrial Controls

### Description

TS190L is a 400V, 150mA, 22Ω 1-Form-A relay with an optocoupler in a single package. It features enhanced peak load current handling capability and improved peak load current capability for specialized telecom applications. Current limiting version is available ("L" suffix, see specification for variations in performance).

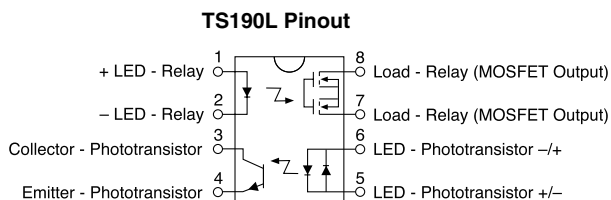
### Approvals

- UL Recognized: File Number E76270
- CSA Certified: File Number LR 43639-10
- BSI Certified to:
  - BS EN 60950:1992 (BS7002:1992)  
Certificate #: 7344
  - BS EN 41003:1993  
Certificate #: 7344

### Ordering Information

| Part #    | Description                     |
|-----------|---------------------------------|
| TS190L    | 8 Pin DIP (50/Tube)             |
| TS190LP   | 8 Pin Flatpack (50/Tube)        |
| TS190LPTR | 8 Pin Flatpack (1000/Reel)      |
| TS190LS   | 8 Pin Surface Mount (50/Tube)   |
| TS190LSTR | 8 Pin Surface Mount (1000/Reel) |

### Pin Configuration



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

| Parameter                      | Min  | Typ | Max              | Units            |
|--------------------------------|------|-----|------------------|------------------|
| Input Power Dissipation        | -    | -   | 150 <sup>1</sup> | mW               |
| Input Control Current          | -    | -   | 50               | mA               |
| Peak (10ms)                    | -    | -   | 1                | A                |
| Reverse Input Voltage          | -    | -   | 5                | V                |
| Total Power Dissipation        | -    | -   | 800 <sup>2</sup> | mW               |
| Isolation Voltage              |      |     |                  |                  |
| Input to Output                | 3750 | -   | -                | V <sub>RMS</sub> |
| Operational Temperature        | -40  | -   | +85              | °C               |
| Storage Temperature            | -40  | -   | +125             | °C               |
| Soldering Temperature          |      |     |                  |                  |
| DIP Package                    | -    | -   | +260             | °C               |
| Flatpack/Surface Mount Package | -    | -   | +220             | °C               |
| (10 Seconds Max.)              |      |     |                  |                  |

<sup>1</sup> Derate Linearly 1.33 mW/°C<sup>2</sup> Derate Linearly 6.67 mW/°C

*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**

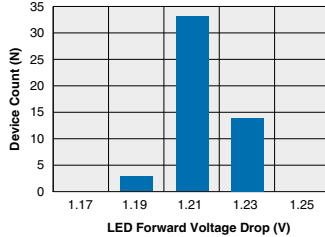
| Parameter                            | Conditions                               | Symbol            | Min | Typ | Max  | Units |
|--------------------------------------|------------------------------------------|-------------------|-----|-----|------|-------|
| <b>Relay Portion (Pins 7, 8)</b>     |                                          |                   |     |     |      |       |
| <b>Output Characteristics @ 25°C</b> |                                          |                   |     |     |      |       |
| Load Voltage (Peak)                  | -                                        | V <sub>L</sub>    | -   | -   | 400  | V     |
| Load Current (Continuous)            | -                                        | I <sub>L</sub>    | -   | -   | 150  | mA    |
| Peak Load Current                    | 10ms                                     | I <sub>LPK</sub>  | -   | -   | -    | mA    |
| On-Resistance                        | I <sub>L</sub> =150mA                    | R <sub>ON</sub>   | -   | 18  | 25   | Ω     |
| Off-State Leakage Current            | V <sub>L</sub> =400V                     | I <sub>LEAK</sub> | -   | -   | 1    | μA    |
| Switching Speeds                     |                                          |                   |     |     |      |       |
| Turn-On                              | I <sub>F</sub> =5mA, V <sub>L</sub> =10V | T <sub>ON</sub>   | -   | -   | 1    | ms    |
| Turn-Off                             | I <sub>F</sub> =5mA, V <sub>L</sub> =10V | T <sub>OFF</sub>  | -   | -   | 0.25 | ms    |
| Output Capacitance                   | 50V; f=1MHz                              | C <sub>OUT</sub>  | -   | 25  | -    | pF    |
| Load Current Limit                   |                                          | I <sub>CL</sub>   | 190 | 235 | 280  | mA    |
| <b>Relay Portion (Pins 1, 2)</b>     |                                          |                   |     |     |      |       |
| <b>Input Characteristics @ 25°C</b>  |                                          |                   |     |     |      |       |
| Input Control Current                | I <sub>L</sub> =150mA                    | I <sub>F</sub>    | 5   | -   | 50   | mA    |
| Input Dropout Current                | -                                        | I <sub>F</sub>    | 0.4 | 0.7 | -    | mA    |
| Input Voltage Drop                   | I <sub>F</sub> =5mA                      | V <sub>F</sub>    | 0.9 | 1.2 | 1.4  | V     |
| Reverse Input Voltage                | -                                        | V <sub>R</sub>    | -   | -   | 5    | V     |
| Reverse Input Current                | V <sub>R</sub> =5V                       | I <sub>R</sub>    | -   | -   | 10   | μA    |

### Electrical Characteristics (Continued)

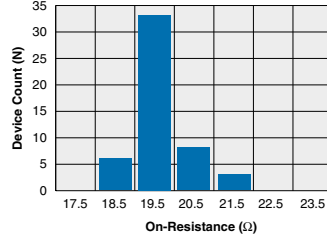
| Parameter                                   | Conditions              | Symbol     | Min  | Typ | Max | Units     |
|---------------------------------------------|-------------------------|------------|------|-----|-----|-----------|
| <b>Detector Portion (Pins 3,4)</b>          |                         |            |      |     |     |           |
| <b>Output Characteristics @ 25°C</b>        |                         |            |      |     |     |           |
| Phototransistor Blocking Voltage            | $I_C=10\mu A$           | $BV_{CEO}$ | 20   | 50  | -   | V         |
| Phototransistor Output Current              | $V_{CE}=5V, I_F=0mA$    | $I_{CEO}$  | -    | 50  | 500 | nA        |
| Saturation Voltage                          | $I_C=2mA, I_F=16mA$     | $V_{SAT}$  | -    | 0.3 | 0.5 | V         |
| Current Transfer Ratio                      | $I_F=6mA, V_{CE}=0.5V$  | CTR        | 33   | 100 | -   | %         |
| <b>Detector Portion (Pins 5,6)</b>          |                         |            |      |     |     |           |
| <b>Input Characteristics @ 25°C</b>         |                         |            |      |     |     |           |
| Input Control Current                       | $I_C=2mA, V_{CE}=0.5V$  | $I_F$      | 6    | 2   | 100 | mA        |
| Input Voltage Drop                          | $I_F=5mA$               | $V_F$      | 0.9  | 1.2 | 1.4 | V         |
| Input Current<br>(Detector must be off)     | $I_C=1\mu A, V_{CE}=5V$ | $I_F$      | 5    | 25  | -   | $\mu A$   |
| Input to Output Capacitance<br>(Relay Only) | -                       | $C_{I/O}$  | -    | 3   | -   | pF        |
| Capacitance Input to Output                 | -                       | -          | -    | 3   | -   | pF        |
| Input to Output Isolation                   | -                       | $V_{I/O}$  | 3750 | -   | -   | $V_{RMS}$ |

## PERFORMANCE DATA\*

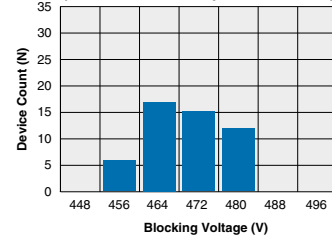
**TS190L**  
Typical LED Forward Voltage Drop  
(N=50 Ambient Temperature = 25°C;  $I_F$  = 5mADC)



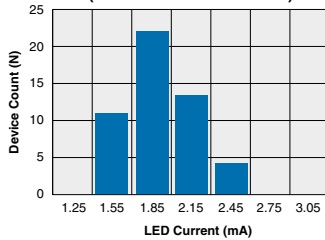
**TS190L**  
Typical On-Resistance Distribution  
(N=50 Ambient Temperature = 25°C)  
(Load Current = 150mADC;  $I_F$  = 5mADC)



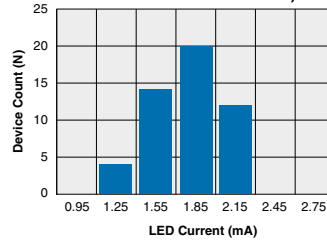
**TS190L**  
Typical Blocking Voltage Distribution  
(N=50 Ambient Temperature = 25°C)



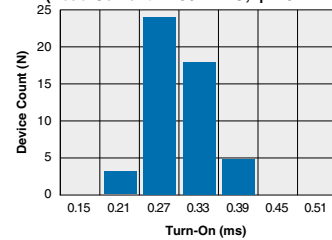
**TS190L**  
Typical  $I_F$  for Switch Operation  
(N=50 Ambient Temperature = 25°C)  
(Load Current = 150mADC)



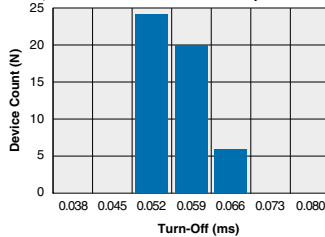
**TS190L**  
Typical  $I_F$  for Switch Dropout  
(N=50 Ambient Temperature = 25°C;  
Load Current = 150mADC)



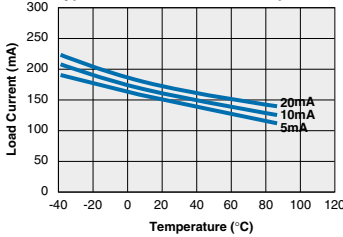
**TS190L**  
Typical Turn-On Time  
(N=50 Ambient Temperature = 25°C)  
(Load Current = 150mADC;  $I_F$  = 5mADC)



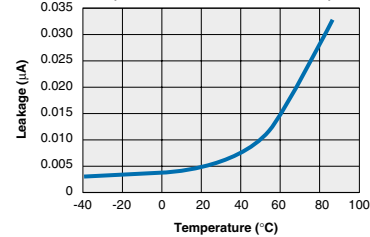
**TS190L**  
Typical Turn-Off Time  
(N=50 Ambient Temperature = 25°C)  
(Load Current = 150mADC;  $I_F$  = 5mADC)



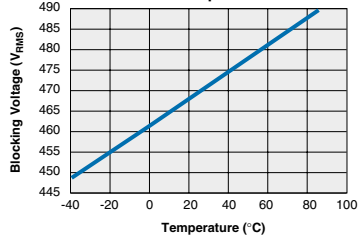
**TS190L**  
Typical Load Current vs. Temperature



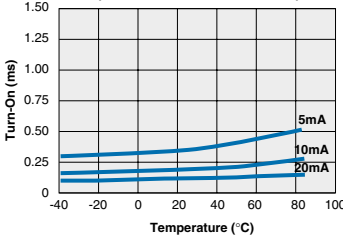
**TS190L**  
Typical Leakage vs. Temperature  
(Measured across Pins 7 & 8)



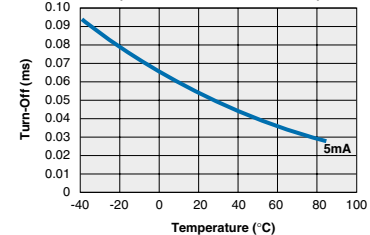
**TS190L**  
Typical Blocking Voltage vs. Temperature



**TS190L**  
Typical Turn-On vs. Temperature  
(Load Current = 150mADC)

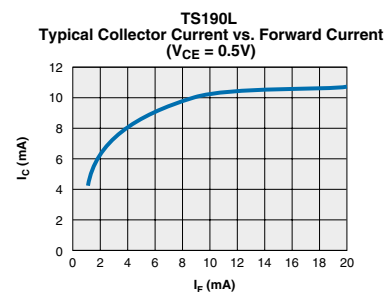
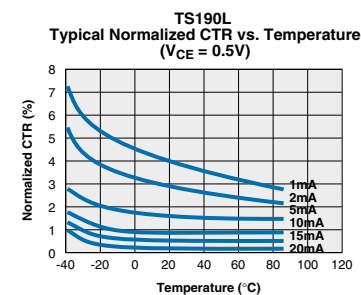
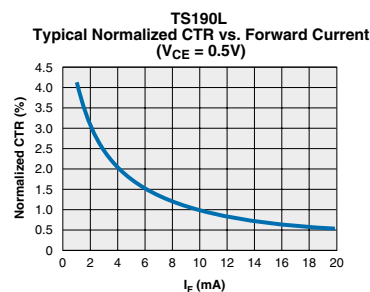
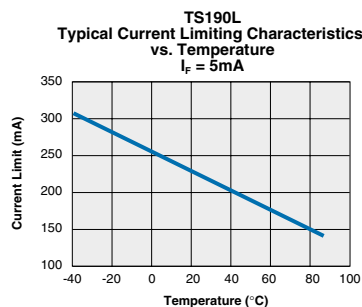
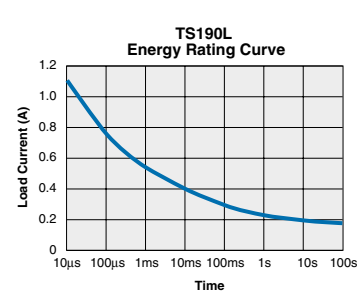
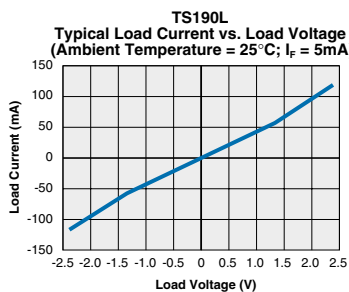
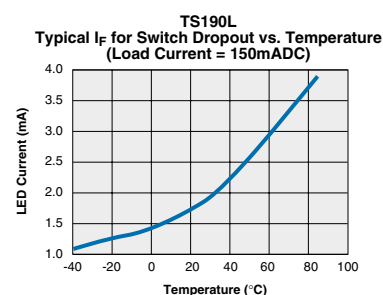
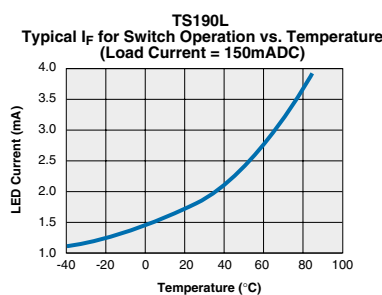
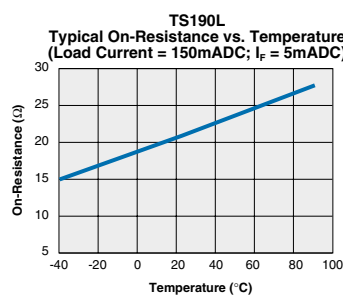
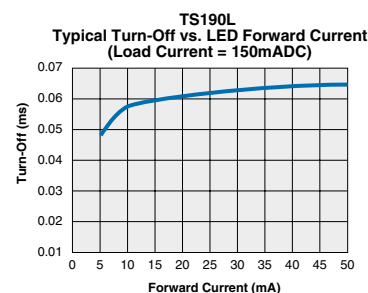
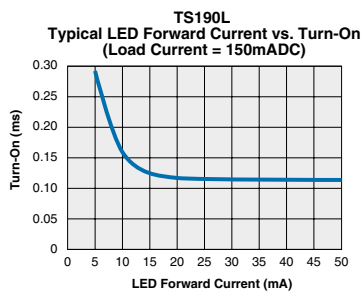
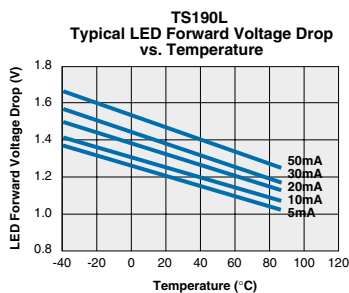


**TS190L**  
Typical Turn-Off vs. Temperature  
(Load Current = 150mADC)



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.

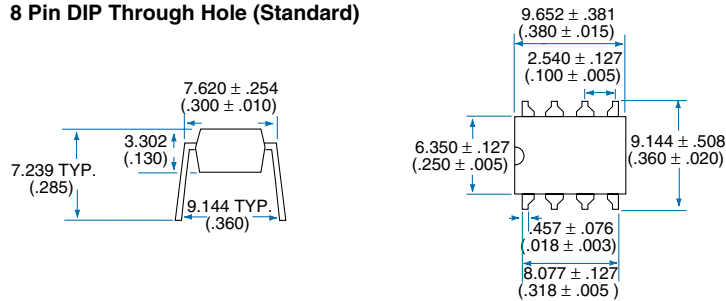
## PERFORMANCE DATA\*



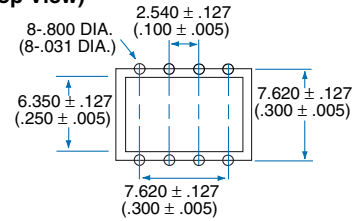
\*The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

## Mechanical Dimensions

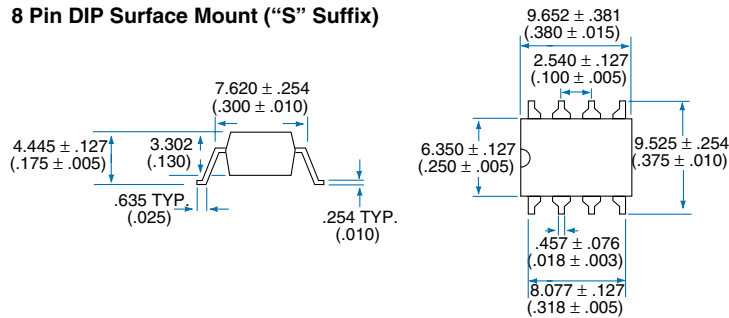
### 8 Pin DIP Through Hole (Standard)



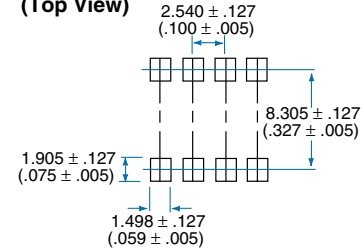
### PC Board Pattern (Top View)



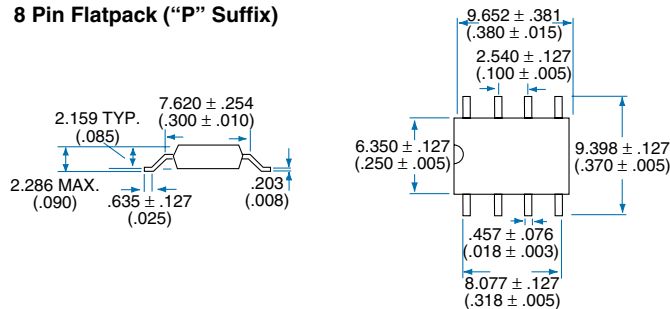
### 8 Pin DIP Surface Mount ("S" Suffix)



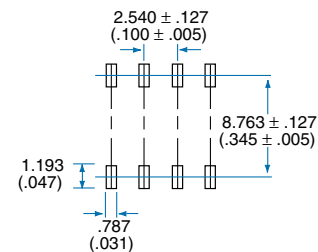
### PC Board Pattern (Top View)



### 8 Pin Flatpack ("P" Suffix)



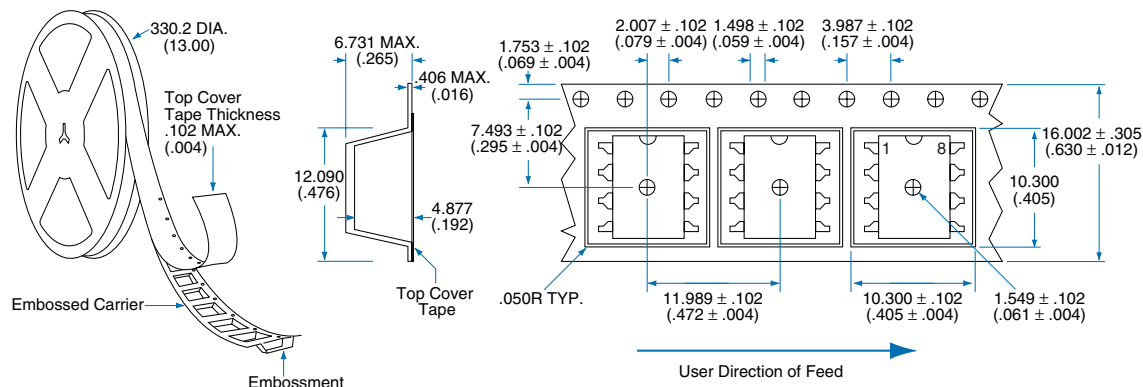
### PC Board Pattern (Top View)



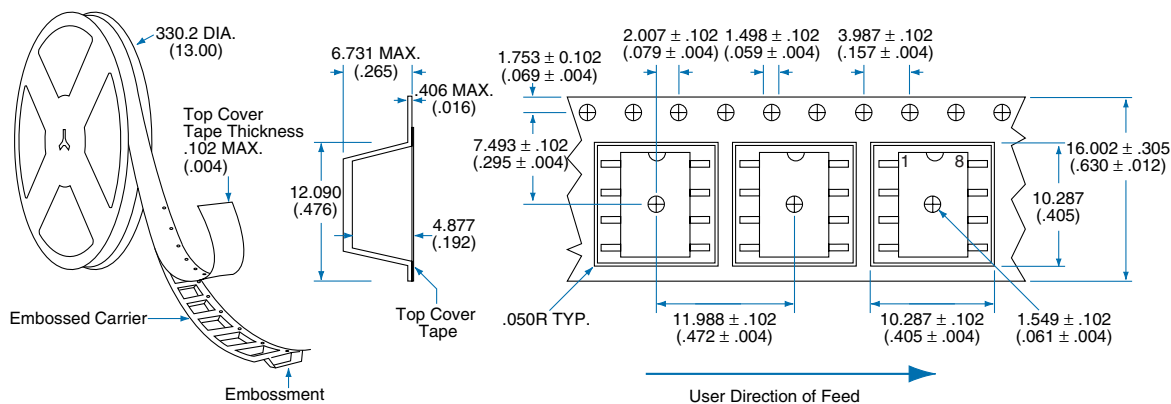
Dimensions  
mm  
(inches)

## Mechanical Dimensions

### Tape and Reel Packaging for 8 Pin Surface Mount Package



### Tape and Reel Packaging for 8 Pin Flatpack Package



Dimensions  
mm  
(inches)

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Specification: DS-TS190L-R4  
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2/27/01