TS120
Multifunction Telecom Switch

Parameter	Rating	Units
Blocking Voltage	350	V_P
Load Current	120	mA
Max On-resistance	35	Ω

Features
- 3750V_{rms} Input/Output Isolation
- Low Drive Power Requirements (TTL/CMOS Compatible)
- FCC Compatible
- VDE Compatible
- No EMI/RFI Generation
- No Moving Parts
- High Reliability
- Arc-Free With No Snubbing Circuits
- Small 8-Pin Package
- Machine Insertable, Wave Solderable
- Surface Mount and Tape & Reel Versions Available

Applications
- Telecommunications
  - Telecom Switching
  - Tip/Ring Circuits
  - Modem Switching (Laptop, Notebook, Pocket Size)
  - Hook Switch
  - Dial Pulsing
  - Ground Start
  - Ringing 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
The TS120 integrated circuit device combines a 350V normally open (1-Form-A) relay with a Darlington transistor optocoupler in a single package. The relay uses optically coupled MOSFET technology to provide 3750V_{rms} of input to output isolation. The efficient MOSFET switches and photovoltaic die use Clare's patented OptoMOS® architecture, while the optically coupled output is controlled by highly efficient GaAlAs infrared LEDs.

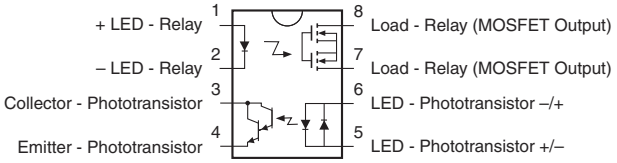
The TS120 enables telecom circuit designers to combine two discrete functions in a single component that uses less space than traditional discrete component solutions.

Approvals
- UL Recognized Component: File E76270
- CSA Certified Component: Certificate 1175739
- EN/IEC 60950 Certified Component: TUV Certificate: B 10 05 49410 006

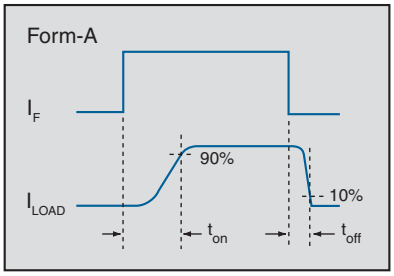
Ordering Information

Part #	Description
TS120	8-Pin DIP (50/Tube)
TS120P	8-Pin Flatpack (50/Tube)
TS120PTR	8-Pin Flatpack (1000/Reel)
TS120S	8-Pin Surface Mount (50/Tube)
TS120STR	8-Pin Surface Mount (1000/Reel)

Pin Configuration



Switching Characteristics of Normally Open Devices



Absolute Maximum Ratings @ 25ºC

Parameter	Ratings	Units
Input Power Dissipation [1]	150	mW
Input Control Current, Relay	50	mA
Peak (10ms)	1	A
Input Control Current, Detector	100	mA
Total Power Dissipation [2]	800	mW
Isolation Voltage, Input to Output	3750	V_{rms}
Operational Temperature	-40 to +85	°C
Storage Temperature	-40 to +125	°C

[1] Derate linearly 1.33 mW / ºC

[2] Derate linearly 6.67 mW / ºC

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 conditions beyond those indicated in the operational sections of this data sheet is not implied.

Electrical Characteristics @25ºC: Relay Section

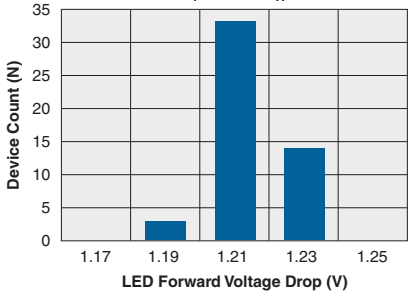
Parameter	Conditions	Symbol	Min	Typ	Max	Units
Output Characteristics						
Blocking Voltage (Peak)	-	V_L	-	-	350	V_P
Load Current						
Continuous	-	I_L	-	-	120	mA
Peak	t=10ms	I_{LPK}	-	-	350	mA
On-Resistance	I_L=120mA	R_{ON}	-	23	35	Ω
Off-State Leakage Current	V_L=350V	I_{LEAK}	-	-	1	µA
Switching Speeds						
Turn-On	I_F=5mA, V_L=10V	t_{on}	-	-	3	ms
Turn-Off		t_{off}	-	-	3	ms
Output Capacitance	V_L=50V, f=1MHz	C_{OUT}	-	25	-	pF
Input Characteristics						
Input Control Current to Activate	I_L=120mA	I_F	-	-	5	mA
Input Control Current to Deactivate	-	I_F	0.4	0.7	-	mA
Input Voltage Drop	I_F=5mA	V_F	0.9	1.2	1.4	V
Reverse Input Voltage	-	V_R	-	-	5	V
Reverse Input Current	V_R=5V	I_R	-	-	10	µA
Common Characteristics						
Input to Output Capacitance	-	$C_{I/O}$	-	3	-	pF

Electrical Characteristics @25ºC: Detector Section

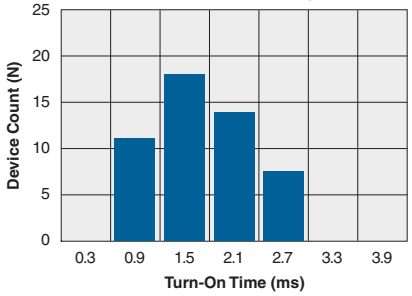
Parameter	Conditions	Symbol	Min	Typ	Max	Units
Output Characteristics						
Phototransistor Blocking Voltage	I_C=10µA	BV_{CEO}	20	50	-	V
Phototransistor Dark Current	V_{CE}=5V, I_F=0mA	I_{CEO}	-	100	1000	nA
Saturation Voltage	I_C=0.15mA, I_F=0.05mA	V_{SAT}	-	0.5	0.8	V
Current Transfer Ratio	I_F=0.05mA, V_{CE}=0.8V	CTR	300	1000	-	%
Input Characteristics						
Input Control Current	I_C=2mA, V_{CE}=0.5V	I_F	-	1	2	mA
Input Voltage Drop	I_F=5mA	V_F	0.9	1.2	1.4	V
Input to Output Capacitance	-	-	-	3	-	pF
Isolation, Input to Output	-	$V_{I/O}$	3750	-	-	V_{rms}

PERFORMANCE DATA: RELAY

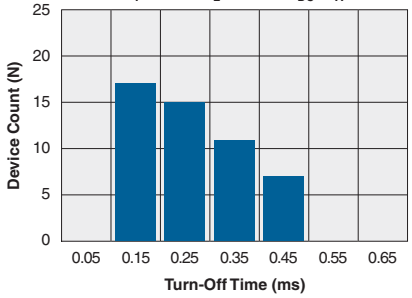
Typical LED Forward Voltage Drop
(N=50, I_F=5mA, T_A=25°C)



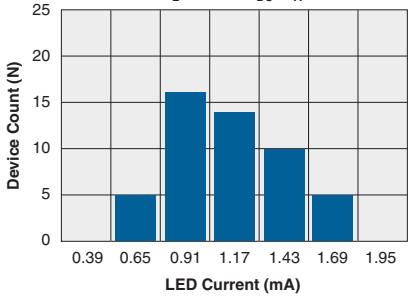
Typical Turn-On Time
(N=50, I_F=5mA, I_L=120mA$_{DC}$, T_A=25°C)



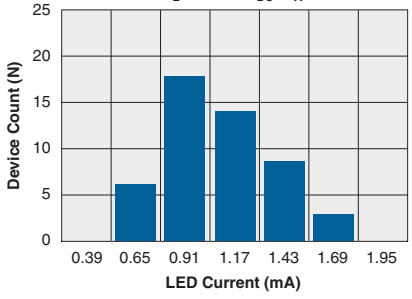
Typical Turn-Off Time
(N=50, I_F=5mA, I_L=120mA$_{DC}$, T_A=25°C)



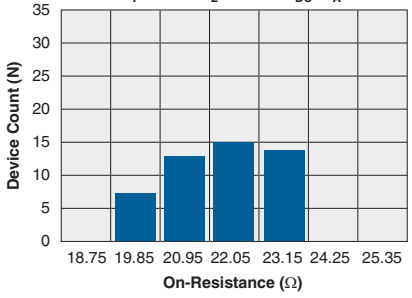
Typical I_F for Switch Operation
(N=50, I_L=120mA$_{DC}$, T_A=25°C)



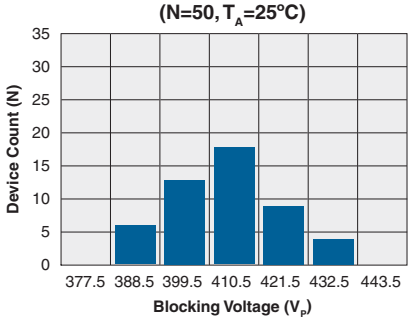
Typical I_F for Switch Dropout
(N=50, I_L=120mA$_{DC}$, T_A=25°C)



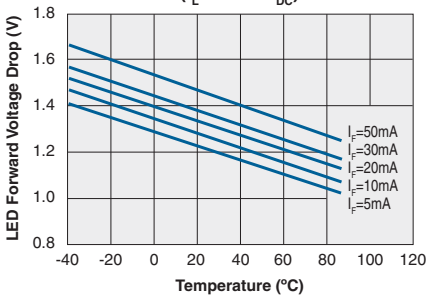
Typical On-Resistance Distribution
(N=50, I_F=5mA, I_L=120mA$_{DC}$, T_A=25°C)



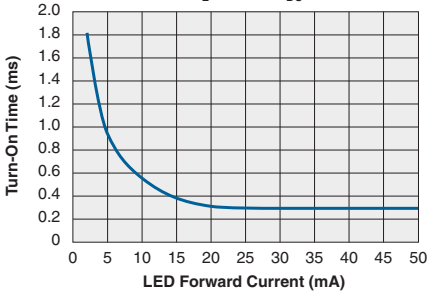
Typical Blocking Voltage Distribution
(N=50, T_A=25°C)



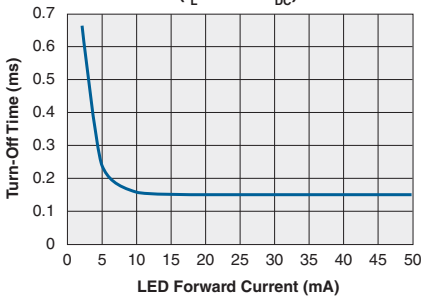
Typical LED Forward Voltage Drop
vs. Temperature
(I_L=120mA$_{DC}$)



Typical Turn-On Time
vs. LED Forward Current
(I_L=120mA$_{DC}$)



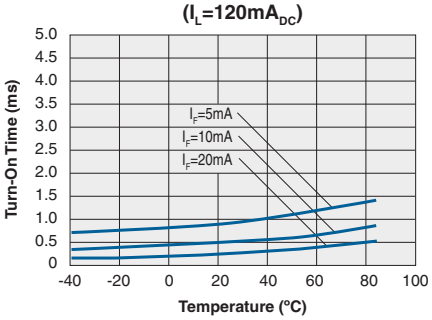
Typical Turn-Off Time
vs. LED Forward Current
(I_L=120mA$_{DC}$)



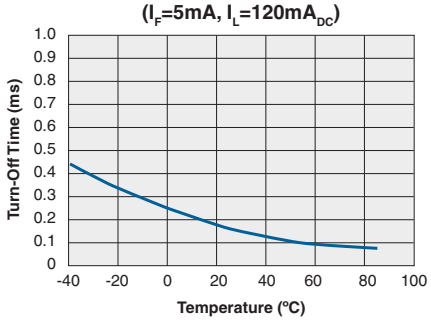
* The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

PERFORMANCE DATA: RELAY (cont.)

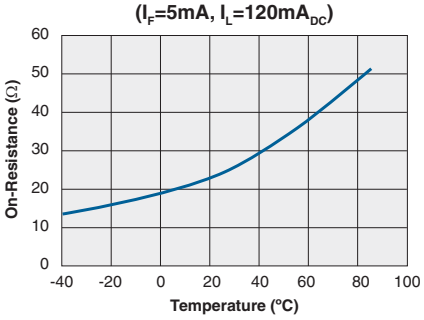
Typical Turn-On Time vs. Temperature (I_L=120mA$_{DC}$)



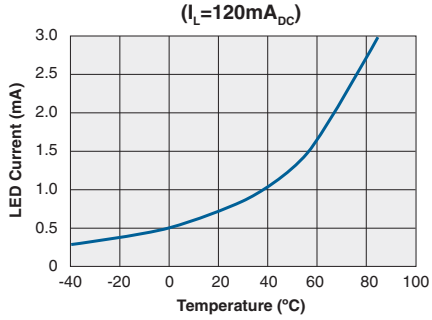
Typical Turn-Off Time vs. Temperature (I_F=5mA, I_L=120mA$_{DC}$)



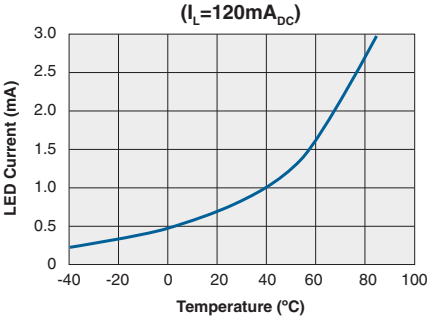
Typical On-Resistance vs. Temperature (I_F=5mA, I_L=120mA$_{DC}$)



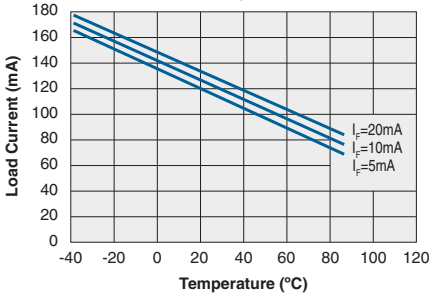
Typical I_F for Switch Operation vs. Temperature (I_L=120mA$_{DC}$)



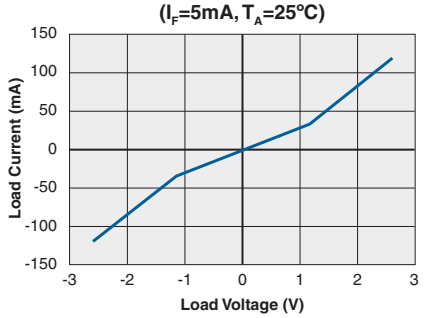
Typical I_F for Switch Dropout vs. Temperature (I_L=120mA$_{DC}$)



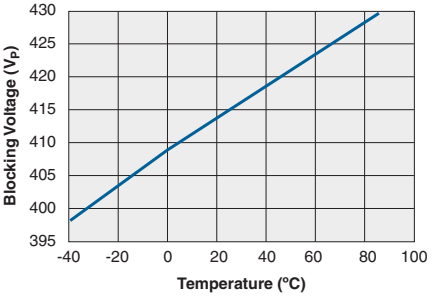
Typical Load Current vs. Temperature



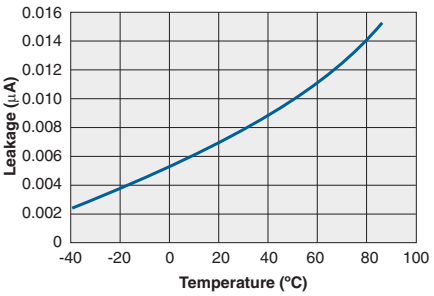
Typical Load Current vs. Load Voltage (I_F=5mA, T_A=25°C)



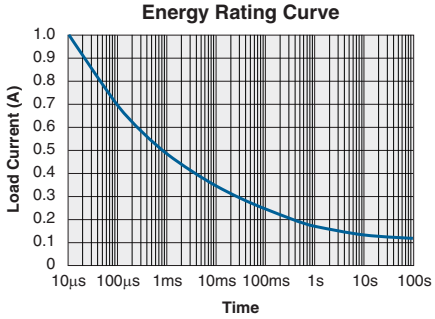
Typical Blocking Voltage vs. Temperature



Typical Leakage vs. Temperature Measured across Pins 7&8



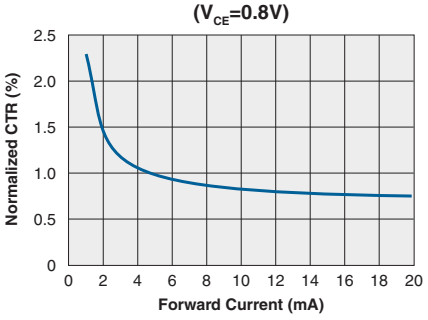
Energy Rating Curve



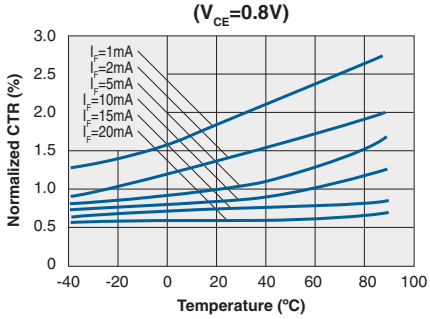
* The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

PERFORMANCE DATA: DETECTOR

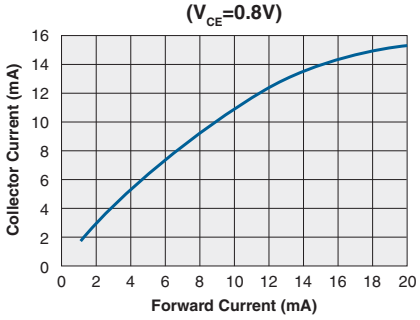
Typical Normalized CTR vs. Forward Current (V_{CE}=0.8V)



Typical Normalized CTR vs. Temperature (V_{CE}=0.8V)



Typical Collector Current vs. Forward Current (V_{CE}=0.8V)



* 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.

Manufacturing Information

Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. Clare classified all of its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL) rating** as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

Device	Moisture Sensitivity Level (MSL) Rating
TS120 / TS120P / TS120S	MSL 1

ESD Sensitivity

This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

Reflow Profile

This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

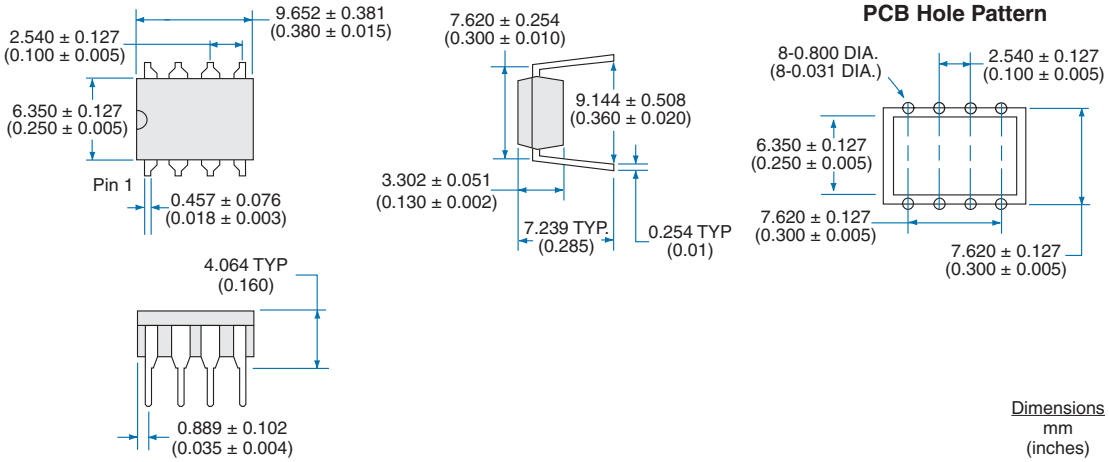
Device	Maximum Temperature x Time
TS120 / TS120S	250°C for 30 seconds
TS120P	260°C for 30 seconds

Board Wash

Clare recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable. Since Clare employs the use of silicone coating as an optical waveguide in many of its optically isolated products, the use of a short drying bake could be necessary if a wash is used after solder reflow processes. Chlorine- or Fluorine-based solvents or fluxes should not be used. Cleaning methods that employ ultrasonic energy should not be used.

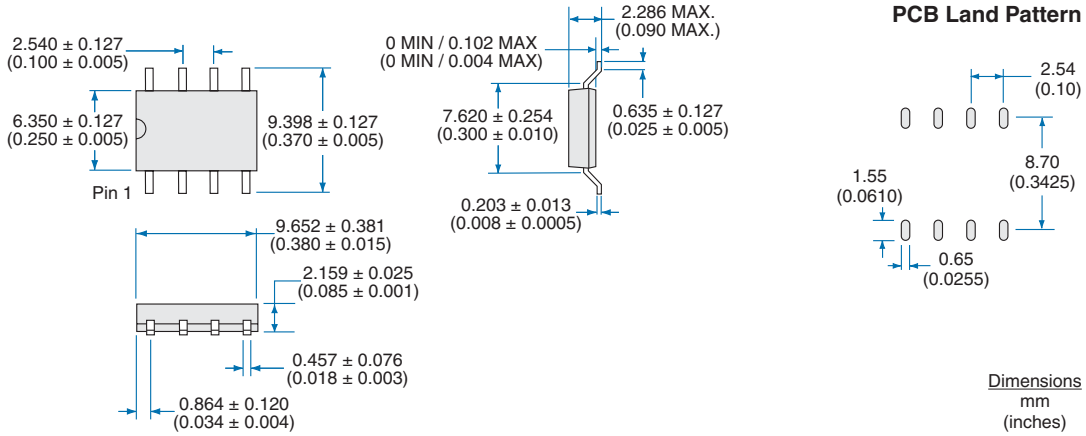
Mechanical Dimensions

TS120



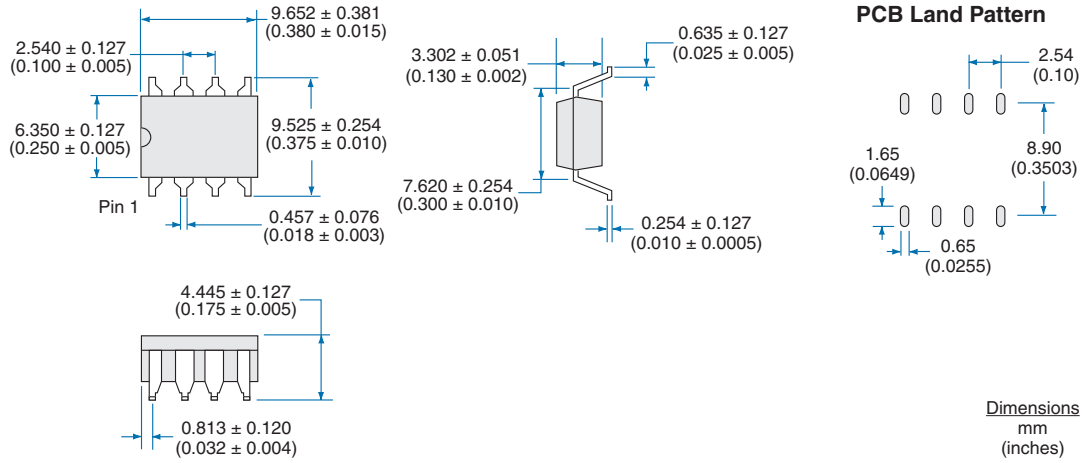
Dimensions
mm
(inches)

TS120P



Dimensions
mm
(inches)

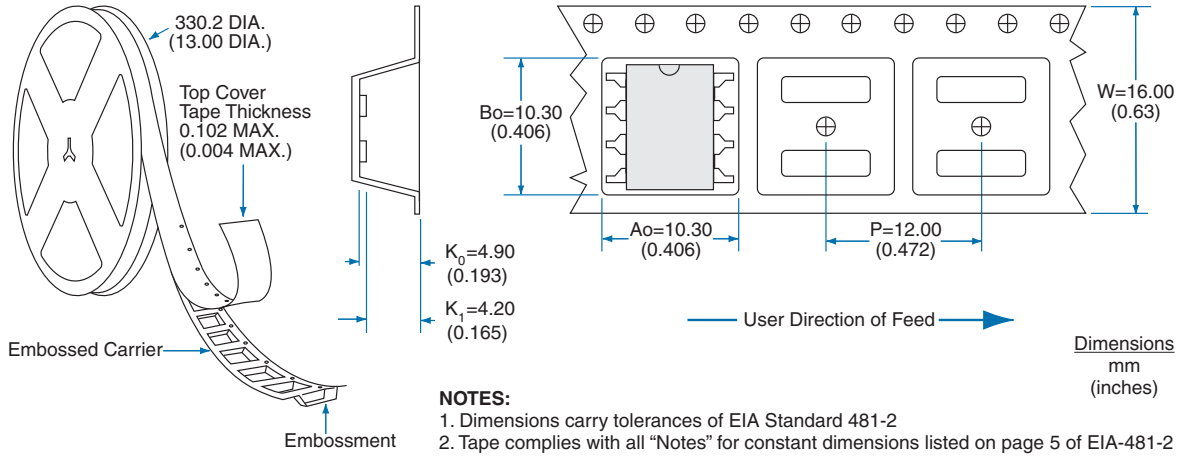
TS120S



Dimensions
mm
(inches)

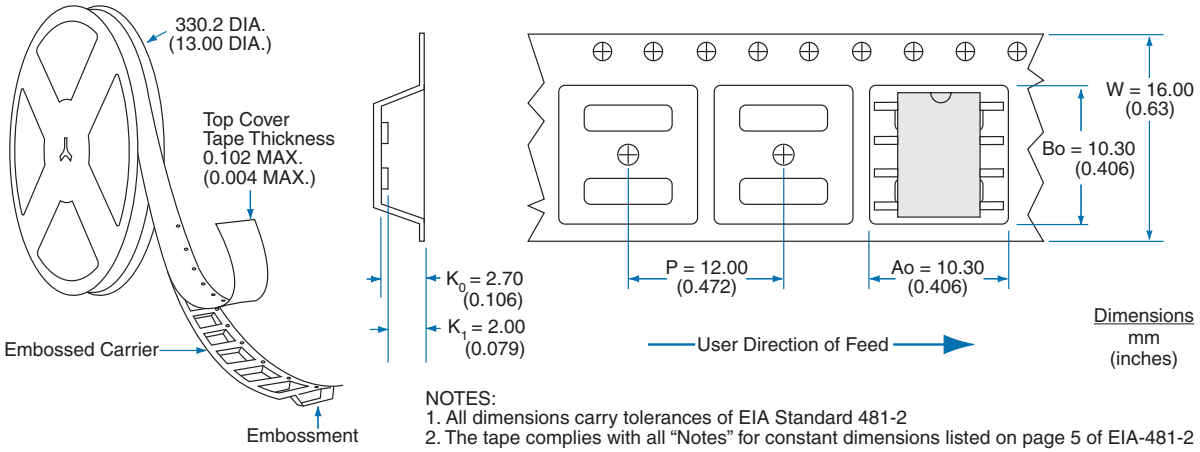
Mechanical Dimensions

TS120S Tape & Reel



NOTES:
1. Dimensions carry tolerances of EIA Standard 481-2
2. Tape complies with all "Notes" for constant dimensions listed on page 5 of EIA-481-2

TS120P Tape & Reel



NOTES:
1. All dimensions carry tolerances of EIA Standard 481-2
2. The tape complies with all "Notes" for constant dimensions listed on page 5 of EIA-481-2

For additional information please visit our website at: www.clare.com

Specification: DS-TS120-R11