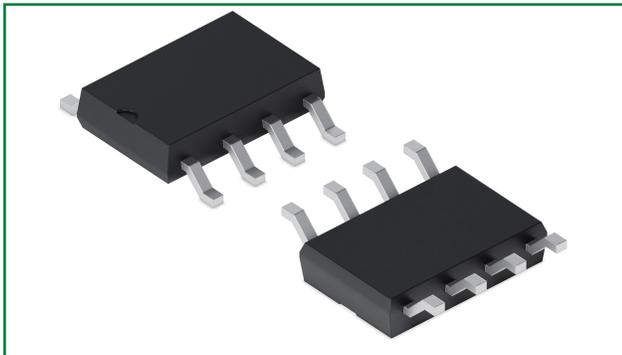


PAA110

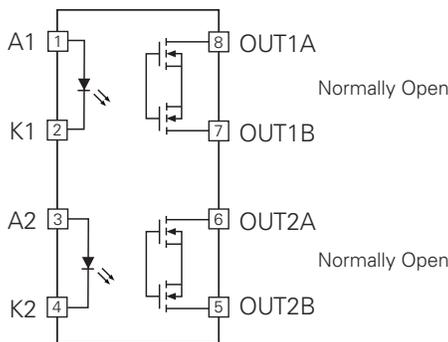
400V, 150 mA Dual Single-Pole 1-Form-A (NO) Relay

Key Attributes

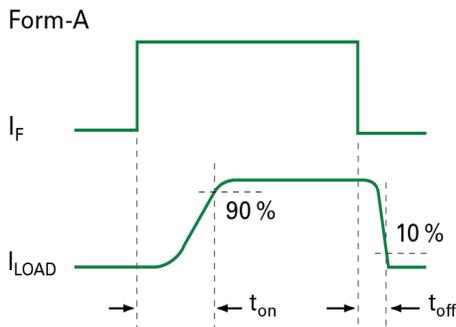
Characteristic	Rating	Unit
Blocking Voltage	400	V_P
Load Current	150	A_{RMS}/A_{DC}
On-resistance (max.)	22	Ω
LED Current to Operate	8	mA



Pin Configuration



Switching Characteristics of Normally Open Device



Description



PAA110 is a 400 V, 150 mA, 22 Ω , dual normally open (1-Form-A) optically isolated Solid State Relay. Its efficient MOSFET switches and photovoltaic die use Littelfuse Integrated Circuits' patented OptoMOS architecture to provide 3750 V_{RMS} of input to output isolation. The optically coupled output is controlled by a highly efficient infrared LED.

This performance leader provides high peak load voltage handling capability and improved peak load current handling.

Features

- 3750 V_{RMS} Input/Output Isolation
- Low Drive Power Requirements
- Greater Reliability than Electromechanical Relays
- FCC Compatible
- VDE Compatible
- No EMI/RFI Generation
- Small 8-Pin Package
- Surface Mount Tape and 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
- Industrial Controls

Approvals

- UL 1577 Recognized Component: File E76270
- CSA Certified Component: Certificate # 1175739
- TUV EN 62368-1: Certificate # B 082667 0008

Ordering Information

Part Number	Description
PAA110	8-Pin DIP (50/Tube)
PAA110P	8-Pin Flatpack (50/Tube)
PAA110PTR	8-Pin Flatpack Tape & Reel (1000/Reel)
PAA110S	8-Pin Surface Mount (50/Tube)
PAA110STR	8-Pin Surface Mount Tape & Reel (1000/Reel)

Specifications

Absolute Maximum Ratings

Parameter	Ratings	Units
Blocking Voltage	400	V _P
Reverse Input Voltage	5	V
Input Control Current	50	mA
Peak (10 ms)	1	A
Input Power Dissipation ¹	150	mW
Total Power Dissipation ²	800	
Isolation Voltage, Input to Output	3750	V _{RMS}
Operational Temperature, Ambient	-40 to +85	°C
Storage Temperature	-40 to +125	

¹ Derate linearly 1.33 mW/°C

² Derate output power 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 conditions beyond those indicated in the operational sections of this data sheet is not implied.

Typical values are characteristic of the device at +25 °C, and are the result of engineering evaluations. They are provided for information purposes only, and are not part of the manufacturing testing requirements.

Electrical Characteristics @ 25°C

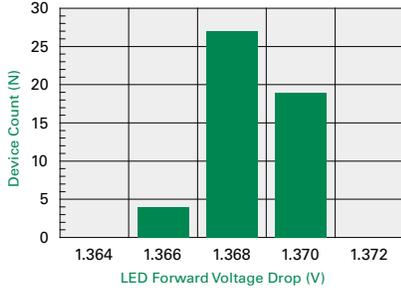
Parameter	Conditions	Symbol	Value			Units
			Minimum	Typical	Maximum	
Output Characteristics						
Blocking voltage	I _L = 1 μA	V _{DRM}	400	—	—	V _P
Load current: ¹						
Continuous	—	I _L	—	—	150	mA _{RMS} /mA _{DC}
Peak	t = 10 ms	I _{LPK}	—	—	±400	mA _P
On-resistance ²	I _L = 150 mA	R _{ON}	—	15	22	Ω
Off-state leakage current	V _L = 400 V _P	I _{LEAK}	—	—	1	μA
Switching speeds:						
Turn-on	I _F = 5 mA, V _L = 10 V	t _{on}	—	—	1	ms
Turn-off		t _{off}	—	—	0.25	
Output capacitance	I _F = 0 mA, V _L = 50 V, f = 1 MHz	C _{OUT}	—	25	—	pF
Input Characteristics						
Input control current to activate	I _L = 150 mA	I _F	—	—	5	mA
Input control current to deactivate	—	I _F	0.1	0.7	—	
Input voltage drop to deactivate	—	V _F	0.8	—	—	V
Input voltage drop	I _F = 5 mA	V _F	0.9	1.36	1.5	
Reverse input current	V _R = 5 V	I _R	—	—	10	μA
Common Characteristics						
Capacitance, input to output	V _{IO} = 0 V, f = 1 MHz	C _{IO}	—	3	—	pF

¹ If both poles operate simultaneously, then load current must be derated in order not to exceed package power dissipation value.

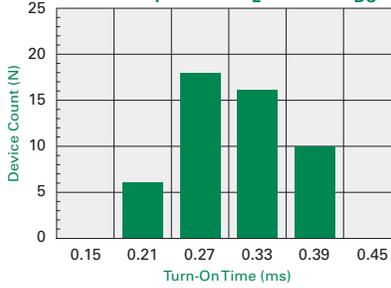
² Measurement taken within 1 second of on-time.

PERFORMANCE DATA*

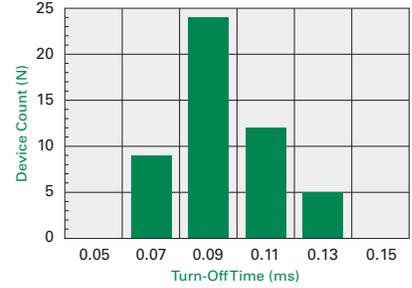
Typical LED Forward Voltage Drop
(N = 50, I_F = 5 mA)



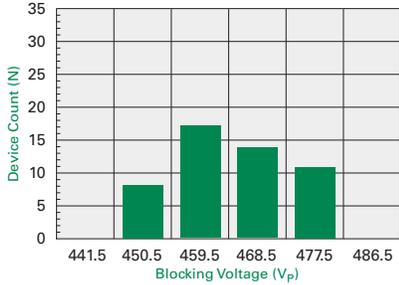
Typical Turn-On Time
(N = 50, I_F = 5 mA, I_L = 150 mA_{DC})



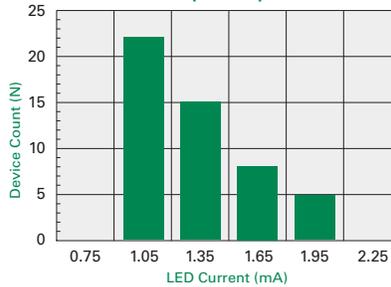
Typical Turn-Off Time
(N = 50, I_F = 5 mA, I_L = 150 mA_{DC})



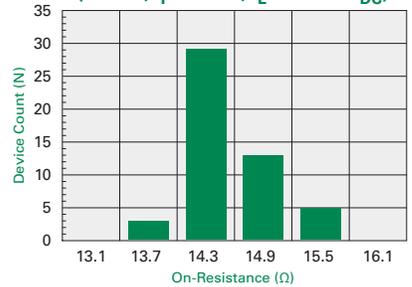
Typical Blocking Voltage Distribution
(N = 50)



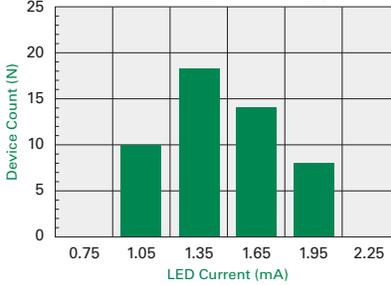
Typical I_F for Switch Dropout
(N = 50)



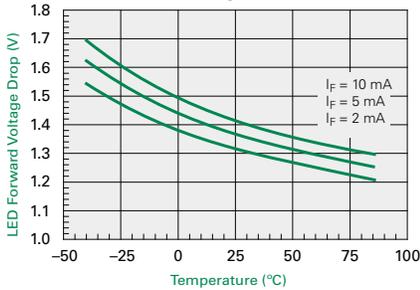
Typical On-Resistance Distribution
(N = 50, I_F = 5 mA, I_L = 150 mA_{DC})



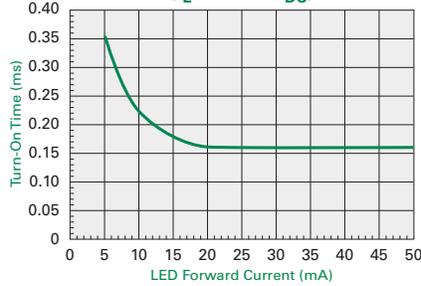
Typical I_F for Switch Operation
(N = 50, I_L = 150 mA_{DC})



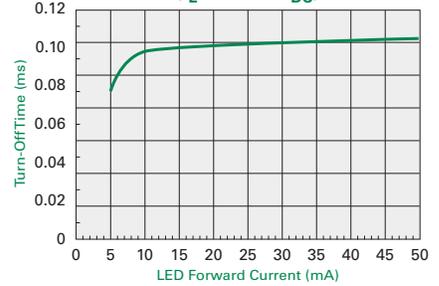
Typical LED Forward Voltage Drop
vs. Temperature



Typical Turn-On Time
vs. LED Forward Current
(I_L = 150 mA_{DC})

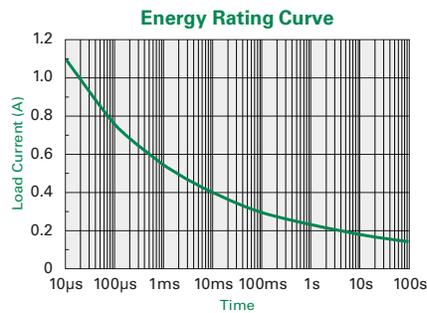
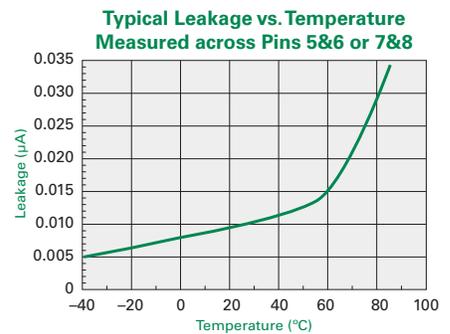
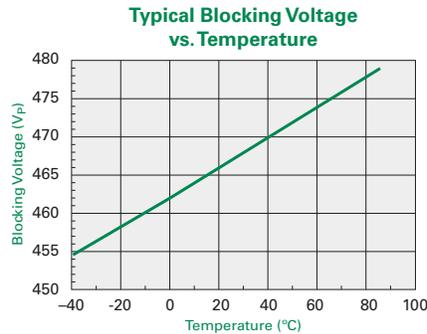
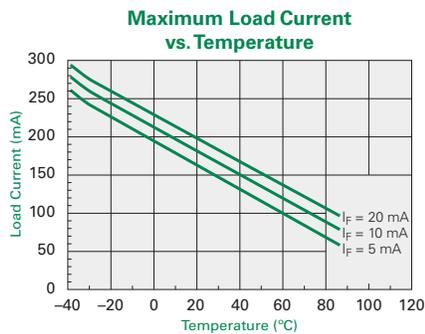
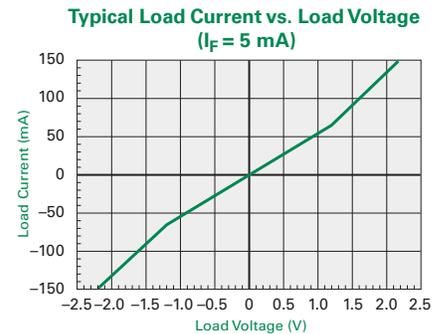
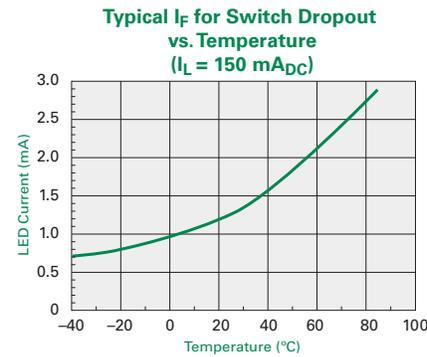
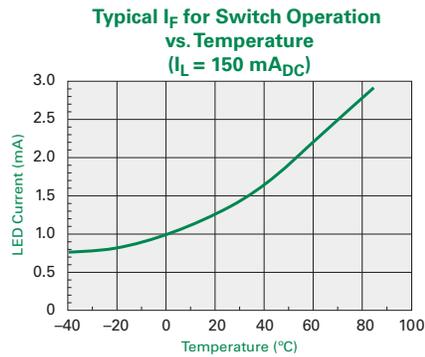
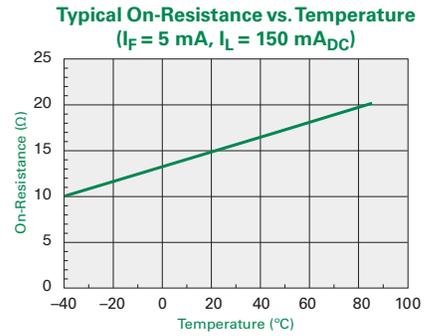
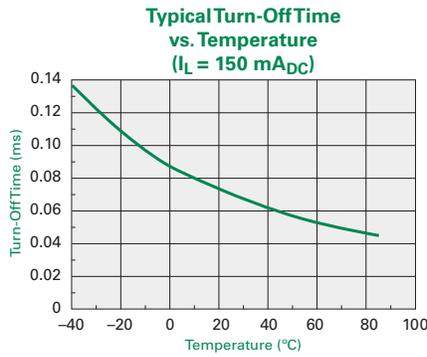
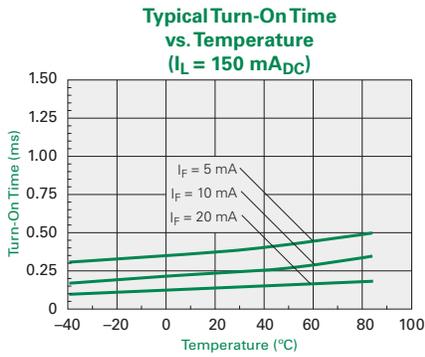


Typical Turn-Off Time
vs. LED Forward Current
(I_L = 150 mA_{DC})



*Unless otherwise noted, data presented in these graphs is typical of device operation at T_A = 25°C.

PERFORMANCE DATA*



*Unless otherwise noted, data presented in these graphs is typical of device operation at $T_A = 25^\circ\text{C}$.

Manufacturing Information

Moisture Sensitivity



All plastic encapsulated semiconductor packages are susceptible to moisture ingress. Littelfuse classifies 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)** classification 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) Classification
PAA110S / PAA110P	MSL 1

ESD Sensitivity



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

Soldering Profile

Provided in the table below is the **IPC/JEDEC J-STD-020** Classification Temperature (T_C) and the maximum dwell time ($T_C - 5^\circ\text{C}$). The Classification Temperature sets the Maximum Body Temperature allowed for these devices during reflow soldering processes.

Device	Classification Temperature (T_C)	Dwell Time (T_P)	Max Reflow Cycles
PAA110S	250°C	30 seconds	3
PAA110P	260°C	30 seconds	3

For through-hole devices, the maximum pin temperature and maximum dwell time through all solder waves is provided in the table below. Dwell time is the interval beginning when the pins are initially immersed into the solder wave until they exit the solder wave. For multiple waves, the dwell time is from entering the first wave until exiting the last wave. During this time, pin temperatures must not exceed the maximum temperature given in the table below. Body temperature of the device must not exceed the limit shown in the table below at any time during the soldering process.

Device	Maximum Pin Temperature	Maximum Body Temperature	Maximum Dwell Time	Wave Cycles
PAA110	260°C	250°C	10 seconds*	1

*Total cumulative duration of all waves.

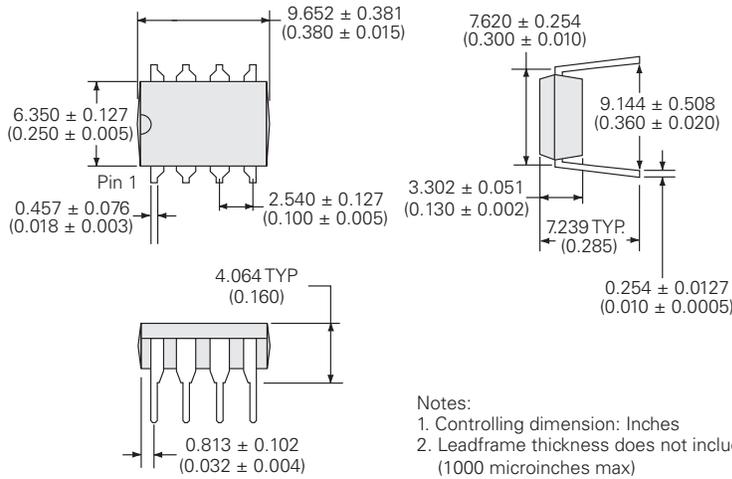
Board Wash

Littelfuse recommends the use of no-clean flux formulations. Board washing to reduce, or remove flux residue following the solder reflow process is acceptable, provided proper precautions are taken to prevent damage to the device. These precautions include, but are not limited to: Using a low pressure wash and providing a follow-up bake cycle sufficient to remove any moisture trapped within the device, due to the washing process. Due to the variability of the wash parameters used to clean the board, determination of the bake temperature and duration necessary to remove the moisture trapped within the package is the responsibility of the user (assembler). Cleaning, or drying methods that employ ultrasonic energy may damage the device and should not be used. Additionally, the device must not be exposed to halide flux or solvents.

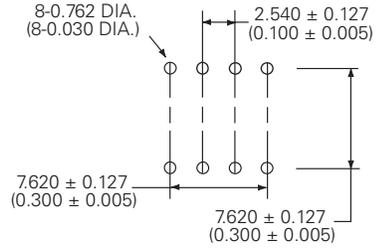


Mechanical Dimensions

PAA110



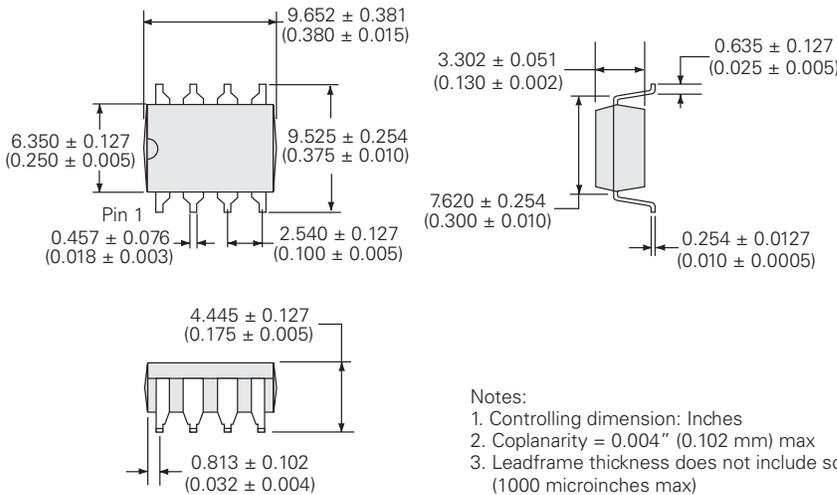
PCB Hole Pattern



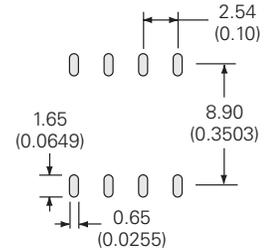
- Notes:
 1. Controlling dimension: Inches
 2. Leadframe thickness does not include solder plating (1000 microinches max)

Dimensions
 mm
 (inches)

PAA110S



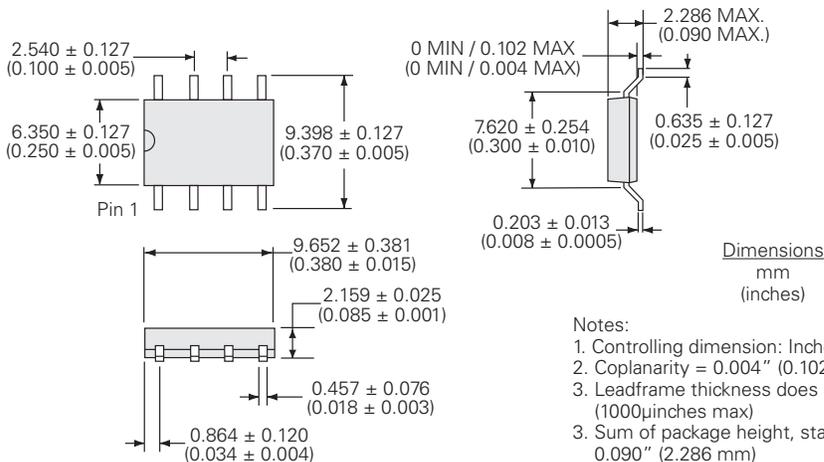
PCB Land Pattern



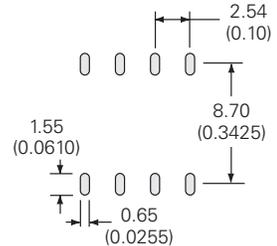
- Notes:
 1. Controlling dimension: Inches
 2. Coplanarity = 0.004" (0.102 mm) max
 3. Leadframe thickness does not include solder plating (1000 microinches max)

Dimensions
 mm
 (inches)

PAA110P



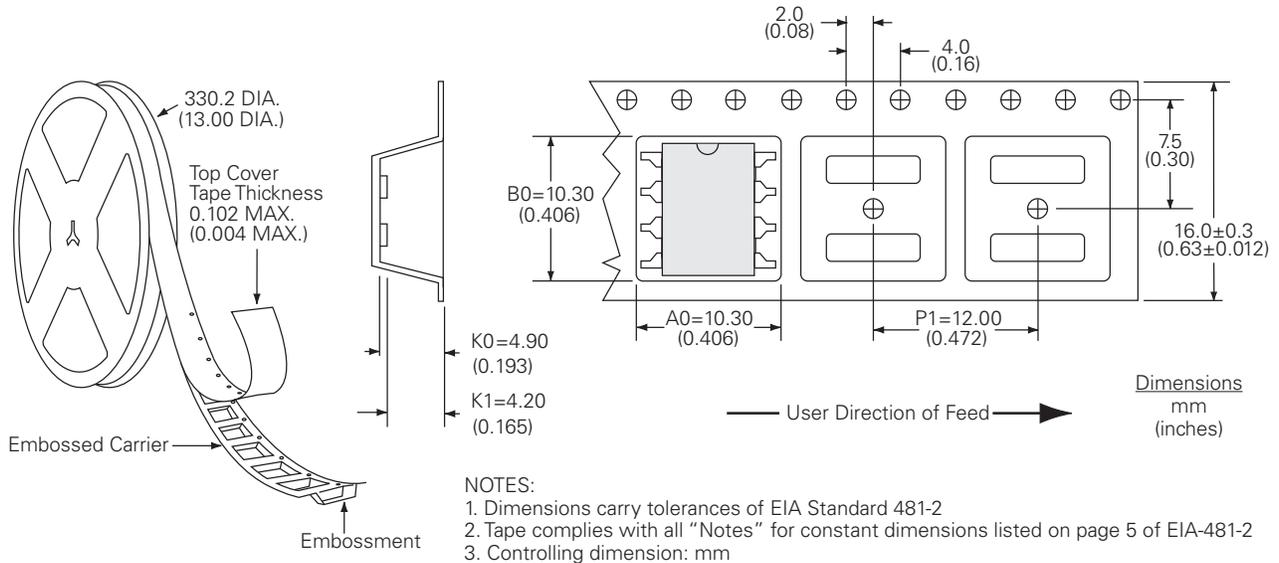
PCB Land Pattern



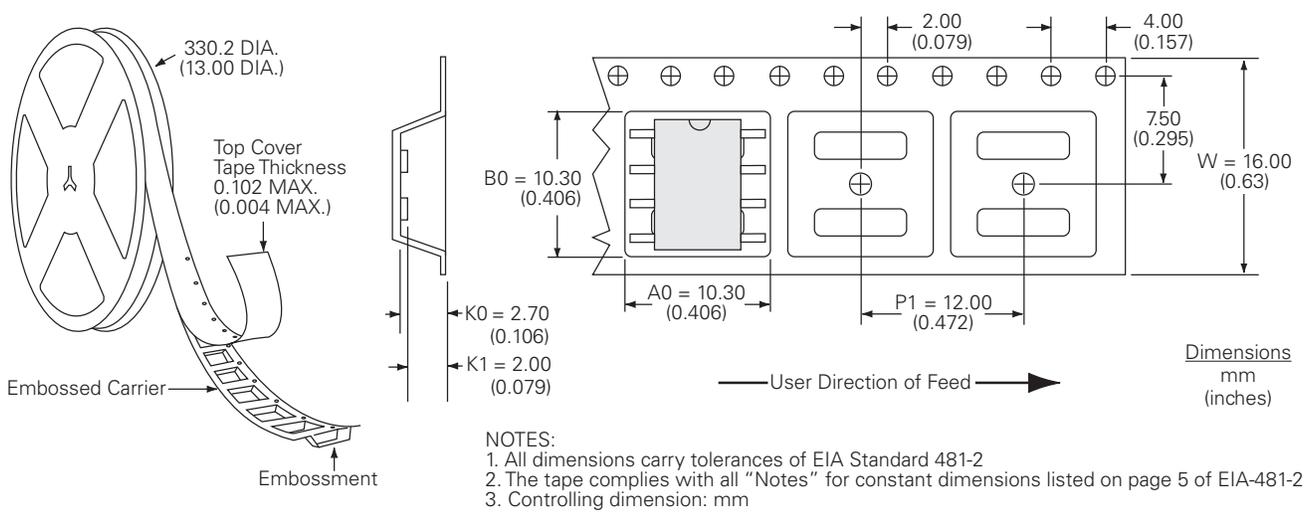
- Notes:
 1. Controlling dimension: Inches
 2. Coplanarity = 0.004" (0.102 mm) max
 3. Leadframe thickness does not include solder plating (1000µinches max)
 3. Sum of package height, standoff, and coplanarity shall not exceed 0.090" (2.286 mm)

Dimensions
 mm
 (inches)

PAA110STR Tape and Reel



PAA110PTR Tape and Reel



Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at <https://www.littelfuse.com/disclaimer-electronics>