

PROTECTION PRODUCTS

Description

TClamp®3602P provides dedicated surge and ESD protection for RS-485 and other 36V lines in industrial applications. It features high surge current capability of 30A ($t_p=8/20\mu s$) and low clamping voltage making them ideal for use in harsh transient environments.

This device is designed to replace multiple discrete components by integrating low capacitance, surge rated compensation diodes with a high power transient voltage suppressor (TVS). Capacitance is limited to 4pF maximum to ensure correct signal transmission on high-speed lines. Each TClamp3602P may be used to protect up to two lines.

The TClamp3602P is in a DFN 2.0 x 1.0 x 0.55mm 5-Lead package. The flow-through package design simplifies PCB layout.

Features

- High ESD withstand Voltage: +/-30kV (Contact and Air) per IEC 61000-4-2
- Protects up to two lines
- Low capacitance: 4pF Maximum
- Operating voltage: 36V
- Low leakage current
- Solid-state silicon-avalanche technology

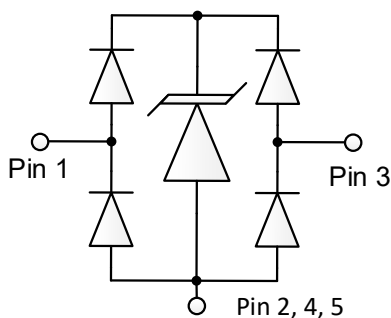
Mechanical Characteristics

- Package: DFN 2.0 x 1.0 x 0.55mm 5-Lead
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Lead Finish: Lead Free
- Molding Compound Flammability Rating: UL 94V-0
- Marking : Marking code + Date Code
- Packaging : Tape and Reel

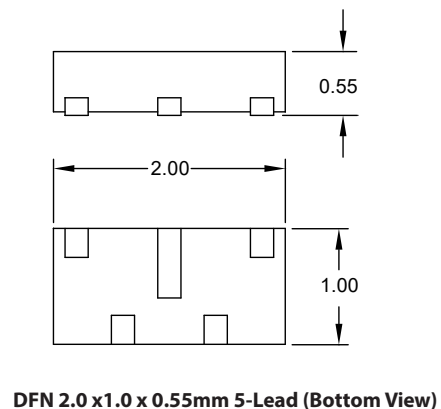
Applications

- RS-485 Surge Protection
- RS-422 Surge Protection
- Industrial Equipment
- Remote Meter Readers
- Automatic Teller Machines
- Digital Surveillance Cameras
- CAN-bus

Functional Circuit Diagram



Nominal Dimensions (mm)



Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power ($t_p = 8/20\mu s$), Pin 1 to 3	P_{PK}	350	W
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{PP}	30	A
ESD per IEC 61000-4-2 (Air) ⁽¹⁾ ESD per IEC 61000-4-2 (Contact) ⁽¹⁾	V_{ESD}	± 30 ± 30	kV
Operating Temperature	T_{OP}	-40 to +105	°C
Junction Temperature & Storage Temperature	T_J & T_{STG}	-55 to +150	°C

Electrical Characteristics ($T=25^\circ C$ unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pins 1 or 3 to Pins 2, 4 and 5 ⁽⁴⁾ , Pin 1 to 3, -40 °C to +105 °C			36	V
Reverse Breakdown Voltage	V_{BR}	$I_{BR} = 10mA$, Pin 1 to 3	40	44	50	V
Holding Current	I_H	Pin 1 to Pin 3		20		mA
Reverse Leakage Current	I_R	$V_{RWM} = 36V$ Pins 1 or 3 to Pins 2, 4 and 5 ⁽⁴⁾	$T = 25^\circ C$	<0.01	0.1	μA
			$T = 85^\circ C$	<0.02	0.1	
Clamping Voltage	V_C	$t_p = 8/20\mu s$, Pin 1 to 3 $I_{PP} = 30A$		9.3	11.5	V
Dynamic Resistance ^{(2),(3)}	R_{DYN}	$t_p = 0.2/100ns$, Pins 1 to Pin 3		0.07		Ω
Junction Capacitance	C_J	$V_R = 0V$, $f = 1MHz$ Pins 1 or 3 to Pins 2, 4 and 5 ⁽⁴⁾		2.6	4	pF

Notes

(1) ESD gun return path connected to ESD ground plane

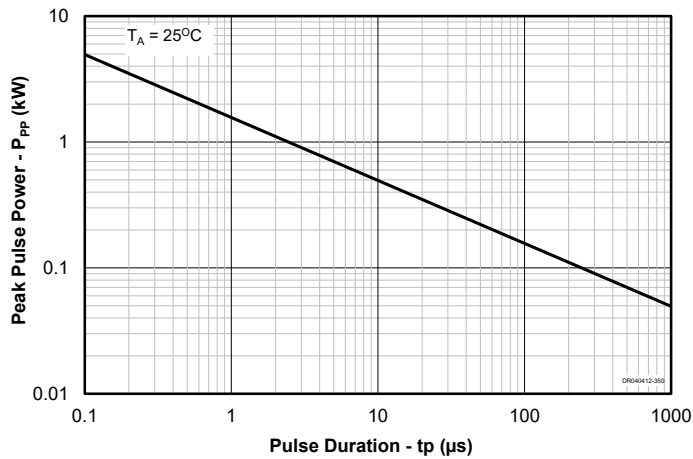
(2) Transmission Line Pulse Test (TLP) Settings: $t_p = 100ns$, $t_r = 0.2ns$, I_{TLP} and V_{TLP} averaging window: $t_1 = 70ns$ to $t_2 = 90ns$

(3) Dynamic resistance calculated from $I_{TLP} = 4A$ to $I_{TLP} = 16A$

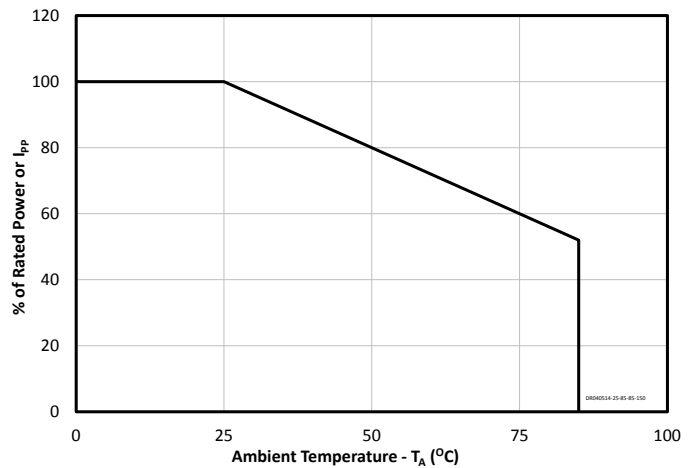
(4) Pin 2, 4, 5 are internally connected.

Typical Characteristics

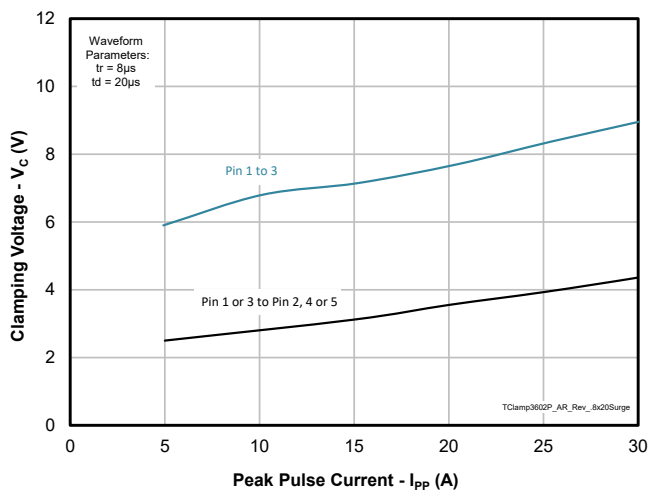
**Non-Repetitive Peak Pulse Power vs. Pulse Time
Pin 1 to 3**



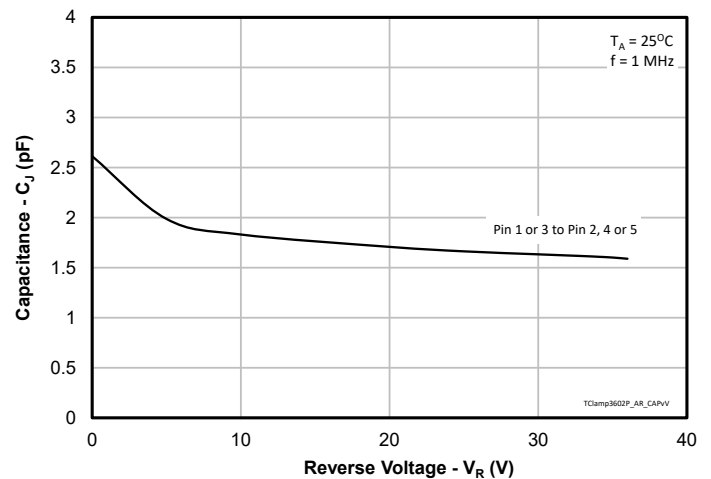
Power Derating Curve



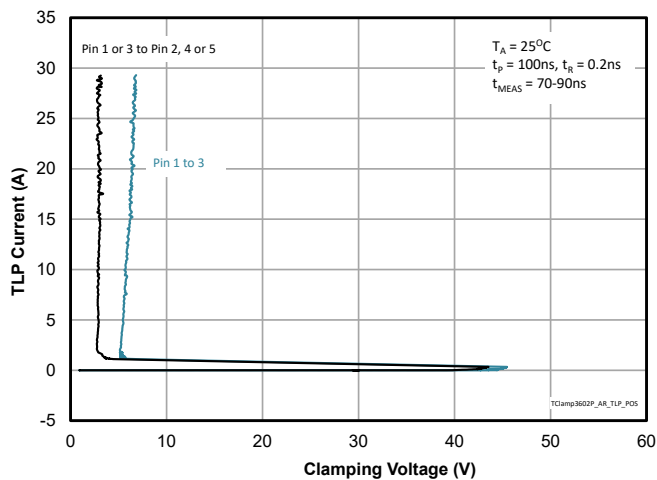
Clamping Voltage vs. Peak Pulse Current ($t_p=8/20\mu$ s)



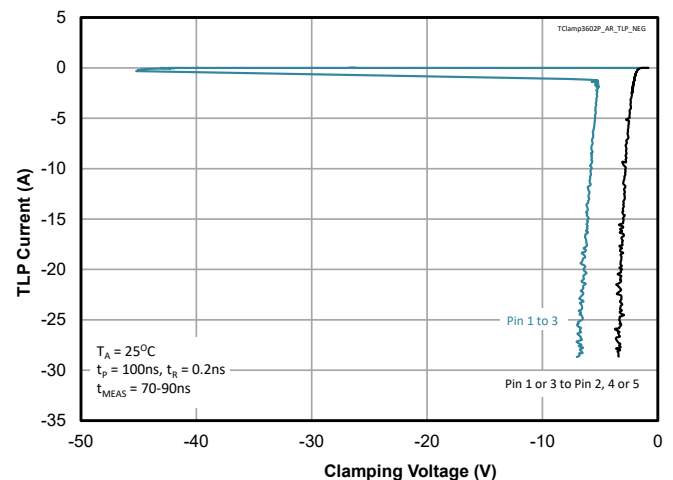
Capacitance vs. Voltage



TLP Characteristics (Positive)

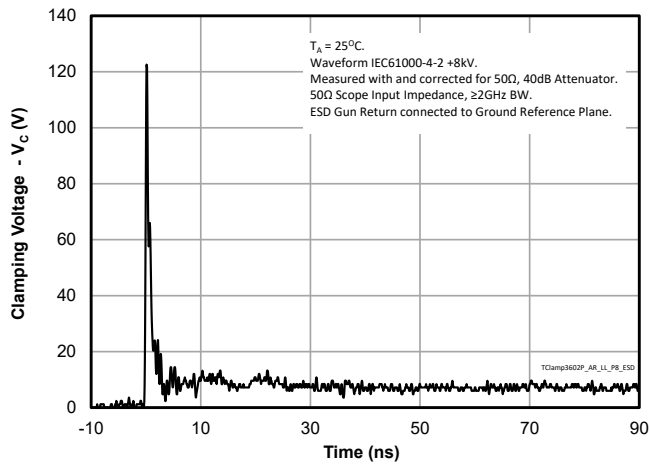


TLP Characteristics (Negative)

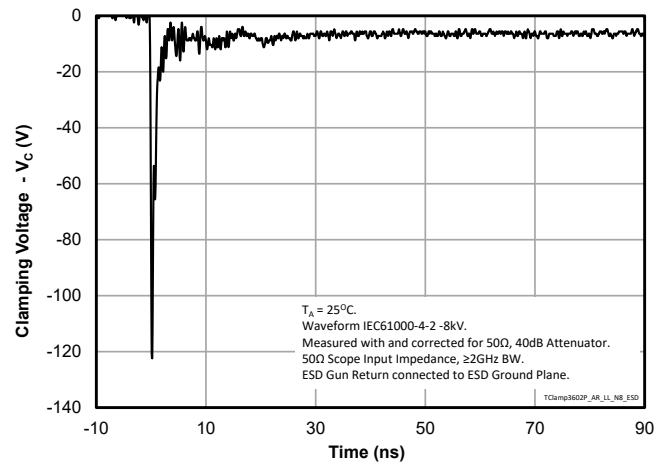


Typical Characteristics (Continued)

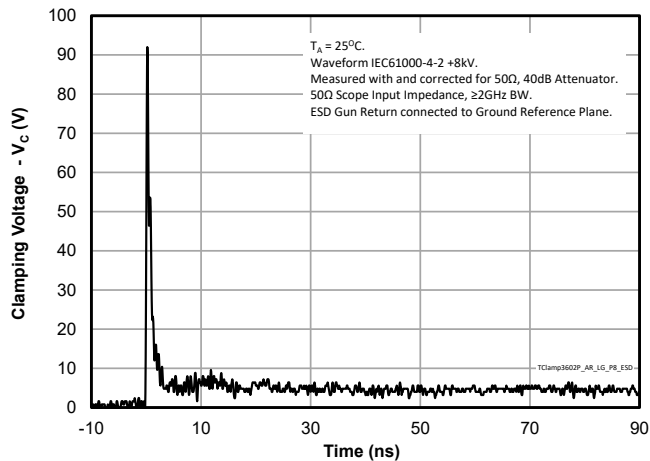
**ESD Clamping (8kV Contact per IEC 61000-4-2)
Pin 1 to Pin 3**



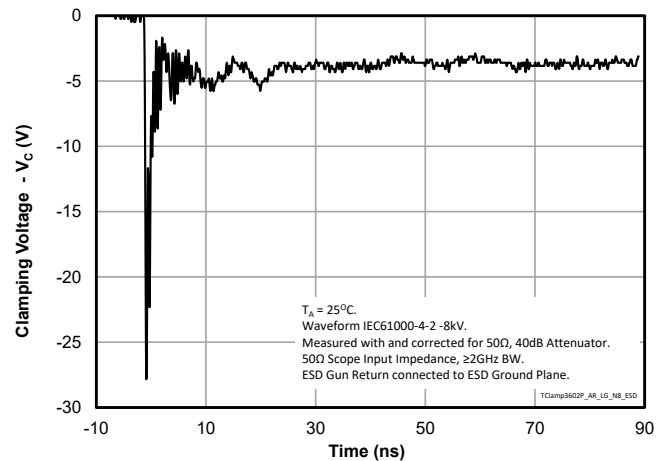
**ESD Clamping (-8kV Contact per IEC 61000-4-2)
Pin 1 to Pin 3**



**ESD Clamping (8kV Contact per IEC 61000-4-2)
Pin 1 to Pin 2, 4, or 5**



**ESD Clamping (-8kV Contact per IEC 61000-4-2)
Pin 1 to Pin 2, 4, or 5**



Application Information

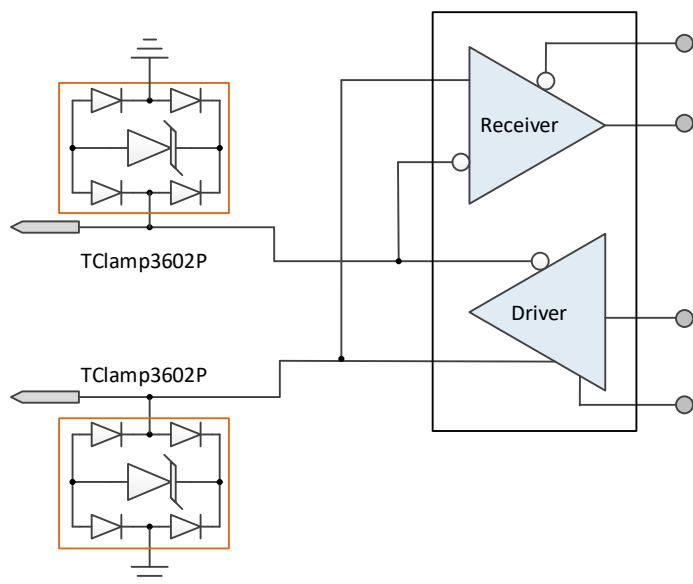
Protecting RS-485 Interfaces

There are two primary types of EOS threats in industrial RS-485 networks. The first is due to the physical installation. It is common for industrial DC supply voltages to be distributed through the same conduits as an RS-485 network. Short circuits between the supply and data conductors can occur because of faulty wiring and insulation breaks. Overvoltage protected transceivers are available, which have bus terminals with high standoff voltage capability. These transceivers are designed to survive the aforementioned short circuit events. The second type of threat is due to transient overvoltages that occur because of EFT, ESD, and lightning induced surges. For this type of threat, an external protection device is required. Transient Voltage Suppressors (TVS's) are preferred due to their fast response time and low clamping voltage as compared to other protection technologies.

TClamp3602P Connection Options

TClamp3602P can be used to protect RS-485 interfaces to the transient surge requirements of IEC 61000-4-2 (ESD), IEC 61000-4-4 (EFT), and IEC 61000-4-5 (Lightning). Connection options are shown below. For transceivers

Figure 1: Symmetrical Clamping Solution with Full Common-Mode Range



with a common-mode voltage range (CMVR) as high as $\pm 25V$, one TClamp3602P is connected from each line to ground as shown in Figure 1. This configuration is recommended for industrial applications where the voltage excursions on the bus can reach to 36 Volts. The asymmetrical clamping of the single TVS solution in Figure 2 applies to data links without negative CMVR, or in applications with small common-mode variations. Figure 3 shows protection scheme for common mode and differential surge protection in RS-485.

Figure 2: Asymmetrical Clamping Solution with Partial Common-Mode Range

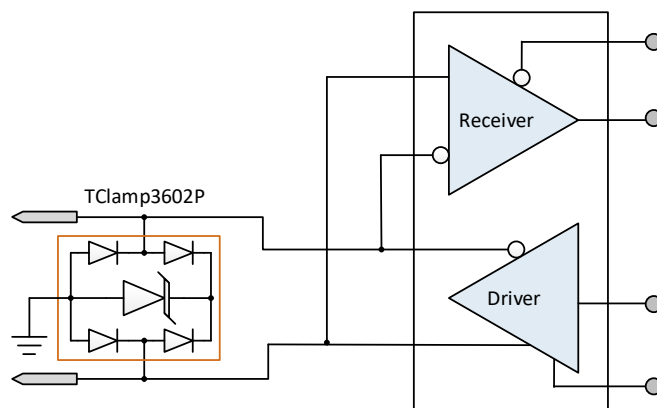
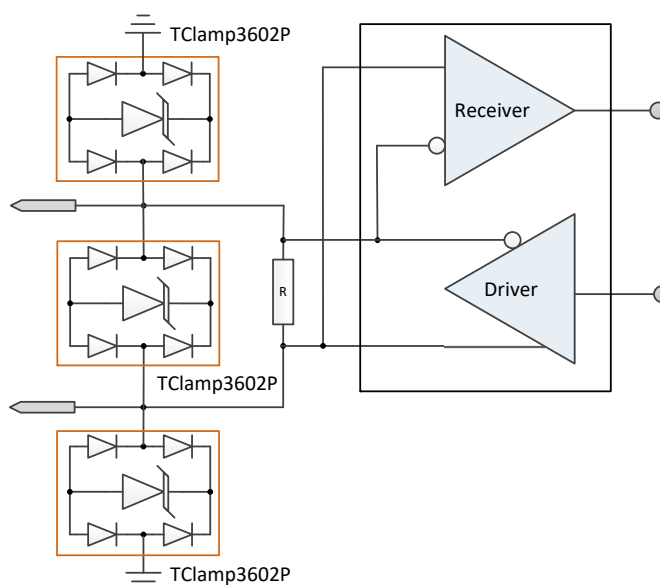
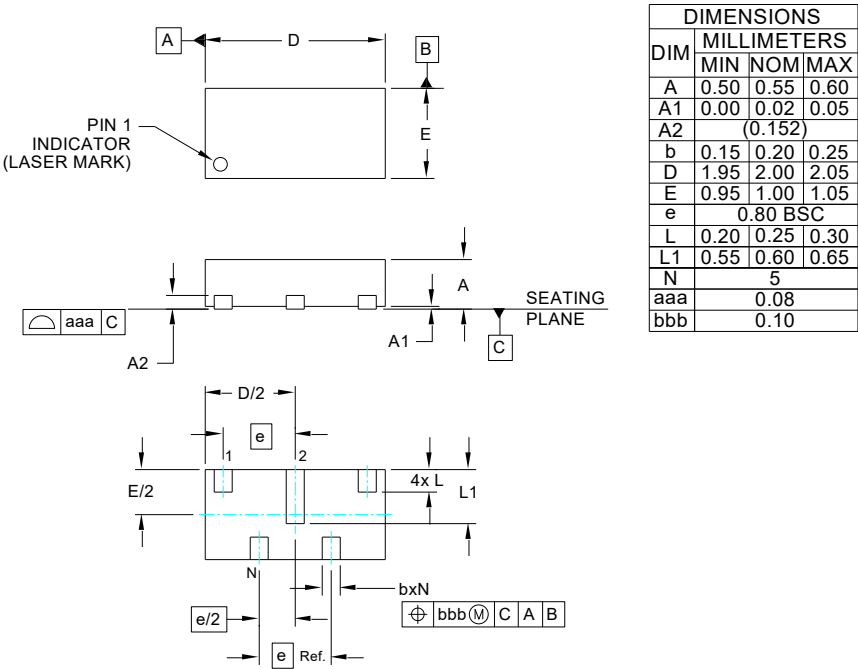


Figure 3: RS-485 Common Mode and Differential Surge Protection

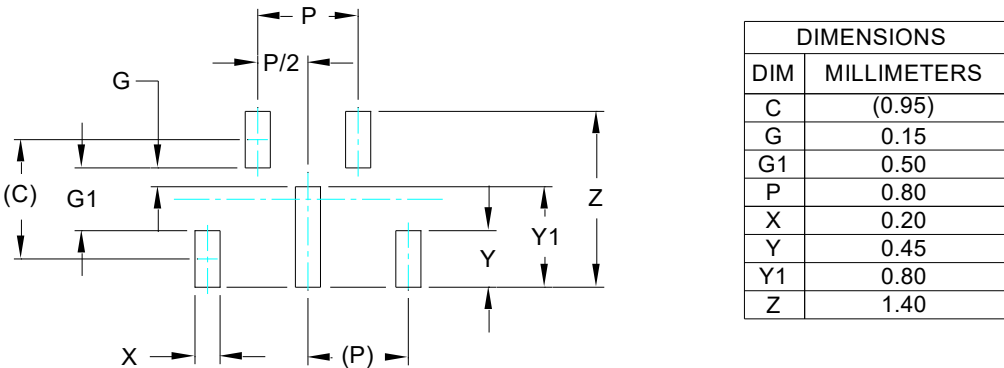


Outline Drawing - DFN 2.0 x 1.0 x 0.55mm 5-Lead



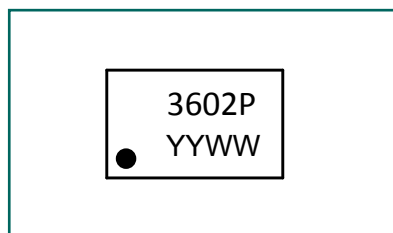
NOTES:
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

Land Pattern - DFN 2.0 x 1.0 x 0.55mm 5-Lead



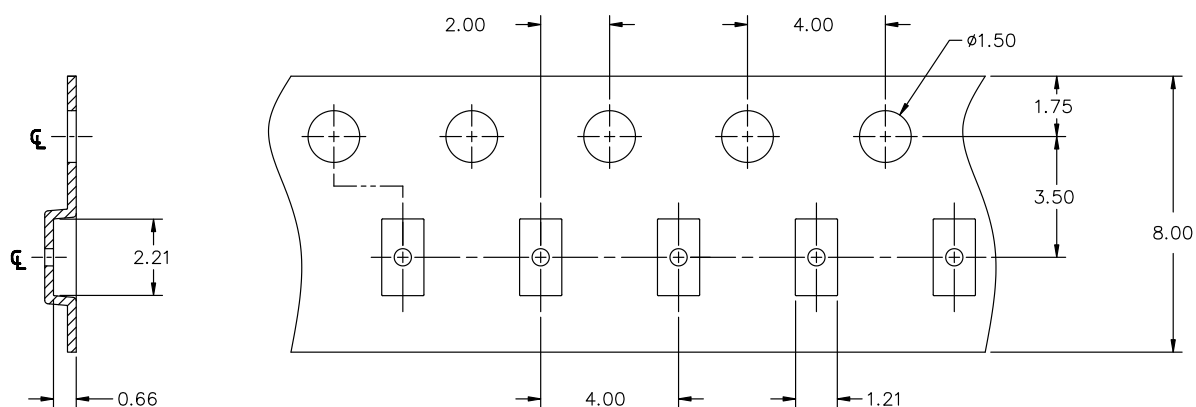
NOTES:
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY.
CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

Marking Code

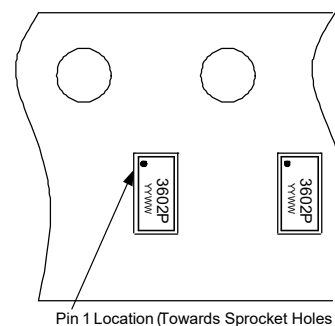


Note: YYWW = Alphanumeric character date code

Tape and Reel Specification



Note: All dimensions are nominal dimensions in mm.



Ordering Information

Part Number	Qty per Reel	Reel Size
TClamp3602P. TCT	3,000	7"



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