WS3220

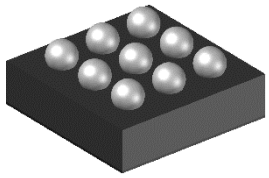
Over-Voltage Protection Load Switch

http://www.sh-willsemi.com

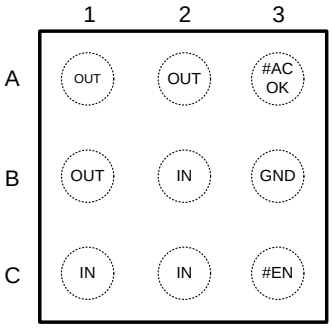
Descriptions

The WS3220 features a low R_{ON} internal High Voltage Switch and an input range of absolute maximum 35V DC. An internal Over-Voltage Protection (OVP) that shuts off the internal Switch if input voltage exceeds the fixed OVP threshold 6.2V / 6.8V / 10.5V / 14.0V. The off-state Switch can disconnect the input pin to output pin and protect output from the input high voltage stress. Integrated Over-Temperature Protection (OTP) also shuts off the Switch to protect the device.

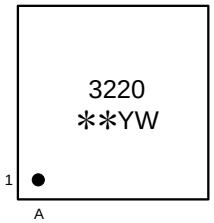
The WS3220 is available in 1.17mm x 1.17mm CSP-9L package. Standard product is Pb-free and Halogen-free.



CSP-9L (Bottom View)



Pin Configuration (Top View)



Marking

3220 = Device code
**** = Special code**
Y = Year code
W = Week Code

Features

- Absolute Maximum Input Voltage : 35V
- Low R_{ON} Switch (@V_{IN}=5V/9V/12V) : 30mΩ
- Fixed OVP Threshold
  - WS3220C5 : 6.2V
  - WS3220C6 : 6.8V
  - WS3220C9 : 10.5V
  - WS3220C12 : 14.0V
- Fast OVP Response : 65 ns
- Thermal Shutdown Protection
- Robust ESD Protection
  -Human Body Model (HBM) : 4000V
  -Machine Model (MM) : 400V

Applications

- Mobile Handsets and Tablets
- Portable Media Players
- Peripherals

Order information

Device	Package	Mark **	Shipping
WS3220C5-9/TR	CSP-9L	05	3K/R&T
WS3220C6-9/TR	CSP-9L	06	3K/R&T
WS3220C9-9/TR	CSP-9L	09	3K/R&T
WS3220C12-9/TR	CSP-9L	12	3K/R&T

Typical Applications

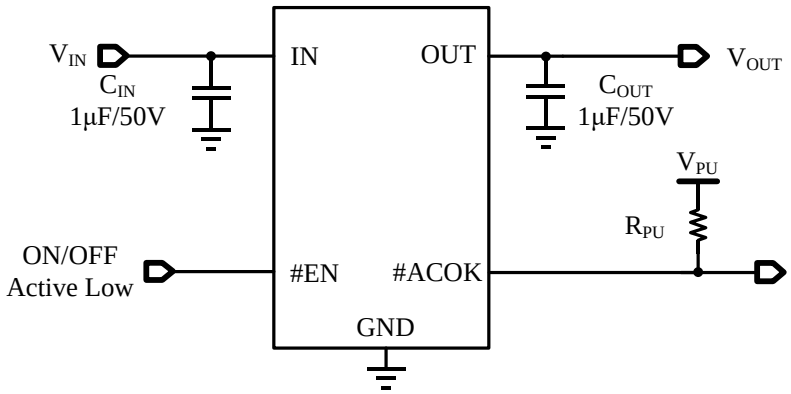


Fig. 1. Typical Application with #EN and #ACOK Used

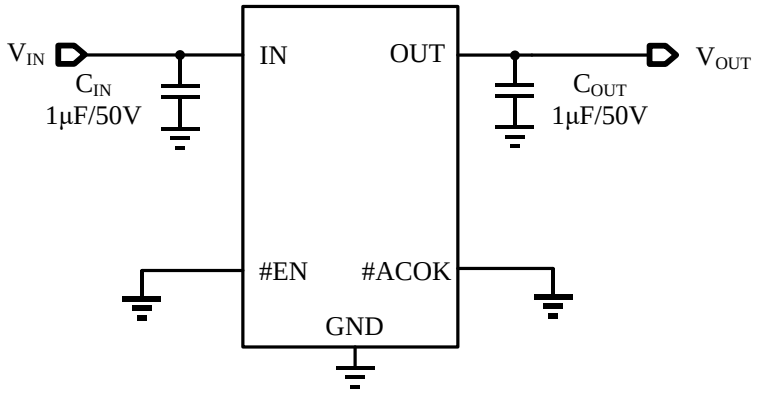
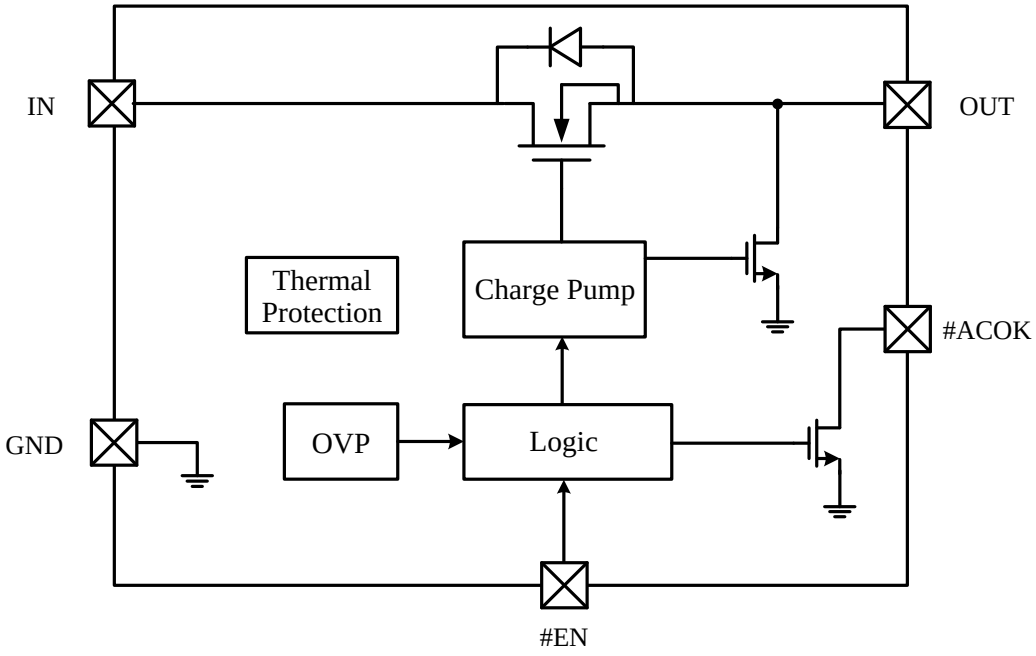


Fig. 2. Typical Application with #EN and #ACOK Connected to GND

Pin Descriptions

Pin Number	Symbol	Descriptions		
1C, 2B, 2C	IN	Switch Input Pin and Device Power Supply.		
1A, 1B, 2A	OUT	Switch Output Pin to Load.		
3A	#ACOK	Power Good. Connect to GND if not used	0	Input Stable
			1	Disabled, UVLO, OVLO, or OTP
3C	#EN	Device Enable. Active Low. Connect to GND if not used.		
3B	GND	Device Ground Pin.		

Block Diagram



Absolute maximum ratings

Parameter		Symbol		Value	Unit
V_IN voltage range		V_{IN}		-0.3~35	V
V_OUT voltage range		V_{OUT}		-0.3~V_{OVP}	V
#EN, #ACOK voltage range		$V_{\#EN}$, $V_{\#ACOK}$		-0.3~6.5	V
Switch I/O Continuous Current		I_{IN}	WS3220C5	4.0	A
			WS3220C6	4.0	
			WS3220C9	3.5	
			WS3220C12	3.0	
Body Diode Forward Peak Pulse Current *1	Pulse Width = 10ms	I_{PP}		20	A
	Pulse Width = 20μs			50	A
Junction temperature		T_J		125	°C
Lead temperature(Soldering, 10s)		T_L		260	°C
Storage temperature		Tstg		-55~150	°C
ESD Ratings		HBM		4000	V
		MM		200	V

***1 Single Pulse**

These are stress ratings only. Stresses exceeding the range specified under “Absolute Maximum Ratings” may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Recommend Operating Conditions

Parameter	Symbol	Value	Unit
VIN supply input voltage range	V_{cc}	3.2~30	V
Operating ambient temperature	T_A	-40~85	°C
Thermal Resistance	$R_{\theta JA}$	95	°C/W

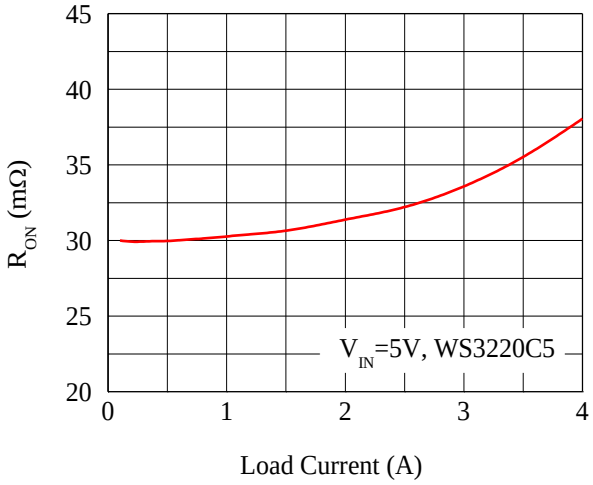
Electrical Characteristics (T_A = 25°C, C_{IN} = 1μF/50V, C_{OUT} = 1μF/50V, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Basic Operation						
Quiescent Supply Current	I_Q	V_{IN} = 5V, $V_{\#EN}$=0, No Load, WS3220C5		65		μA
		V_{IN} = 6V, $V_{\#EN}$=0, No Load, WS3220C6		70		
		V_{IN} = 9V, $V_{\#EN}$=0, No Load, WS3220C9		80		
		V_{IN} = 12V, $V_{\#EN}$=0, No Load, WS3220C12		85		
UVLO Threshold Voltage	V_{UVLO}	V_{IN} rising		2.4	3.2	V
Start-up Delay Time	T_{START_DLY}	V_{IN} = 0-> 5V to V_{OUT} = 0.1 x V_{IN}, $V_{\#EN}$ = 0		15		ms
Soft-Start Time	T_{SS}	V_{IN} = 0-> 5V to #ACOK goes low, $V_{\#EN}$ = 0		30		ms
Main Switch ON-Resistance	R_{ON}	V_{IN} = 5V, I_{OUT} = 0.5A, WS3220C5		30	39	mΩ
		V_{IN} = 6V, I_{OUT} = 0.5A, WS3220C6		28	39	
		V_{IN} = 9V, I_{OUT} = 0.5A, WS3220C9		30	39	
		V_{IN} = 12V, I_{OUT} = 0.5A, WS3220C12		32	40	
Enable High Voltage	$V_{IH\_\#EN}$		1.4			V
Enable Low Voltage	$V_{IL\_\#EN}$				0.4	V
#EN Input Leakage Current	$I_{\#EN}$	$V_{\#EN}$=5V		10		μA
		$V_{\#EN}$=0V			0.1	
#ACOK Output Low Voltage	V_{OL}	I_{SINK} = 1mA			0.4	V
#ACOK Leakage Current	$I_{\#ACOK}$	$V_{\#ACOK}$ = 3V, #ACOK De-asserted			1.0	μA
Surge and Over-Voltage Protection						
VIN OVP Threshold	V_{OVP}	V_{IN} rising, WS3220C5	6.00	6.20	6.40	V
		V_{IN} rising, WS3220C6	6.58	6.80	7.02	
		V_{IN} rising, WS3220C9	10.0	10.5	11.0	V
		V_{IN} rising, WS3220C12	13.5	14.0	14.5	V
OVP Response Time	t_{OVP}	V_{IN} rising at 1V / 0.1μs *1		65		ns
OVP Hysteresis Voltage	V_{HYS_OVP}	V_{IN} falling		0.1		V
OVP Recovery Time	t_{R_OVP}	V_{IN} recovery from OVP to output on		15		ms
Output discharge resistance	R_{DCHG}	OVP, V_{OUT} = 5V, WS3220C5		90		Ω
		OVP, V_{OUT} = 6V, WS3220C6		90		

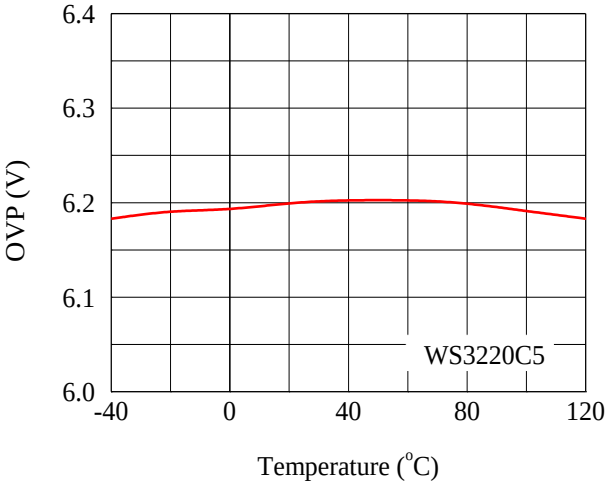
		OVP, V_{OUT} = 9V, WS3220C9		95		Ω
		OVP, V_{OUT} = 12V, WS3220C12		100		
Thermal Protection						
Over-Temperature Protection Threshold	T_{SD}			140		°C
Over-Temperature Protection Hysteresis	T_{HYS}			20		°C

***1: Guaranteed by design**

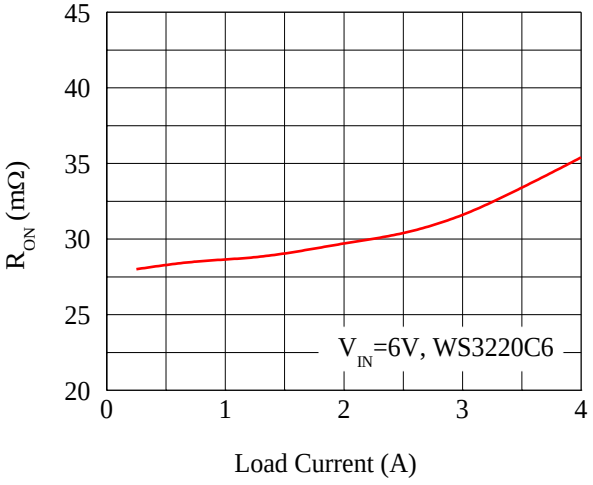
Typical Characteristics (T_A = 25°C, C_{IN} = 1μF/50V, C_{OUT} = 1μF/50V, unless otherwise noted)



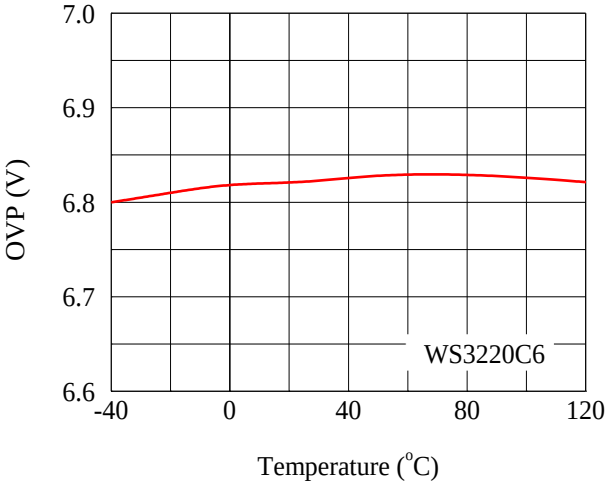
ON-Resistance vs. Load Current



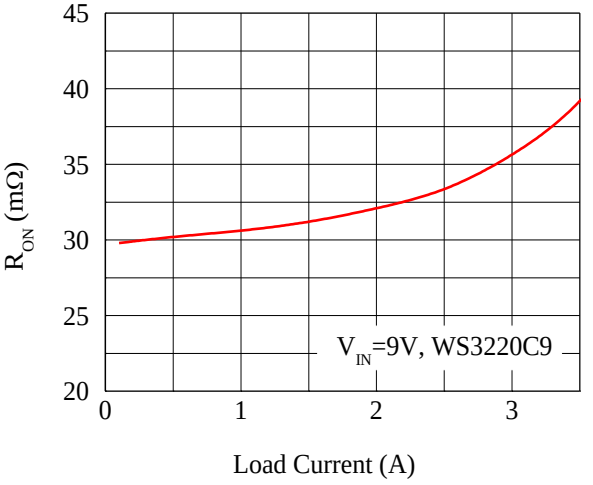
OVP Threshold vs. Temperature



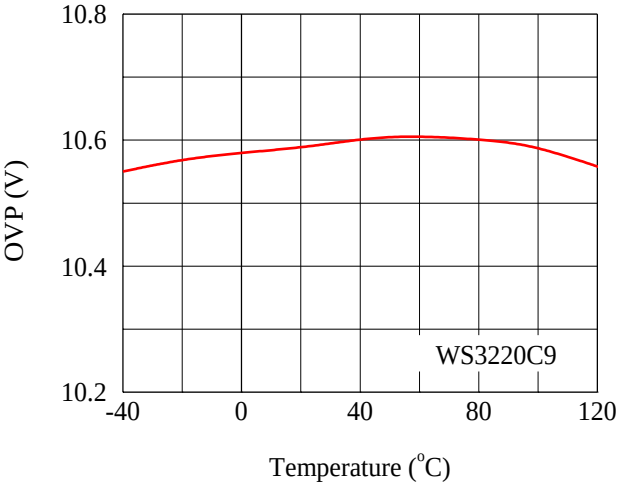
ON-Resistance vs. Load Current



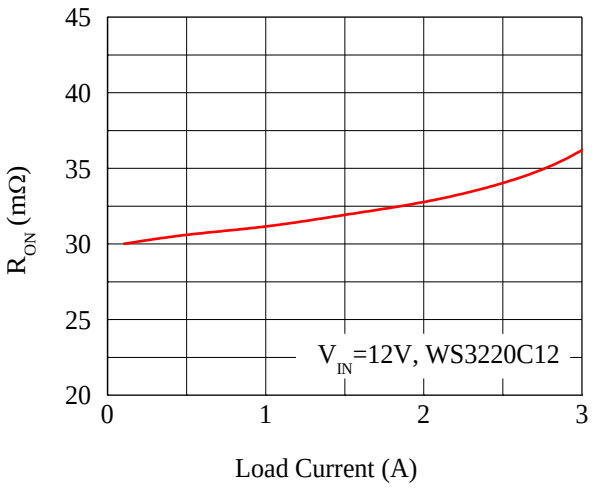
OVP Threshold vs. Temperature



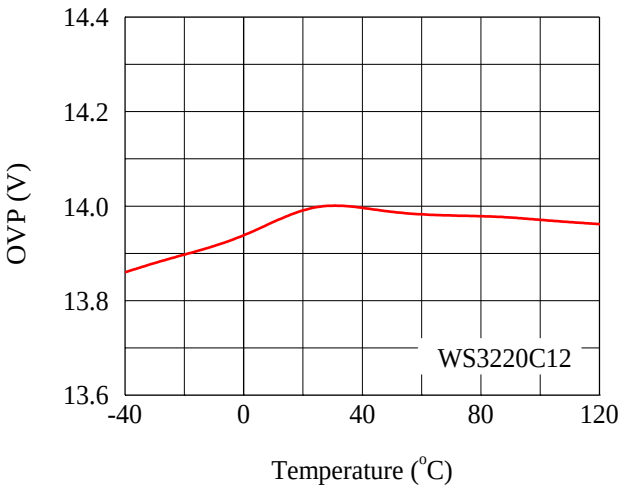
ON-Resistance vs. Load Current



OVP Threshold vs. Temperature



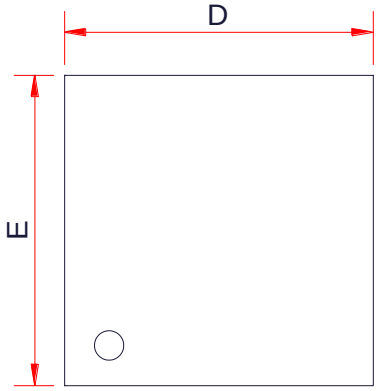
ON-Resistance vs. Load Current



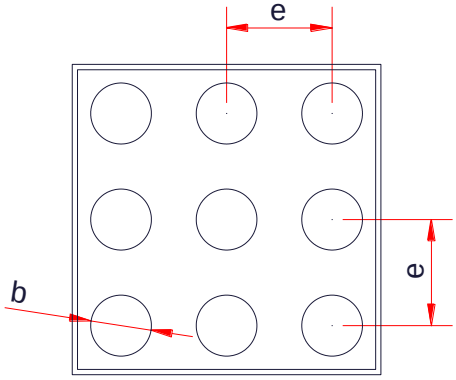
OVP Threshold vs. Temperature

Package Outline Dimensions

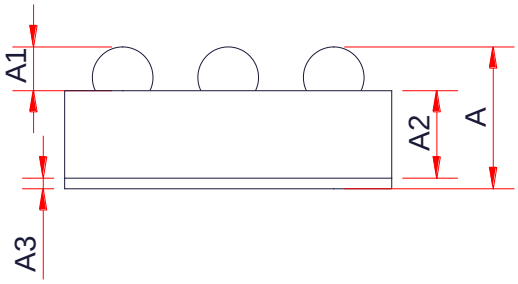
CSP-9L



TOP VIEW



BOTTOM VIEW

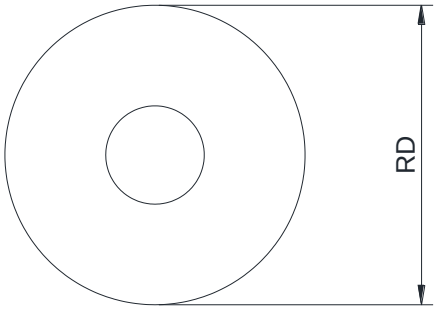


SIDE VIEW

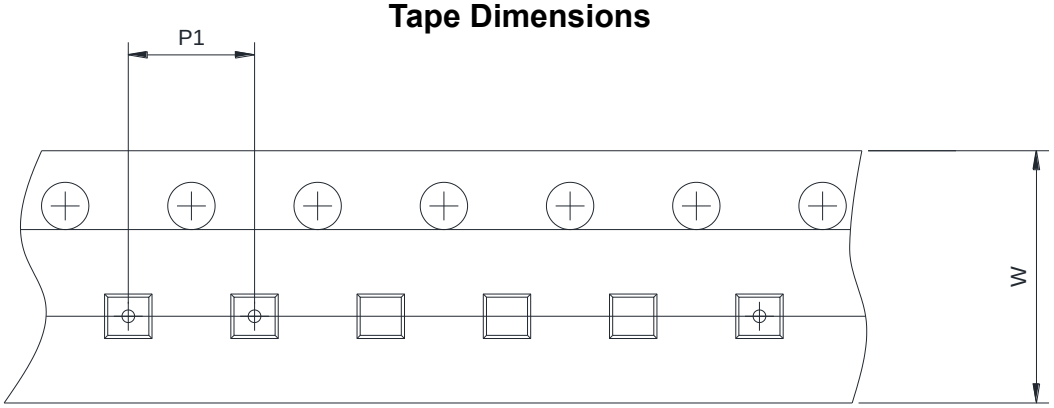
Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.54	-	0.61
A1	0.16	-	0.21
A2	0.35	-	0.38
A3	0.03 Ref.		
D	1.14	1.17	1.20
E	1.14	1.17	1.20
b	0.21	0.23	0.25
e	0.40 BSC		

Tape and Reel Information

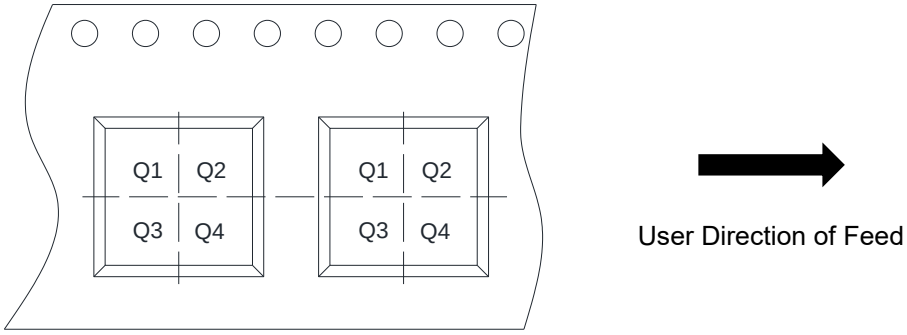
Reel Dimensions



Tape Dimensions



Quadrant Assignments For PIN1 Orientation In Tape



RD	Reel Dimension	☑ 7inch	☐ 13inch		
W	Overall width of the carrier tape	☑ 8mm	☐ 12mm		
P1	Pitch between successive cavity centers	☐ 2mm	☑ 4mm	☐ 8mm	
Pin1	Pin1 Quadrant	☑ Q1	☐ Q2	☐ Q3	☐ Q4