SOLID STATE OPTRONICS



AD4C213

1 Form A / 1 Form B
400V / 25 Ω
MOSFET Output Solid State Relay

Description

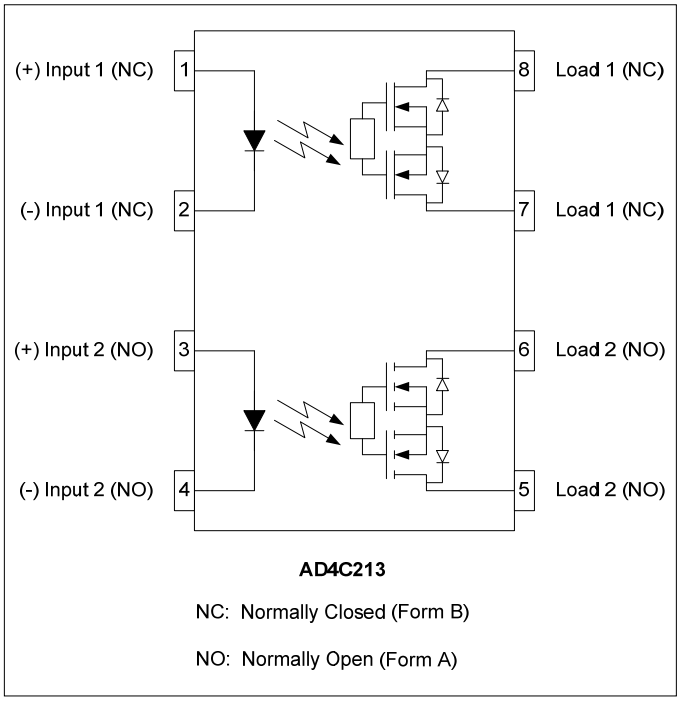
The AD4C213 is composed of two isolated relays; one normally open and one normally closed. Each relay has a bi-directional, single-pole, single-throw contact. Completely independent of its counterpart, each consists of an LED that activates an integrated circuit, which in turn drives a pair of DMOS transistors. These transistors are protected with free-wheeling diodes that can handle up to 1.5A of inrush current, making the relay ideal for switching lamps and highly inductive loads.

The AD4C213 comes standard in a miniature 8 pin DIP package making it ideal for high-density board applications.

Applications

- Meter Reading Systems
- Multiplexers
- Data Acquisition
- Medical Equipment
- Battery Monitoring
- Home / Safety Security Systems

Schematic Diagram



AD4C213

NC: Normally Closed (Form B)

NO: Normally Open (Form A)

Features

- 1 Form A / 1 Form B Integrated in 1 Package
- Low Input Control Current (1.5mA TYP)
- 150mA Maximum Continuous Load Current
- Low On Resistance (25Ω MAX – Both Poles)
- High Isolation Voltage (2.5kV$_{RMS}$, 3.75kV$_{RMS}$ -H Option)
- Long Life / High Reliability
- RoHS / Pb-Free / REACH Compliant

Agency Approvals

UL/C-UL:	File # E201932
VDE:	File # 40035191 (EN 60747-5-2)

Absolute Maximum Ratings

The values indicated are absolute stress ratings. Functional operation of the device is not implied at these or any conditions in excess of those defined in electrical characteristics section of this document. Exposure to absolute Maximum Ratings may cause permanent damage to the device and may adversely affect reliability.

Storage Temperature	-55 to +125°C
Operating Temperature	-40 to +85°C
Continuous Input Current	50mA
Transient Input Current	500mA
Reverse Input Control Voltage	5V
Input Power Dissipation	40mW
Output Power Dissipation	800mW
Solder Temperature – Wave (10sec)	260°C
Solder Temperature – IR Reflow (10sec)	260°C

Ordering Information

Part Number	Description
AD4C213	8 pin DIP, (50/Tube)
AD4C213-H	3.75kV$_{RMS}$ V$_{ISO}$, 8 pin DIP, (50/Tube)
AD4C213-S	8 pin SMD, (50/Tube)
AD4C213-HS	3.75kV$_{RMS}$, 8 pin SMD, (50/Tube)
AD4C213-STR	8 pin SMD, Tape and Reel (1000/Reel)
AD4C213-HSTR	3.75kV$_{RMS}$, 8 pin SMD, Tape and Reel (1000/Reel)

NOTE: Suffixes listed above are not included in marking on device for part number identification

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Electrical Characteristics, T_A = 25°C (unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Input Specifications						
LED Forward Voltage	V_F	-	1.2	1.5	V	I_F = 10mA
LED Reverse Voltage	BV_R	5	-	-	V	I_R = 10µA
Turn-On Current (Form A – Normally Open)	$I_{F(NO)}$	-	1.5	5	mA	I_O = 150mA
Turn-On Current (Form B – Normally Closed)	$I_{F(NC)}$	-	0.5	-	mA	I_O = 150mA
Turn-Off Current (Form A – Normally Open)	$I_{FOFF(NO)}$	-	0.5	-	mA	I_O = 150mA
Turn-Off Current (Form B – Normally Open)	$I_{FOFF(NC)}$	-	1.5	5	mA	I_O = 150mA
Output Specifications – Form A (Normally Open)						
Blocking Voltage	V_B	400	-	-	V	I_O=1µA
Continuous Load Current	I_O	-	-	150	mA	I_F=5mA
On Resistance	R_{ON}	-	17	25	Ω	I_F=5mA, I_O=150mA
Leakage Current	I_{Oleak}	-	0.2	1	µA	I_F=0mA, V_O=400V
Output Capacitance	C_{OUT}	-	25	-	pF	V_O=25V, f=1.0MHz
Offset Voltage	V_{OFFSET}	-	-	0.2	mV	I_F=5mA
Turn-On Time	T_{ON}	-	1	5	mS	I_F=5mA, I_O=150mA
Turn-Off Time	T_{OFF}	-	0.05	5	mS	I_F=0mA, I_O=150mA
Output Specifications – Form B (Normally Closed)						
Blocking Voltage	V_B	400	-	-	V	I_F=5mA, I_O=1µA
Continuous Load Current	I_O	-	-	150	mA	I_F=0mA
On Resistance	R_{ON}	-	20	25	Ω	I_F=0mA, I_O=150mA
Leakage Current	I_{Oleak}	-	0.2	1	µA	I_F=5mA, V_O=400V
Output Capacitance	C_{OUT}	-	15	-	pF	I_F=5mA, V_O=25V, f=1.0MHz
Offset Voltage	V_{OFFSET}	-	-	0.2	mV	I_F=0mA
Turn-On Time	T_{ON}	-	0.1	5	mS	I_F=0mA, I_O=150mA
Turn-Off Time	T_{OFF}	-	1	5	mS	I_F=5mA, I_O=150mA
Coupled Specifications						
Coupled Capacitance	$C_{COUPLED}$	-	3	-	pF	
Contact Transient Ratio	-	2,000	7,000	0	V/µS	dV = 50V
Isolation Specifications						
Isolation Voltage	V_{ISO}	2,500	-	-	V_{RMS}	RH ≤ 50%, t=1min
-H Option	V_{ISO}	3,750	-	-	V_{RMS}	RH ≤ 50%, t=1min
Input-Output Resistance	R_{I-O}	-	10^{12}	-	Ω	V_{I-O} = 500V_{DC}

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AD4C213 Performance & Characteristics Plots, T_A = 25°C (unless otherwise specified)

Figure 1: *Normally Open*
Typical Turn-On Time Distribution
(N = 100, T_a = 25ºC)

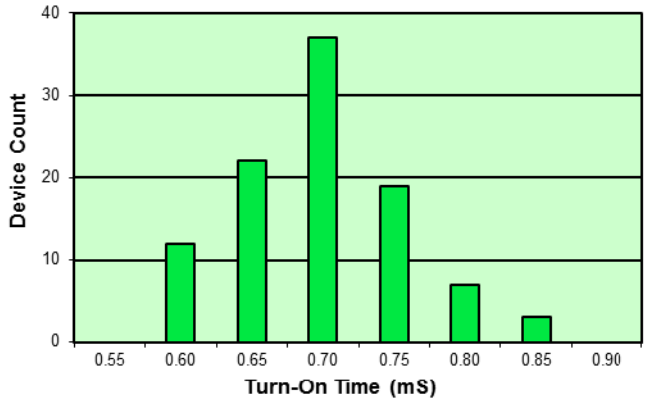


Figure 2: *Normally Open*
Typical Turn-Off Time Distribution
(N = 100, T_a = 25ºC)

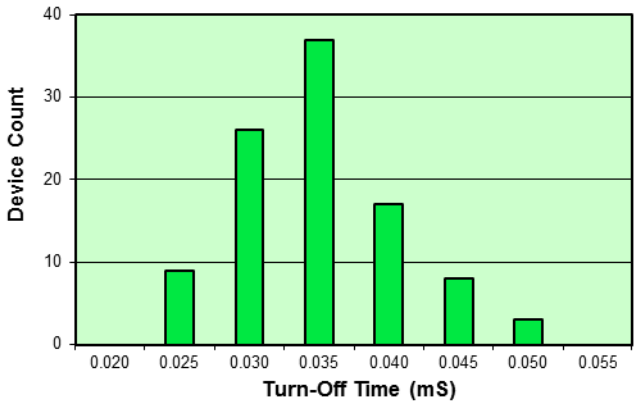


Figure 3: *Normally Open*
Typical On-Resistance Distribution
(N = 100, T_a = 25ºC)

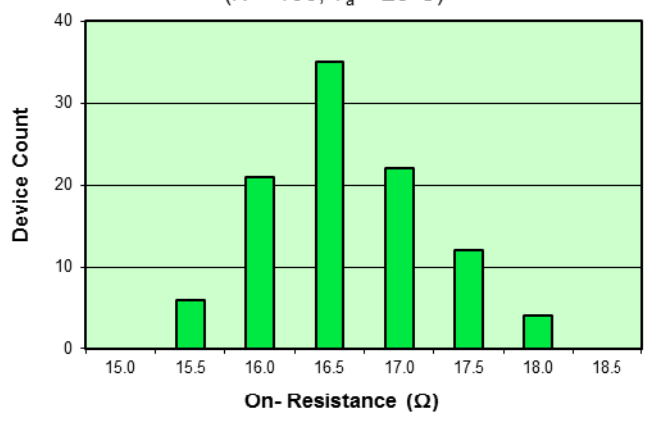


Figure 4: *Normally Open*
Typical Output Leakage Current Distribution
(N = 100, T_a = 25ºC)

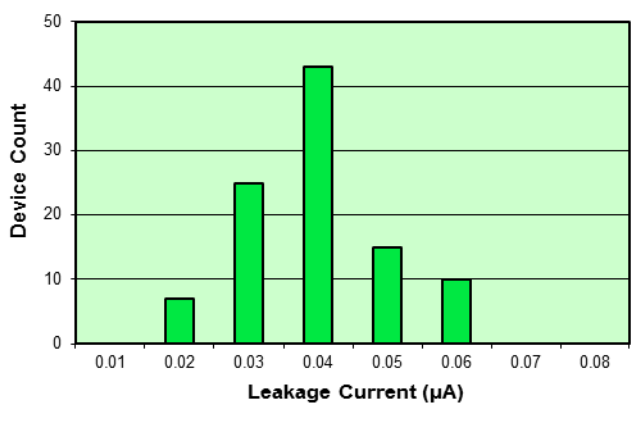


Figure 5: *Normally Open*
Typical Blocking Voltage Distribution
(N = 100, Ta = 25ºC)

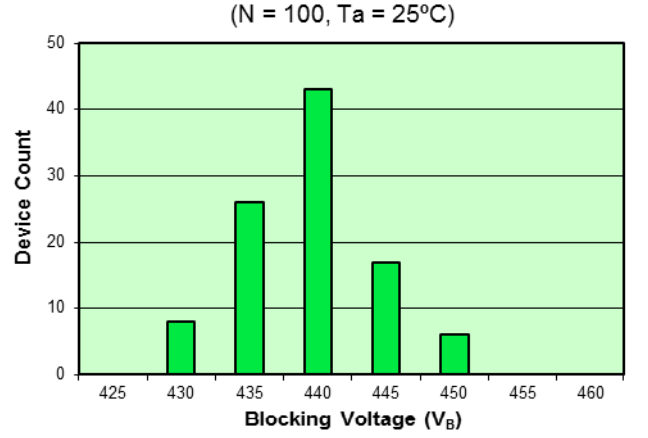
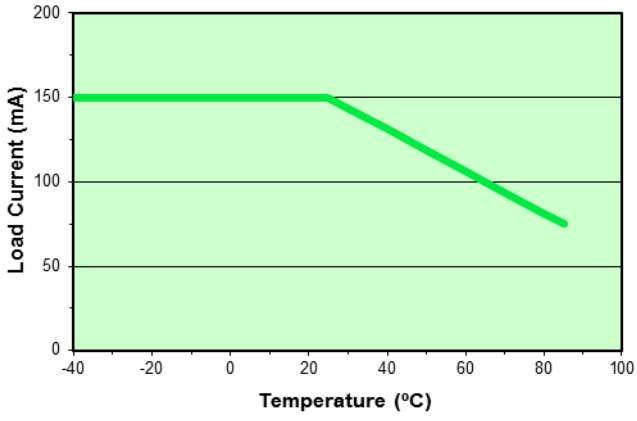


Figure 6: *Normally Open*
Maximum Load Current vs. Temperature



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AD4C213 Performance & Characteristics Plots, Cont… T_A = 25°C (unless otherwise specified)

Figure 7: *Normally Closed*
Typical Turn-On Time Distribution
(N = 100, T_a = 25ºC)

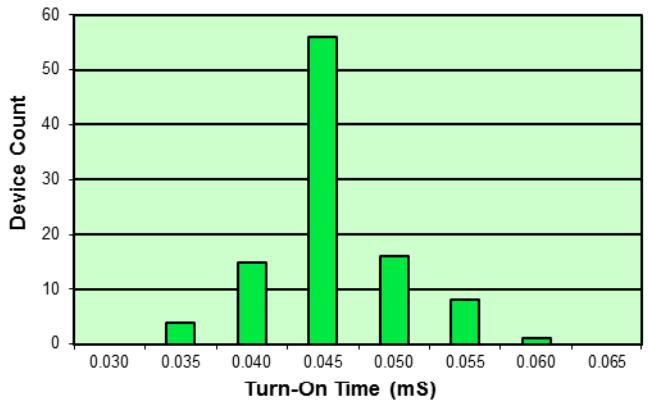


Figure 8: *Normally Closed*
Typical Turn-Off Time Distribution
(N = 100, T_a = 25ºC)

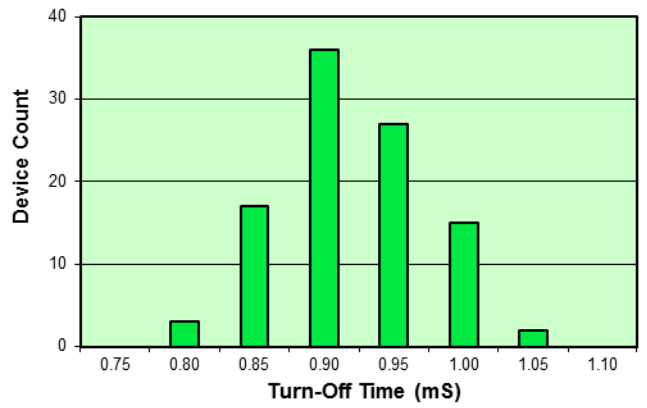


Figure 9: *Normally Closed*
Typical On-Resistance Distribution
(N = 100, T_a = 25ºC)

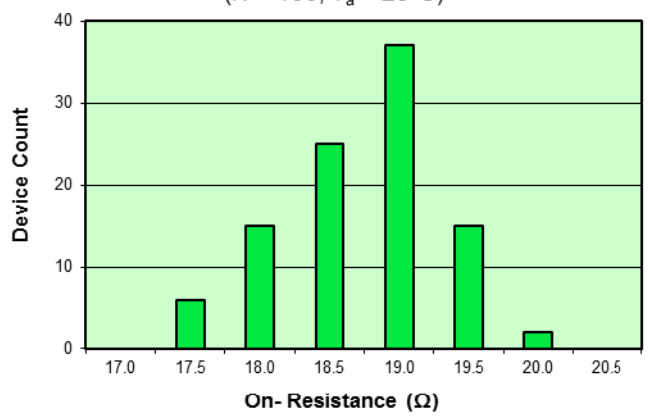


Figure 10: *Normally Closed*
Typical Output Leakage Current Distribution
(N = 100, T_a = 25ºC)

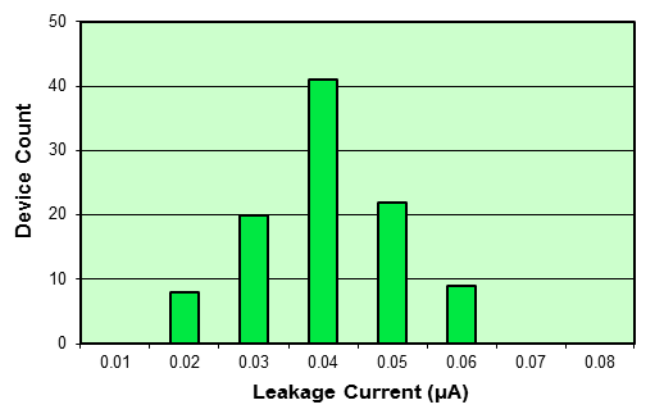


Figure 11: *Normally Closed*
Typical Blocking Voltage Distribution
(N = 100, Ta = 25ºC)

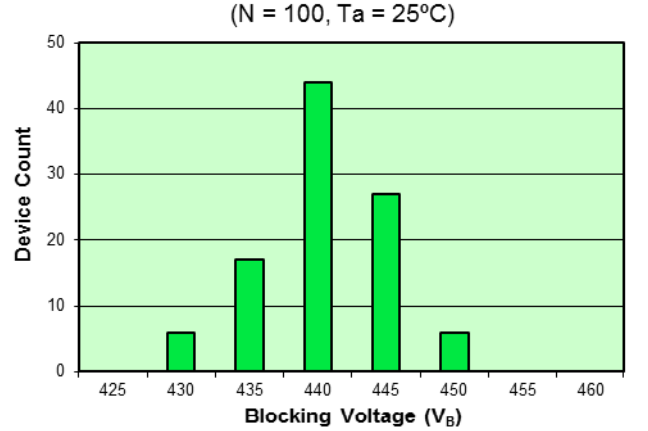
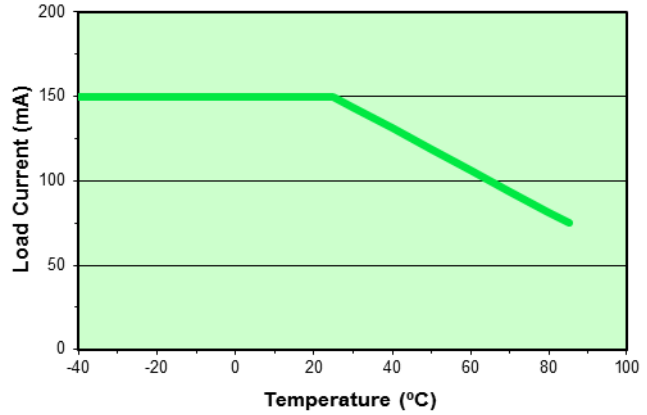


Figure 12: *Normally Closed*
Maximum Load Current vs. Temperature



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AD4C213 Solder Temperature Profile Recommendations

(1) *Infrared Reflow:*

Refer to the following figure as an example of an optimal temperature profile for single occurrence infrared reflow. Soldering process should not exceed temperature or time limits expressed herein. Surface temperature of device package should not exceed 250ºC:

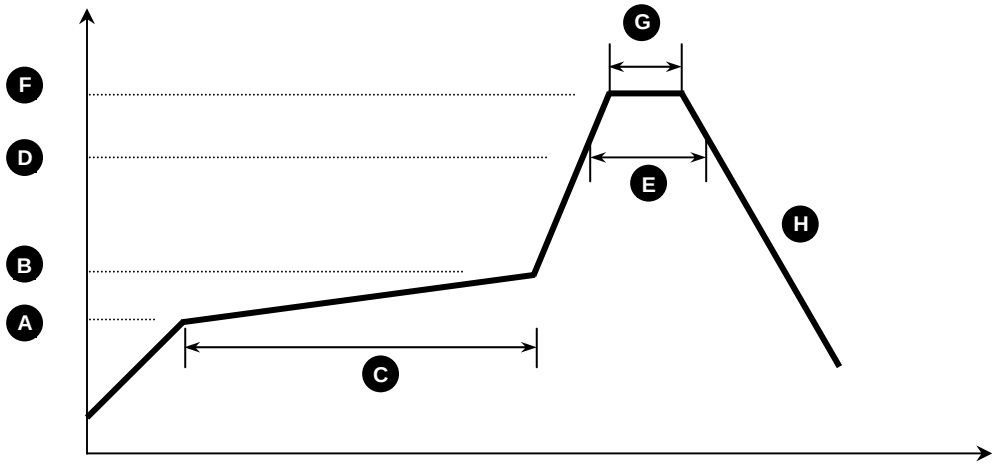


Figure 1

Process Step	Description	Parameter
A	Preheat Start Temperature (ºC)	150ºC
B	Preheat Finish Temperature (ºC)	180ºC
C	Preheat Time (s)	90 - 120s
D	Melting Temperature (ºC)	230ºC
E	Time above Melting Temperature (s)	30s
F	Peak Temperature, at Terminal (ºC)	260ºC
G	Dwell Time at Peak Temperature (s)	10s
H	Cool-down (ºC/s)	<6ºC/s

(2) *Wave Solder:*

Maximum Temperature:	260ºC (at terminal)
Maximum Time:	10s
Pre-heating:	100 - 150ºC (30 - 90s)
Single Occurrence	

(3) *Hand Solder:*

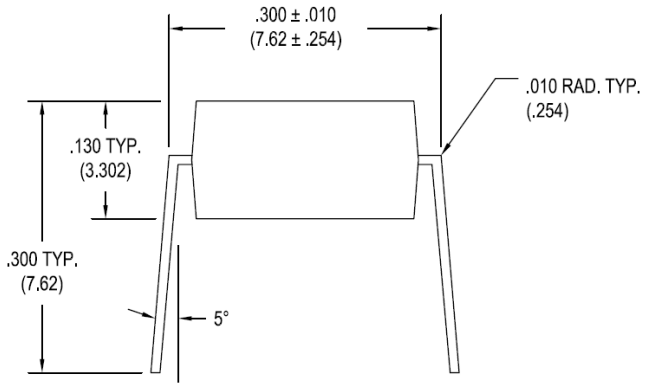
Maximum Temperature:	350ºC (at tip of soldering iron)
Maximum Time:	3s
Single Occurrence	

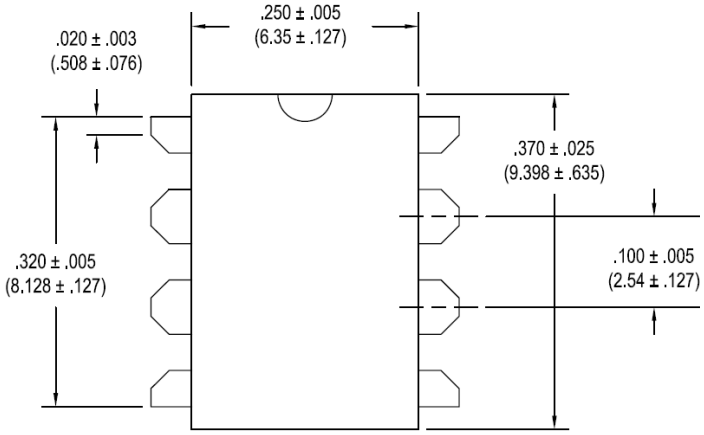
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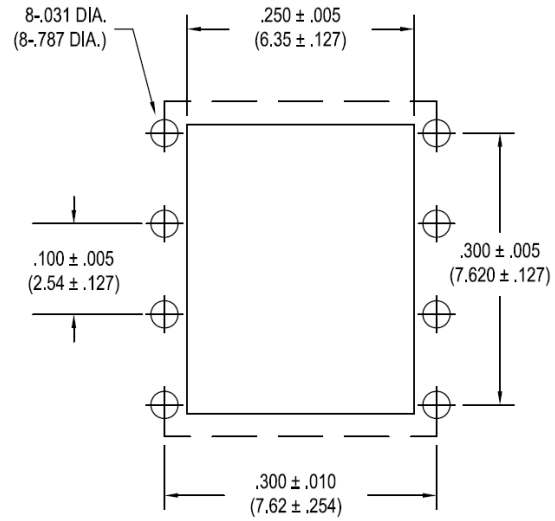
AD4C213 Package Dimensions

8 PIN DIP Package

Note: *All dimensions in inches ["] with millimeters in parenthesis ()*





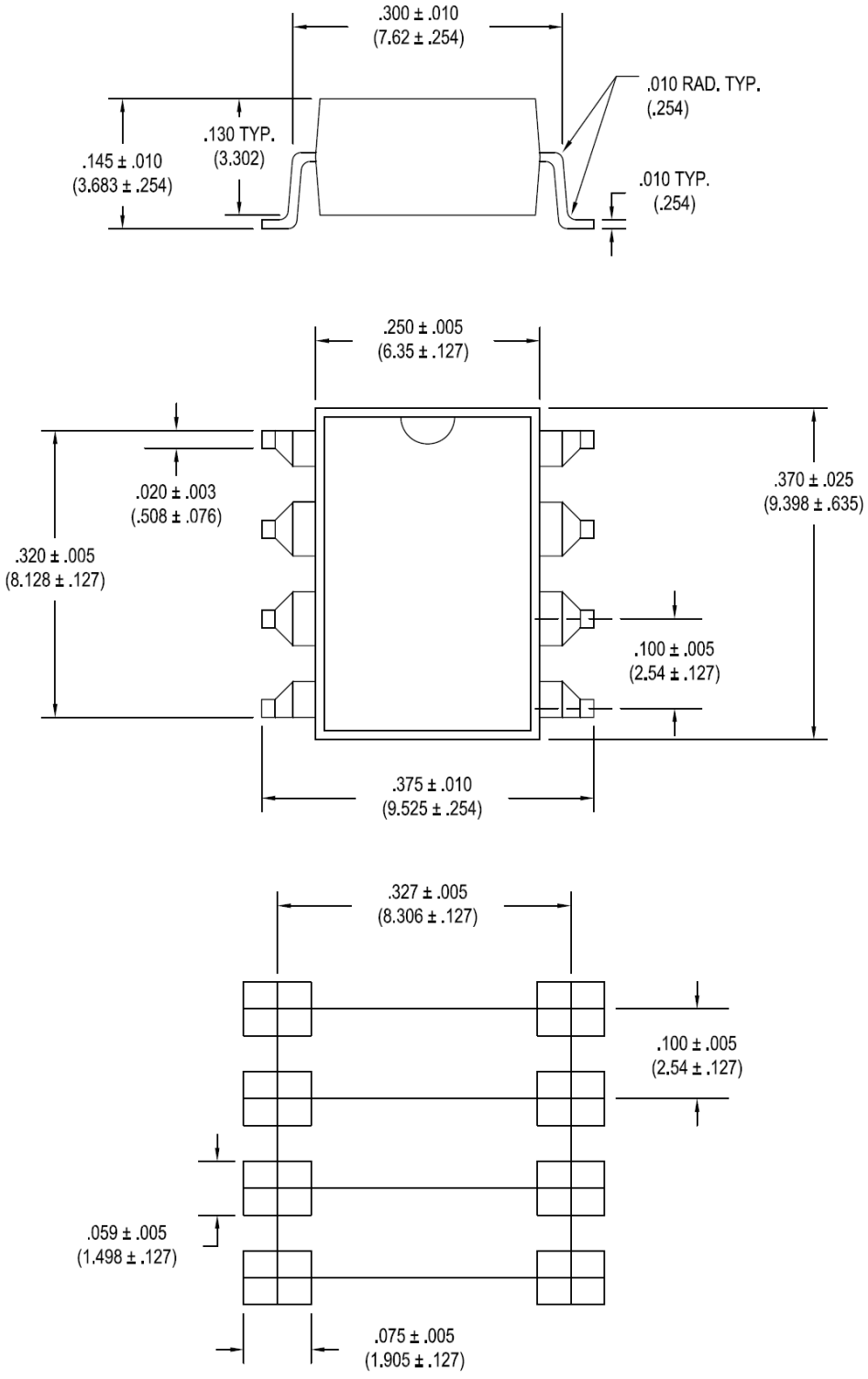


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AD4C213 Package Dimensions

8 PIN SMD Surface Mount Package (-S)

Note: *All dimensions in inches ["] with millimeters in parenthesis ()*

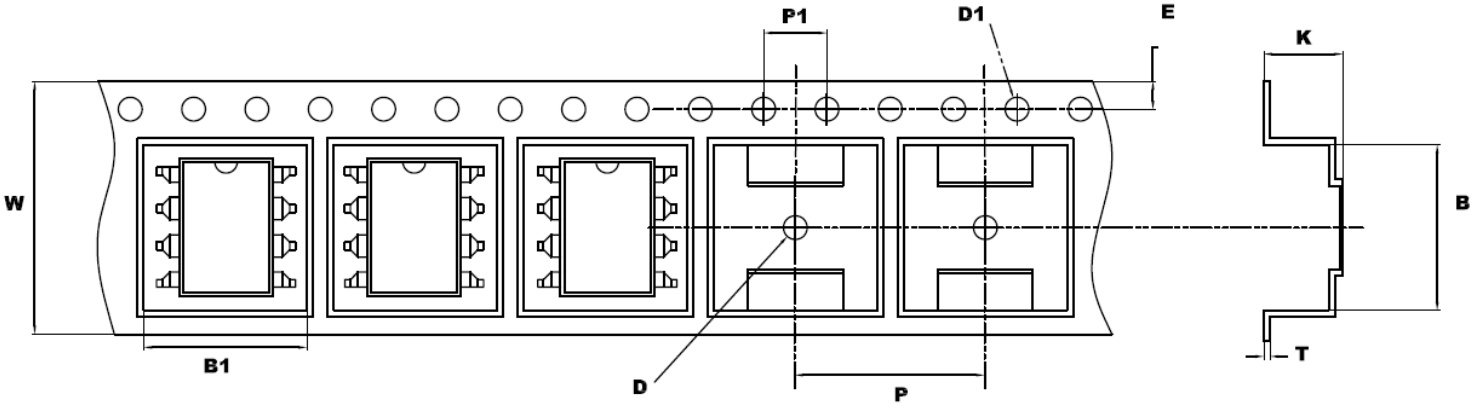


AD4C213 Package Dimensions

8 PIN SMD Tape & Reel (-STR)

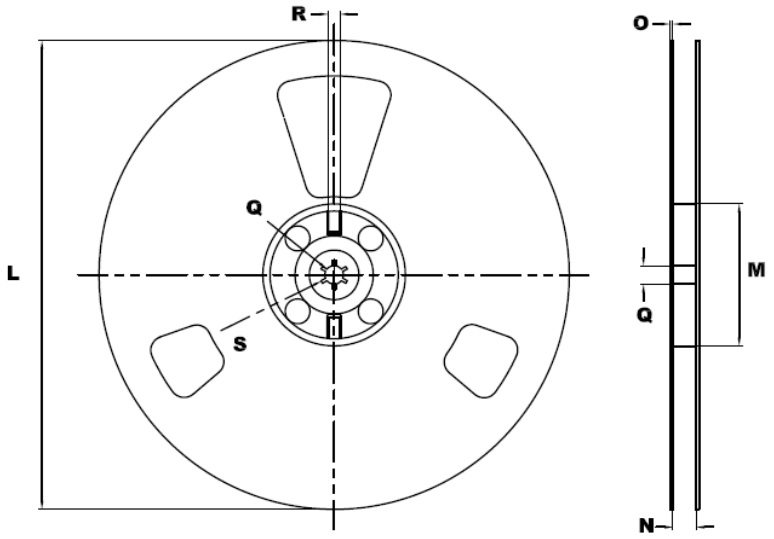
Note: *All dimensions in millimeters*

Outline and Dimension (Tape)



W	B	B1	P	P1	K	E	T	D	D1
16.00 ±0.1	10.50 ±0.1	10.30 ±0.1	12.00 ±0.1	4.00 ±0.1	5.00 ±0.1	1.75 ±0.1	0.40 ±0.1	1.50 ±0.1	1.50 ±0.1

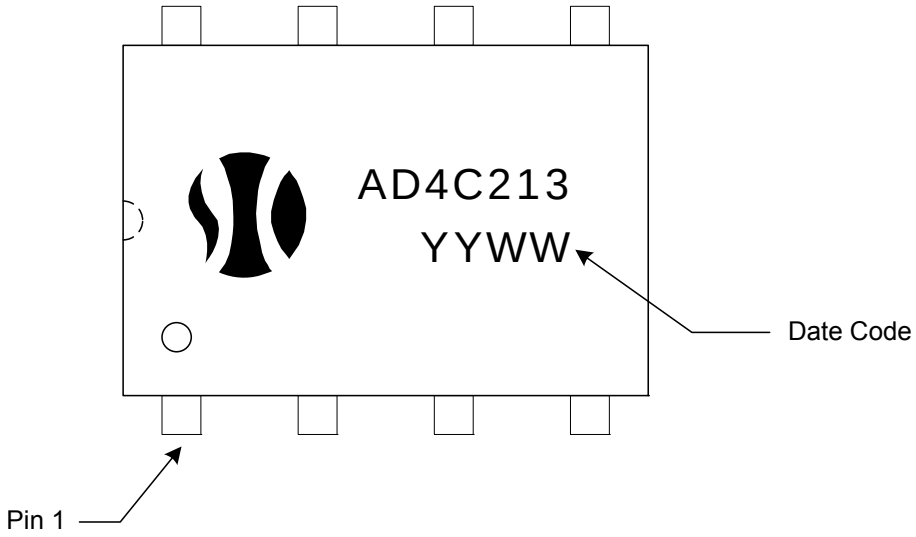
Outline and Dimensions (Reel)



Packaging: 1,000 pcs / reel

L	M	N	O	Q	R	S
330.00	100.00	16.40 +0.2	2.00 ±0.1	13.00 ±0.2	2.00	10.00

AD4C213 Package Marking



AD4C213 Package Weights

Device	Single Unit	Full Tube (50pcs)	Full Pouch (10 tubes)	Full Reel (1000pcs)
AD4C213-(H)	0.54	48	490	-
AD4C213-(H)S	0.53	46	470	-
AD4C213-(H)STR	0.53	-	-	952

Note: *All weights above are in GRAMS, and include packaging materials where applicable*

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