

PS4157N**Negative Voltage SPDT Switch**

Features

- Operating Voltage Range: $V_{EE} = -12\text{ V to }-4\text{ V}$
- Switch Signal Voltage Range: $V_{IS} = V_{EE} \text{ to GND}$
- Positive Control Signal Voltage: $V_{IN} = 0 \text{ to } 3.3\text{ V}$
- Low ON Resistance: $R_{ON} \leq 5\ \Omega$ when $V_{EE} = -10\text{ V}$
- Extended Industrial Temperature Range: -55°C to 125°C
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](#) or your local Diodes representative.
<https://www.diodes.com/quality/product-definitions/>
- Packaging (Pb-free and Green):
 - 6-pin Small Compact SC70

Description

The DIODES™ PS4157N is a bidirectional, single-channel, single-pole double-throw (SPDT) analog switch. The device can pass analog and digital negative voltages that may vary across the full power-supply range (from V_{EE} to GND).

Applications

- 5G NR AAU

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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Pin Configuration

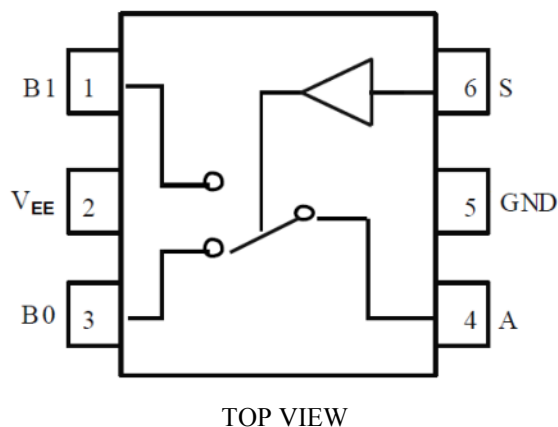


Figure 1. 6-lead SC70

Pin Description

Pin#	Pin Name	Description
1	B1	Data Port (NO)
2	VEE	Negative Voltage Power Supply
3	B0	Data Port (NC)
4	A	Data Port (COM)
5	GND	Ground
6	S	Select Pin

Logic Function Table

Select Pin (S)	Function
0	B0 Connected to A
1	B1 Connected to A

Maximum Ratings

Supply Voltage, V_{EE}	-13 V to +0.5 V
Switch Input / Output Voltage, V_{IS}	$V_{EE} - 0.5$ V to +0.5 V
Select Input Voltage, V_{IN}	-0.5 V to +3.6 V
Switch Input / Output Diode Current, I_{IOK}	±50 mA
Select Input Diode Current, I_{IK}	-50 mA
Power Dissipation, P_D	60 mW
Lead Temperature, T_L	260 °C
Junction Temperature, T_J	150 °C
Storage Temperature, T_S	-65 °C to +150 °C
Thermal Resistance, θ_{JA}	400 °C/W
Latch-up	±300 mA
ESD (HBM)	3 kV
ESD (MM)	150 V

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{EE}	Supply Voltage	-	-12	-	-4	V
V_{IN}	Select Input Voltage	-	0	-	3.3	V
V_{IS}	Switch Input / Output Voltage	-	V_{EE}	-	0	V
T_A	Operating Temperature	-	-55	25	125	°C
tr, tf	Select Input Rise and Fall Time ⁽¹⁾	-	0		100	ns/V

1. Select input must be held HIGH or LOW; it must not be made to float.

DC Electrical Characteristics

(Voltage referenced to GND; $T_A = -55$ °C to 125 °C; unless otherwise specified. Typical characteristics are T_A at 25 °C.)

Parameter	Description	Condition	Min.	Typ.	Max.	Units
Power Supply						
I _{DD}	Quiescent Supply Current	V _{IN} = 0 V or 3.3 V, V _{IS} = V _{EE} or 0 V, -10 V ≤ V _{EE} ≤ -4 V	-	25	80	μA
Analog Switch						
R _{ON}	Maximum ON Resistance ⁽¹⁾⁽²⁾	V _{IN} = V _{IL} or V _{IH} , V _{IS} = V _{EE} to 0 V, I _{LOAD} ≤ 10 mA				
		V _{EE} = -12V	-	2.6	4.5	Ω
		V _{EE} = -10V	-	3.0	5	
		V _{EE} = -8V	-	3.5	5.8	
		V _{EE} = -6V	-	4.5	7.5	
		V _{IN} = V _{IL} or V _{IH} , V _{IS} = V _{EE} to 0 V, I _{LOAD} ≤ 5 mA, V _{EE} = -4 V	-	9	15	
R _{FLAT}	ON Resistance Flatness ⁽²⁾	V _{IN} = V _{IL} or V _{IH} , V _{IS} = V _{EE} to 0 V, I _{LOAD} ≤ 10 mA				
		V _{EE} = -12V	-	0.4	-	Ω
		V _{EE} = -10V	-	1.2	-	
		V _{EE} = -8V	-	1.7	-	
		V _{EE} = -6V	-	2.5	-	
		V _{IN} = V _{IL} or V _{IH} , V _{IS} = V _{EE} to 0V,	-	6	-	

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Parameter	Description	Condition	Min.	Typ.	Max.	Units
		$I_{LOAD} \leq 5 \text{ mA}$, $V_{EE} = -4 \text{ V}$				
ΔR_{ON}	ON Resistance Mismatch Between Channels ⁽²⁾⁽³⁾	$V_{EE} = -12 \text{ V}$, $I_A = -10 \text{ mA}$, $V_{Bn} = -8.4 \text{ V}$	-	0.2	-	Ω
		$V_{EE} = -10 \text{ V}$, $I_A = -10 \text{ mA}$, $V_{Bn} = -7 \text{ V}$		0.2		
		$V_{EE} = -8 \text{ V}$, $I_A = -10 \text{ mA}$, $V_{Bn} = -5.6 \text{ V}$	-	0.25	-	
		$V_{EE} = -6 \text{ V}$, $I_A = -10 \text{ mA}$, $V_{Bn} = -4.2 \text{ V}$	-	0.25	-	
		$V_{EE} = -4 \text{ V}$, $I_A = -5 \text{ mA}$, $V_{Bn} = -2.8 \text{ V}$	-	0.3	-	
$I_{Bn(OFF)}$	B_0 or B_1 OFF Leakage Current	$V_{IN} = V_{IL}$ or V_{IH} , $V_{Bn} = 0 \text{ V}$, $V_A = V_{EE}$ to 0 V , $V_{EE} = -10 \text{ V}$	-	± 1.0	± 20	μA
$I_{A(ON)}$	A On Leakage Current	$V_{IN} = V_{IL}$ or V_{IH} , $V_{EE} = -10 \text{ V}$ $V_A = 0 \text{ V}$ or V_{EE} , $V_{B0} = 0 \text{ V}$ or V_{EE} with V_{B1} floating, or $V_{B1} = 0 \text{ V}$ to V_{EE} with V_{B0} floating	-	± 2.0	± 20	μA
Select Input						
V_{IH}	High-Level Input Voltage	$V_{EE} = -12 \text{ V}$	1.8	-	3.3	V
		$V_{EE} = -10 \text{ V}$	1.6	-	3.3	
		$V_{EE} = -8 \text{ V}$	1.35	-	3.3	
		$V_{EE} = -6 \text{ V}$	1.2	-	3.3	
		$V_{EE} = -4 \text{ V}$	1.0	-	3.3	
V_{IL}	Low-Level Input Voltage	$V_{EE} = -12 \text{ V}$	0	-	0.8	V
		$V_{EE} = -10 \text{ V}$	0	-	0.7	
		$V_{EE} = -8 \text{ V}$	0	-	0.6	
		$V_{EE} = -6 \text{ V}$	0	-	0.5	
		$V_{EE} = -4 \text{ V}$	0	-	0.4	
I_{IN}	Input Leakage Current	$V_{IN} = 0 \text{ V}$ or 3.3 V , $V_{EE} = -10 \text{ V}$	-	± 0.2	± 50	μA
		$V_{IN} = 0 \text{ V}$ or 3.3 V , $V_{EE} = -10 \text{ V}$, T_A at 25°C			± 0.5	

Note:

- $R_{ON} = (\Delta V_{ON}) / I_{LOAD}$. ΔV_{ON} = Voltage drop between A and Bn pins
- Parameters is characterized but not tested in production.
- $\Delta R_{ON} = R_{ONMAX} - R_{ONMIN}$ is measured at same V_{EE} , T_A , V_{IS} and I_{LOAD} .

AC Electrical Characteristics

(Voltage referenced to GND; $T_A = -55^\circ\text{C}$ to 125°C ; unless otherwise specified. Typical characteristics are T_A at 25°C .)

Parameter	Description	Condition	Min.	Typ.	Max.	Units
t _{PHL} , t _{PLH}	Propagation Delay, Bus to Bus (A to B _n) ⁽¹⁾	C _L = 100 pF, -12V ≤ V _{EE} ≤ -4V (Figure 2, 3)	-	-	2	ns
t _{PZL} , t _{PZH}	Switch Enable Time Turn-On Time (A to B _n)	C _L = 100 pF (Figure 2, 3)				
		V _{EE} = -12V	-	-	220	ns
		V _{EE} = -10V	-	-	175	
		V _{EE} = -8V	-	-	165	
		V _{EE} = -6V	-	-	165	
		V _{EE} = -4V	-	-	200	
t _{PLZ} , t _{PHZ}	Switch Disable Time Turn-Off Time (A to B _n)	C _L = 100 pF (Figure 2,3)				
		V _{EE} = -12V	-	-	225	ns
		V _{EE} = -10V	-	-	155	
		V _{EE} = -8V	-	-	150	

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Parameter	Description	Condition	Min.	Typ.	Max.	Units
		V _{EE} = -6V	-	-	120	
		V _{EE} = -4V	-	-	145	
t _B	Switch Break Time	R _L = 50 Ω, C _L = 100 pF, V _{IS} = -2.5V (Figure 4)				
		V _{EE} = -12V	5		60	ns
		V _{EE} = -10V	5		60	
		V _{EE} = -8V	7		75	
		V _{EE} = -6V	10		90	
		V _{EE} = -4V	20		135	
t _{POR}	Power ON Reset Time	-12 V ≤ V _{EE} ≤ -4V	-	-	20	μs
Q	Charge Injection ⁽¹⁾	C _L = 1 nF, V _{GEN} = 0V, R _{GEN} = 0 Ω (Figure 5)				
		V _{EE} = -12V	-	170	-	pC
		V _{EE} = -10V	-	120	-	
		V _{EE} = -8V	-	95	-	
		V _{EE} = -6V	-	55	-	
		V _{EE} = -4V	-	40	-	
BW	-3 dB Bandwidth	R _L = 50 Ω, -12V ≤ V _{EE} ≤ -4V (Figure 10)	-	200	-	MHz
QIRR	Off-Isolation ⁽²⁾	R _L = 50 Ω, f = 10 MHz, -12V ≤ V _{EE} ≤ -4V (Figure 6)	-	-33	-	dB
Xtalk	Crosstalk	R _L = 50 Ω, f = 10 MHz, -12V ≤ V _{EE} ≤ -4V (Figure 7)	-	-42	-	dB

Note:

- Guaranteed by design but not tested.
- Off Isolation = $20\ \text{Log}_{10} [V_A / V_{B_n}]$

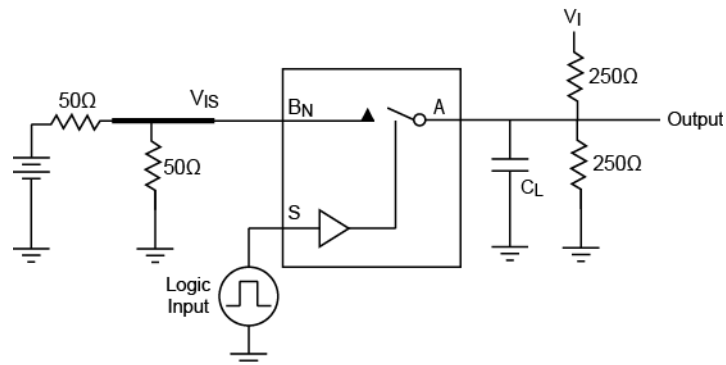
Capacitance ⁽¹⁾

(Typical characteristics are $T_A = 25^\circ C$)

Parameter	Description	Condition	Min.	Typ.	Max.	Units
C_{IN}	Input Capacitance, Select Input	$V_{EE} = -12\ V$, $f = 1\ MHz$	-	6	-	pF
C_{IOB_OFF}	B-Port OFF Capacitance	$V_{EE} = -10\ V$, $f = 1\ MHz$ (Figure 8)	-	45	-	
C_{IOA_ON}	A-Port Capacitance when Switch is Enabled	$V_{EE} = -10\ V$, $f = 1\ MHz$ (Figure 9)	-	100	-	

Note:

- Capacitance is characterized but not tested in production



Note: C_L includes load and stray capacitance.

Input PRR = 100kHz, $t_w = 5\mu s$

Parameter	V_I	V_{IS}
t_{PLH}/t_{PHL}	Open	Source
t_{PZL}/t_{PLZ}	GND	V_{EE}
t_{PZH}/t_{PHZ}	$2 \times V_{EE}$	GND

Figure 2. AC Test Circuit

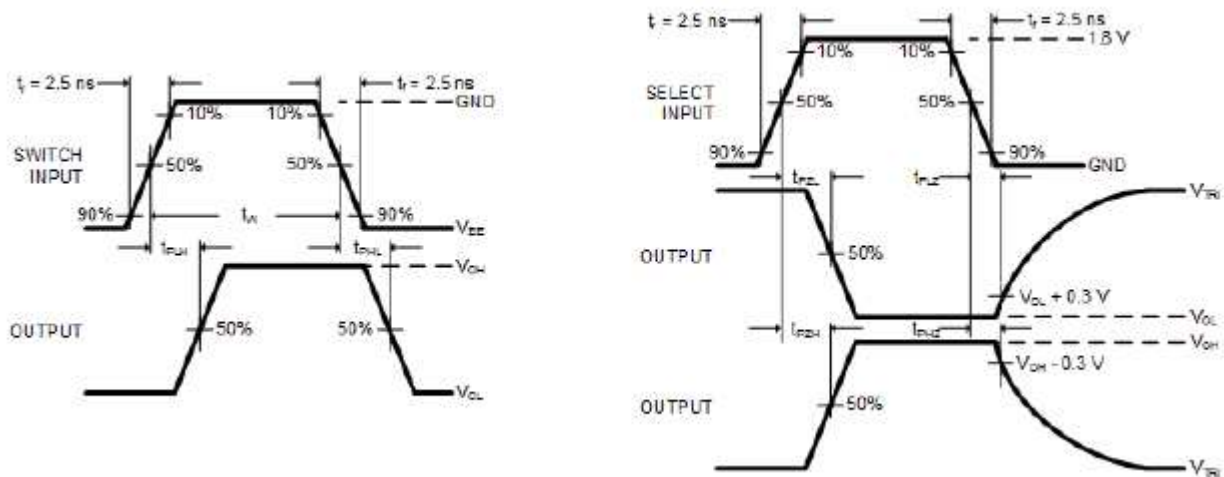


Figure 3. AC Test Waveforms

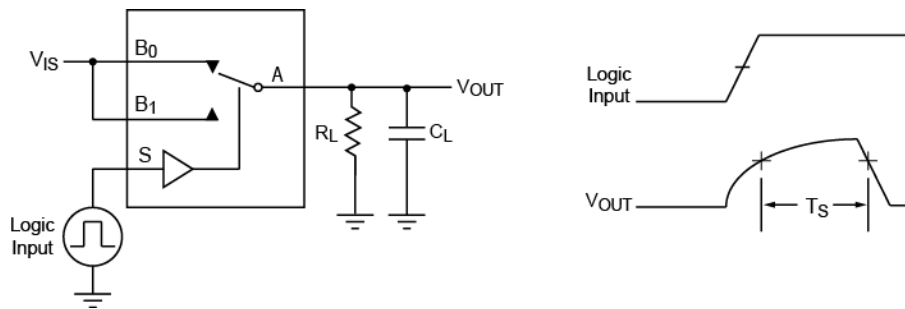


Figure 4. Switch Break Interval Timing

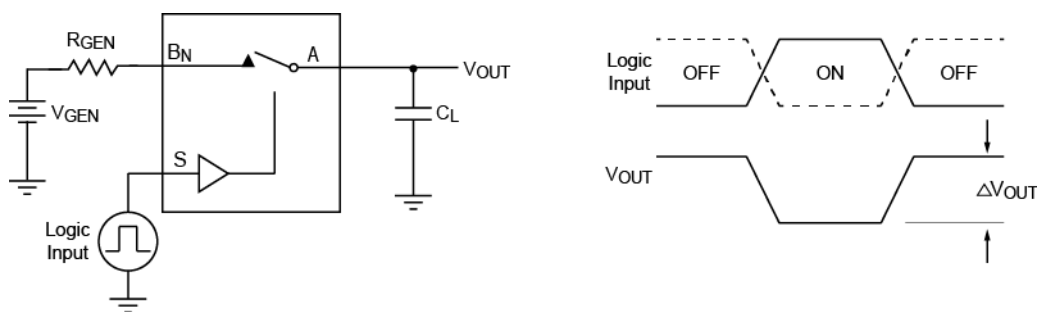


Figure 5. Charge Injection Test

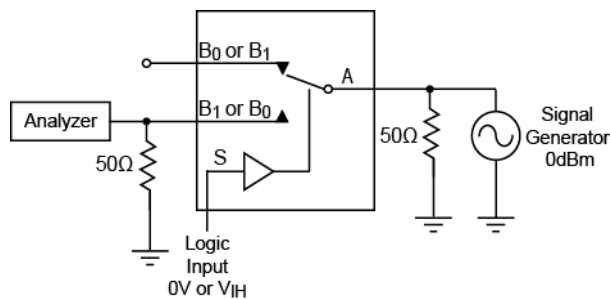


Figure 6. Off Isolation

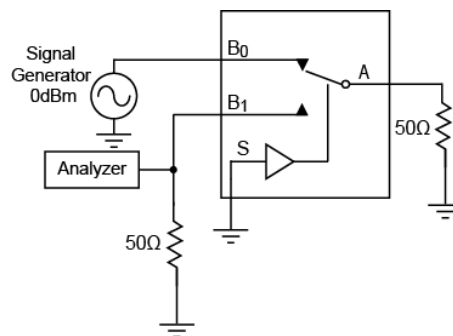


Figure 7. Crosstalk

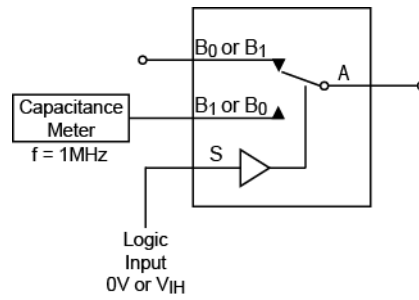


Figure 8. Channel Off Capacitance

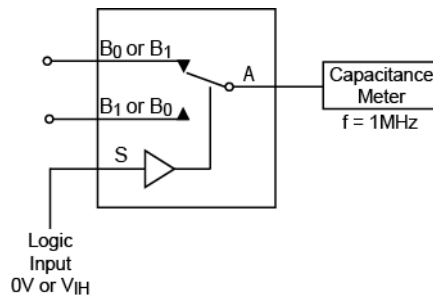


Figure 9. Channel On Capacitance

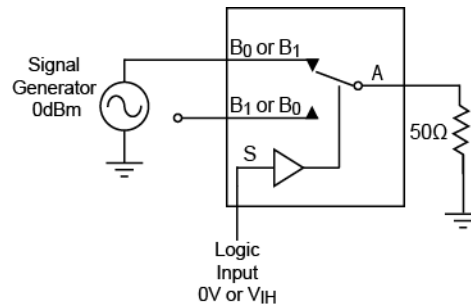
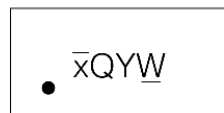


Figure 10. Bandwidth

Part Marking

xQ = PS4157NCE

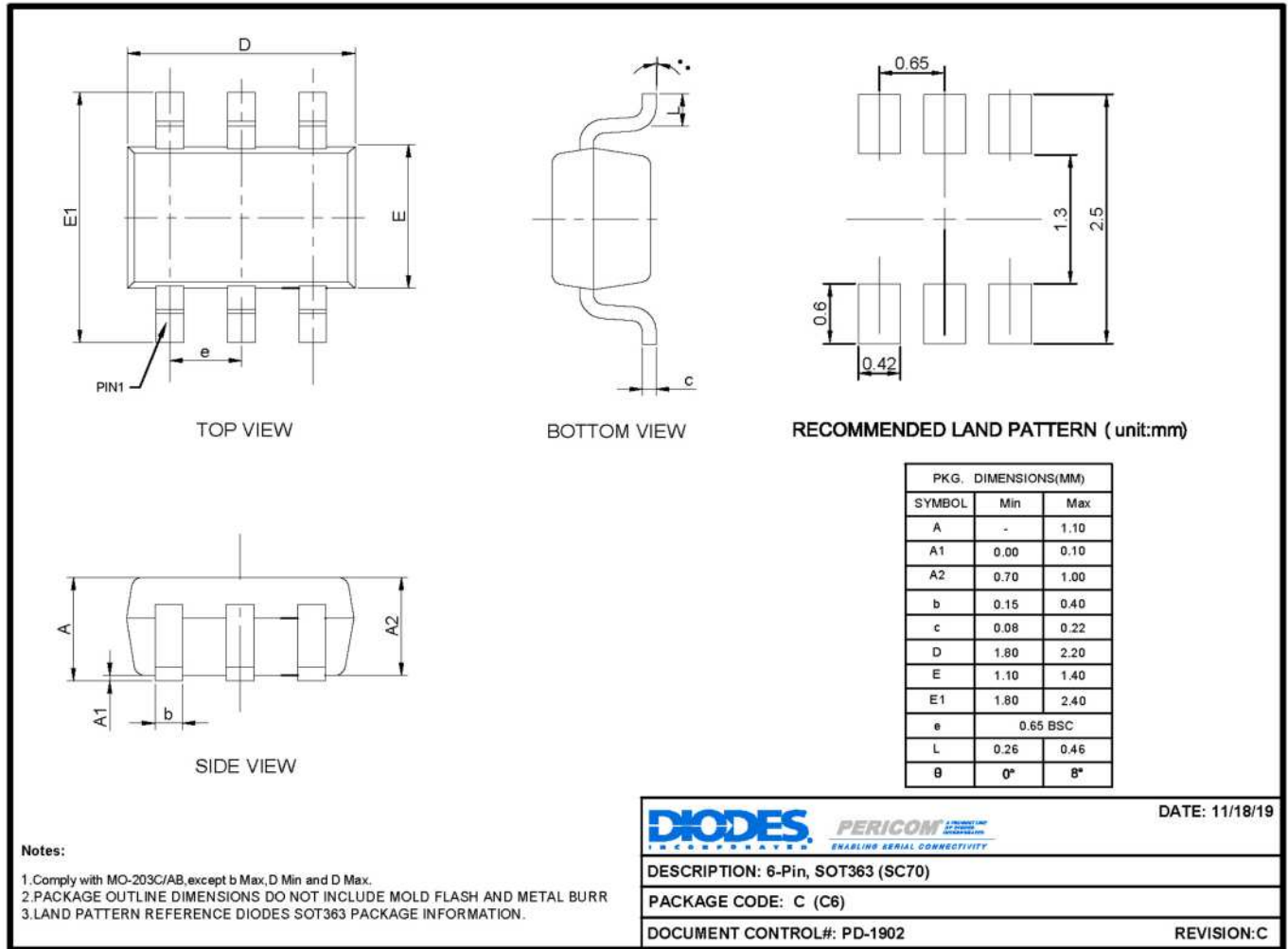


Y: Date Code (Year)

W: Date Code (Workweek)

Packaging Mechanical

C-6 (SC70)



19-1160

For latest package info.

please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>

Ordering Information

Part Number	Package Code	Package Description
PS4157NCEX	C	6-Pin, SOT363 (SC70)

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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