Low Voltage 3.3-Ω SPDT Analog Switch

Features

- Supply Voltage: 1.8 V to 5.5 V
- Low Leakage: Maximum 500 pA at 85℃
- Low ON-State Resistance: Typical 3.3 Ω at V_{DD} = 5 V
- Low On-State Resistance Flatness: Typical 0.8 Ω at V_{DD} = 5 V
- −3 dB Bandwidth > 300 MHz
- Rail-to-Rail Operation
- Fast Switching Times:
  - t_{ON} = 11 ns
  - t_{OFF} = 6 ns
- Break-Before-Making Switching
- Fail Safe Logic
- Operation Temperature Range: −40°C to 125°C

Applications

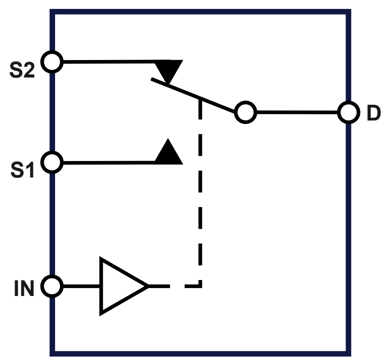
- Industry Control Systems
- Battery-Powered Systems
- Audio Signal Routing
- Portable Instruments and Mobile Devices

Description

The TPW3126P is a monolithic CMOS SPDT switch. This switch is designed on a submicron process that provides low power dissipation yet gives high switching speed, low on resistance, and low leakage currents. The TPW3126P can operate from a single-supply range of 1.8 V to 5.5 V.

The TPW3126P is available in the SOT363 package, and is characterized from −40°C to +125°C.

Block Diagram and Function Table



IN	Switch S1	Switch S2
0	ON	OFF
1	OFF	ON

NOTE: Switches shown for logic "1" input.

Table of Contents

Revision History

Date	Revision	Notes
2025-09-08	Rev.A.0	Initial Version.

Pin Configuration and Functions

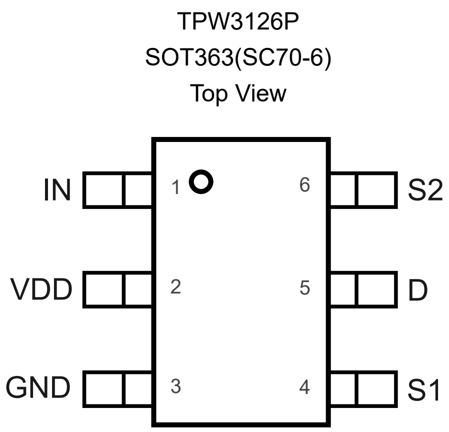


Table 1. Pin Functions: TPW3126P

Pin No.	Name	I/O	Description
1	IN	I	Digital control input pin.
2	VDD		Most positive power supply pin.
3	GND		Ground (0 V) reference pin.
4	S1	I/O	Source terminal of the multiplexer. Can be used as input or output.
5	D	I/O	Drain terminal of the multiplexer. Can be used as input or output.
6	S2	I/O	Source terminal of the multiplexer. Can be used as input or output.

Table 2. Functional Table

IN	Switch S1	Switch S2
0	ON	OFF
1	OFF	ON

Specifications

Absolute Maximum Ratings (1)

	Parameter	Min	Max	Unit
	Supply Voltage	−0.3	7	V
	Select Input Voltage	–0.3	7	V
	Select Input Diode Current		30	mA
	Switch I/O Port Voltage	–0.3	V_{DD} + 0.3	V
I_S or $I_{D(CONT)}$	Switch I/O Continuous Current	–30	+30	mA
I_S or $I_{D(PEAK)}$	Switch I/O Peak Current	−100	+100	mA
T_J	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range	−65	150	°C
T_L	Lead Temperature (Soldering, 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 (1)	±2.5	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 (2)	±1.5	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions (1)

Parameter	Min	Max	Unit
Supply Voltage, V_{DD}	1.8	5.5	V
Select Input Voltage	0	V_{DD}	V
Input Transition Rise and Fall Rate		100	ns/V
Switch I/O Port Voltage	0	V_{DD}	V
Operating Temperature Range	–40	125	°C

(1) Input select must be held HIGH or LOW and it shouldn't float.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT363	250	81	°C/W

Electrical Characteristics

All test conditions: over operating temperature range (−40℃ to 125℃), typical at T_A = 25℃, V_{DD} = 4.5 V to 5.5 V, and GND = 0 V, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Typ	Max	Unit
Power Supply							
I_{DD}	Quiescent Supply Current	V_{IN} = 0 V or V_{CC}	5			1	μA
Digital Input							
V_{IH}	Input Voltage High		5	2.4			V
V_{IL}	Input Voltage Low		5			0.8	V
I_{IN}	Control Input Leakage	V_{IN} = 0 V or V_{CC}	5	−0.1		0.1	μA
Analog Switch							
R_{ON}	On Resistance	V_S = 0 V to V_{DD}, I_S = −10 mA, Figure 7	5		3.3	6	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA, T_A = −40℃ to 85℃, Figure 7				5.5	Ω
ΔR_{ON}	On Resistance Match Between Channels	V_S = 0 V to V_{DD}, I_S = −10 mA	5		0.1	0.5	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA,T_A = −40℃ to 85℃				0.5	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	V_S = 0 V to V_{DD}, I_S = −10 mA	5		0.8	1.7	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA, T_A = −40℃ to 85℃				1.4	Ω
I_S(Off)	Source Off Leakage	V_S = 4.5 V, 1V, V_D = 1 V, 4.5 V, Figure 8	5.5	−7	±0.03	7	nA
		V_S = 4.5 V, 1V, V_D = 1 V, 4.5 V, T_A = −40℃ to 85℃, Figure 8		−0.5		0.5	nA
I_S, I_D(On)	Channel On Leakage	V_S = V_D = 1 V or V_S = V_D = 4.5 V, Figure 8	5.5	−14	±0.05	14	nA
		V_S = V_D = 1 V or V_S = V_D = 4.5 V, T_A = −40℃ to 85℃, Figure 8		−0.5		0.5	nA
Dynamic Characteristics (1)							
t_{ON}	Switch Turn-on Time	V_S = 3 V, R_L = 300 Ω, C_L = 35 pF, Figure 9	5		11		ns
t_{OFF}	Switch Turn-off Time	V_S = 3 V, R_L = 300 Ω, C_L = 35 pF, Figure 9	5		6		ns
t_B	Break-Before-Make Time	V_{S1} = V_{S2} = 3 V, R_L = 300 Ω, C_L = 35 pF, Figure 10	5		6		ns
OISO	OFF-Isolation	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz, Figure 11	5		−75		dB

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Typ	Max	Unit
		R_L = 50 Ω, C_L = 5 pF, f = 10 MHz, Figure 11			−50		dB
XTALK	Crosstalk	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz, Figure 12	5		−75		dB
		R_L = 50 Ω, C_L = 5 pF, f = 10 MHz, Figure 12			−50		dB
BW	Bandwidth	R_L = 50 Ω, C_L = 5 pF, Figure 13	5		380		MHz
Capacitance (1)							
C_S(Off)	Source Off Capacitance	f = 1 MHz	5		6.5		pF
C_D(On)	Drain On Capacitance	f = 1 MHz	5		15		pF
C_S(On)	Source On Capacitance	f = 1 MHz	5		15		pF

Electrical Characteristics (Continued)

All test conditions: over operating temperature range (−40℃ to 125℃), typical at T_A = 25℃, V_{DD} = 3 V to 3.6 V and GND = 0V, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Typ	Max	Unit
Power Supply							
I_{DD}	Quiescent Supply Current	V_{IN} = 0 V or V_{CC}	3.3			1	μA
Digital Input							
V_{IH}	Input Voltage High		3.3	2			V
V_{IL}	Input Voltage Low		3.3			0.8	V
I_{IN}	Control Input Leakage	V_{IN} = 0 V or V_{CC}	3.3	−0.1		0.1	μA
Analog Switch							
R_{ON}	On Resistance	V_S = 0 V to V_{DD}, I_S = −10 mA, Figure 7	3.3		4.5	7.5	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA, T_A = −40℃ to 85℃, Figure 7				7	Ω
$ΔR_{ON}$	On Resistance Match Between Channels	V_S = 0 V to V_{DD}, I_S = −10 mA	3.3		0.1	0.5	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA, T_A = −40℃ to 85℃				0.5	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	V_S = 0 V to V_{DD}, I_S = −10 mA	3.3		1	2.3	Ω
		V_S = 0 V to V_{DD}, I_S = −10 mA, T_A = −40℃ to 85℃				2	Ω
Dynamic Characteristics (1)							
t_{ON}	Switch Turn-on Time	V_S = 2 V, R_L = 300 Ω, C_L = 35 pF, Figure 9	3.3		13		ns
t_{OFF}	Switch Turn-off Time	V_S = 2 V, R_L = 300 Ω, C_L = 35 pF, Figure 9	3.3		7		ns
t_B	Break-Before-Make Time	V_{S1} = V_{S2} = 2 V, R_L = 300 Ω, C_L = 35 pF, Figure 10	3.3		6		ns
OISO	OFF-Isolation	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz, Figure 11	3.3		−75		dB
		R_L = 50 Ω, C_L = 5 pF, f = 10 MHz, Figure 11			−50		dB
XTALK	Crosstalk	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz, Figure 12	3.3		−75		dB
		R_L = 50 Ω, C_L = 5 pF, f = 10 MHz, Figure 12			−50		dB
BW	Bandwidth	R_L = 50 Ω, C_L = 5 pF, Figure 13	3.3		380		MHz
Capacitance (1)							

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Typ	Max	Unit
C_S(Off)	Source Off Capacitance	f = 1 MHz	3.3		6.5		pF
C_D(On)	Drain On Capacitance	f = 1 MHz	3.3		15		pF
C_S(On)	Source On Capacitance	f = 1 MHz	3.3		15		pF

(1) Provided by design simulation and lab test, not subject to production test.

Typical Performance Characteristics

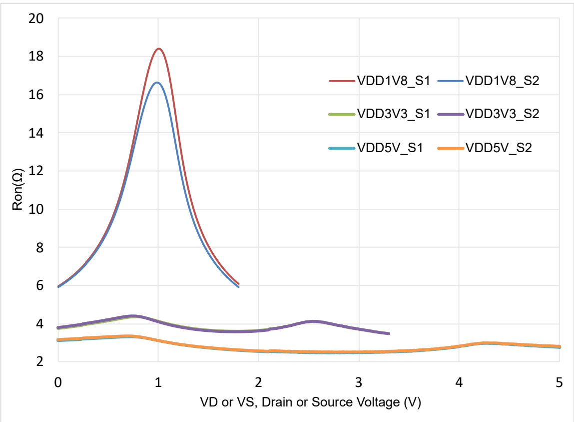


Figure 1. R_{ON}, V_{DD} = 1.8 V, 3.3 V, 5 V, Temp = 25°C

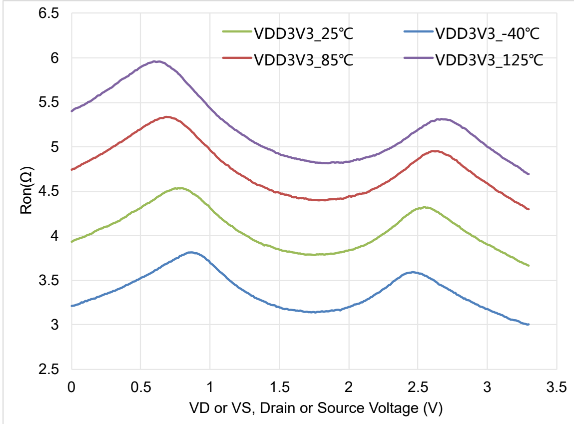


Figure 2. R_{ON}, V_{DD} = 3.3 V, Temp = −40, 25, 85, 125°C

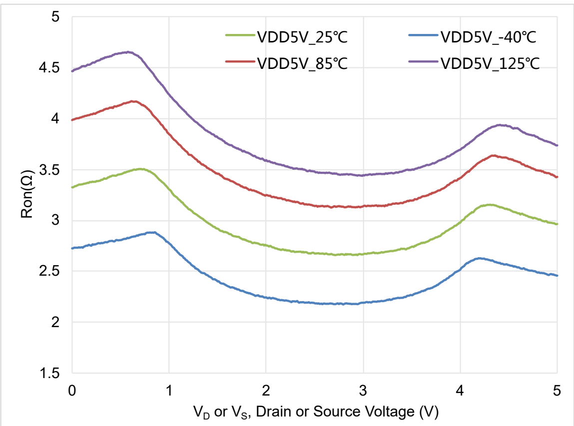


Figure 3. R_{ON}, V_{DD} = 5 V, Temp = −40, 25, 85, 125°C

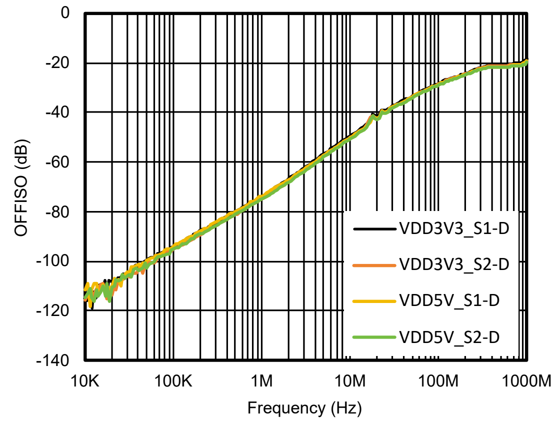


Figure 4. OFFISO, V_{DD} = 3.3, 5 V

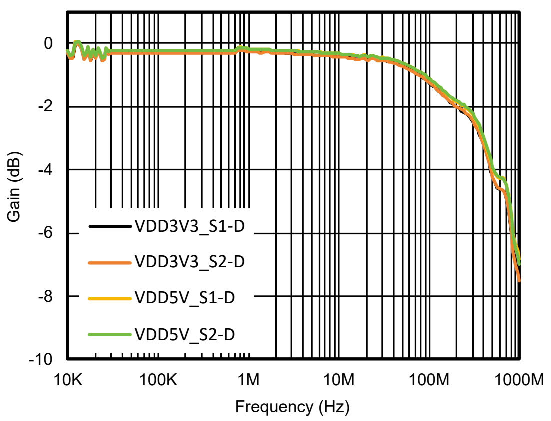


Figure 5. Bandwidth, V_{CC} = 3.3 V, 5 V

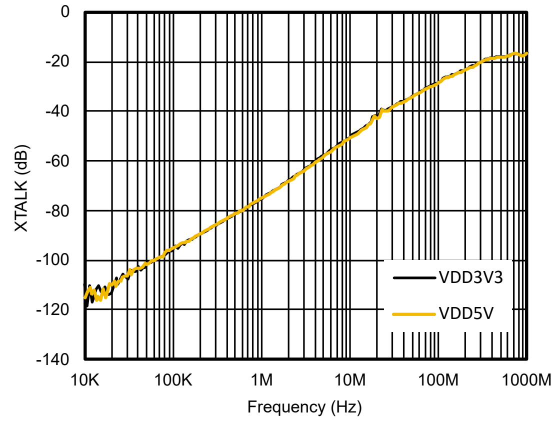


Figure 6. Crosstalk, V_{CC} = 3.3 V, 5 V

Test Circuit and Waveforms

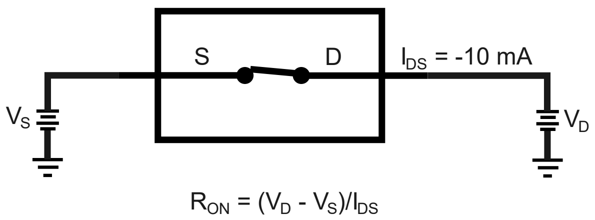


Figure 7. On Resistance

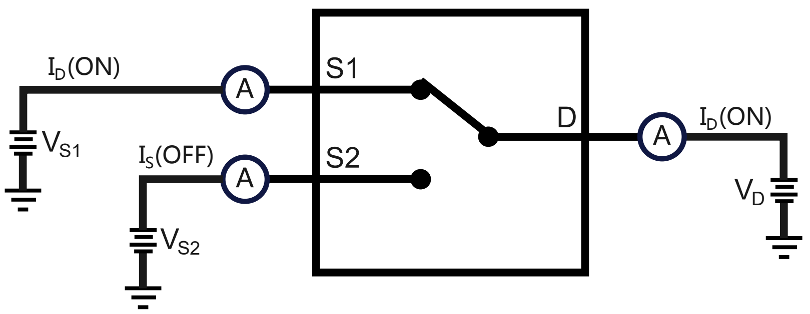


Figure 8. Leakage

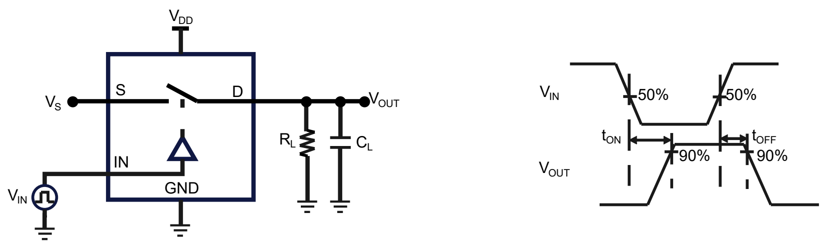


Figure 9. AC Test Circuit and Test Waveforms

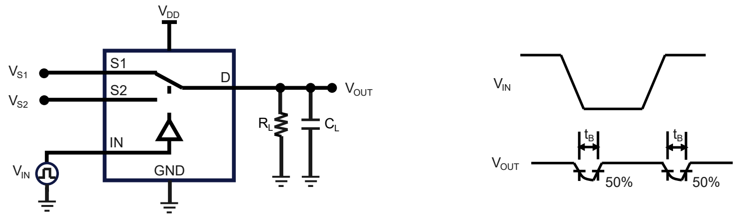


Figure 10. Switch Break Time

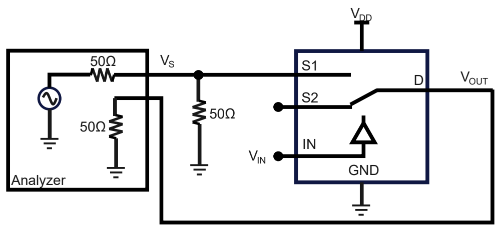


Figure 11. Off Isolation

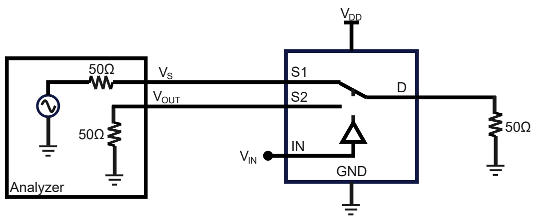


Figure 12. Crosstalk

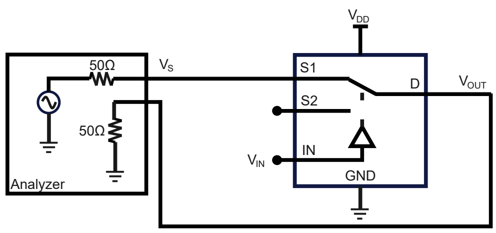


Figure 13. Bandwidth

Application and Implementation

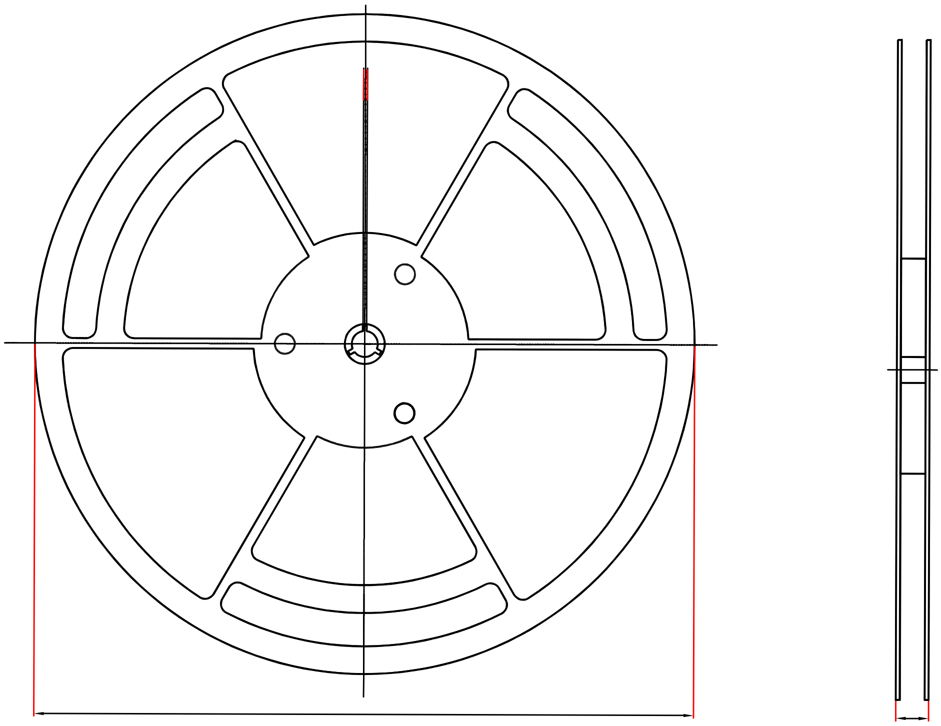
Note

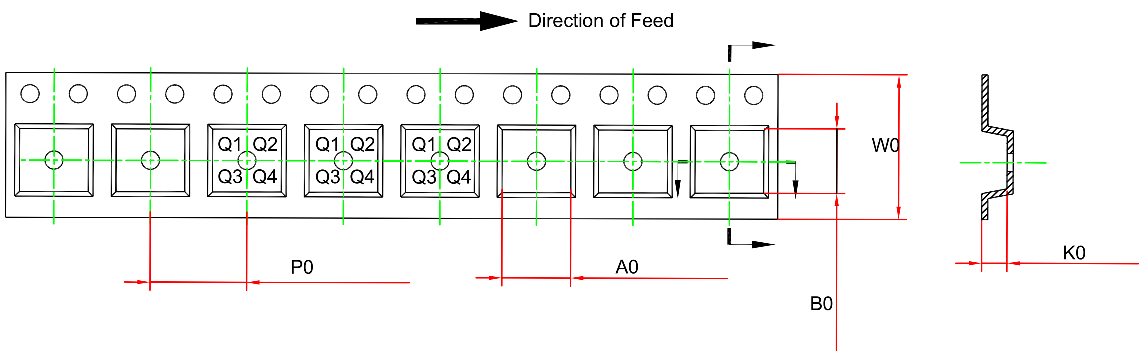
Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Application Information

A 0.1-μF bypass capacitor on V_{DD} is recommended to prevent power disturbance.

Tape and Reel Information





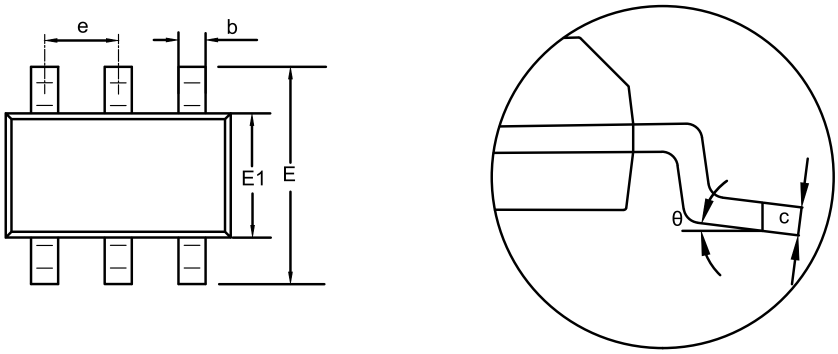
Order Number	Package	D1 (mm)	A0 (mm) (1)	K0 (mm) (1)	W0 (mm)	W1 (mm)	B0 (mm) (1)	P0 (mm)	Pin1 Quadrant
TPW3126P-SC6R	SOT363	178	2.4	1.2	8	12.1	2.5	4	Q3

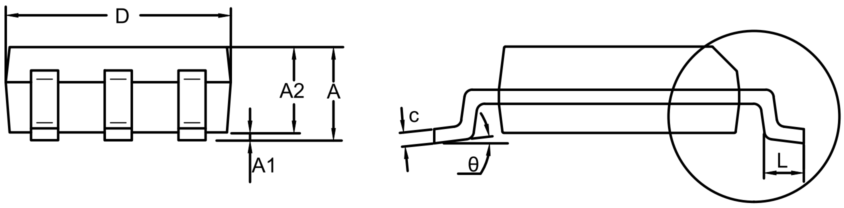
(1) The value is for reference only. Contact the 3PEAK factory for more information.

Package Outline Dimensions

SOT363

Package Outline Dimensions SC6(SOT363-6-A)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.850	1.100	0.033	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.230	0.003	0.009
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650 BSC		0.026 BSC	
L	0.260	0.460	0.010	0.018
θ	0	8°	0	8°

NOTES
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPW3126P-SC6R	−40 to 125°C	SOT363	AAA	MSL3	Tape and Reel,3000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

IMPORTANT NOTICE AND DISCLAIMER

Performance Information. Performance tests or performance range contained in this document/material are either results of design simulation or actual tests conducted under designated testing environment. Any variation in testing environment or simulation environment, including but not limited to testing method, testing process or testing temperature, may affect actual performance of the product.

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