5-V Low-Power Comparators with Push-Pull Output

Features

- Power Supply Voltage: 1.5 V to 5.5 V
- Low Supply Current: 40 μA per Channel
- High-to-Low Propagation Delay: 100 ns
- Internal Hysteresis Ensures Clean Switching
- Offset Voltage: ±5 mV
- Input Bias Current: 10 pA (Typ)
- Input Common-Mode Range Extends 200 mV
- Push-Pull Output

Applications

- Peak and Zero-Crossing Detectors
- Threshold Detectors/Discriminators
- Sensing at the Ground or Supply Line
- Logic Level Shifting or Translation
- Window Comparators
- IR Receivers

Description

The devices are low-power comparators with internal hysteresis. The common-mode input voltage range extends 200 mV beyond the power rail. The devices have 100-ns propagation delay which makes the devices suitable for general applications. The internal input hysteresis eliminates output switching caused by input noise voltage. The devices have push-pull output to support rail-to-rail output swing.

The operating temperature range of the devices is from −40°C to +125°C.

Typical Application Circuit

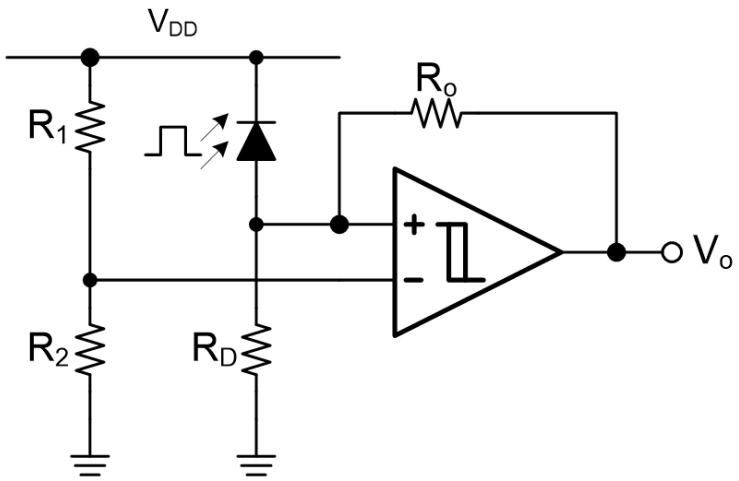


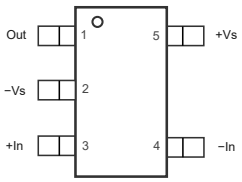
Table of Contents

Revision History

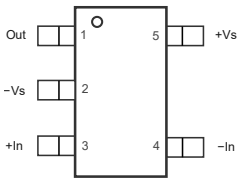
Date	Revision	Notes
2025-04-14	Rev.A.0	Initial release.
2025-08-20	Rev.A.1	The following updates are all about new formats or typo corrections. The actual product remains unchanged: • Updated the POD information and orderable part number list.

Pin Configuration and Functions

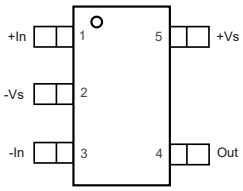
TPCMP191-S5TR
SOT23-5
Top View



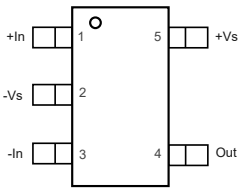
TPCMP191-SC5R
SOT353 (SC70-5)
Top View



TPCMP191U-S5TR
SOT23-5
Top View



TPCMP191U-SC5R
SOT353 (SC70-5)
Top View



TPCMP191U-DF0R
DFN0.8X0.8-4 (5PIN)
Top View

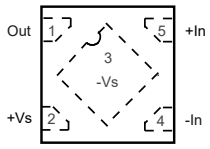
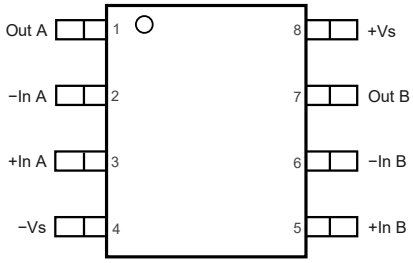


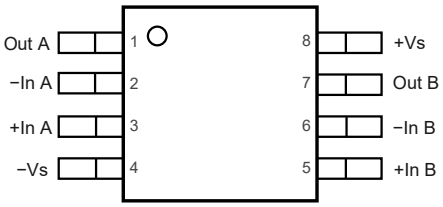
Table 1. Pin Functions: TPCMP191

Pin No.					Name	I/O	Description
TPCMP191 -S5TR	TPCMP191 -SC5R	TPCMP191 U-S5TR	TPCMP191 U-SC5R	TPCMP191 U-DF0R			
1	1	4	4	1	Out	O	Output
2	2	2	2	3	$-V_S$	−	Negative power supply
3	3	1	1	5	+In	I	Non-inverting input
4	4	3	3	4	−In	I	Inverting input
5	5	5	5	2	$+V_S$	−	Positive power supply

TPCMP192-SO1R
SOP8
Top View



TPCMP192-VS1R
MSOP8
Top View



TPCMP192-DFGR
DFN2X2-8
Top View

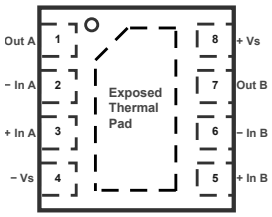


Table 2. Pin Functions: TPCMP192-SO1R/TPCMP192-VS1R/TPCMP192-DFGR

Pin No.			Name	I/O	Description
TPCMP192-SO1R	TPCMP192-VS1R	TPCMP192-DFGR			
1	1	1	Out A	O	Output
2	2	2	−In A	I	Inverting input
3	3	3	+In A	I	Non-inverting input
4	4	4	$-V_S$	−	Negative power supply
5	5	5	+In B	I	Non-inverting input
6	6	6	−In B	I	Inverting input
7	7	7	Out B	O	Output
8	8	8	$+V_S$	−	Positive power supply.
−	−	EP	Exposed Thermal Pad	−	Exposed Thermal Pad. The exposed pad is tied to the $-V_S$.

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
	Supply Voltage, $(+V_S) – (-V_S)$	0	5.5	V
	Input Voltage	$(-V_S) – 0.3$	$(+V_S) + 0.3$	V
	Input Current: +IN, −IN (2)	−10	10	mA
	Output Current: OUT	−10	10	mA
	Output Short-Circuit Duration (3)		Continuous	
T_J	Maximum Junction Temperature		150	°C
T_A	Operating Temperature Range	−40	125	°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.
(2) The inputs are protected by ESD protection diodes to each power supply. If the input extends more than 500 mV beyond the negative power supply, the input current should be limited to less than 10 mA.
(3) A heat sink may be required to keep the junction temperature below the absolute maximum. This depends on the power supply voltage and how many comparators are shorted. Thermal resistance varies with the amount of PC board metal connected to the package. The specified values are for short traces connected to the leads.

ESD, Electrostatic Discharge Protection

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

Parameter		Min	Typ	Max	Unit
V_S	Supply Voltage, $(+V_S) – (-V_S)$	1.5		5.5	V

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT353 (SC70-5)	400	150	°C/W
SOT23-5	250	81	°C/W
SOP8	158	43	°C/W
MSOP8	210	45	°C/W
DFN0.8X0.8-4(5PIN)	500	200	°C/W
DFN2X2-8	100	60	°C/W

Electrical Characteristics

All test conditions: V_S = 5 V, T_A = 25°C, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Power Supply						
IQ	Quiescent Current per Comparator	V_S = 5 V, No Load, Output High, V_{INP} = 1 V, V_{INN} = 0 V		38	70	μA
		V_S = 5 V, No Load, Output Low, V_{INP} = 0V, V_{INN} = 1 V		34	70	μA
		V_S = 1.8 V, No Load, Output High, V_{INP} = 1 V, V_{INN} = 0 V		27	60	μA
		V_S = 1.8 V, No Load, Output Low, V_{INP} = 0 V, V_{INN} = 1 V		26	60	μA
PSRR	Power Supply Rejection Ratio	V_S = 1.5 V to 5.5 V, V_{CM} = 0 V	65	91		dB
		V_S = 1.5 V to 5.5 V, V_{CM} = 0 V, T_A = −40°C to 125°C	60			dB
Input Characteristics						
V_{OS}	Input Offset Voltage (1)	V_S = 5 V, V_{CM} = 0 V	−5	1.2	5	mV
		V_S = 5 V, V_{CM} = 0 V, T_A = −40°C to 125°C	−6		6	mV
V_{OS}TC	Input Offset Voltage Drift (2)	V_S = 5 V, V_{CM} = 0 V, T_A = −40°C to 125°C		5		uV/℃
V_{HYST}	Input Hysteresis Voltage (1)	V_S = 5 V, V_{CM} = 0	3	4.5	7	mV
		V_S = 5 V, V_{CM} = 0 V, T_A = −40°C to 125°C	2		8	mV
V_{OS}	Input Offset Voltage (1)	V_S = 1.8 V, V_{CM} = 0	−5	1.2	5	mV
		V_S = 1.8 V, V_{CM} = 0 V, T_A = −40°C to 125°C	−6		6	mV
V_{OS}TC	Input Offset Voltage Drift (2)	V_S = 1.8 V, V_{CM} = 0V, T_A = −40°C to 125°C		2		μV/℃
V_{HYST}	Input Hysteresis Voltage (1)	V_S = 1.8 V, V_{CM} = 0 V	3	4.5	7	mV
		V_S = 1.8 V, V_{CM} = 0 V, T_A = −40°C to 125°C	2		8	mV
I_B	Input Bias Current	V_S = 5 V, V_{CM} = V_S/2		10		pA
		V_S = 5 V, V_{CM} = V_S/2, T_A = −40°C to 125°C			200	pA
I_{OS}	Input Offset Current	V_S = 5 V, V_{CM} = V_S/2		1		pA
		V_S = 5 V, V_{CM} = V_S/2, T_A = −40°C to 125°C	−100		100	pA
V_{CM}	Common-mode Voltage Range	V_S = 5 V, T_A = −40°C to 125°C	−0.2		5.2	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
CMRR	Common-mode Rejection Ratio	V_S = 5 V, V_{CM} = −0.2 V to 5.2 V	60	80		dB
		V_S = 5 V, V_{CM} = −0.2 V to 5.2 V, T_A = −40°C to 125°C	55			dB
Output						
V_{OL}	Output Voltage Swing from Negative Rail	V_S = 5 V, I_{OL} = 4 mA		150	190	mV
		V_S = 5 V, I_{OL} = 4 mA, T_A = −40°C to 125°C			220	mV
		V_S = 3.3 V, I_{OL} = 1 mA		40	55	mV
		V_S = 3.3 V, I_{OL} = 1 mA, T_A = −40°C to 125°C			65	mV
V_{OH}	Output Voltage Swing from Positive Rail	V_S = 5 V, I_{OH} = 4 mA		150	210	mV
		V_S = 5 V, I_{OH} = 4 mA, T_A = −40°C to 125°C			240	mV
		V_S = 3.3 V, I_{OH} = 1 mA		40	60	mV
		V_S = 3.3 V, I_{OH} = 1 mA, T_A = −40°C to 125°C			70	mV
I_{SOURCE}	Source Current	V_S = 5 V		70		mA
I_{SINK}	Sink Current	V_S = 5 V		60		mA
Switching Characteristics (3)						
T_{PLH}	Propagation Delay Time, Low to High	V_S = 5 V, ΔV_{IN} = 1 V, V_{CM} = V_S/2, 100mV overdrive, Delay time is measured from mid-point of input to mid-point of output.		90		ns
		V_S = 5 V, ΔV_{IN} = 1 V, V_{CM} = V_S/2, 20mV overdrive, Delay time is measured from mid-point of input to mid-point of output.		200		ns
T_{PHL}	Propagation Delay Time, High to Low	V_S = 5 V, ΔV_{IN} = 1 V, V_{CM} = V_S/2, 100mV overdrive, Delay time is measured from mid-point of input to mid-point of output.		100		ns
		V_S = 5 V, ΔV_{IN} = 1 V, V_{CM} = V_S/2, 20mV overdrive, Delay time is measured from mid-point of input to mid-point of output.		190		ns
T_R	Rise Time (4)(5)	V_S = 5 V		1.85		ns
T_F	Fall Time (4)(5)	V_S = 5 V		1.7		ns
Ton	Power-up Time (4)	V_S = 5 V, The time between V_S exceed 1.5V and the output is in a correct state.		20		us
f_{toggle}	Toggle Frequency (4)	V_S = 5 V		5		MHz

(1) The input offset voltage is the average of the input-referred trip points. The input hysteresis is the difference between the input-referred trip points.
(2) Provided by bench tests and design simulation.
(3) Delay time is measured from the mid-point of the input to the mid-point of the output.
(4) Provided by design simulation.

(5) Measured between 20% of V_S and 80% of V_S.

Typical Performance Characteristics

All test conditions: V_S = 5 V, V_{CM} = 2.5 V, unless otherwise noted.

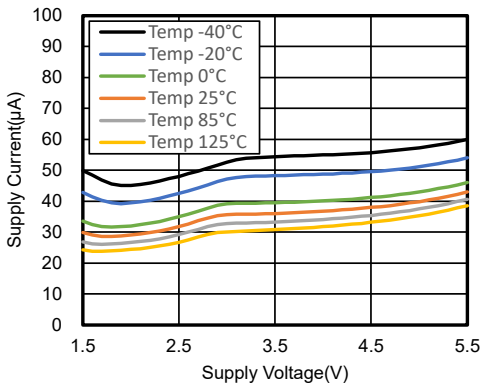


Figure 1. Supply Current vs. Supply Voltage, Output High

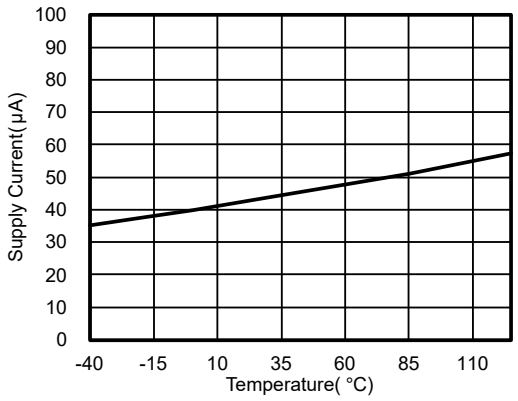


Figure 2. Supply Current vs. Temperature

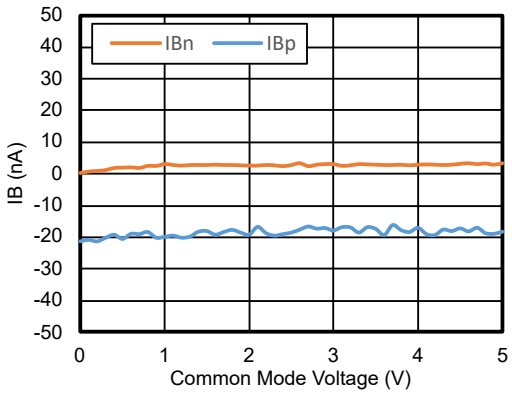


Figure 3. IB vs. Common-Mode Voltage

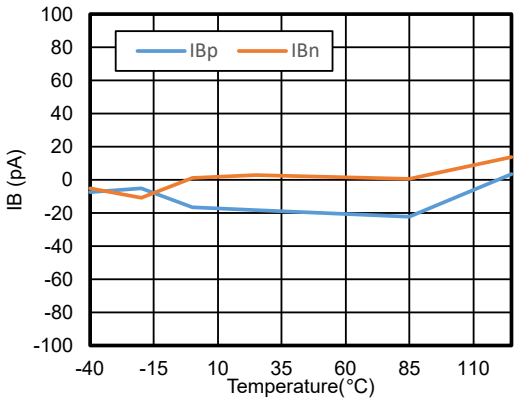


Figure 4. IB vs. Temperature

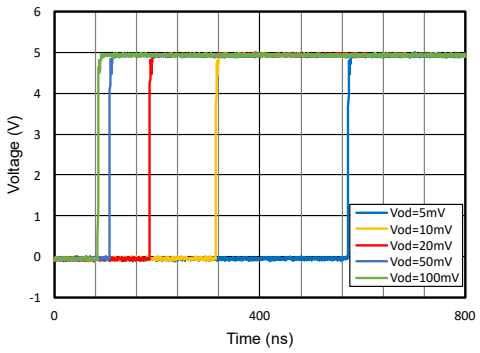


Figure 5. Propagation Delay, Low to High, 5 V

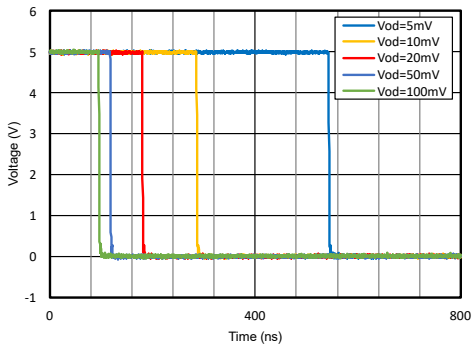


Figure 6. Propagation Delay, High to Low, 5 V

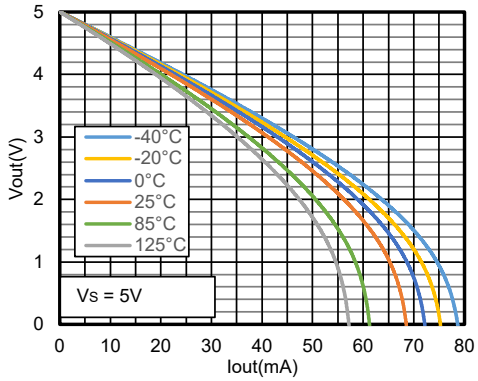


Figure 7. Output Voltage vs. Output Sourcing Current, 5 V

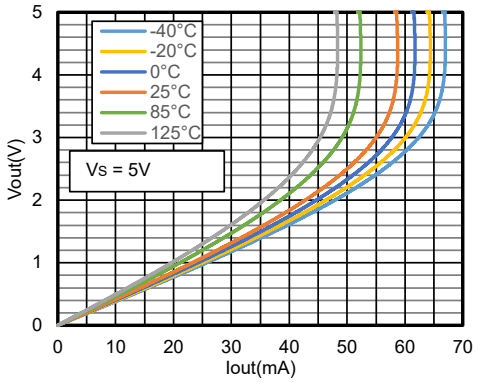


Figure 8. Output Voltage vs. Output Sinking Current, 5 V

Detailed Description

Overview

The devices feature 100-ns response time and include 4.5 mV of internal hysteresis for improved noise immunity with an input common-mode range that extends 0.2 V beyond the power supply rails, having the ability to operate from 1.5 V to 5.5 V on the supply pin.

Functional Block Diagram

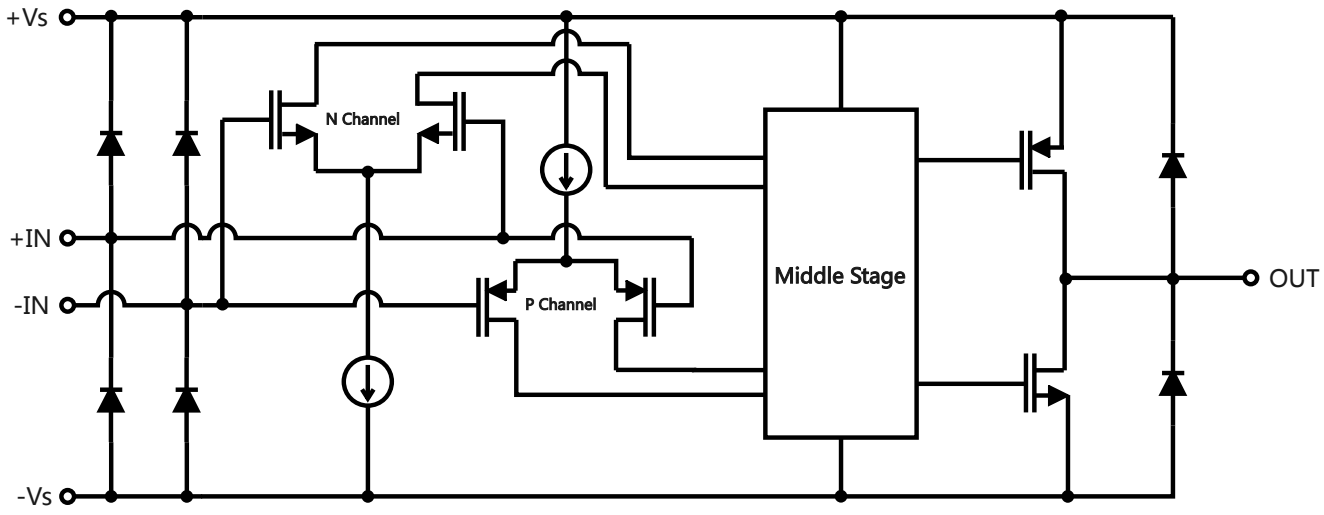


Figure 9. Functional Block Diagram

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

Power Supply Layout and Bypass

The power supply pins of TPCMP191 and TPCMP192 families should have local bypass capacitors (i.e., 0.01 μF to 0.1 μF) within 2 mm for high-frequency performance. They can also use a bulk capacitor (i.e., 1 μF or larger) within 100 mm to provide large and slow currents. This bulk capacitor can be shared with other analog parts.

A good ground layout improves performance by decreasing the amount of stray capacitance and noise at the inputs and outputs of the comparator. To decrease stray capacitance, minimize PCB lengths and resistor leads, and place external components to the pins of the comparator as close as possible.

Operation Outside of the Common Input Voltage Range

A list of input voltage situations and the corresponding outcomes are as follows:

1. When both −IN and +IN are within the common-mode range:
   a. If the voltage at the −IN pin is higher than the voltage at the +IN pin and the offset voltage, the output is low, and the output MOSFET is sinking current.
   b. If the voltage at the −IN pin is lower than the voltage at the +IN pin and the offset voltage, the output is high impedance.
2. When the voltage at the −IN pin is higher than the common-mode voltage range and the voltage at the +IN pin is within the common-mode voltage range, the output is low, and the output MOSFET is sinking current.
3. When the voltage at the +IN pin is higher than the common-mode voltage range and the voltage at the −IN pin is within the common-mode voltage range, the output is high impedance.
4. When the voltages at the −IN and +IN pins are both higher than the common-mode voltage range, the output is in an uncertain state.

Typical Application

IR Receiver

The device is an ideal candidate to be used as an infrared receiver shown in Figure 10. The infrared photo diode creates a current relative to the amount of infrared light present. The current creates a voltage across R_D. When this voltage level crosses the voltage applied by the voltage divider to the inverting input, the output transitions. Optional R_O provides additional hysteresis for noise immunity.

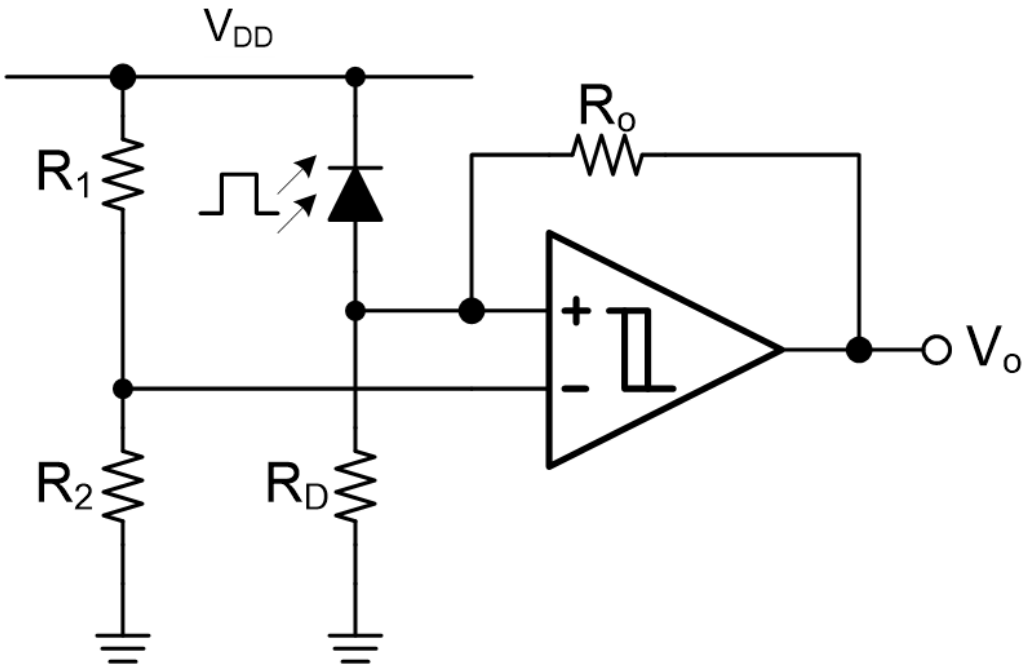
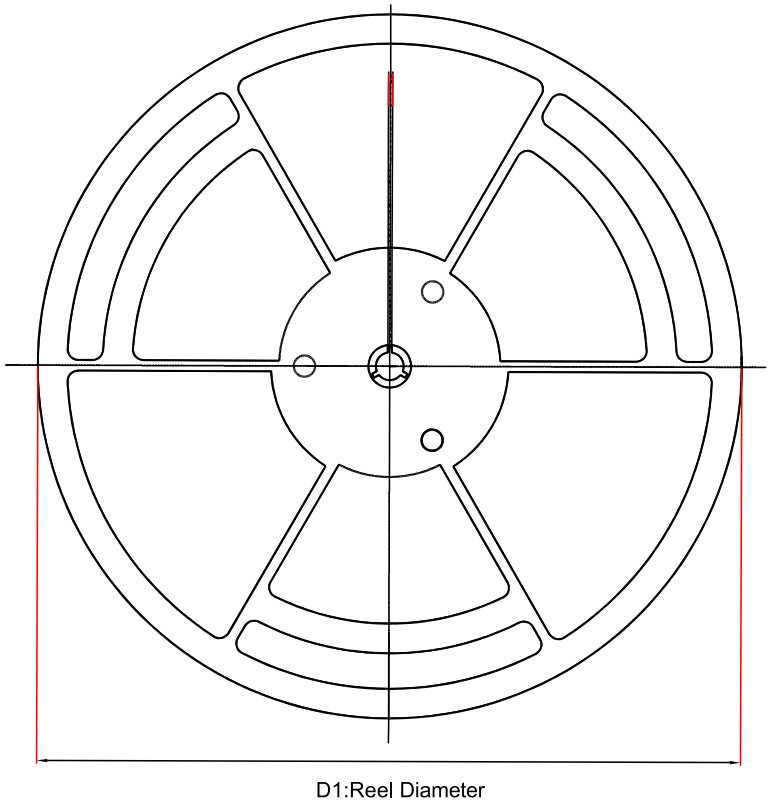
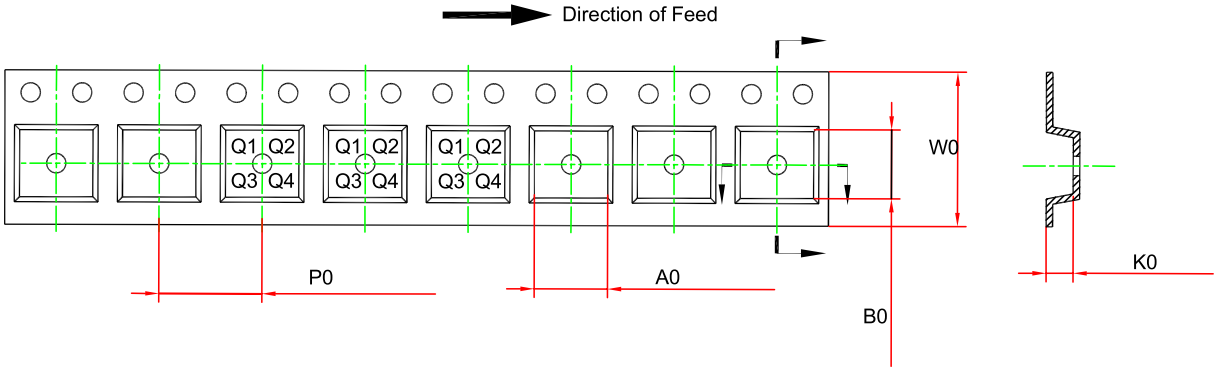


Figure 10. Typical Application Circuit

Tape and Reel Information





Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm) (1)	B0 (mm) (1)	K0 (mm) (1)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPCMP191-S5TR	SOT23-5	180	12	3.3	3.25	1.4	4	8	Q3
TPCMP191-SC5R	SOT353(SC70-5)	178	12.1	2.4	2.5	1.2	4	8	Q3
TPCMP191U-S5TR	SOT23-5	180	12	3.3	3.25	1.4	4	8	Q3
TPCMP191U-SC5R	SOT353(SC70-5)	178	12.1	2.4	2.5	1.2	4	8	Q3

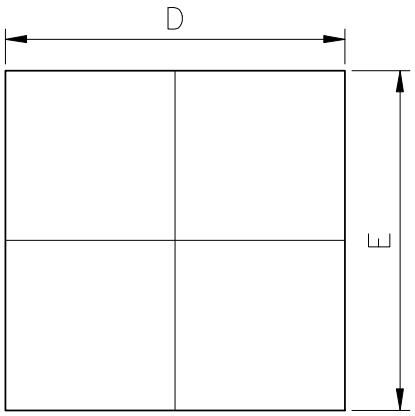
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm) (1)	B0 (mm) (1)	K0 (mm) (1)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPCMP191U-DF0R	DFN0.8X0.8-4(5PIN)	180	12.5	0.91	0.91	0.5	2	8	Q2
TPCMP192-SO1R	SOP8	330	17.6	6.5	5.4	2	8	12	Q1
TPCMP192-VS1R	MSOP8	330	17.6	5.3	3.4	1.3	8	12	Q1
TPCMP192-DFGR	DFN2X2-8	180	12.5	2.3	2.3	1.1	4	8	Q2

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

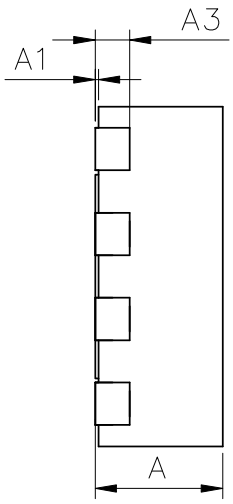
Package Outline Dimensions

DFN2×2-8

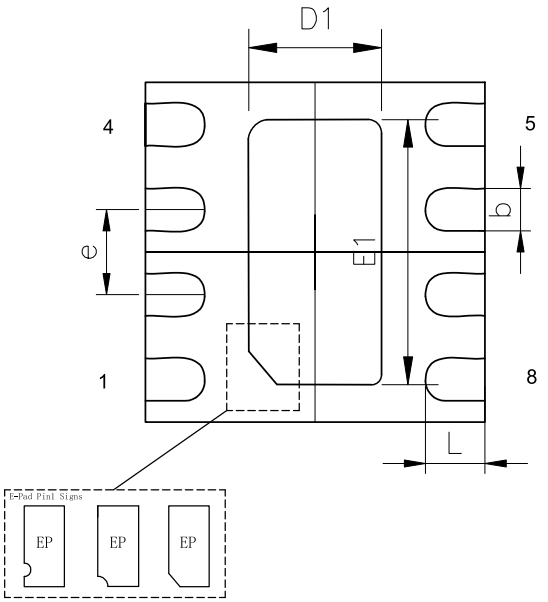
Package Outline Dimensions DFG(DFN2X2-8-E)



Top View



Side View



Bottom View

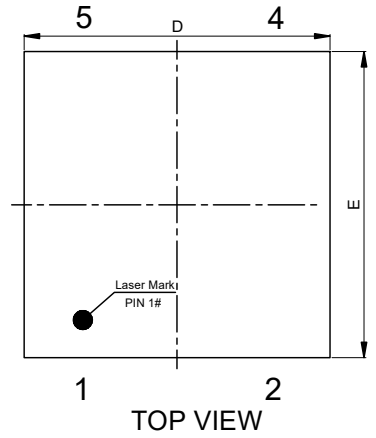
NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

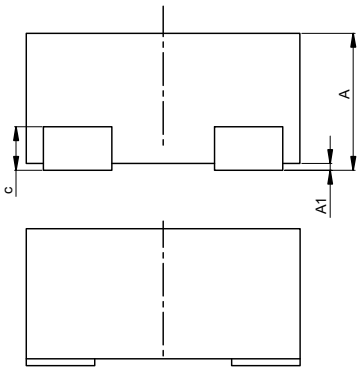
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
b	0.150	0.300	0.006	0.012
A3	0.100	0.200	0.004	0.008
D	1.900	2.100	0.075	0.083
D1	0.800	1.000	0.031	0.039
E	1.900	2.100	0.075	0.083
E1	1.600	1.800	0.063	0.071
e	0.500 BSC		0.020BSC	
L	0.224	0.376	0.009	0.015

DFN0.8×0.8-4

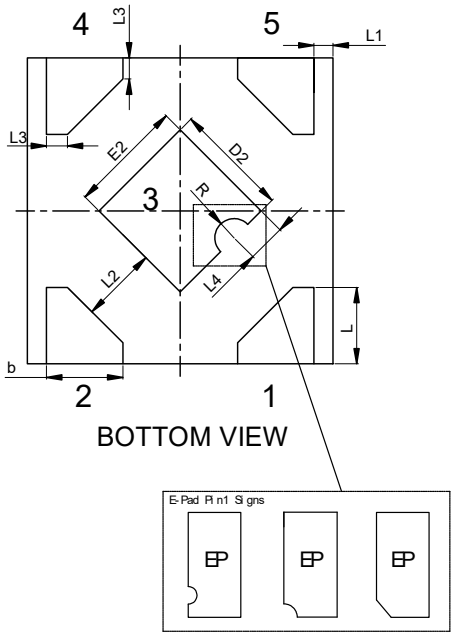
Package Outline Dimensions DF0(DFN0.8X0.8-4-A)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

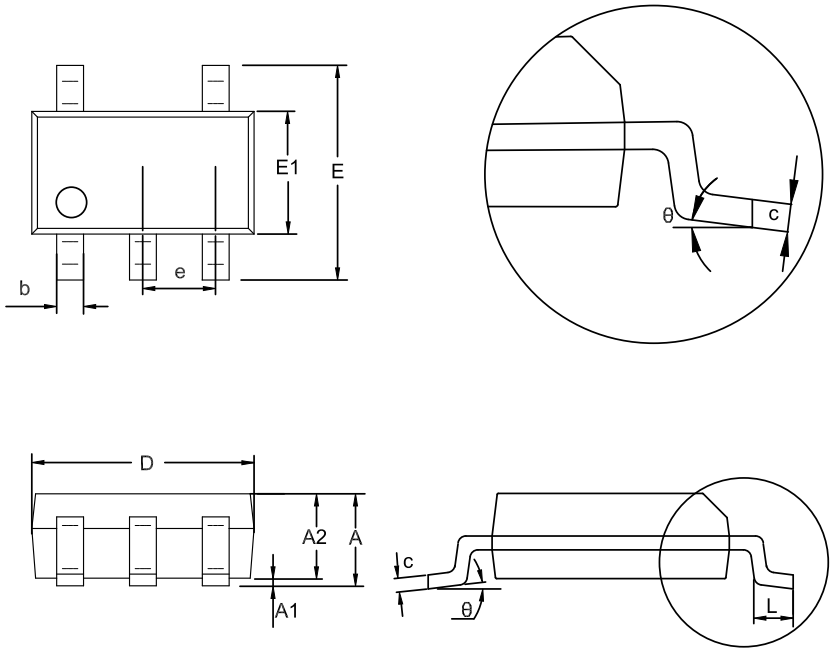
NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.370	0.430	0.015	0.017
A1	0.000	0.050	0.000	0.002
b	0.150	0.250	0.006	0.010
c	0.100	0.150	0.004	0.006
D	0.750	0.850	0.030	0.033
D2	0.200	0.400	0.008	0.016
E	0.750	0.850	0.030	0.033
E2	0.200	0.400	0.008	0.016
e	0.500 BSC		0.020 BSC	
L	0.150	0.250	0.006	0.010
L1	0.050 BSC		0.002 BSC	
L2	0.200 BSC		0.008 BSC	
L3	0.055 BSC		0.002 BSC	
L4	0.100 BSC		0.004 BSC	

SOT23-5

Package Outline Dimensions S5T(SOT23-5-A)



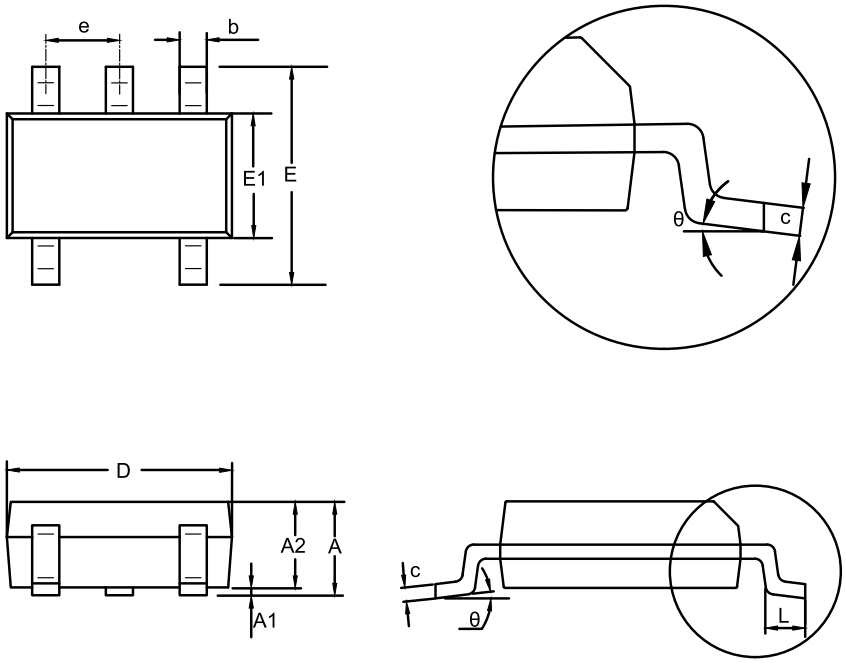
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.280	0.500	0.011	0.020
c	0.100	0.230	0.004	0.009
D	2.820	3.020	0.111	0.119
E	2.600	3.000	0.102	0.118
E1	1.500	1.720	0.059	0.068
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0	8°	0	8°

NOTES

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

SOT353 (SC70-5)

Package Outline Dimensions SC5(SOT353-5-A)



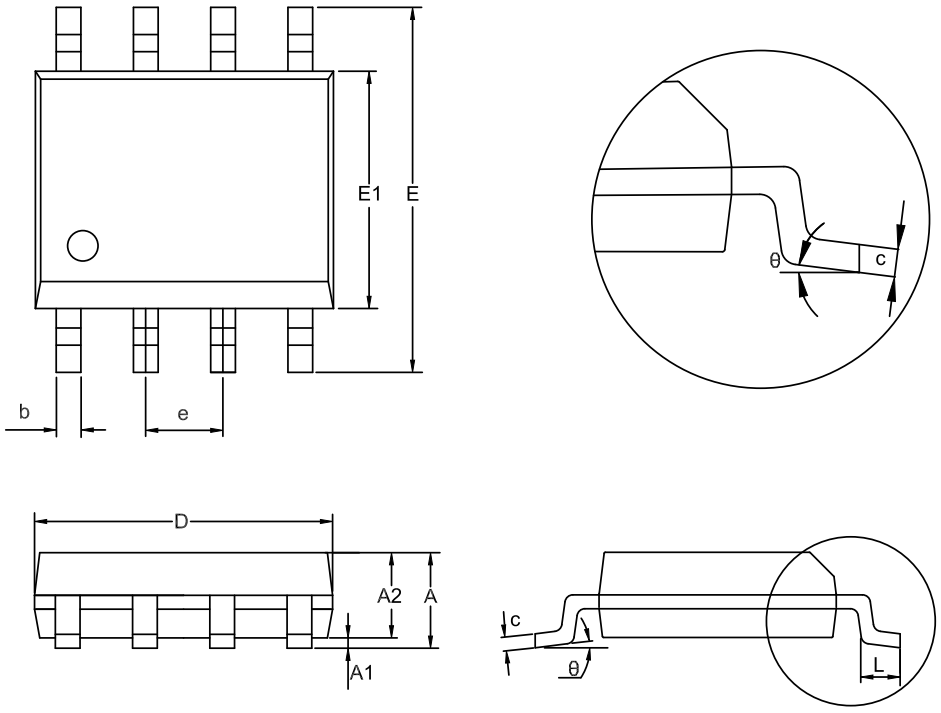
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.850	1.100	0.033	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.230	0.004	0.009
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650 BSC		0.026 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.

SOP8

Package Outline Dimensions SO1(SOP-8-A)



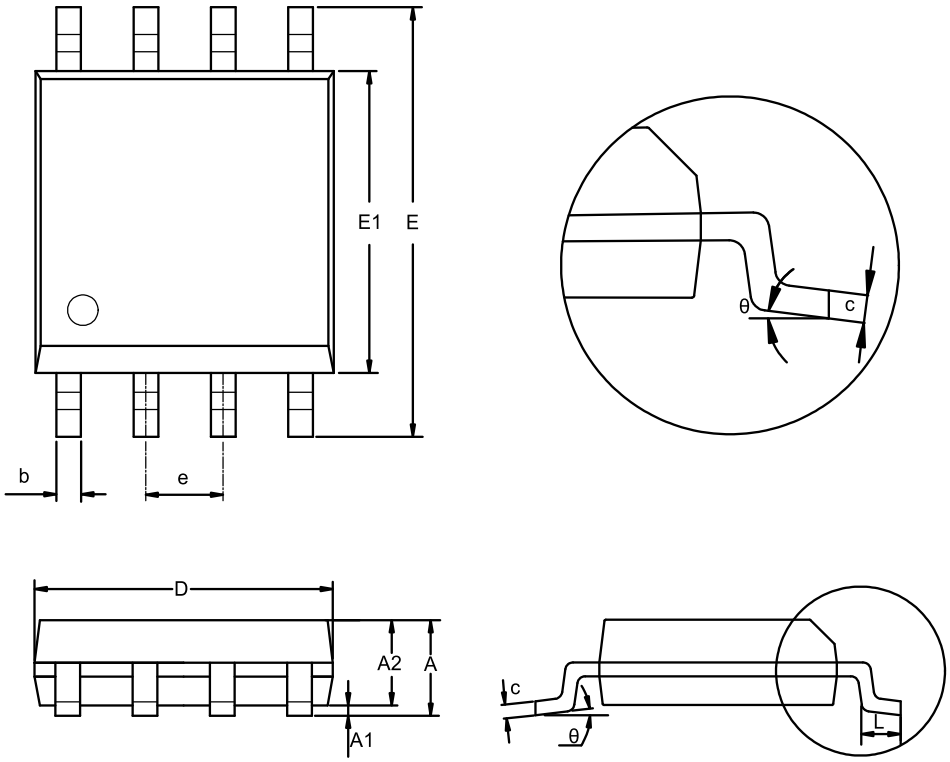
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.550	0.049	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050 BSC	
L	0.400	1.000	0.016	0.039
θ	0	8°	0	8°

NOTES

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

MSOP8

Package Outline Dimensions VS1(MSOP-8-A)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	4.700	5.100	0.185	0.201
E1	2.900	3.100	0.114	0.122
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
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
TPCMP191-S5TR	−40 to 125°C	SOT23-5	A9J	MSL1	Tape and Reel,3000	Green
TPCMP191-SC5R (1)	−40 to 125°C	SOT353(SC70-5)	A9J	MSL1	Tape and Reel,3000	Green
TPCMP191U-S5TR (1)	−40 to 125°C	SOT23-5	A9K	MSL1	Tape and Reel,3000	Green
TPCMP191U-SC5R (1)	−40 to 125°C	SOT353(SC70-5)	A9K	MSL1	Tape and Reel,3000	Green
TPCMP191U-DF0R (1)	−40 to 125°C	DFN0.8X0.8-4(5PIN)	5	MSL3	Tape and Reel,12000	Green
TPCMP192-SO1R	−40 to 125°C	SOP8	CM192	MSL1	Tape and Reel,4000	Green
TPCMP192-VS1R (1)	−40 to 125°C	MSOP8	CM192	MSL1	Tape and Reel,3000	Green
TPCMP192-DFGR (1)	−40 to 125°C	DFN2X2-8	A9L	MSL1	Tape and Reel,3000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

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

IMPORTANT NOTICE AND DISCLAIMER

Trademarks. Any of the 思瑞浦 or 3PEAK trade names, trademarks, graphic marks, and domain names contained in this document /material are the property of 3PEAK. You may NOT reproduce, modify, publish, transmit or distribute any Trademark without the prior written consent of 3PEAK.

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.

Disclaimer. 3PEAK provides technical and reliability data (including data sheets), design resources (including reference designs), application or other design recommendations, networking tools, security information and other resources "As Is". 3PEAK makes no warranty as to the absence of defects, and makes no warranties of any kind, express or implied, including without limitation, implied warranties as to merchantability, fitness for a particular purpose or non-infringement of any third-party's intellectual property rights. Unless otherwise specified in writing, products supplied by 3PEAK are not designed to be used in any life-threatening scenarios, including critical medical applications, automotive safety-critical systems, aviation, aerospace, or any situations where failure could result in bodily harm, loss of life, or significant property damage. 3PEAK disclaims all liability for any such unauthorized use.

This page intentionally left blank