

1. Description

The XPA5132 is a small size, low on-resistance load switch with controlled turn-on.

XPA5132 contains a MOSFET that can deliver up to 2A current from 1.4V to 5.5V source. An enable logic input turns on or off the device. Internally controlled slew rate limits the inrush current on capacitive loads. It has an integrated 160Ω output discharge resistor to eliminate residual voltage on the output rail.

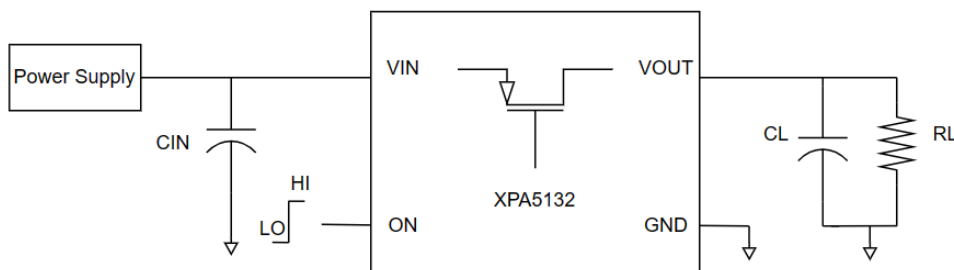
The XPA5132 comes in a compact 4 pin WLCSP package with 0.85mm x 0.85mm size, 0.5mm pitch.

2. Applications

- Optical modules
- Cellular Phones
- Tablets
- Wireless Data Cards
- Embedded Power supply
- Wearables and IoT
- Security and Surveillance

3. Features

- Integrated Single-Channel Load Switch
- Input Voltage: 1.4V to 5.5V
- 2A Continuous Output Current
- Ultra-Low 20mΩ On-Resistance
- 12uA Quiescent Current @3.6Vin
- 20nA Shutdown Current @5.5Vin
- Logic Enable Input
- 160Ω Output Discharge Resistor
- Controlled Slew Rate to Avoid Inrush Currents
- Low Junction-to-Ambient Thermal Resistance
- Small WLCSP-4 Package 0.85mm x 0.85mm, 0.5mm pitch
- RoHS compliance, Pb/Halogen free



Typical Application Circuit

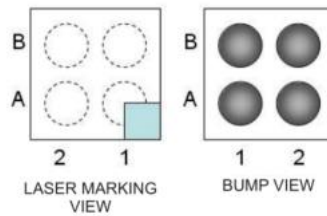
4. Ordering Information

Family	Part Number	Current rating (A)	Top Marking	MPQ
XPA5132	XPA5132C04R	2	A3	3000

MPQ means Minimum Packing Quantity.

For production orders greater than MPQ, the order must be a multiple of MPQ per package size above.

5. PIN Configuration and Description



B	ON	GND
A	VIN	VOUT
	2	1

Pin	Name	Description
A1	VOUT	Output pin. Connect to Load.
A2	VIN	Power supply input. Place a decoupling capacitor from VIN to GND.
B1	GND	Ground.
B2	ON	Enable control. Part is active when ON > 1.1V. Part is disabled with internal discharge resistor when ON < 0.4V.

6. Absolute Maximum Ratings⁽¹⁾

Parameter	Min	Max	Units
DC Supply Voltage, V_{IN}	-0.3	+6	V
Voltage on other pins, V_{OUT} , ON	-0.3	$V_{IN} + 0.3$	V
Operating Temperature Range	-40	+85	°C
Storage Temperature Range	-40	+150	°C
Junction Temperature	-40	+125	°C
Electrostatic Discharge (HBM)	-8000	+8000	V
Electrostatic Discharge (CDM)	-2000	+2000	V

Note: (1) Operation of the device outside of these parameters may cause permanent damage.

7. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Input Voltage	V_{IN}	1.4		5.5	V
Output Voltage	V_{OUT}	0		V_{IN}	V
High-level Input Voltage, ON	V_{IH}	1.1		5.5	V
Low-level Input Voltage, ON	V_{IL}	0		0.4	V
Input Capacitor	C_{IN}		1		μF
Ambient Temperature	T_A	-40		+85	°C
Junction Temperature	T_J	-40		+125	°C

8. Thermal Information

Junction to ambient thermal resistance is a function of board layout and ambient air flow condition. This data is based on four layers PCB (30mm x 30mm; 70μm Cu top signal layer) in still air box in accordance with JEDEC standard JESD51 on natural convection.

Parameter	Symbol	Typ	Units
Junction-to-Ambient Thermal Resistance	θ_{JA}	92	°C/W
Junction-to-Case Thermal Resistance	θ_{JC}	11.7	°C/W

9. Electrical Specifications

(Typical values are at $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{IN} = 1.4\text{V}$ to 5.5V . Unless otherwise noted.)

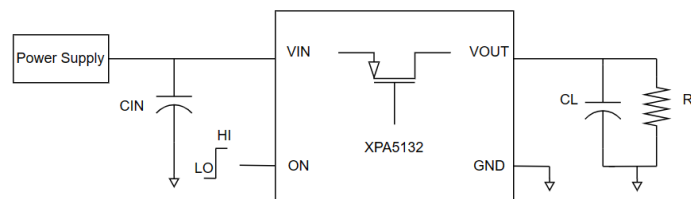
Parameter	Symbol	Test Condition	T_A	Min	Typ	Max	Units
Quiescent Current	I_Q	$V_{IN} = 5.25\text{V}$	Full	20.5			μA
		$V_{IN} = 4.2\text{V}$		13			
		$V_{IN} = 3.6\text{V}$		13			
		$V_{IN} = 2.5\text{V}$		81			
		$V_{IN} = 1.5\text{V}$		31.5			
Shutdown Current	I_{SHDN}	ON = GND, $V_{IN} = 5.25\text{V}$, $V_{OUT} = 0\text{V}$	Full	0.02		2	μA
		ON = GND, $V_{IN} = 4.2\text{V}$, $V_{OUT} = 0\text{V}$		0.02		2	
		ON = GND, $V_{IN} = 3.6\text{V}$, $V_{OUT} = 0\text{V}$		0.01		1	
		ON = GND, $V_{IN} = 2.5\text{V}$, $V_{OUT} = 0\text{V}$		0.01		1	
		ON = GND, $V_{IN} = 1.5\text{V}$, $V_{OUT} = 0\text{V}$		0.01		1	
On Resistance	R_{ON}	$V_{IN} = 5.25\text{V}$, $I_{OUT} = -200\text{mA}$	25°C	20		22	mΩ

			Full	27	
		$V_{IN} = 5V, I_{OUT} = -200mA$	25°C	20	
			Full	27	
		$V_{IN} = 4.2V, I_{OUT} = -200mA$	25°C	20	
			Full	27	
		$V_{IN} = 3.3V, I_{OUT} = -200mA$	25°C	20	
			Full	27	
		$V_{IN} = 2.5V, I_{OUT} = -200mA$	25°C	22	
			Full	29	
		$V_{IN} = 1.8V, I_{OUT} = -200mA$	25°C	25	
			Full	39	
		$V_{IN} = 1.5V, I_{OUT} = -200mA$	25°C	29	
			Full	43	
Output pulldown resistance	R_{PD}	ON=GND, $V_{IN} = 3.6V$	Full	160	200 Ω
Enable pin leakage current	I_{LPIN}	$V_{ON} = 1.4V$ to $5.5V$	Full	760	nA
Under voltage lockout	UVLO	V_{IN} increasing, $V_{ON} = 1.5V$	Full	1.2	V
		V_{IN} decreasing, $V_{ON} = 1.5V$		0.5	

10. Switching Characteristics

Parameter	Symbol	Test Condition	Typ	Units
TA = +25°C, VIN=5.0V, unless otherwise noted				
Turn-on Time	tON	RL=10 Ω, CIN=1uF, CL=0.1uF	540	us
Turn-off Time	tOFF	RL=10 Ω, CIN=1uF, CL=0.1uF	1.8	
Vout rise time	tr	RL=10 Ω, CIN=1uF, CL=0.1uF	840	
Vout fall time	tf	RL=10 Ω, CIN=1uF, CL=0.1uF	2	
TA = +25°C, VIN=3.3V, unless otherwise noted				
Turn-on Time	tON	RL=10 Ω, CIN=1uF, CL=0.1uF	720	us
Turn-off Time	tOFF	RL=10 Ω, CIN=1uF, CL=0.1uF	1.8	
Vout rise time	tr	RL=10 Ω, CIN=1uF, CL=0.1uF	980	
Vout fall time	tf	RL=10 Ω, CIN=1uF, CL=0.1uF	2.1	
TA = +25°C, VIN=1.5V, unless otherwise noted				
Turn-on Time	tON	RL=10 Ω, CIN=1uF, CL=0.1uF	120	us
Turn-off Time	tOFF	RL=10 Ω, CIN=1uF, CL=0.1uF	1.6	
Vout rise time	tr	RL=10 Ω, CIN=1uF, CL=0.1uF	150	
Vout fall time	tf	RL=10 Ω, CIN=1uF, CL=0.1uF	2.1	

11. Parameter Measurement Information

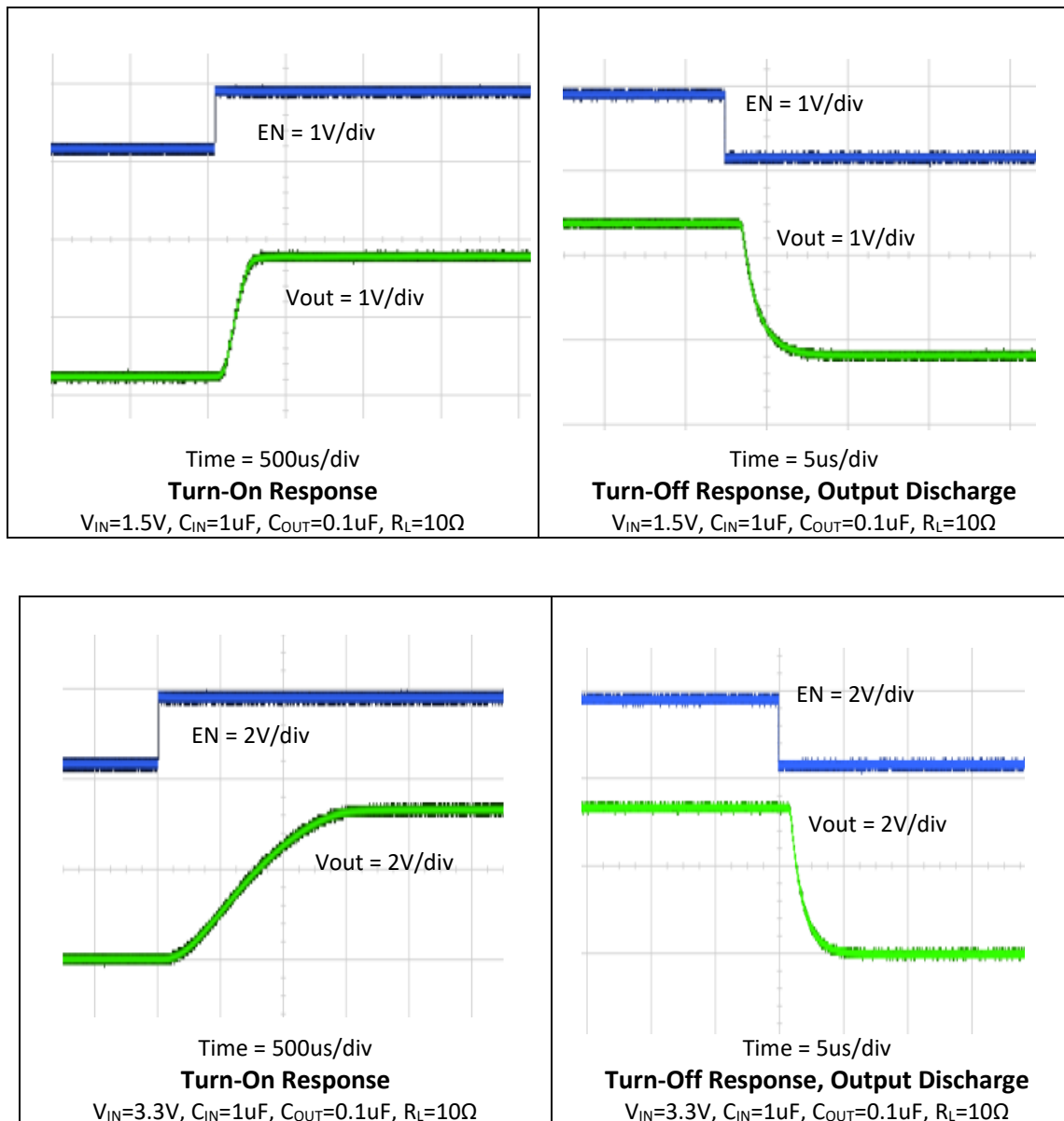


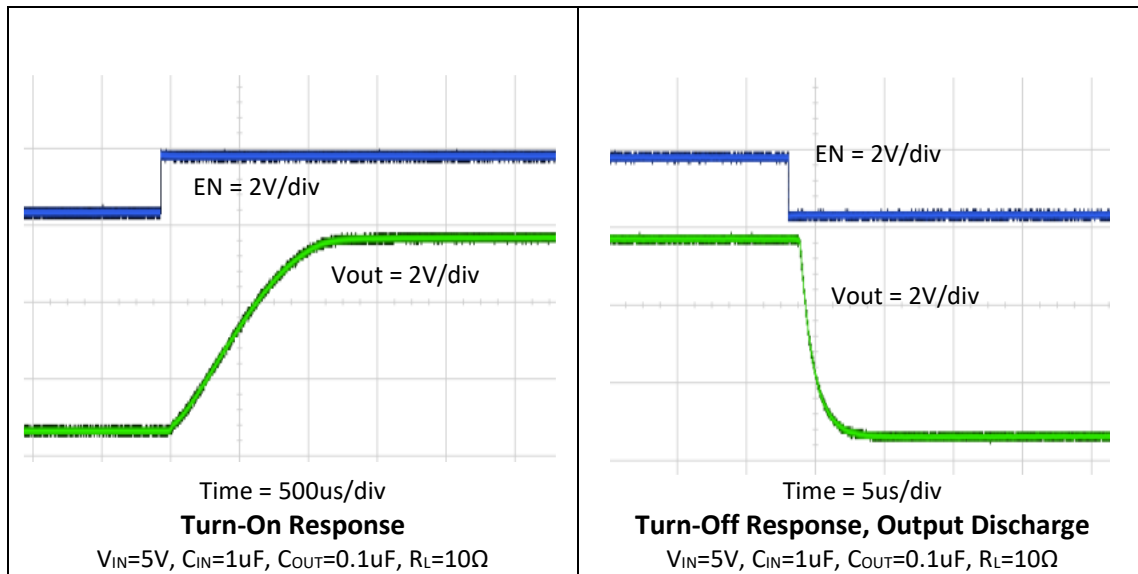
Test circuit



Timing waveforms

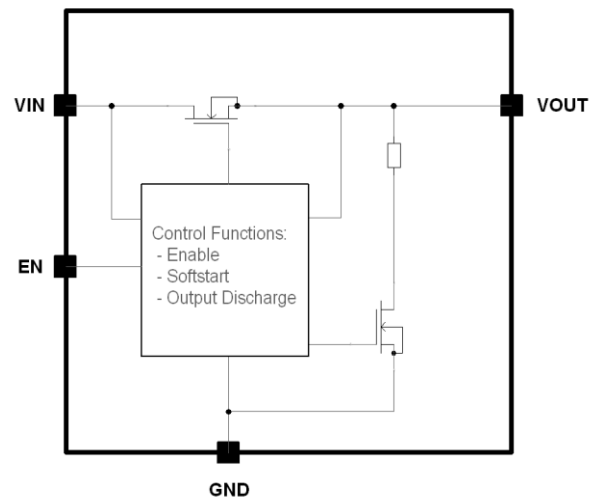
12. Typical Performance and Operating Characteristics





13. Functional Description

The XPA5132 is a low on-resistance switch with logic enable/disable function. XPA5132 has a soft-start functionality to limit inrush current of capacitive loads during turn-on. It operates at input voltage between 1.4V and 5.5V and can deliver up to 2A of load current.



Block Diagram

Functional Table

EN	V _{IN} TO V _{OUT}	Output Discharge ⁽¹⁾
L	Off	Active
H	On	Disabled

Note (1): This feature discharges the output of the switch to ground through a 160ohm resistor, preventing the output from floating.

Enable

Setting the ON voltage to logic level High enables the device. Alternatively, the device is disabled when the ON voltage is set to logic level Low. In this state the IC draws less than 1.5μA of current and the output is pulled to ground through a resistive load. This pin has an internal discharge resistor.

Soft-Start

When the device is enabled, internal soft-start circuitry ramps V_{OUT} up at 980us @ 3.3V_{in} to limit inrush current. This feature protects a high impedance source from being pulled to a lower voltage as the device turns on.

Active Output Discharge

When the device is disabled through the ON pin, a discharge path for the output capacitor is created between V_{OUT} and ground through a 160Ω resistor.

14. Application Information

Input and Output Capacitors

It is recommended to place 1uF capacitor between VIN and GND and 0.1uF capacitor between VOUT and GND, in close proximity to improve stability.

Higher output capacitance can be used but inrush current during startup should be considered and managed. Inrush current can be calculated by below formula.

$$I_{\text{Inrush}} = C_{\text{out}} \times \frac{dv}{dt}$$

Where:

- C_{OUT} is Output capacitance
- d_v = Output voltage
- d_t = Rise time

Power Dissipation

The MOSFET power dissipation is the main contributor to device junction temperature.

Assuming this, the power dissipation and the junction temperature in stable status can be calculated with the following equations.

$$P_D = R_{\text{ON}} \times I_{\text{OUT}}^2$$

Where:

- P_D = Power dissipation (W)
- R_{ON} = Power MOSFET on-resistance (Ω)
- I_{OUT} = Output current (A)

$$T^J = P_D \times \theta_{JA} + T_A$$

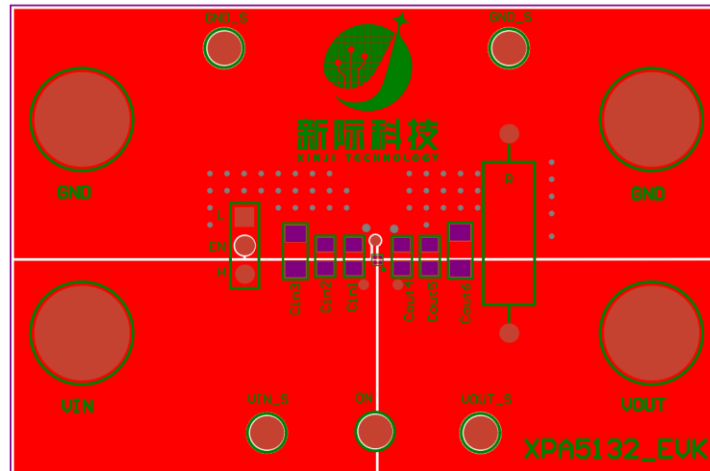
Where:

- T_J = Junction temperature ($^{\circ}\text{C}$)
- θ_{JA} = Junction-to-Ambient Thermal Resistance ($^{\circ}\text{C}/\text{W}$)
- T_A = Ambient temperature ($^{\circ}\text{C}$)

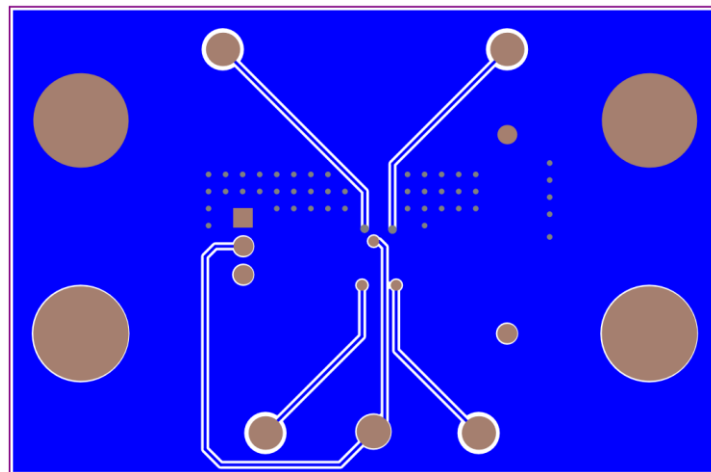
PCB Layout

Place the input and output capacitors as close to the device as possible.

All traces should be as short as possible to minimize parasitic inductance effects. Wide traces for VIN, VOUT, and GND can help reduce signal degradation and parasitic effects during dynamic operation as well as improve the thermal performance at high load currents.



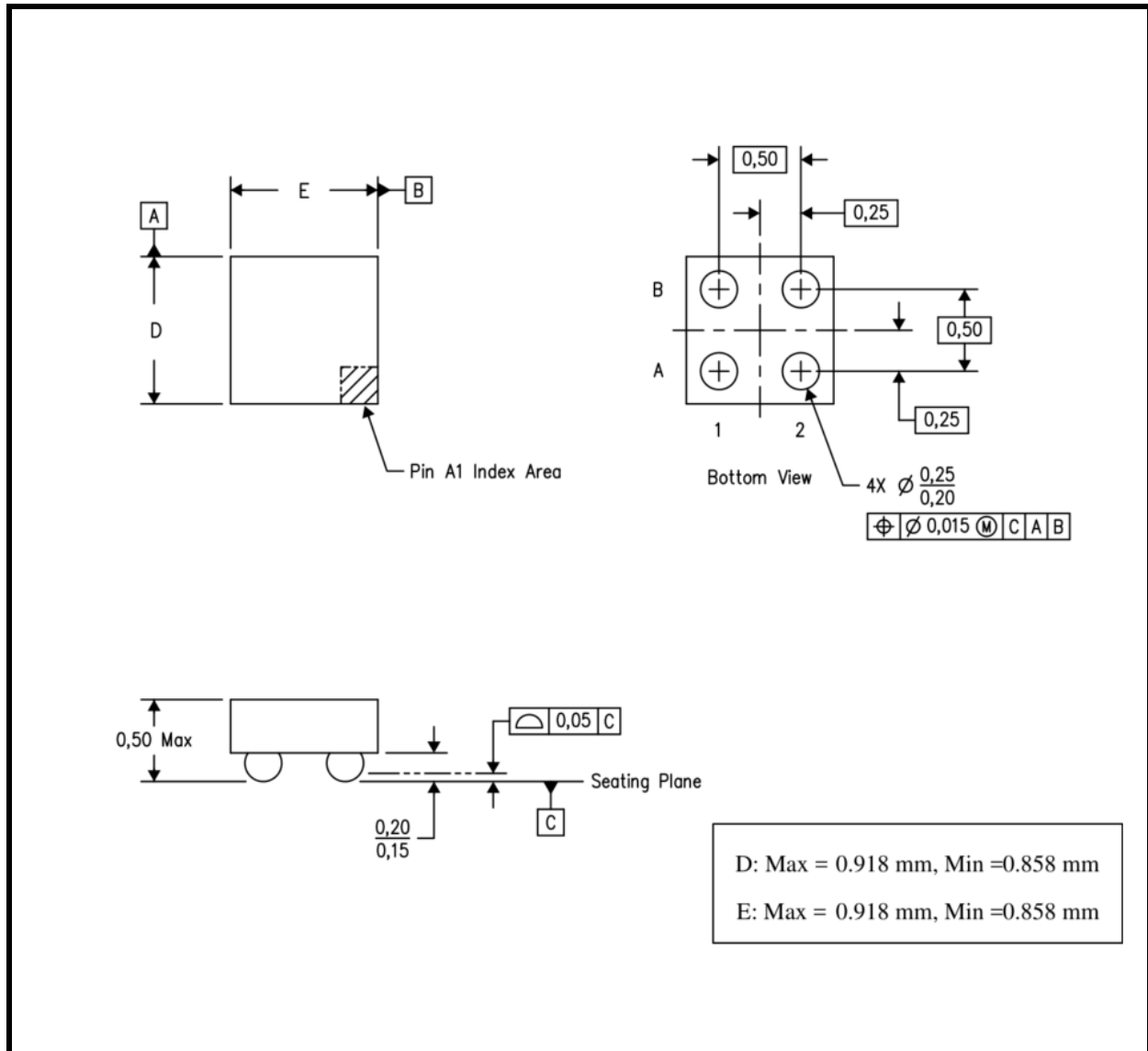
Demo Board Top Layer



Demo Board Bottom Layer

15. Physical Dimensions

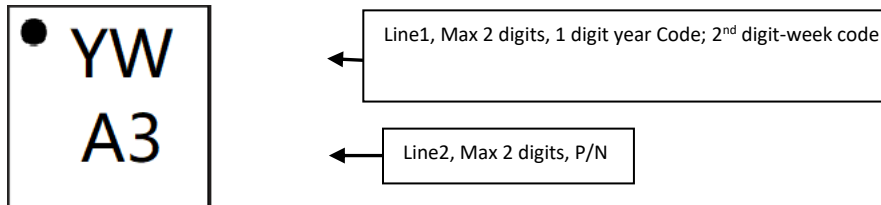
WLCSP-0.9mm x 0.9mm-4B



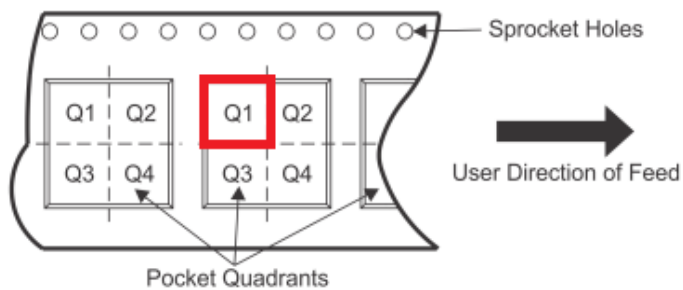
16. Package Marking and PQ information

XPA5132C04R Marking

Format:



Pin 1 located in Q1 direction in T&R



Trace-ability Code:

1. Date code Line 1

The first digit named as year code: Last digit of the year should be marked as year code.

Year Code 2020-2051

Year	Code
2020	0
2021	1
2022	2
2023	3
2024	4
2025	5
2026	7
2027	C

Year	Code
2028	D
2029	E
2030	F
2031	H
2032	I
2033	J
2034	K
2035	L

Year	Code
2036	N
2037	P
2038	R
2039	S
2040	T
2041	U
2042	V
2043	X

Year	Code
2044	Y
2045	Z
2046	b
2047	c
2048	d
2049	h
2050	i
2051	j

2nd digit named week code. 1~9, A~Z (10~35), a~z (36~53)

XPA5132

Ultra-small, Low-On Resistance Load Switch with Controlled Turn-on



WK01	WK02	WK03	WK04	WK05	WK06	WK07	WK08	WK09
1	2	3	4	5	6	7	8	9

WK10	WK11	WK12	WK13	WK14	WK15	WK16	WK17	WK18
A	B	C	D	E	F	G	H	I

WK19	WK20	WK21	WK22	WK23	WK24	WK25	WK26	WK27
J	K	L	M	N	O	P	Q	R

WK28	WK29	WK30	WK31	WK32	WK33	WK34	WK35	WK36
S	T	U	V	W	X	Y	Z	a

WK37	WK38	WK39	WK40	WK41	WK42	WK43	WK44	WK45
b	c	d	e	f	g	h	i	j

WK46	WK47	WK48	WK49	WK50	WK51	WK52	WK53
k	l	m	n	o	p	q	r

2. Product Number Code: Line 2

Product Name	P/N Code	Remark
XPA5132C04R	A3	Apollo3