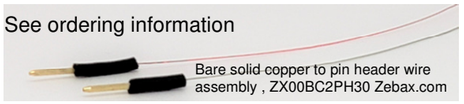
Product Name: ZX122S2BPS PCISIG M.2 NGFF Socket 2 Key B passive breakout adapter, power measurement module

Product Description: ZX122S2BPS is PCISIG M.2 breakout adapter providing access to all PCISIG signals as well as providing method of power supplies test and measurement. ZX122S2BPS is breakout adapter to be used for :

1- Test and measurement for signal quality, characterization , test and debug of any PCISIG signals via onboard 0405 SMD shunt landing pads.
- a) Each PCISIG (excluding GND signals) are routed to 0402 SMD shunt package for easy probe access.
- b) Each 0402 SMD shunt package may be wired for signal measurement via scope / test equipment.
- c) Each 0402 SMD shunt package may be cut and redirected to another signal (onboard or offboard) for test and debug.

2- Measure and analyze power supply ripple, transients, Device Under Test, DUT, power consumption and more.
- a) Each power supply rail is designed with current sensing power resistor, please see block diagram.
- b) Utilizing scope probe – test equipment , measure power supply noise, ripples, transients, and DUT power consumption.
- c) Utilizing eLoad (Electronic Load) , qualify host's power supply & maximum output power.
- d) Identify power supply trace impedance, Rdc , for improved Host / DUT PCB design.

ZX122S2BPS features:
1- Provides access to ALL PCISIG signals via onboard 0402 SMD shunt packages
2- Onboard current sense resistors for all supply rails – Please see table 1 for details.
3- Listed number adjacent to each 0402 SMD shunt package represents the associated PCISIG M.2 connector's pin number.
4- All traces are 50 Ohms impedance controlled.
5- Four layers PCB design, inner layers are GND planes.
6- Accessible GND exposed copper, enabling for ease of access for test and measurement.
7- Mates with any key matching M.2 Host and Device / DUT
8- The module is shipped with 12pc of probing wires , ZX00BC2PH30 , See ordering information



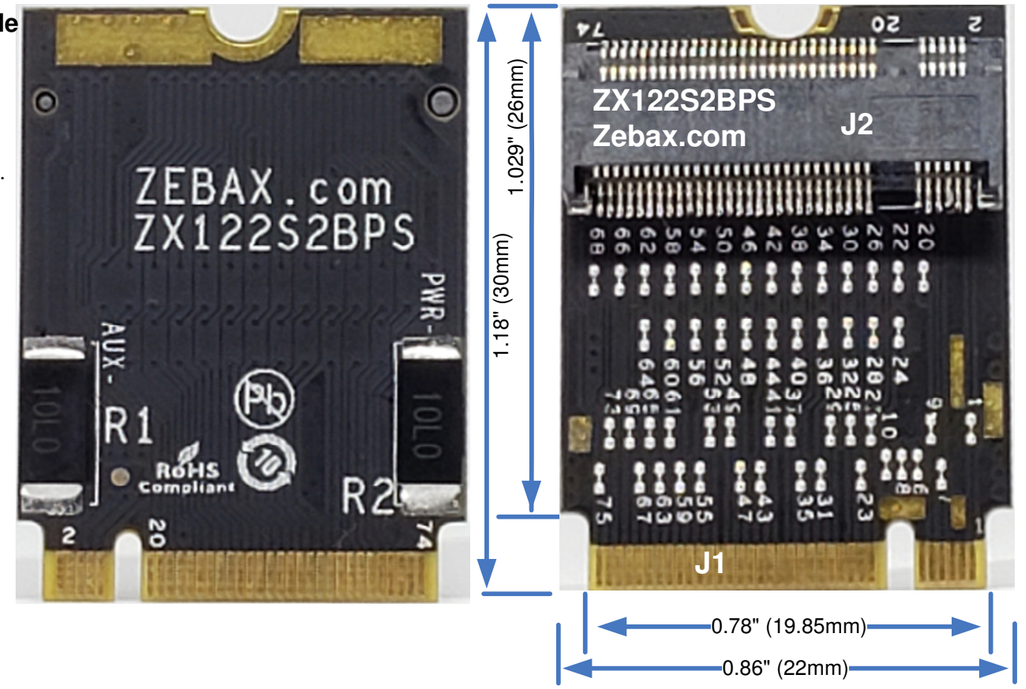


Figure 1 – ZX122S2BPS

Electrical:
Insertion loss > -2dB @6GHz
Trace impedance: 50 Ω
Operating Temperature: -65°C to +170°C
M.2 Edge Connector type (J1) : Key B
Mates with: M.2 Key B
Plating: Gold 100U
M.2 Receptacle (J2) :
Key Type: Key B
Height: 0.16" (4.2mm)
Spacer : 0.1" (2.54mm) – See Figure 3
Plating: Gold 100U
Current per pin: 0.5A (maximum)
Current Sense:
R1,R2 : 10mΩ 2512 SMD 7W - Thickness: 0.02" (0.5mm) Max - See Figure 3
Ratings: AEC-Q200
Temperature Coefficient: ±75ppm / °C
Operating Temperature:-65°C to +85°C at 100% listed power rating, see Table 1
-65°C to +170°C see section Power Rating on page 3
Shunt:
Package: 0402 SMD

Figure 3- M.2 receptacle

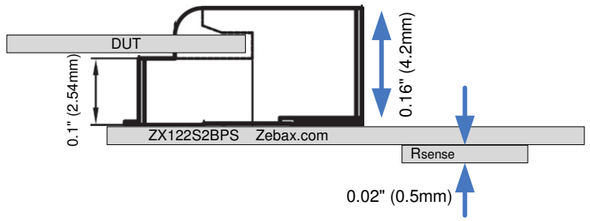
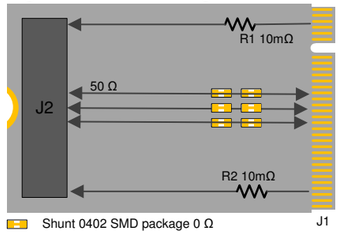
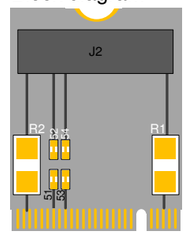


Figure 2 – Circuit diagram

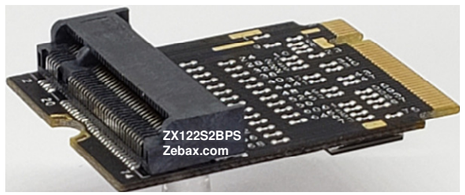


Shunt 0402 SMD package 0 Ω
50 Ω : All traces are designed 50 Ω trace impedance control
J2 : PCISIG M.2 receptacle connector for the ZX122S2BPS

Figure 1 – ZX122S2BPS
Block diagram



R1, R2 : current sense 3.3V / V_{BAT}
51 .. 54 PCISIGN connector pin number routed to the 0402 SMD shunts.



Compliance:
ISO2001 certified
RoHs - Lead Free
EU RoHS2
UL E111594 document
ELV- Vehicle Directive (Directive 2000/EC)
European Union Directive (203/11/EC)
Halogen Free per IEC-61249-2.21 : 2003
RoHs Directive 2011/65/EU
WEEE Directive (2012/12/EU)

Certificate of Compliance for Radioactive substances
Certificate of Compliance for Asbestos
Certificate of Compliance for Ozone Depleting Substances, ODS
Certificate REACH SVHC
Certificate of Compliance RoHS_EN_CoC

Current Sense resistors: Table 1 lists onboard ZX122S2BPS current sense resistors and associated PCISIG M.2 connector assignment

Table 1

Current Sense Resistor	PCISIG M.2 Connector pin number	PCISIG M.2 Supply Rail	Description	Package (inch)	Package (mm)
R1	2, 4,	3.3 V/VBAT	10m Ohms 1% 7W	2512	6432
R2	70, 72, 74	3.3 V/VBAT	10m Ohms 1% 7W	2512	6432

ZX122S2BPS package includes:

Part number	PCB Edge	J2	Quantity	Description
ZX122S2BPS	Key B	Key B	1	M.2 PCISIG Socket 2 Key B module
ZX00BC2PH30			12	32AWG Bare Copper wire to pin header wire assembly

ZX00BC2PH30 site page for ordering ZX00BC2PH30 wire assembly

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ASSEMBLY DRAWING
ITEM: ZX122S2BPS

DESCRIPTION: PCISIG M.2 NGFF Socket 2 Key B passive breakout adapter power measurement module

CHECKED: M. MARINA
DRAWN: MATTHEW CT
REVISSION: 1.0
SHEET: 1 OF 3

Product Name: ZX122S2BPS PCISIG M.2 NGFF Socket 2 Key B passive breakout adapter - power measurement module – Page 2 of 3

Current Sense resistors: The current sense resistors may be removed if external electronic load , eLoad, is used. eLoad test equipment may be applied to ZX122S2BPS for power supply characterization , test and measurements. Eload suppliers : BK Precision , Chroma, Instek , Kikusui and more

Signal assignments: Table 2 exhibits the routed M.2 PCISIG signals on the ZX122S2BPS module.

1- Table 2 represents only the PCISIG M.2 Socket 2 Key B power supply and the assigned GND , PCISIG M.2 reference ground, signal assignments for “Socket 2 Key B” applications.

2- Table 2 represents only the PCISIG M.2 Socket 2 Key B signal assignments for the listed application. However; **there are other PCISIG** signal assignment for the M.2 Socket 2 Key B design configuration. All PCISIG M.2 assigned Power Supply rails and GND reference M.2 pin assignments are identical across PCISIG M.2 Socket 2 Key B solutions. Please apply your design signal name convention to non-power supply rail signals as the listed signal names on the Table 1 applies to the listed specific M.2 application.

Ground / Exposed Copper :
All of the PCISIG M.2 GND , reference ground , signals are connected to each other along with the 2 inner GND planes. In addition; the exposed copper on the ZX122S2BPS is the module’s GND for purpose of rework and probing purpose.

PCISIG M.2 signals :
ZX122S2BPS passes through all PCISIG M.2 signals (excluding the power supply rails . All traces are 50 Ohms impedance controlled. ZX122S2BPS passes through the reserved “NC” No Connect signals as well.

Application: Bringup, testing, emulation, development, modular design evaluations
M.2 PCISIG Socket power supply test characterization
SDIO SSD SATA WWAN DP WIFI GPS GYRO Compass BT FM sensor module
Socket 2 Add-in Card Key B-E , Socket 2 DisplayPort Key B , Socket 2 SDIO Key E
Socket 2 WWAN Key C , Socket 2 PCIe-based SSD Key B-M , Socket 2 SATA-based SSD Key B-M
Socket 2 PCIe / USB 3.1 Gen1-Based WWAN Key B , Socket2 PCIe-Based WWAN Key B
Socket 2 USB3.1 Gen1-based WWAN Key B , Socket 2 SSIC WWAN Key B
Socket 3 PCIe-based Key M , Socket 3 SATA-based Key M

Mates with : Any standard M.2 NGFF PCISIG connector on host and device Key B
TE 2199125 2199119 2199230 2199133 JAE SM3ZS067
Bellwether: SD-80148 SD-80149 SD-80152 SD-80159 Amphenol

Module Insertion, Removal process:

In order to avoid any mechanical stress or damage to ZX122S2BPS, please follow the below listed guidelines for insertion and removal process:

1- Move the Module against the housing chamber, see figure 1
2- Rotate module to 25°, insert it until the module surface reaches the ramp, figure 2, 3
3- Rotate the module to horizontal position, see figure 4
4- Fix the module by screw, see figure 5

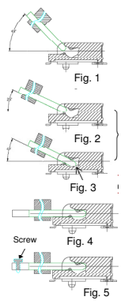

Figure 4 – Typical application **- Rx, Ry : Current sense resistors**

Table 2 – PCISIG M.2 Socket 2 Key B

Table 2 represents only the PCISIG M.2 Socket 2 Key B power supply and the assigned GND , PCISIG M.2 reference ground, signal assignments for “Socket 2 Key B” applications.

Socket2 PCIe / USB 3.1 Gen1-Based WWAN Key B					
Signal	PCISIG M.2 connector pin	ZX122S2BPS		PCISIG M.2 connector pin	Signal
	Pin	Label[1]	Label[1]	Pin	
3.3 V/VBAT	74	R2[2]		75	CONFIG_2 (States 4, 5, 6, 7)
3.3 V/VBAT	72		73	73	VIO_CFG (O)
3.3 V/VBAT	70		71	71	GND
SUSCLK (I)(0/1.8 V/3.3 V)	68	68		69	CONFIG_1 (States 4, 5, 6, 7)
SIM_DETECT (I)	66	66	67	67	RESET# (I)(0/1.8V)
COEX_TXD (O)(0/1.8 V)	64	64	65	65	ANTCTL3 (O)(0/1.8V)
COEX_RXD (I)(0/1.8 V)	62	62		63	ANTCTL2 (O)(0/1.8V)
COEX3 (I/O)(0/1.8 V)	60	60	61	61	ANTCTL1 (O)(0/1.8V)
NC	58	58	59	59	ANTCTL0 (O)(0/1.8V)
NC	56	56		57	GND
PEWAKE# (I/O)(0/1.8 V/3.3 V)	54	54	55	55	NC
CLKREQ# (I/O)(0/1.8 V/3.3 V)	52	52	53	53	NC
PERST# (I)(0/1.8 V/3.3 V)	50	50		51	GND
VENDOR DEFINED or GPIO_4 - TX_BLANKING/GNSS_1/UIM_PWR2/IPC_4 (I/O)(0/1.8V*)	48	48	49	49	NC
VENDOR DEFINED or GPIO_3 - SYSCLK/GNSS_0/UIM_RST2/IPC_3 (I/O)(0/1.8V*)	46	46	47	47	NC
VENDOR DEFINED or GPIO_2 - GNSS_IRQ/GNSS_IRQ/UIM_CLK2/IPC_2 (I/O)(0/1.8V*)	44	44		45	GND
VENDOR DEFINED or GPIO_1 - GNSS_SDA/GNSS_SDA/UIM_DATA2/IPC_1 (I/O)(0/1.8V*)	42	42	43	43	NC
VENDOR DEFINED or GPIO_0 - GNSS_SCL/GNSS_SCL/SIM_DET2/IPC_0 (I/O)(0/1.8V*)	40	40	41	41	NC
NC	38	38		39	GND
UIM_PWR (O)	36	36	37	37	USB3.1-Rx+
UIM_DATA (I/O)	34	34	35	35	USB3.1-Rx-
UIM_CLK (O)	32	32		33	GND
UIM_RESET (O)	30	30	31	31	USB3.1-Tx+
VENDOR DEFINED or GPIO_8 - AUDIO_3/AUDIO_3/PLA_S2#/IPC_ 6-AUDIO_3 (I/O) (0/1.8V)	28	28	29	29	USB3.1-Tx-
VENDOR DEFINED or GPIO_10 - W_DISABLE2#/W_ DISABLE2#/W_DISABLE2# (I/O)(0/1.8V)/HSIC_STROBE (I/O) (0/1.2V)	26	26	27	27	GND
VENDOR DEFINED or GPIO_7 - AUDIO_2/AUDIO_2/RFU/IPC_ 5-AUDIO_2 (I/O) (0/1.8V)	24	24	25	25	DPR (I)(0/1.8V)
VENDOR DEFINED or GPIO_6 - AUDIO_1/AUDIO_1/RFU/AUDIO_1 (I/O)(0/1.8V)	22	22	23	23	GPIO_11-WoWWAN#/WoWWAN#/WoWWAN# (O)(0/1.8V)/HSIC_DATA (I/O)(0/1.2V)
VENDOR DEFINED or GPIO_5 - AUDIO_0/AUDIO_0/RFU/AUDIO_0 (I/O)(0/1.8V)	20	20	21	21	CONFIG_0 = GND
ADD-IN CARD KEY B	18	18	19	19	ADD-IN CARD KEY B
	16	16	17	17	
	14	14	15	15	
	12	12	13	13	
VENDOR DEFINED or GPIO_9 - LED_1#/LED_1#/LED_1# (O)(OD)(0/3.3V) /IPC_7 (I/O)(0/1.8V)	10	10	11	11	GND
W_DISABLE1# (I)(0/1.8 V/3.3V)	8	8	9	9	USB_D-
FULL_CARD_POWER_OFF# (I)(0/1.8V)	6	6		7	USB_D+
3.3 V/VBAT	4	R1[2]	5	5	GND
3.3 V/VBAT	2		3	3	GND
				1	CONFIG_3 = NC

Note 1: ***Label*** is the labled number on the adjacent 0402 SMD shunt package on the ZX122S2BPS module. The listed signal name in table 2 may vary depending to your M.2 design configuration. Please apply your design signal name convention to non-power supply rail signals & GND.
2: The supply power is available on the listed current sense resistor.

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ITEM: ZX122S2BPS

DESCRIPTION: PCISIG M.2 NGFF Socket 2 Key B passive breakout adapter power measurement module

CHECKED: M. MARINA

DRAWN: MATTHEW CT

REVISSION: 1.0

SHEET: 2 OF 3

Product Name: ZX122S2BPS PCISIG M.2 NGFF Socket 2 Key B passive breakout adapter - power measurement module – Page 3 of 3

Typical Application: ZX122S2BPS is designed for purpose of PCISIG M.2 power supply characterization, test and debug at full connector's bandwidth. It provides onboard current sense resistors where scope probe could be utilized for measuring characterization data for qualifying the host or device functional behavior. Additionally, the current sense resistors may be replaced by eLoad for transient and dynamic load throttling. Below are few suggestions in respect to proper power supply measurements using ZX122S2BPS module:

Scope Probe wire Installation:

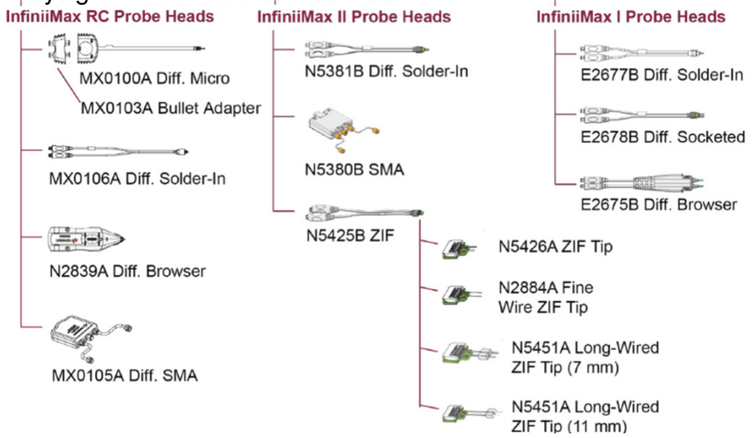
Utilize the supplied ZX00BC2PH30 bare copper to pin wire assembly whenever possible – Based on availability of type of scope + probing options, install probe wire as listed below

1- It is recommended to keep the +probe wire length at 0.5" (1.2cm) long.
2- In order to avoid ground loop problems, please use the shortest Ground probe wire interfacing to the nearest GND reference. ZX122S2BPS provides several exposed copper test points for probing purpose.
3- Ensure scope probe's bandwidth is set at 20MHz – Certain tests require full scope + scope probe bandwidth; however , industry standard is 20MHz bandwidth for power supply test and measurements.
3- Both Keysight as well as Tektronix offer variety of single ended as well as differential probes along with their accessories, below are few probes from each vendor:

a) Keysight differential probe or similar N2795A, N2796A, 1168V, 1134B along with E2677B differential Solder-in probe, N5426A ZIF Tip, N2884A Fine Wire ZIF Tip and more – See the figure "probe head accessories".
b) Tektronix offers several single-ended as well as differential probes such as : P6243, P6245, P6248, P6246, P6247 or any TP1500, TAP2500, TAP3500, TAP4000, P7240 of TDP7000 series or equivalent

4- Please follow your vendor's guideline in installation of probe wires & accessories.

Keysight Probe Head accessories



Power Rating : Onboard current sense resistors on ZX122S2BPS module are designed for maximum power consumption per PCISIG M.2 specification operating within -65°C to 85°C temperature range. The current sense resistor's power rating will degrade at above 85°C test environment. It is highly recommended to utilize external cooling fan if your design expects to exceed maximum current via each PCISIG M.2 pin (0.5A per pin) at **above** 85°C test environment.
The onboard current sense resistors operate at 100% listed power ratings (see Table 1) within temperature range :
R1, R2 : -65°C ≤ operating temperatures ≤ 85°C with tolerance = ±1%

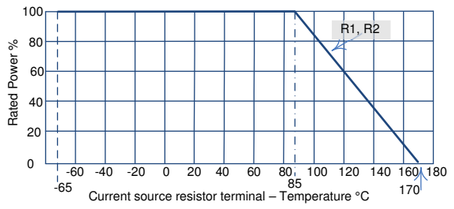
The onboard current sense resistors **power ratings** derail at **above** 85°C. Figure 4 exhibits the current sense resistors derating curve.
Current sense resistors rated power ; P = VI = I**2 x R where I is the maximum current for the listed resistor value R

Below are few suggestions, if your test & measurement environment falls ≥ **+85°C** temperature range :

1- Apply cooling fan where the current sense resistor's terminal blocks are measured at 85°C – Please note - The ZX122S2BPS module design provides heatsink solution to the onboard current sense resistors via inner layers thermal distribution method.
2- Replace the onboard current sense resistors with lower values (similar footprint), resulting at higher power ratings at ≥ 85°C test environment.
3- Replace onboard current sense resistors with eLoad (electronic Load Board / System) – eLoad system resides outside of test chamber, therefore it is not subject to temperature degradation.

Tektronix P6243 scope probe

Figure 4 – Current sense resistor Derating chart



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