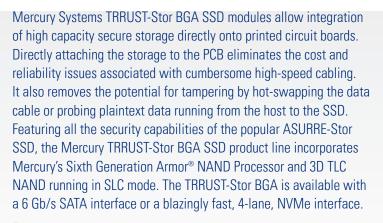
# mercury systems, sys

# Secure Solid State Drives (SSD) TRRUST-Stor® BGA

MBAxxxAM6S-0001xx-aa

- Engineered to CSfC, FIPS 140-2, and Common Criteria (CC) requirements (Planned)
- SATA and NVMe models
- Supports all popular military sanitized protocols plus non-thermal self-destruct
- AES-256 XTS encryption with user fillable keys





### **Features**

- Designed, manufactured in a secure DMEA-accredited facility
- Size: 32mm x 22mm x 3.5mm (BGA) (Preliminary)
- Mercury proprietary Armor 6 NAND processor
- 3D TLC NAND running in SLC mode
- AES-256 XTS encryption
- · Customer controllable boot partition for authentication
- NMVe and SATA models
- Host accessible capacity: 80, 160 GB1
- Total Bytes Written: 1.6 PB (160 GB model)
- FIPS 140-2 and CSfC certified models F and C suffix (planned)
  - Compliant to the NIAP EE and AA protection profiles
  - Multiple key management modes including user defined boot image
  - User and Crypto Officer Roles
- AES Key-Flipper technology eliminates key burn-in
- Fast Clear: Less than 10 seconds
- Self-Destruct capability.

- Supports all popular military sanitization protocols
- DS-101 support for SKL and CYZ-10 compatibility
- Sequential performance

MBA160AM6S-000IC-01

- 1000 MB/s (4 Lane NVMe, 160 GB model)
- 540 MB/s (SATA, 160 GB model)
- Ultra-strong LDPC Hard/Soft Error Correction
- UBER (Uncorrectable Bit Error Rate): 10<sup>-18</sup>
- Leaded BGA balls
- Hot Swap capable
- MTBF: 2 million hours @ 25 °C, Telcordia
- Shock/Vibration: Dependent on mounted environment
- Operating Temperature: -40 °C to +85 °C $^3$
- Storage Temperature: -55 °C to +105 °C3
- Humidity: 95%, non-condensing
- Altitude: 80,000 feet
- Weight: 8 grams
- Voltages: 3.3V, 1.8V, 1.2V, 0.72V
- Power: 5W (TBD)

### **Optional Features**

- Extended temperature and burn-in screening
- Capacity de-stroking
- Custom Identification text for re-branding

## NOTES:

- 1. One Gigabyte (GB) = 1,000,000,000 bytes. 100 MB/s = 100,000,000 bytes per second.
- 2. Performance values based on 128 KiB sequential transfers and largest capacity model.
- 3. Data retention can diminish with extended storage at temperatures above 70 °C. Operation at 85 °C requires maintaining BGA surface at 85 °C or less.
- \* This product is under development, is not qualified or characterized and is subject to change or cancellation without notice.

Mercury Systems is a leading commercial provider of secure sensor and safety-critical processing subsystems. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.













# **Ball Descriptions**

Ball No.	Ball Name	1/0	Description
A3	SMDATA	IN/ OUT	Reserved for possible future use. I2C SM-Bus Data input/output from NVMe/PCle. This signal is part of the standard NVMe signal set but it is not currently supported by the module.
A23	TP0	OUT	Reserved for future use. This pin must be left open.
A24	TP5	OUT	Reserved for future use. This pin must be left open.
A26	TP7	OUT	Reserved for future use. This pin must be left open.
A29	TP1	OUT	Reserved for future use. This pin must be left open.
В3	SMCLK	IN/ OUT	Reserved for possible future use. I2C SM-Bus Clock input/output from NVMe/PCle. This signal is part of the standard NVMe signal set but it is not currently supported by the module.
B23	TP2	OUT	Reserved for future use. This pin must be left open.
B24	TP6	OUT	Reserved for future use. This pin must be left open.
B29	DUALPORTEN_N	IN	This is the NVMe dual port enable signal. Dual port operation is planned in a future firmware release. This pin should be externally pulled high.
C23	TP4	OUT	Reserved for future use. This pin must be left open.
C24	TP3	OUT	Reserved for future use. This pin must be left open.
C29	MOD_ACTIVE	OUT	This is an output notifying the host that the module successfully booted and is ready for normal operation.
C30	MODE_LED_BLUE	OUT	Error mode indicator. When the module is operating normally, this signal will be low. If the module encounters an unrecoverable error, this signal will transition to a high level. This signal is intended to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
C31	ACTIVITY	OUT	This is a high true output that indicates the module is actively executing a host operation. This signal is intended to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
D30	FACTORY_LED	OUT	Reserved for use by Mercury systems
D31	LINK_SPEED_LED	OUT	Interface connection speed indicator. This signal indicates the link speed that the module negotiated with the host system. For SATA models, this signal is high when the link speed is 3 Gb/s or 1.5Gb/s and is low for a 6 Gb/s link. For NVMe models, this signal is high for link speeds of 2.5 Gb/s and 5 Gb/s and low for a link speed of 8 Gb/s.
E1	MON_232TX	OUT	Security port RS-232 TX output signal. This is the LVTTL <sup>1</sup> RS-232 transmit signal from the module to the host. This signal and the MON-232RX form a security port that allows a host to configure the module for pre-boot security features and to read status from the module.
E2	MON_232RX	IN	Security port RS-232 RX input signal. This is the LVTTL <sup>1</sup> RS-232 receive signal from the host to the module. This signal and the MON-232TX form a security port that allows a host to configure the module for pre-boot security features and to read status from the module.
F30	MODE_LED_GREEN	OUT	Power and normal operation LED. When the module is operating normally, this signal will be high. This signal is intended to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
F31	OVER85C_LED	OUT	During normal operation, this signal will be low. When the module internal temperature exceeds 85C, this signal will transition from a low level to a high level. This signal is intended to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
G1	DN_ KEYFILL_232RX	IN	Isolated Key-Fill Daisy Chain RX input. This is the LVTTL <sup>1</sup> RS-232 Receive line from a downstream module to this module. This signal is used when multiple SSD modules are daisy chained together.
G2	DN_KEYFILL_232TX	OUT	Isolated Key-Fill Daisy Chain TX output. This is the LVTTL <sup>1</sup> RS-232 Transmit line from this module to the downstream module. This signal is used when multiple SSD modules are daisy chained together. The data transmitted from this port is data received by the UP_KEYFILL_232_RX signal of the down stream module.
G30	KEY_LED	OUT	This signal goes high to indicate to a user that the module is waiting for entry of the encryption key. This signal is intended for use to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
G31	PASSWORD_LED	OUT	This signal goes high to indicate to a user that the module is waiting for entry of a password. This signal is intended to drive an external FET to illuminate an LED. This signal cannot directly drive an LED.
J1	UP_KEYFILL_232RX	IN	Isolated Key-Fill port RX input. This is an LVTTL¹ RS-232 receive line from the host to this module. The host uses this signal to send the AES 256 encryption key to this module. The module may output the key on the DN_KEYFILL_232TX to fill the key of a downstream daisy chained module.
J2	UP_KEYFILL_232TX	OUT	Isolated Key-Fill port TX output. This is an LVTTL <sup>1</sup> RS-232 Transmit line from this module to the host system.
J30	PRSNT_N	OUT	This is an NVMe control signal. This pin should be externally pulled high.
J31	IFDET_N	OUT	This is an NVMe control signal. This pin should be externally pulled high.
K30	ERASE_TRIGGER	IN	This input, when high for 10 ms, can trigger a Secure Erase operation that erases the AES key value and/or the NAND media. This input contains a weak internal pulldown.
K31	AUTH	IN/ OUT	This ia a bi-directional signal that is used by the module to communicate with an external Atmel ATSH204A crypto authentication device.
L1	NVME2_RX_M	IN	For NVMe models, this signal is the Lane 2 negative receive signal from the host to the module.

# Ball Descriptions (continued)

Ball No.	Ball Name	1/0	Description
L2	NVME2_RX_P	IN	For NVMe models, this signal is the Lane 2 positive receive signal from the host to the module.
M30	SHUT_DWN_N	IN	This is a low true input to the module that allows a host system to request that the SSD module perform an immediate backup operation and then enter a low power shutdown state.
M31	PS_PWR_ MEASURE	IN	Voltage input that allows the module to measure the voltage of the external main supply rail. The external main supply rail voltage must be scaled so that the max rail voltage is presented as 0.8V to the module.
N1	NVME0_SATA_ TX_P	OUT	For SATA models, this is the positive high speed SATA transmit signal from the module to the host. For NVMe models, this signal is the positive transmit signal for Lane 0 from the module to the host.
N2	NVME0_SATA_ TX_M	OUT	For SATA models, this is the negative high speed SATA transmit signal from the module to the host. For NVMe models, this signal is the negative transmit signal for Lane 0 from the module to the host.
N30	BKUP_MEASURE	IN	Voltage input that allows the module to measure the voltage of the external backup power supply. The external backup power supply voltage must be scaled so that the max rail voltage is presented as 0.8V to the module.
N31	WRITE_ PROTECT_N	IN	Write protection. When this input is low, host write commands are inhibited.
R1	NVME3_RX_P	IN	For NVMe models, this signal is the Lane 3 positive receive signal from the host to the module.
R2	NVME3_RX_M	IN	For NVMe models, this signal is the Lane 3 negative receive signal from the host to the module.
R30	DESTRUCT	IN	When the module is configured to allow a Destruct operation, this signal will trigger a non-reversible self-destruct operation when the module detects a transition of this pin from a low level then to a high level and remaining at a high level for a minimum of 10 ms. To avoid accidental destruct operations, the module ignores self-destruct requests when the signal is detected high at power on time. The signal must be sampled low, once, after the module boots to arm the self-destruct trigger and enable monitoring for a destruct trigger.
R31	PS_LOW	IN	This is a high true input that indicates that the voltage PS_PWR is too low for safe operation. PS_PWR is the name the module uses for the voltage rail that is used to derive the supplies that power the module. The module uses the PS_LOW signal to trigger a deterministic shutdown process. When the module detects a high level on PS_LOW, it immediately saves all critical volatile data in non-volatile memory and transitions to an idle state. The host must continue to maintain all voltages suppled to the module for 20 ms after asserting the PS_LOW signal. The module restarts normal operation when PS_LOW returns to a low level for at least 100 ms.
U1	NVME1_TX_P	OUT	For NVMe models, this signal is the Lane 1 positive transmit signal from the module to the host.
U2	NVME1_TX_M	OUT	For NVMe models, this signal is the Lane 1 negative transmit signal from the module to the host.
W1	REFCLK_P	IN	Positive Reference clock from the NVMe/PCIe connector.
W2	REFCLK_N	IN	Negative Reference clock from the NVMe/PCle connector.
Y3	NVME0_SATA_ RX_P	IN	For SATA models, this is the positive high speed SATA receive signal from the host to the module. For NVMe models, this signal is the positive receive signal for Lane 0 from the host to the module.
Y5	NVME1_RX_P	IN	For NVMe models, this signal is the Lane 1 positive receive signal from the host to the module.
Y7	NVME3_TX_M	OUT	For NVMe models, this signal is the Lane 3 negative transmit signal from the module to the host.
Y9	NVME2_TX_M	OUT	For NVMe models, this signal is the Lane 2 negative transmit signal from the module to the host
AA3	NVMEO_SATA_ RX_M	IN	For SATA models, this is the negative high speed SATA receive signal from the host to the module. For NVMe models, this signal is the negative receive signal for Lane 0 from the host to the module.
AA5	NVME1_RX_M	IN	For NVMe models, this signal is the Lane 1 negative receive signal from the host to the module.
AA7	NVME3_TX_P	OUT	For NVMe models, this signal is the Lane 3 positive transmit signal from the module to the host.
AA9	NVME2_TX_P	OUT	For NVMe models, this signal is the Lane 2 positive transmit signal from the module to the host

NOTE:
1. Unless otherwise specified, module input and output signals are 3.3V LVTTL
2. The drive direction of all signals are with respect to the SSD module. An input is an input to the SSD module. An output is an output from the SSD module.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
AA	GND	GND	NVMEO_ SATA_ RX_M	GND	NVME1_ RX_M	GND	NVME3_ TX_P	GND	NVME2_ TX_P	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
Y	GND	GND	NVME0_ SATA_ RX_P	GND	NVME1_ RX_P	GND	NVME3_ TX_M	GND	NVME2_ TX_M	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MI:
w	REFCLK_P	REFCLK_N	0.9V	0.9V	1.2V	1.2V	0.9V	0.9V	1.2V	1.2V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
v	GND	GND	0.9V	GND	1.2V	GND	0.9V	GND	1.2V	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
U	NVME1_ TX_P	NVME1_ TX_M	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
т	GND	GND	1.8V	1.8V	GND	GND	1.8V	1.8V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
R	NVME3_ RX_P	NVME3_ RX_M	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
Р	GND	GND	1.8V	1.8V	GND	GND	0.85V	0.85V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
N	NVME0_ SATA_ TX_P	NVME0_ SATA_ TX_M	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
М	GND	GND	1.8V	1.8V	GND	GND	0.85V	0.85V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
L	NVME2_ RX_M	NVME2_ RX_P	GND	GND	0.85V	0.85V	1.8V	1.8V	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
к	GND	GND	1.8V	1.8V	GND	GND	0.85V	0.85V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
J	UP_ KEYFILL_ 232RX	UP_ KEYFILL_ 232TX	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
н	GND	GND	NC	1.8V	GND	GND	0.85V	0.85V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
G	DN_ KEYFILL_ 232RX	DN_ KEYFILL_ 232TX	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
F	GND	GND	NC	1.8V	GND	GND	1.8V	1.8V	GND	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
E	MON_ 232TX	MON_ 232RX	GND	GND	0.85V	0.85V	GND	GND	0.85V	0.85V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
D	GND	GND	NC	GND	1.2V	GND	1.8V	GND	1.2V	1.2V	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
С	NC	NC	1.8V	1.8V	1.2V	1.2V	1.8V	1.8V	1.2V	NC	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS B
В	GND	GND	SMCLK	GND	NC	GND	NC	GND	NC	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MIS
Α	MISSING BALL	GND	SMDATA	GND	NC	GND	NC	GND	NC	GND	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MI

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6	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	TP0	TP5	GND	TP7	NC	GND	TP1	GND	GND	A
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	TP2	TP6	GND	NC	NC	GND	DUAL PORTEN_N	GND	GND	В
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	0.6V_VTT	TP4	TP3	GND	NC	NC	GND	MOD_ ACTIVE	MODE_ LED_BLUE	ACTIVITY	С
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	0.6V_VTT	2.5V_VPP_ DDR4	2.5V_VPP_ DDR4	NC	NC	NC	GND	GND	FACTORY_ LED	LINK_ SPEED_ LED	D
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	1.2V	1.2V	3.3V	3.3V	1.2V	1.2V	GND	GND	E
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	1.2V	1.2V	GND	GND	1.2V	1.2V	GND	GND	MODE_ LED_ GREEN	OVER85C_ LED	F
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	3.3V	3.3V	GND	GND	1.2V	1.2V	KEY_LED	PASS WORD_ LED	G
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	1.2V	1.2V	GND	GND	1.2V	1.2V	GND	GND	GND	GND	н
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	NC	NC	NC	NC	1.2V	1.2V	PRSNT_N	IFDET_N	J
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	3.3V	3.3V	NC	NC	NC	NC	3.3V	3.3V	ERASE_ TRIGGER	AUTH	К
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	NC	NC	NC	NC	GND	GND	GND	GND	L
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	3.3V	3.3V	NC	NC	NC	NC	3.3V	3.3V	SHUT_ DWN_N	PS_PWR_ MEASURE	М
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	NC	NC	NC	NC	1.2V	1.2V	BKUP_ MEASURE	WRITE_ PROTECT_ N	N
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	1.2V	1.2V	GND	GND	1.2V	1.2V	GND	GND	GND	GND	P
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	3.3V	3.3V	GND	GND	1.2V	1.2V	DESTRUCT	PS_LOW	R
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	1.2V	1.2V	GND	GND	1.2V	1.2V	GND	GND	NC	NC	Т
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	GND	1.2V	1.2V	3.3V	3.3V	1.2V	1.2V	GND	GND	U
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	v
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	NC	NC	GND	NC	NC	GND	NC	NC	NC	w
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	NC	NC	GND	NC	NC	GND	NC	GND	GND	Y
SING	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	MISSING BALL	GND	NC	NC	GND	NC	NC	GND	NC	GND	GND	AA
6	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

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Construction:

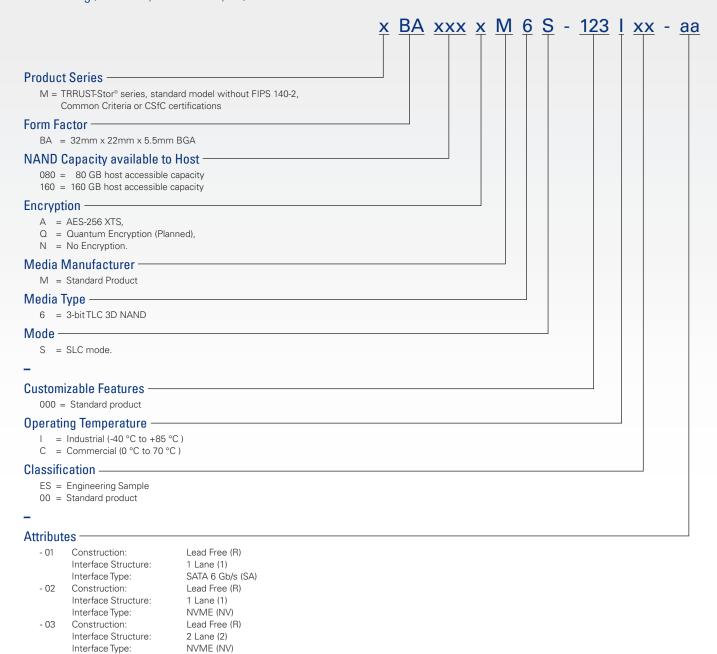
Interface Type:

Interface Structure:

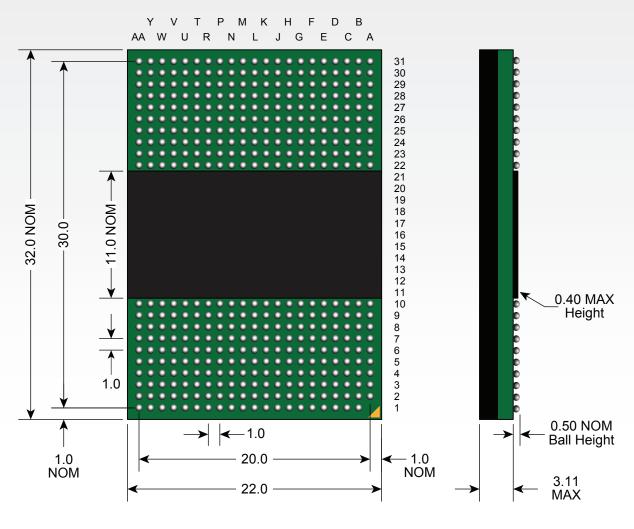
Lead Free (R)

4 Lane (4)

NVME (NV)



Example part Number: MBA160AM6S-000IC-01



NOTES:

Internal BGA construction uses SAC305 (lead-free) solder. External solder ball composition: Eutectic Sn63Pb37. Pads are Solder Mask Defined (SMD), pads openings are 0.48mm

All linear dimensions are millimeters

# Need More Help? Need a Variant of This Product?

Contact Mercury's Secure SSD application engineering team at secure.ssd@mrcy.com



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5023.10E 0818 ds SSD Mercury TRRUST-Stor BGA SSD



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