Application Note

TID MEMORY MAPS FOR MONZA SELF-SERIALIZATION

TECHNICAL REFERENCE

Version 7.0

www.impinj.com

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1 INTRODUCTION

RFID tags have been applied to billions of apparel items and an increasing number of retailers are requesting RFID tagged items from their suppliers. RFID systems require that each item have a unique serial number so that it can be identified or counted; so brand owners are faced with the challenge of managing and encoding unique serial numbers across their global, and often complex, supply chains.

In the past, brand owners only had a choice between implementing and administering their own IT-based serialization systems or outsourcing serial number management to one or more qualified third-party service bureaus. These options for implementing or outsourcing serialization may force brand owners to change their business processes in ways that increase costs or decrease their supply chain responsiveness and flexibility.

With Monza® Self-Serialization brand owners have an easy-to-deploy and scalable EPC serialization method based on Impinj's breakthrough tag chip serial number management and an ecosystem of high-performance encoding solutions. Monza Self-Serialization enables brand owners to generate a serial number directly from their tag chip, eliminating the need for IT systems to coordinate, distribute and synchronize serial numbers. In addition, brand owners gain control and flexibility to choose when, where and how they manage their RFID tagging processes and deliver properly tagged products.

At the heart of Monza Self-Serialization are Impinj's endpoint ICs. Boasting leading encoding performance and built-in scalable serialization, these tag chips are supported by a global ecosystem of high-quality inlay manufacturers and service bureaus. Monza Self-Serialization allows RFID printer encoders and inline or bulk encoding solutions based on the Impinj ItemEncode software to construct a unique Serialized Global Trade Item Number (SGTIN) under the hood, using existing IT-based barcode and variable data management business processes.

Monza Self-Serialization allows:

- Scalable serialization built into Impinj endpoint ICs
- SGTIN serial numbers generated directly from Monza's unalterable Tag Identifier (TID)
- EPC data quality and integrity with verifiable SGTIN at any point in supply chain
- Forward compatible with future generations of Impinj endpoint ICs

Monza Self-Serialization is an easy to deploy and scalable chip-based serialization method for item-level RFID tagging where a unique EPC serial number is generated from the unalterable serialized Tag Identifier (TID) and encoded as part of a unique Electronic Product Code (EPC) into the EPC memory bank of an Impinj endpoint ICs.

This application note documents the use of the unalterable serialized Tag Identifier (TID) for generating serial numbers which may be stored in the EPC memory bank.

Table 1: TID Bits for Impinj Tag Chip Models

SERIALIZATION FAMILY	TAG CHIP	1ST 32-BITS OF TID	NOTES
Monza	Impinj M750	E2801190	
Monza	Impinj M730	E2801191	
Monza	Monza R6-P	E2801170	
Monza	Monza R6-A	E2801171*	Wafer Mask Revision: 000
Monza	Monza R6-B	E2801171*	Wafer Mask Revision: 001
Monza	Monza R6	E2801160	
Monza	Monza 5	E2801130	
Monza	Monza 4D	E2801100	
Monza	Monza 4E	E280110C	
Monza	Monza 4QT	E2801105	
Monza	Monza 4i	E2801114	
MonzaX	Monza X-2K	E2801140	
MonzaX	Monza X-8K	E2801150	

**Monza R6-A and Monza R6-B share the same Tag Model Number (TMN) but they can be distinguished by their wafer mask revision numbers. Monza R6-A has a wafer mask revision value of 000_2, and Monza R6-B has a wafer mask revision value of 001_2.*

2 MONZA SELF-SERIALIZATION FORMULAS

To accommodate differences in TID serial number structures between Impinj endpoint ICs and to enable forward compatible innovation in future generations of Impinj endpoint ICs, Impinj utilizes Monza model specific "formulas" to specify which bits should be used from the TID and how those bits should be ordered to construct a unique serial number that can be used in EPC compliant or other customer specific tag data schemas.

2.1 Monza Series

- Impinj endpoint ICs contain 2-bit Monza Series ID in the TID memory bank to identify the serial number pool that the serial number was generated from. These tag chips can support Series 0 [00] through Series 3 [11].
- Currently, there are two different serialization families: Monza and MonzaX.
- For a serialization family and a given series there is a unique set of 38-bit serial number values which may be shared across multiple tag chip models. Serial numbers are not unique across multiple series and serialization families. As an example, Monza R6 Series 1 and Monza 5 Series 1 are each independent SKUs that contain serial numbers from the same Monza Series 1 serial number pool. Meanwhile, Monza 4 Series 0, Monza 5 Series 1 and Monza X-8K Series 3 span multiple serialization families and multiple series, so these serial numbers come from different pools and would not be guaranteed unique.

- End users can utilize Monza Self-Serialization on tag chips with different serial number sources (Example: Monza 5 Series 1 and Monza 4 Series 0) by assigning a unique serialization prefix (MSB of generated 38-bit serial number) to each.
- The 96-bit TIDs and 96-bit serial numbers for all Impinj endpoint ICs are unique.
- Currently the “Monza” serialization family uses Series 1 and the “MonzaX” serialization family uses Series 3 specifically for the Monza X tag chip family.

2.2 Monza Series Cycle Counter

- The Series Cycle Counter is a Series specific 1-bit value that increments when the series rolls over.
- The cycle counter is used to identify series rollover by downstream customers and to maintain 96-bit TID uniqueness.
- The cycle counter is not contained in the TID memory of Impinj M700, Monza 5, Monza 4, Monza X-2K or Monza X-8K tag chips and is always set to zeros. The Monza 6 family tag chips supports the cycle counter in TID NVM.

2.3 Serialization Bits

Impinj endpoint ICs come with a 48-bit serialized number found in bits 30_h-$5F_h$ of TID memory. This number may include additional information such as the Monza Series ID and the Monza Series Cycle Counter along with a 38-bit serial number that is unique for a serialization family for a given series as defined for each Impinj endpoint ICs in the following sections.

The table below shows how the bits from Monza Self-Serialization are used for generating serialized 96-bit EPC values.

Table 2: Supported EPC Memory Serialization Bits When Using Monza Self-Serialization

BITS	DATA (ZEROS FROM MSS)	VALUES
35	FFFFFFFFFFFFFFF800000000	[61-bits Data][35-bit Serial Number]
36	FFFFFFFFFFFFFFF000000000	[60-bits Data][36-bit Serial Number]
37	FFFFFFFFFFFFFFE000000000	[59-bits Data][37-bit Serial Number]
38	FFFFFFFFFFFFFFC000000000	[58-bits Data][38-bit Serial Number]
96	000000000000000000000000	[96-bit Serial Number]

2.4 Impinj M700 Series Memory Map

Table 3: Impinj M700 Series TID Memory Map

IMPINJ M700 SERIES TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
40_h-$4F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30_h-$3F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	M
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	
Tag Model Number (TMN)	14_h-$1F_h$	12	00011001000M	Impinj M700 series, where the variable M specifies the tag model • "1" for Impinj M730 • "0" for Impinj M750
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-32_h	3		Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-54_h	5	00000	
Monza Series ID	55_h-56_h	2	01	Supports Series 0 – Series 3
Serial Number		38		

*Note: The values for x denotes the unique serialization values for each chip, and the M denotes the model specific TMN numbers. *The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*

- **Impinj M700, Series 0 [00] – Series 3 [11] 96-bit Serial Number Formula**

```
[00h:07h][08h:13h][14h:1Fh] 1010 0101 0000 0[30h:32h] 000[50h:56h][57h:5Fh][40h:4Fh][33h:3Fh]
```

- **Impinj M700, Series 0 [00] – Series 3 [11] 38-bit Serial Number Formula**

```
[57h:5Fh][40h:4Fh][33h:3Fh]
```

2.4.1 Example - Impinj M750 Series 2 Serial Number

Table 4: TID Memory Map EXAMPLE – Impinj M750 Series TID E2801190200069F009420300

IMPINJ M750 TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
40_h-$4F_h$	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1	0
30_h-$3F_h$	0	1	1	0	1	0	0	1	1	1	1	1	0	0	0	0
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	000110010000	"0" for Impinj M750
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-32_h	3	011	Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-54_h	5	00000	
Monza Series ID	55_h-56_h	2	01	Supports Series 0 – Series 3
Serial Number		38	10000000000001001010000100100111110000	

**The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*

- **Impinj M750 Example, Series 2 [10] 96-bit Serial Number Formula**

```
[00h:07h][08h:13h][14h:1Fh] 1010 0101 0000 0[30h:32h] 000[50h:56h][57h:5Fh][40h:4Fh][33h:3Fh]
```

  - 96-bit Serial Number (binary):

```
1110 0010 1000 0000 0001 0001 1001 0000 1010 0101 0000 0011
0000 0000 0110 0000 0000 0001 0010 1000 0100 1001 1111 0000
```

  - 96-bit Serial Number (hex):

```
E280 1190 A503 0060 0128 49F0
```

- **Impinj M750 Example, Series 2 [10] 38-bit Serial Number Formula**

```
[57h:5Fh][40h:4Fh][33h:3Fh]
```

- 38-bit Serial Number (binary):

```
10 0000 0000 0001 0010 1000 0100 1001 1111 0000
```

- 38-bit Serial Number (hex):

```
20012849F0
```

2.5 Monza 6 Family TID Memory Map

Table 5: Monza 6 TID Memory Map

IMPINJ M700 SERIES TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
40_h-$4F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30_h-$3F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	1	1	M	M	M	M	M
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	
Tag Model Number (TMN)	14_h-$1F_h$	12	0001011MMMMM	Monza 6 family, where MMMMM specifies the Monza 6 tag model (See Table 6)
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-32_h	3		Indicates the Mask Revision for the tag
Integra™ TID Parity	33_h	1	(Parity)	Bit is set to guarantee bits 30:5F have even parity
Reserved for Future Use	50_h-52_h	3	000	
Monza Series ID	53_h-54_h	2	01	Supports Series 0 – Series 3
Monza Series Cycle Counter	34_h	1	0	Series rollover indicator
Serial Number		38		

*Note: The values for x denotes the unique serialization values for each chip, and the M denotes the model specific TMN numbers. *The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*

Table 6: Monza 6 Model Numbers

TAG MODEL	TAG MODEL NUMBER	WAFER MASK REVISION
Monza R6	000101100000	011
Monza R6-A	000101110001	000
Monza R6-B	000101110001	001
Monza R6-P	000101110000	000

- **Monza 6 Series 0 [00] – Series 3 [11] 96-bit Serial Number Formula**

  $[00_h:07_h][08_h:13_h][14_h:1F_h][30_h:32_h]0\ [50_h:52_h]0\ 0000\ 0000\ 0000\ 0[53_h:54_h]0\ 0[34_h][55_h:5F_h][40_h:4F_h][35_h:3F_h]$

- **Monza 6 Series 0 [00] – Series 3 [11] 38-bit Serial Number Formula**

  $[55_h:5F_h][40_h:4F_h][35_h:3F_h]$

- Implementation notes:
  - Monza 6 family tag chip's EPC is pre-serialized using the 96-bit serial number formula above.
  - Last 48-bits of TID should always have even parity.

2.5.1 Example – Monza R6-P Series 1 Serial Number

Table 7: TID Memory Map EXAMPLE – Monza R6-P TID E280117020001089CCEB08DF

MONZA 6 TID MEMORY BANK																
Word	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
50_h-$5F_h$	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1
40_h-$4F_h$	1	1	0	0	1	1	0	0	1	1	1	0	1	0	1	1
30_h-$3F_h$	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	1	1	1	0	0	0	0
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	Location	Bits	Binary	Value
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	000101110000	Tag model number (Monza R6-P)
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-32_h	3	000	Indicates the Mask Revision for the tag
Integra™ TID Parity	33_h	1	1	Bit is set to guarantee bits 30:5F have even parity
Reserved for Future Use	50_h-52_h	3	000	
Monza Series ID	53_h-54_h	2	01	Supports Series 0 – Series 3
Monza Series Cycle Counter	34_h	1	0	Series rollover indicator
Serial Number		38	00011011111111001100 11101011000100010001	30037989513 (decimal)

**The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*

- **Monza R6-P Example, Series 0 [00] – Series 3 [11] 96-bit Serial Number Formula**

  `[00h:07h][08h:13h][14h:1Fh][30h:32h]0 [50h:52h]0 0000 0000 0000 0[53h:54h]0 0[34h][55h:5Fh][40h:4Fh][35h:3Fh]`

  - Series 1 96-bit Serial Number (binary):

```
1110 0010 1000 0000 0001 0001 0111 0000 0000 0000 0000 0000
0000 0010 0000 0110 1111 1110 0110 0111 0101 1000 1000 1001
```

- Series 1 96-bit Serial Number (hex):

```
E280117000000206FE675889
```

- **Monza R6-P Example, Series 0 [00] – Series 3 [11] 38-bit Serial Number Formula**

$[55_h:5F_h][40_h:4F_h][35_h:3F_h]$

- Series 1 38-bit Serial Number (binary):

```
00 0110 1111 1110 0110 0111 0101 1000 1000 1001
```

- Series 1 38-bit Serial Number (hex):

```
06FE675889
```

2.6 Monza 5 TID Memory Map

Table 8: Monza 5 TID Memory Map

IMPINJ M750 TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
40_h-$4F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30_h-$3F_h$	x	x	x	x	x	x	0**	x	x	x	x	x	x	x	x	x
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	000100110000	Monza 5 family TMN
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-33_h	4		Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-52_h	3	000	
Monza Series ID	53_h-54_h	2	01	Supports Series 0 – Series 3
Serial Number		38		

Note: The values for X will be replaced by the unique serialization values for each chip.
** The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*
*** This bit is always fixed to zero on Monza 5. For this reason, it is not included in the Serial Number formula.*

Table 9: Monza 5 Model Numbers

TAG MODEL	TAG MODEL NUMBER	WAFER MASK REVISION
Monza 5	000100110000	0011

- **Monza 5 Series 0 [00] 96-bit Serial Number Formula**

```
[00h:07h][08h:13h][14h:1Fh][30h:33h] [50h:52h]0 0000 0000 0000 0[53h:54h]0 0000
0[55h:5Ch][41h:4Fh][5Dh:5Fh][40h][38h:3Fh]
```

- **Monza 5 Series 0 [00] 38-bit Serial Number Formula**

```
000[55h:5Ch][41h:4Fh][5Dh:5Fh][40h][38h:3Fh]
```

- **Monza 5 Series 1 [01] – Series 3 [11] 96-bit Serial Number Formula**

```
[00h:07h][08h:13h][14h:1Fh][30h:33h] [50h:52h]0 0000 0000 0000 0[53h:54h]0
00[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]
```

- **Monza 5 Series 1 [01] – Series 3 [11] 38-bit Serial Number Formula**

```
[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]
```

2.6.1 Example – Monza 5 Series 1 Serial Number

Table 10: TID Memory Map EXAMPLE – Monza 5 TID E280113020003993EEE1088E

IMPINJ M750 TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	0	0	0	0	1	0	0	0	1	0	0	0	1	1	1	0
40_h-$4F_h$	1	1	1	0	1	1	1	0	1	1	1	0	0	0	0	1
30_h-$3F_h$	0	0	1	1	1	0	0**	1	1	0	0	1	0	0	1	1
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	000100110000	Monza 5 family
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID) – 48-bit SN
Wafer Mask Revision	30_h-33_h	4	0011	Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-52_h	3	000	
Monza Series ID	53_h-54_h	2	01	Supports Series 0 – Series 3
Serial Number		38	00010001110111011101110000110110010011	

** The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*
*** This bit is always fixed to zero on Monza 5. For this reason, it is not included in the Serial Number formula.*

- **Monza 5 Example – Series 1 [01] – Series 3 [11] 96-bit Serial Number Formula**

  `[00h:07h][08h:13h][14h:1Fh][30h:33h] [50h:52h]0 0000 0000 0000 0[53h:54h]0 00[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]`

  - Series 1 96-bit Serial Number (binary):

    ```
    1110 0010 1000 0000 0001 0001 0011 0000 0011 0000 0000 0000
    0000 0010 0000 0100 0111 0111 0111 0111 0000 1101 1001 0011
    ```

  - Series 1 96-bit Serial Number (hex):

    ```
    E2801130300020477770D93
    ```

- **Monza 5 Example – Series 1 [01] – Series 3 [11] 38-bit Serial Number Formula**

  `[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]`

  - Series 1 38-bit Serial Number (binary):

    ```
    00 0100 0111 0111 0111 0111 0000 1101 1001 0011
    ```

  - Series 1 38-bit Serial Number (hex):

    ```
    0477770D93
    ```

2.7 Monza 4 TID Memory Map

Table 11: Monza 4 TID Memory Map

IMPINJ M750 TID MEMORY BANK																
Bit Address	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
40_h-$4F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30_h-$3F_h$	x	x	x	x	x	x	x	x	x	x	0**	x	x	x	x	x
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	0	0	M	M	M	M	M
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	0001000MMMMM	Monza 4 family, where MMMMM specifies the Monza 4 tag model (See Table 12)
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID)
Wafer Mask Revision	30_h-33_h	4		Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-52_h	3	000	
Monza Series ID	53_h-54_h	2	01	Supports Series 0 – Series 3
Serial Number		38		

Note: The values for X will be replaced by the unique serialization values for each chip.
** The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*
*** This bit is always fixed to zero on Monza 5. For this reason, it is not included in the Serial Number formula.*

Table 12: Monza 4 Model Numbers

TAG MODEL	TAG MODEL NUMBER	WAFER MASK REVISION
Monza 4D	000100000000	0111
Monza 4E	000100001100	0111
Monza 4QT	000100000101	0111
Monza 4i	000100010100	0111

- **Monza 4 Series 0 [00] 96-bit Serial Number Formula**

  $[00_h:07_h][08_h:13_h][14_h:1F_h][30_h:33_h]\ [50_h:52_h]0\ 0000\ 0000\ 0000\ 0[53_h:54_h]0\ 0000$
  $0[55_h:5C_h][41_h:4F_h][5D_h:5F_h][40_h][36_h:39_h][3C_h:3F_h]$

- **Monza 4 Series 0 [00] 38-bit Serial Number Formula**

  $000[55_h:5C_h][41_h:4F_h][5D_h:5F_h][40_h][36_h:39_h][3C_h:3F_h]$

- **Monza 4 Series 1 [01] – Series 3 [11] 96-bit Serial Number Formula**

  $[00_h:07_h][08_h:13_h][14_h:1F_h][30_h:33_h]\ [50_h:52_h]0\ 0000\ 0000\ 0000\ 0[53_h:54_h]0$
  $00[55_h:5F_h][40_h:4F_h][34_h:35_h][3B_h][36_h:39_h][3C_h:3F_h]$

- **Monza 4 Series 1 [01] – Series 3 [11] 38-bit Serial Number Formula**

  $[55_h:5F_h][40_h:4F_h][34_h:35_h][3B_h][36_h:39_h][3C_h:3F_h]$

2.8 Monza X Family TID Memory Map

Table 13: Monza X TID Memory Map

IMPINJ M750 TID MEMORY BANK																
Word	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
50_h-$5F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
40_h-$4F_h$	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30_h-$3F_h$	x	x	x	x	x	x	0**	x	x	x	x	x	x	x	x	x
20_h-$2F_h$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10_h-$1F_h$	0	0	0	1	0	0	0	1	0	1	0	M	0	0	0	0
00_h-$0F_h$	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0

MEMORY MAP LEGEND				
Segment	**Location**	**Bits**	**Binary**	**Value**
ISO / IEC 15963 Class Identifier	00_h-07_h	8	11100010	GS1 EPCglobal Class 1 Gen 2
XTID Indicator (X bit)	08_h	1	1	Indicates the presence of an extended TID (XTID)
Security Indicator (S bit)	09_h	1	0	Does not implement *Authenticate* or *Challenge* commands
File Indicator (F bit)	$0A_h$	1	0	Does not implement the *FileOpen* command
Mask Designer Identifier (MDID)	$0B_h$-13_h	9*	000000001	Impinj
Tag Model Number (TMN)	14_h-$1F_h$	12	0001010M0000	Tag Model Number, where M specifies either Monza X-2K or Monza X-8K (See Table 14)
EPC Tag Data Standard Header	20_h-$2F_h$	16	0010000000000000	Supports extended TID (XTID)
Wafer Mask Revision	30_h-33_h	4		Indicates the Mask Revision for the tag
Reserved for Future Use	50_h-52_h	3	000	Supports Series 0 – Series 3
Monza Series ID	53_h-54_h	2	11	Series rollover indicator
Serial Number		38		

Note: The values for X will be replaced by the unique serialization values for each chip.
** The GS1 currently defines the MDID as the 9 bit value from $0B_h$ to 13_h in the Tag Data Standard (TDS). A previous TDS definition included the X, S and F bits in the MDID. For applications using a 12-bit MDID, the value would be 100000000001_b or 801_h.*
*** This bit is always fixed to zero on Monza 5. For this reason, it is not included in the Serial Number formula.*

Table 14: Monza X Model Numbers

TAG MODEL	TAG MODEL NUMBER	WAFER MASK REVISION
Monza X-2K	000101000000	0010
Monza X-8K	000101010000	0001

- **Monza X Series 1 [01] – Series 3 [11] 96-bit Serial Number Formula**

```
[00h:07h][08h:13h][14h:1Fh][30h:33h] [50h:52h]0 0000 0000 0000 0[53h:54h]0
00[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]
```

- **Monza X Series 1 [01] – Series 3 [11] 38-bit Serial Number Formula**

```
[55h:5Fh][40h:4Fh][34h:35h][37h:3Fh]
```

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