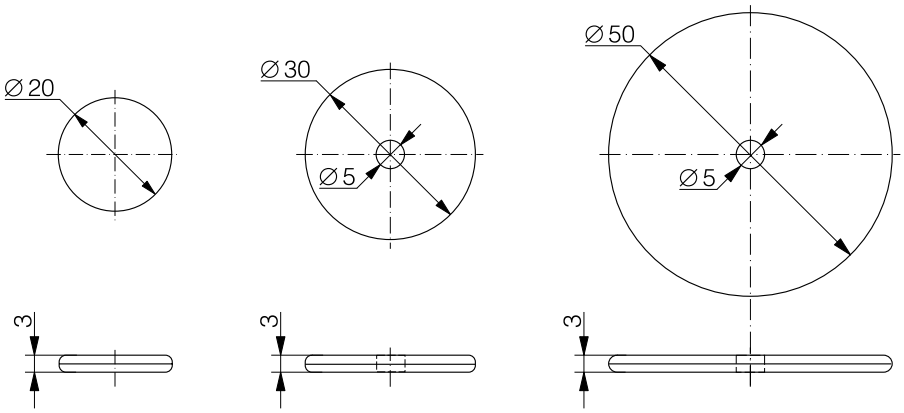
CONTRINEX

HF RFID SYSTEM
TRANSPONDER
RTH-DxxQA-Nx0

HOUSING	MEMORY SIZE	MOUNTING	
Ø 20 mm Ø 30 mm Ø 50 mm	320 Bytes 2048 Bytes	Non-embeddable	✓ Insensitive to dirt ✓ User memory (EEPROM technology) ✓ Large usable memory (FRAM technology) ✓ IP68 & IP69K



RTH-D20QA-Nx0 **RTH-D30QA-Nx0** **RTH-D50QA-Nx0**

TRANSPONDER	RTH-D20QA-NF0	RTH-D30QA-NF0	RTH-D50QA-NF0	RTH-D20QA-ND0	RTH-D30QA-ND0	RTH-D50QA-ND0
GENERAL DATA						
Carrier frequency	13.56 MHz					
Max. transmission speed	53 kbit/s if fast custom commands are used, 26.5 kbit/s otherwise					
Type of integrated circuit	NXP I-Code SLI-X2			Fujitsu MB89R118C		
Compatible standard	ISO 15693			ISO 15693 / ISO 18000-3 (Partly not supported. Refer to table “Note on Using MB89R118C” on page 7.)		
Memory type	EEPROM			FRAM		
Memory size	2560 Bytes			2 kBytes		
Read/write distance max. (with RLS-1301-320)	34 mm	40 mm	58 mm	35 mm	42 mm	54 mm
MEMORY INFORMATION						
Unique identifier	8 Bytes					
Organization	80 x blocks × 4 Bytes			256 blocks × 8 Bytes		
User memory (R/W)	79 blocks, 316 Bytes			250 blocks, 2000 Bytes		
Configuration memory	1 blocks, 4 Bytes			6 blocks, 48 Bytes		
Data retention period (< 55°C)	> 50 years			> 30 years		
Number of “write” cycles	10^5			10^{12}		
Number of “read” cycles	unlimited					

MECHANICAL DATA

Protection degree	IP68 & IP69K
Ambient temperature range TA*	−25 … +80°C
Storage temperature range TS**	−40 … +90°C
Thermal cycling reliability @ 90°C	1000 cycles / 1000 hours
Housing material	PPA (Polyphthalamide)
Weight	See table “Available types” below
Tightening torque	max. 1 Nm

* Read/write operations possible ** Data retention and mechanical stability limit

MEMORY OF TRANSPONDERS

RTH-DxxQA-NF0

The EEPROM has a memory capacity of 2560 bits and is divided in two areas. One user area of 79 blocks and one counter block and a system area not stored in EEPROM, that means a total of 80 blocks of 4 bytes each. The block is the smallest unit used to read and write the EEPROM memory.

EEPROM memory configuration

Area	Block No.	Details	Read Access	Write Access
User memory (316 bytes)	00_h to $4E_h$	User memory	✓	✓
User memory (4 bytes)	$4F_h$	Counter	Special access. See “16-bit counter feature”	Special access. See “16-bit counter feature”
System memory	N/A	UID (64 bits), Access Control Info. Passwords (AFI, EAS) Write protection Destroy Enable privacy 32-byte ECC sign.	See “List of command” features for more details	See “List of command” features for more details

User memory Direct read access to blocks of this memory is always possible. Direct write access to blocks of this memory is possible depending on the value of its corresponding block security status bit.

System memory Direct read or write access to blocks of this memory area is not possible.

Structure of a single user memory block

MSB			LSB
Byte 3	Byte 2	Byte 1	Byte 0

RTH-DxxQA-ND0

The FRAM has a memory capacity of 16,384 bits and is divided in two areas. One user area of 250 blocks and one system area of 6 blocks, that means a total of 256 blocks of 8 bytes each. The block is the smallest unit used to read and write the FRAM memory.

FRAM memory configuration

Area	Block No.	Details	Read Access	Write Access
User memory (2,000 bytes)	00_h to $F9_h$	User memory	✓	✓
System memory (48 bytes)	FA_h	UID (64 bits)	Inv. Cmd	×
	FB_h	AFI, DSFID, EAS, security status	Get System Info Cmd EAS Cmd	Write AFI Cmd Write DSFID Cmd Write EAS Cmd
	FC_h to FE_h	Block security status	Get Multiple Block Security Status Cmd	Lock Block Cmd (OTP)

User memory Direct read access to blocks of this memory is always possible. Direct write access to blocks of this memory is possible depending on the value of its corresponding block security status bit.

System memory Direct read or write access to blocks of this memory area is not possible.

Structure of a single user memory block

MSB							LSB
Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0

AVAILABLE TYPES

Part number	Part reference	⌀	Mounting	Weight
720-000-147	RTH-D20QA-NF0	20 mm	Non-embeddable	1.3 g
720-000-141	RTH-D20QA-ND0	20 mm	Non-embeddable	1.3 g
720-000-148	RTH-D30QA-NF0	30 mm	Non-embeddable	3 g
720-000-142	RTH-D30QA-ND0	30 mm	Non-embeddable	3 g
720-000-149	RTH-D50QA-NF0	50 mm	Non-embeddable	9.5 g
720-000-143	RTH-D50QA-ND0	50 mm	Non-embeddable	9.5 g

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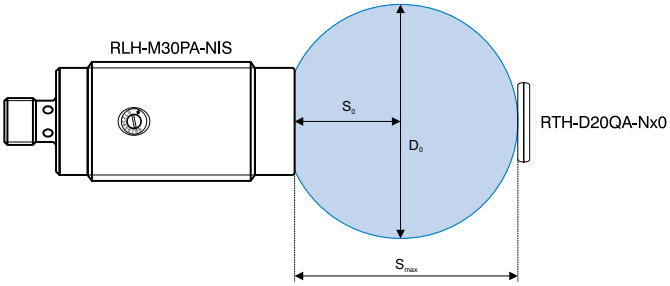
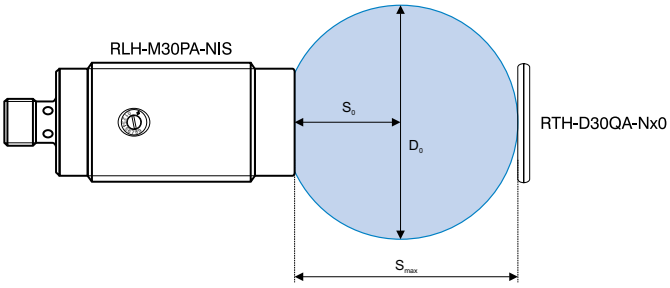
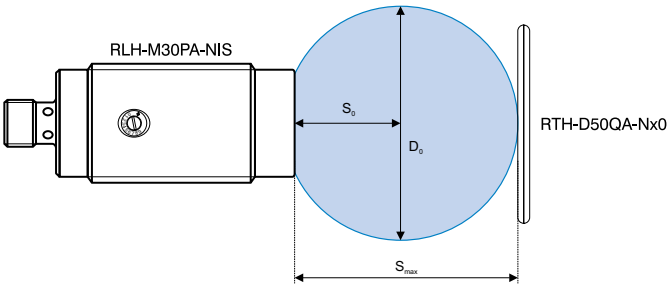
OPERATING ZONE

The operating area is highly dependent on the environment.







Typical values @ 25°C:

	RWM	S_{max} [mm]	S_0 [mm]	D_0 [mm]
RTH-D20QA-NF0	M18 (RSSI≥0)	22	10.5	24
	M18 (RSSI≥1)	18	8	21
	M30 (RSSI≥0)	34	17	36
	M30 (RSSI≥1)	26	12	30
	C44 (RSSI≥0)	50	26	52
	C44 (RSSI≥1)	40	18	44
RTH-D20QA-ND0	M18 (RSSI≥0)	18	8	23
	M18 (RSSI≥1)	17	6	21
	M30 (RSSI≥0)	35	17.5	37
	M30 (RSSI≥1)	26	11.5	31
	C44 (RSSI≥0)	46	23	50
	C44 (RSSI≥1)	38	17	42
RTH-D30QA-NF0	M18 (RSSI≥0)	26	11	28
	M18 (RSSI≥1)	22	9	28
	M30 (RSSI≥0)	40	20	44
	M30 (RSSI≥1)	30	13	38
	C44 (RSSI≥0)	58	29	68
	C44 (RSSI≥1)	44	21	48
RTH-D30QA-ND0	M18 (RSSI≥0)	24	10	31
	M18 (RSSI≥1)	19	5	28
	M30 (RSSI≥0)	42	20	46
	M30 (RSSI≥1)	34	15	38
	C44 (RSSI≥0)	58	29	60
	C44 (RSSI≥1)	46	23	52
RTH-D50QA-NF0	M18 (RSSI≥0)	26	7	42
	M18 (RSSI≥1)	24	6	42
	M30 (RSSI≥0)	58	28	62
	M30 (RSSI≥1)	46	19	54
	C44 (RSSI≥0)	80	43	80
	C44 (RSSI≥1)	64	32	68
RTH-D50QA-ND0	M18 (RSSI≥0)	20	0	44
	M18 (RSSI≥1)	20	0	44
	M30 (RSSI≥0)	54	25	60
	M30 (RSSI≥1)	44	18	54
	C44 (RSSI≥0)	68	33	74
	C44 (RSSI≥1)	58	26	66

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SPECIAL FEATURES

RTH-DxxQA-NF0

Name	Description
EAS*	Electronic Article Surveillance
AFI	Application Family Identifier
DSFID	Data Storage Format Identifier

RTH-DxxQA-ND0

AFI, DSFID, and EAS bits are written at the IC manufacturer factory, and can be updated and locked (disable to write) with specific commands. Only EAS bit cannot be locked. The LSB of Byte 7 holds the EAS bit. If the Electronic Article Surveillance is active (LSB = "1"), the transponder responds to an EAS command, otherwise it remains silent.

Structure of memory block "FB_h"

MSB					LSB
Byte 7	Byte 6 to Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
EAS Status*	RFU	DSFID Lock Status	AFI Lock Status	DSFID	AFI

The security status of the DSFID and AFI Identifier are stored in the Byte 3 and Byte 2 of the system memory blocks "FB_h" and are OTP (one time programmable).

* Features not available with Contrinex RWMs (RLx-xxxx-xxx)

SECURITY AND PROTECTIONS

RTH-DxxQA-NF0

Description
Unique identifier (UID) for each transponder
Lock mechanism for each user memory block (write protection)
Lock mechanism for DSFID, AFI and EAS*
Password (32-bits) protected EAS/AFI functionality*
Initial state of the EAS/AFI passwords 00000000_h
Destroy SLI-X2*
Enable Privacy*
32-byte ECC signature*

* Features not available with Contrinex RWMs (RLx-xxxx-xxx)

RTH-DxxQA-ND0

The security status of the user memory is stored in the block security status bit located in the system memory blocks "FC_h" to "FF_h".

A user memory is unlocked when the corresponding block security status bit is "0". It is locked (disable to write) when the corresponding block security status bit is "1".

The user memory, DSFID and AFI protections are OTP (one time programmable).

Structure of memory block "FC_h" to "FF_h"

Block No.	MSB							Block Security Status (BSS)								LSB
	Byte 7								Byte 6 to Byte 1	Byte 0						
FC_h	3F	3E	3D	3C	3B	3A	39	38	.....	3	2	1	0	FD_3	02	01	00
FD_h	7F	7E	7D	7C	7B	7A	79	78	.....	47	46	45	44	43	42	41	40
FE_h	BF	BE	BD	BC	BB	BA	B9	B8	.....	87	86	85	84	83	82	81	80
FF_h	RFU (6 bits)						F9	F8	.....	C7	C6	C5	C4	C3	C2	C1	C0

UNIQUE IDENTIFICATION NUMBER (UID)

The 64-bits unique identification number (UID) is programmed during the production process according to ISO/IEC 15693-3 and cannot be changed afterwards. The type of TAG and manufacturer code are part of the UID: bytes 5 and 6 respectively.

MSB							LSB
BIT 64:57	**BIT 56:49**	**BIT 48:14**	**BIT 40:1**				
Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
E0	xx	xx	✓ IC manufacturer serial number (40 bits serialization)				

RTH-DXXQA-NF0	**RTH-DXXQA-ND0**
TAG type (01_h: ICODE SLI, SLI-X or SLI-X2)	TAG type (01_h: MB89R118C)
Manufacturer code (04_h: NXP Semiconductors)	Manufacturer code (08_h: FUJITSU Semiconductor)

BIT 37	**BIT 36**	**ICODE TYPE**
0	0	ICODE SLI
1	0	ICODE SLI-X
0	1	ICODE SLI-X2

LIST OF COMMANDS

	Command Name	Command Code	Description	Rxx-xxxx-		
				x20	320	NIS
Mandatory ISO 15693	Inventory	01_h	Execute the anti-collision sequence and return UID	✓	✓	×
	Stay Quiet	02_h	Enter the Quiet state	✓	×	×
Optional ISO 15693	Read Single Block	20_h	Read the requested 1 block data in the user/system memory	✓	✓	✓
	Write Single Block	21_h	Write the requested 1 block data in the user memory	✓	✓	✓
	Lock Block	22_h	Lock permanently the requested 1 block in the user memory	✓	×	×
	Read Multiple Blocks	23_h	Read the requested multiple block data in the user/system memory	×	×	×
	Select	25_h	Enter the Select state	✓	×	×
	Reset to ready	26_h	Enter the Ready state	✓	×	×
	Write AFI	27_h	Write AFI (Application Family Identifier) value into EEPROM	✓	×	×
	Lock AFI	28_h	Lock permanently AFI value	✓	×	×
	Write DSFID	29_h	Write DSFID (Data Storage Format Identifier) value into EEPROM	✓	×	×
	Lock DSFID	$2A_h$	Lock permanently DSFID value	✓	×	×
	Get System Information	$2B_h$	Read the system information value (UID, DSFID, AFI, number of bytes per block, etc)	✓	×	✓
	Get Multiple Block Security Status	$2C_h$	Read the block security status stored in system area	×	×	×
	–	$2D_h$ to $9F_h$	Reserved for future use	–	–	–

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LIST OF COMMANDS

	Command Name	Command Code	Description	Rxx-xxxx- x20	320	NIS
Custom ISO 15693	**RTH-DxxQA-NF0**					
	Inventory Read	**A0$_h$**	Execute the anti-collision sequence and return the requested n blocks data in the user memory	×	×	×
	Fast Inventory Read	**A1$_h$**	Fast response Inventory Read command	×	×	×
	Set EAS	**A2$_h$**	Set EAS bit to “1”	×	×	×
	Reset EAS	**A3$_h$**	Set EAS bit to “0”	×	×	×
	Lock EAS	**A4$_h$**	Lock permanently the EAS bit to its current value	×	×	×
	EAS Alarm	**A5$_h$**	When EAS bit is “1”, reply 13 bytes of data (Flags, EAS, IC Mfg. code, UID and CRC16)	×	×	×
	Write EAS ID	**A6$_h$**	Write a new EAS identifier	×	×	×
	Get NXP System Information	**AB$_h$**	Provide information about IC access conditions and supported features	×	×	×
	Password Protect EAS/AFI	**A6$_h$**	EAS/AFI Password has to be transmitted before with a Set Password command	×	×	×
	Get Random Number	**B2$_h$**	Get a random number calculated in the transponder	✓	×	✓
	Set Password	**B3$_h$**	Get access to the different protected functionalities (EAS/AFI) in function of the password identifier used	✓	×	✓
	Write Password	**B4$_h$**	Write a new password (EAS/AFI) into the system memory in function of the password identifier used	✓	×	×
	Lock Password	**B5$_h$**	Lock permanently one password (EAS/AFI) in function of the password identifier used	✓	×	×
	Protect Page	**B6$_h$**	Set the read and write access condition pagewise	✓	×	×
	Lock Page Protection	**B7$_h$**	Lock permanently the read and write access condition pagewise	✓	×	×
	Destroy SLI-X2	**B9$_h$**	Destroy permanently the transponder ISO15693 air interface	✓	×	×
	Enable Privacy	**BA$_h$**	Enable the SLI-S privacy mode	×	×	×
	64 Bit Password Protection	**BB$_h$**	If 64-Bit Pasword Protection is enabled both read + write passwords are required to access read and write protected blocks (pages)	✓	×	×
	Stay Quiet Persistent	**BB$_h$**	Upon reception, the label IC enters the persistent quiet state and will not send back a response. Stay quiet persists after power-off in case power off time < IC persistence time	×	×	×
	Read signature	**BD$_h$**	Return an IC specific, 32-byte ECC signature, to verify NXP Semiconductors as the silicon vendor	×	×	×
	RTH-DxxQA-ND0					
	EAS	**A0$_h$**	When EAS bit is “1”, reply response code 6 times	×	×	×
	Write EAS	**A1$_h$**	Write EAS data (1 bit). Data “1” validates anti-theft/ goods-monitoring. Data “0” invalidates them	×	×	×
	Read Multiple Blocks Unlimited	**A5$_h$**	Read the specified data of up to 256 blocks in the user/system memory at once	×	×	×
	Fast Inventory	**B1$_h$**	Fast response Inventory command	×	×	×
	Fast Read Single Block	**C0$_h$**	Fast response Read Single Block command	×	×	×
	Fast Write Single Block	**C1$_h$**	Fast response Write Single Block command	×	×	×
	Fast Read Multiple Blocks	**C3$_h$**	Fast response Read Multiple Blocks command	×	×	×
	Fast Write Multiple Blocks	**C4$_h$**	Fast response Write Multiple Blocks command	×	×	×
	Fast Write EAS	**D1$_h$**	Fast response Write EAS command	×	×	×
	Fast Read Multiple Blocks Unlimited	**D5$_h$**	Fast response Read Multiple Blocks Unlimited command	×	×	×

NOTES ON USING MB89R118C

Parameter	ISO/IEC 15693 Specification	MB89R118C
Data coding	1 out of 256	No correspondence
Subcarrier	2-subcarrier	No correspondence
Optional command	Read Multiple Blocks command	Correspondence up to 2 blocks
	Write Multiple Blocks command	Correspondence up to 2 blocks

The above table presents the discrepancies between the IC MB89R118C and the ISO/IEC 15693 standard.

NOTES ON USING I-CODE SLI-X2 – 16-bit counter features

Block 79 of the user memory contains the 16-bit counter. The block can be accessed with the standard READ and WRITE commands but special data considerations are required. The standard password protection mechanisms for the user memory is not valid for block 79.

The 16 bit counter (block 79) can be

- read
- increased by one

The counter can be read with a READ SINGLE BLOCK command to block 79 or a READ MULTIPLE BLOCK command including block 79. The 4 byte data from block 79 provide the following information:

Counter block data structure

Byte	Name	Value	Description
0	C0	0x00 – 0xFF	LSB of the counter value
1	C1	0x00 – 0xFF	MSB of the counter value
2	–	0x00	RFU
3	–	0x00	RFU

To increment the counter, a WRITE SINGLE BLOCK command must be sent to block 79 with the following values: **C0=0x01** and **C1=0x00**.