

# ISO/IEC 11889-2:2015-12 (E)

## Information technology - Trusted Platform Module Library - Part 2: Structures

---

<b>Contents</b>	<b>Page</b>
Foreword .....	xv
Introduction .....	xvi
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	1
4 Symbols and abbreviated terms.....	1
5 Notation .....	1
5.1 Introduction.....	1
5.2 Named Constants.....	2
5.3 Data Type Aliases (typedefs) .....	3
5.4 Enumerations .....	3
5.5 Interface Type .....	4
5.6 Arrays .....	5
5.7 Structure Definitions .....	6
5.8 Conditional Types.....	7
5.9 Unions .....	8
5.9.1 Introduction.....	8
5.9.2 Union Definition .....	8
5.9.3 Union Instance.....	9
5.9.4 Union Selector Definition.....	10
5.10 Bit Field Definitions.....	11
5.11 Parameter Limits .....	12
5.12 Enumeration Macro .....	13
5.13 Size Checking .....	13
5.14 Data Direction.....	14
5.15 Structure Validations .....	15
5.16 Name Prefix Convention .....	15
5.17 Data Alignment.....	16
5.18 Parameter Unmarshaling Errors .....	16
6 Base Types .....	18
6.1 Primitive Types.....	18
6.2 Miscellaneous Types.....	18
7 Constants .....	19
7.1 TPM_SPEC (Specification Version Values).....	19
7.2 TPM_GENERATED .....	19
7.3 TPM_ALG_ID .....	20
7.4 TPM_ECC_CURVE.....	24
7.5 TPM_CC (Command Codes) .....	24

7.5.1	Format .....	24
7.5.2	Description.....	25
7.5.3	TPM_CC Listing .....	26
7.6	TPM_RC (Response Codes) .....	29
7.6.1	Description.....	29
7.6.2	Response Code Formats.....	30
7.6.3	TPM_RC Values.....	33
7.7	TPM_CLOCK_ADJUST .....	38
7.8	TPM_EO (EA Arithmetic Operands) .....	38
7.9	TPM_ST (Structure Tags).....	39
7.10	TPM_SU (Startup Type).....	41
7.11	TPM_SE (Session Type).....	41
7.12	TPM_CAP (Capabilities) .....	42
7.13	TPM_PT (Property Tag).....	43
7.14	TPM_PT_PCR (PCR Property Tag).....	48
7.15	TPM_PS (Platform Specific).....	50
8	Handles .....	51
8.1	Introduction.....	51
8.2	TPM_HT (Handle Types) .....	51
8.3	Persistent Handle Sub-ranges .....	52
8.4	TPM_RH (Permanent Handles) .....	53
8.5	TPM_HC (Handle Value Constants) .....	54
9	Attribute Structures.....	56
9.1	Description .....	56
9.2	TPMA_ALGORITHM .....	56
9.3	TPMA_OBJECT (Object Attributes).....	56
9.3.1	Introduction .....	56
9.3.2	Structure Definition .....	57
9.3.3	Attribute Descriptions .....	58
9.4	TPMA_SESSION (Session Attributes).....	63
9.5	TPMA_LOCALITY (Locality Attribute).....	64
9.6	TPMA_PERMANENT .....	65
9.7	TPMA_STARTUP_CLEAR.....	66
9.8	TPMA_MEMORY .....	67
9.9	TPMA_CC (Command Code Attributes) .....	68
9.9.1	Introduction.....	68
9.9.2	Structure Definition .....	68
9.9.3	Field Descriptions .....	68
10	Interface Types.....	71
10.1	Introduction.....	71
10.2	TPMI_YES_NO .....	71
10.3	TPMI_DH_OBJECT .....	71

10.4	TPMI_DH_PERSISTENT .....	72
10.5	TPMI_DH_ENTITY .....	72
10.6	TPMI_DH_PCR .....	73
10.7	TPMI_SH_AUTH_SESSION .....	73
10.8	TPMI_SH_HMAC .....	73
10.9	TPMI_SH_POLICY .....	73
10.10	TPMI_DH_CONTEXT .....	74
10.11	TPMI_RH_HIERARCHY .....	74
10.12	TPMI_RH_ENABLES .....	74
10.13	TPMI_RH_HIERARCHY_AUTH .....	75
10.14	TPMI_RH_PLATFORM .....	75
10.15	TPMI_RH_OWNER .....	75
10.16	TPMI_RH_ENDORSEMENT .....	76
10.17	TPMI_RH_PROVISION .....	76
10.18	TPMI_RH_CLEAR .....	76
10.19	TPMI_RH_NV_AUTH .....	77
10.20	TPMI_RH_LOCKOUT .....	77
10.21	TPMI_RH_NV_INDEX .....	77
10.22	TPMI_ALG_HASH .....	78
10.23	TPMI_ALG_ASYM (Asymmetric Algorithms) .....	78
10.24	TPMI_ALG_SYM (Symmetric Algorithms) .....	79
10.25	TPMI_ALG_SYM_OBJECT .....	79
10.26	TPMI_ALG_SYM_MODE .....	80
10.27	TPMI_ALG_KDF (Key and Mask Generation Functions) .....	80
10.28	TPMI_ALG_SIG_SCHEME .....	81
10.29	TPMI_ECC_KEY_EXCHANGE .....	81
10.30	TPMI_ST_COMMAND_TAG .....	81
11	Structure Definitions .....	83
11.1	TPMS_EMPTY .....	83
11.2	TPMS_ALGORITHM_DESCRIPTION .....	83
11.3	Hash/Digest Structures .....	84
11.3.1	TPMU_HA (Hash) .....	84
11.3.2	TPMT_HA .....	84
11.4	Sized Buffers .....	85
11.4.1	Introduction .....	85
11.4.2	TPM2B_DIGEST .....	85
11.4.3	TPM2B_DATA .....	86
11.4.4	TPM2B_NONCE .....	86
11.4.5	TPM2B_AUTH .....	86
11.4.6	TPM2B_OPERAND .....	86
11.4.7	TPM2B_EVENT .....	87
11.4.8	TPM2B_MAX_BUFFER .....	87
11.4.9	TPM2B_MAX_NV_BUFFER .....	87
11.4.10	TPM2B_TIMEOUT .....	88
11.4.11	TPM2B_IV .....	88
11.5	Names .....	88
11.5.1	Introduction .....	88
11.5.2	TPMU_NAME .....	88
11.5.3	TPM2B_NAME .....	89
11.6	PCR Structures .....	89
11.6.1	TPMS_PCR_SELECT .....	89

11.6.2	TPMS_PCR_SELECTION.....	90
11.7	Tickets .....	90
11.7.1	Introduction .....	90
11.7.2	A NULL Ticket.....	91
11.7.3	TPMT_TK_CREATION.....	92
11.7.4	TPMT_TK_VERIFIED.....	93
11.7.5	TPMT_TK_AUTH .....	94
11.7.6	TPMT_TK_HASHCHECK.....	95
11.8	Property Structures .....	95
11.8.1	TPMS_ALG_PROPERTY.....	95
11.8.2	TPMS_TAGGED_PROPERTY.....	95
11.8.3	TPMS_TAGGED_PCR_SELECT.....	96
11.9	Lists .....	96
11.9.1	TPML_CC.....	96
11.9.2	TPML_CCA.....	97
11.9.3	TPML_ALG .....	97
11.9.4	TPML_HANDLE .....	97
11.9.5	TPML_DIGEST.....	98
11.9.6	TPML_DIGEST_VALUES .....	98
11.9.7	TPM2B_DIGEST_VALUES .....	98
11.9.8	TPML_PCR_SELECTION.....	99
11.9.9	TPML_ALG_PROPERTY .....	99
11.9.10	TPML_TAGGED_TPM_PROPERTY .....	99
11.9.11	TPML_TAGGED_PCR_PROPERTY .....	100
11.9.12	TPML_ECC_CURVE .....	100
11.10	Capabilities Structures.....	100
11.10.1	TPMU_CAPABILITIES.....	100
11.10.2	TPMS_CAPABILITY_DATA.....	101
11.11	Clock/Counter Structures .....	101
11.11.1	PMS_CLOCK_INFO .....	101
11.11.2	<i>Clock</i> .....	101
11.11.3	<i>ResetCount</i> .....	101
11.11.4	<i>RestartCount</i> .....	102
11.11.5	<i>Safe</i> .....	102
11.11.6	TPMS_TIME_INFO .....	102
11.12	TPM Attestation Structures .....	103
11.12.1	Introduction.....	103
11.12.2	TPMS_TIME_ATTEST_INFO .....	103
11.12.3	TPMS_CERTIFY_INFO .....	103
11.12.1	TPMS_QUOTE_INFO.....	103
11.12.2	TPMS_COMMAND_AUDIT_INFO.....	104
11.12.3	TPMS_SESSION_AUDIT_INFO.....	104
11.12.4	TPMS_CREATION_INFO .....	104
11.12.5	TPMS_NV_CERTIFY_INFO .....	104
11.12.6	TPMI_ST_ATTEST .....	105
11.12.7	TPMU_ATTEST .....	105
11.12.8	TPMS_ATTEST.....	105
11.12.9	TPM2B_ATTEST.....	106
11.13	Authorization Structures.....	106
11.13.1	Introduction.....	106
11.13.2	TPMS_AUTH_COMMAND .....	106
11.13.3	TPMS_AUTH_RESPONSE .....	106
12	Algorithm Parameters and Structures .....	107

12.1 Symmetric .....	107
12.1.1 Introduction .....	107
12.1.2 TPMI_AES_KEY_BITS .....	107
12.1.3 TPMI_SM4_KEY_BITS .....	107
12.1.4 TPMI_CAMELLIA_KEY_BITS .....	108
12.1.5 TPMU_SYM_KEY_BITS .....	108
12.1.6 TPMU_SYM_MODE .....	108
12.1.7 TPMU_SYM_DETAILS .....	109
12.1.8 TPMT_SYM_DEF .....	109
12.1.9 TPMT_SYM_DEF_OBJECT .....	110
12.1.10 TPM2B_SYM_KEY .....	110
12.1.11 TPMS_SYMCIPHER_PARMS .....	110
12.1.12 TPM2B_SENSITIVE_DATA .....	110
12.1.13 TPMS_SENSITIVE_CREATE .....	111
12.1.14 TPM2B_SENSITIVE_CREATE .....	111
12.1.15 TPMS_SCHEME_SIGHASH .....	112
12.1.16 TPMI_ALG_HASH_SCHEME .....	112
12.1.17 HMAC_SIG_SCHEME .....	112
12.1.18 TPMS_SCHEME_XOR .....	113
12.1.19 TPMU_SCHEME_HMAC .....	113
12.1.20 TPMT_KEYEDHASH_SCHEME .....	113
12.2 Asymmetric .....	114
12.2.1 Signing Schemes .....	114
12.2.2 Encryption Schemes .....	116
12.2.3 Key Derivation Schemes .....	116
12.2.4 RSA .....	119
12.2.5 ECC .....	122
12.3 Signatures .....	124
12.3.1 TPMS_SIGNATURE_RSASSA .....	124
12.3.2 TPMS_SIGNATURE_RSAPSS .....	124
12.3.3 TPMS_SIGNATURE_ECDSA .....	125
12.3.4 TPMU_SIGNATURE .....	125
12.3.5 TPMT_SIGNATURE .....	126
12.4 Key/Secret Exchange .....	126
12.4.1 Introduction .....	126
12.4.2 TPMU_ENCRYPTED_SECRET .....	126
12.4.3 TPM2B_ENCRYPTED_SECRET .....	127
13 Key/Object Complex .....	128
13.1 Introduction .....	128
13.2 Public Area Structures .....	128
13.2.1 Description .....	128
13.2.2 TPMI_ALG_PUBLIC .....	128
13.2.3 Type-Specific Parameters .....	128
13.2.4 TPMT_PUBLIC .....	132
13.2.5 TPM2B_PUBLIC .....	132
13.3 Private Area Structures .....	133
13.3.1 Introduction .....	133
13.3.2 Sensitive Data Structures .....	133
13.3.3 TPM2B_SENSITIVE .....	134
13.3.4 Encryption .....	135
13.3.5 Integrity .....	135
13.3.6 _PRIVATE .....	135
13.3.7 TPM2B_PRIVATE .....	135

13.4 Identity Object .....	136
13.4.1 Description.....	136
13.4.2 _ID_OBJECT .....	136
13.4.3 TPM2B_ID_OBJECT .....	136
14 NV Storage Structures .....	137
14.1 TPM_NV_INDEX.....	137
14.2 TPMA_NV (NV Index Attributes).....	138
14.3 TPMS_NV_PUBLIC .....	141
14.4 TPM2B_NV_PUBLIC .....	141
15 Context Data .....	142
15.1 Introduction.....	142
15.2 TPM2B_CONTEXT_SENSITIVE .....	142
15.3 TPMS_CONTEXT_DATA.....	142
15.4 TPM2B_CONTEXT_DATA.....	142
15.5 TPMS_CONTEXT .....	143
15.6 Parameters of TPMS_CONTEXT .....	143
15.6.1 <i>sequence</i> .....	143
15.6.2 <i>savedHandle</i> .....	144
15.6.3 <i>hierarchy</i> .....	145
15.7 Context Protection.....	145
15.7.1 Context Integrity .....	145
15.7.2 Context Confidentiality.....	145
16 Creation Data .....	146
16.1 TPMS_CREATION_DATA .....	146
16.2 TPM2B_CREATION_DATA .....	146
Annex A (informative) Algorithm Constants .....	147
A.1 Introduction.....	147
A.2 Allowed Hash Algorithms .....	147
A.2.1 SHA1 .....	147
A.2.2 SHA256 .....	147
A.2.3 SHA384 .....	147
A.2.4 SHA512 .....	148
A.2.5 SM3_256 .....	148
A.3 Architectural Limits .....	148
Annex B (informative) Implementation Definitions .....	149
B.1 Introduction.....	149
B.2 Logic Values.....	149
B.3 Processor Values .....	149
B.4 Implemented Algorithms.....	150
B.5 Implemented Commands .....	151
B.6 Algorithm Constants .....	154
B.6.1 RSA .....	154
B.6.2 ECC .....	154

B.6.3	AES.....	154
B.6.4	SM4 .....	154
B.6.5	CAMELLIA.....	155
B.6.6	Symmetric.....	155
B.7	Implementation Specific Values .....	156
	Bibliography .....	159