

**NAME**

d2i\_DSAPrivateKey, d2i\_DSAPrivateKey\_bio, d2i\_DSAPrivateKey\_fp, d2i\_DSAPublicKey, d2i\_DSA\_PUBKEY, d2i\_DSA\_PUBKEY\_bio, d2i\_DSA\_PUBKEY\_fp, d2i\_DSAParams, d2i\_RSAPrivateKey, d2i\_RSAPrivateKey\_bio, d2i\_RSAPrivateKey\_fp, d2i\_RSAPublicKey, d2i\_RSAPublicKey\_bio, d2i\_RSAPublicKey\_fp, d2i\_RSA\_PUBKEY, d2i\_RSA\_PUBKEY\_bio, d2i\_RSA\_PUBKEY\_fp, d2i\_DHparams, d2i\_DHparams\_bio, d2i\_DHparams\_fp, d2i\_ECParameters, d2i\_ECPrivateKey, d2i\_ECPrivateKey\_bio, d2i\_ECPrivateKey\_fp, d2i\_EC\_PUBKEY, d2i\_EC\_PUBKEY\_bio, d2i\_EC\_PUBKEY\_fp, i2d\_RSAPrivateKey, i2d\_RSAPrivateKey\_bio, i2d\_RSAPrivateKey\_fp, i2d\_RSAPublicKey, i2d\_RSAPublicKey\_bio, i2d\_RSAPublicKey\_fp, i2d\_RSA\_PUBKEY, i2d\_RSA\_PUBKEY\_bio, i2d\_RSA\_PUBKEY\_fp, i2d\_DHparams, i2d\_DHparams\_bio, i2d\_DHparams\_fp, i2d\_DSAPrivateKey, i2d\_DSAPrivateKey\_bio, i2d\_DSAPrivateKey\_fp, i2d\_DSAPublicKey, i2d\_DSA\_PUBKEY, i2d\_DSA\_PUBKEY\_bio, i2d\_DSA\_PUBKEY\_fp, i2d\_DSAParams, i2d\_ECParameters, i2d\_ECPrivateKey, i2d\_ECPrivateKey\_bio, i2d\_ECPrivateKey\_fp, i2d\_EC\_PUBKEY, i2d\_EC\_PUBKEY\_bio, i2d\_EC\_PUBKEY\_fp - DEPRECATED

**SYNOPSIS**

The following functions have been deprecated since OpenSSL 3.0, and can be hidden entirely by defining **OPENSSL\_API\_COMPAT** with a suitable version value, see **openssl\_user\_macros(7)**:

```

TYPE *d2i_TYPEPrivateKey(TYPE **a, const unsigned char **ppin, long length);
TYPE *d2i_TYPEPrivateKey_bio(BIO *bp, TYPE **a);
TYPE *d2i_TYPEPrivateKey_fp(FILE *fp, TYPE **a);
TYPE *d2i_TYPEPublicKey(TYPE **a, const unsigned char **ppin, long length);
TYPE *d2i_TYPEPublicKey_bio(BIO *bp, TYPE **a);
TYPE *d2i_TYPEPublicKey_fp(FILE *fp, TYPE **a);
TYPE *d2i_TYPEparams(TYPE **a, const unsigned char **ppin, long length);
TYPE *d2i_TYPEparams_bio(BIO *bp, TYPE **a);
TYPE *d2i_TYPEparams_fp(FILE *fp, TYPE **a);
TYPE *d2i_TYPE_PUBKEY(TYPE **a, const unsigned char **ppin, long length);
TYPE *d2i_TYPE_PUBKEY_bio(BIO *bp, TYPE **a);
TYPE *d2i_TYPE_PUBKEY_fp(FILE *fp, TYPE **a);

```

```

int i2d_TYPEPrivateKey(const TYPE *a, unsigned char **ppout);
int i2d_TYPEPrivateKey(TYPE *a, unsigned char **ppout);
int i2d_TYPEPrivateKey_fp(FILE *fp, const TYPE *a);
int i2d_TYPEPrivateKey_fp(FILE *fp, TYPE *a);
int i2d_TYPEPrivateKey_bio(BIO *bp, const TYPE *a);
int i2d_TYPEPrivateKey_bio(BIO *bp, TYPE *a);
int i2d_TYPEPublicKey(const TYPE *a, unsigned char **ppout);

```

```

int i2d_TYPEPublicKey(TYPE *a, unsigned char **ppout);
int i2d_TYPEPublicKey_fp(FILE *fp, const TYPE *a);
int i2d_TYPEPublicKey_bio(BIO *bp, const TYPE *a);
int i2d_TYPEparams(const TYPE *a, unsigned char **ppout);
int i2d_TYPEparams(TYPE *a, unsigned char **ppout);
int i2d_TYPEparams_fp(FILE *fp, const TYPE *a);
int i2d_TYPEparams_bio(BIO *bp, const TYPE *a);
int i2d_TYPE_PUBKEY(const TYPE *a, unsigned char **ppout);
int i2d_TYPE_PUBKEY(TYPE *a, unsigned char **ppout);
int i2d_TYPE_PUBKEY_fp(FILE *fp, const TYPE *a);
int i2d_TYPE_PUBKEY_bio(BIO *bp, const TYPE *a);
int i2d_TYPE_PUBKEY_bio(BIO *bp, TYPE *a);

```

## DESCRIPTION

All functions described here are deprecated. Please use **OSSL\_DECODER(3)** instead of the **d2i** functions and **OSSL\_ENCODER(3)** instead of the **i2d** functions. See "Migration" below.

In the description here, **TYPE** is used a placeholder for any of the OpenSSL datatypes, such as **RSA**. The function parameters *ppin* and *ppout* are generally either both named *pp* in the headers, or *in* and *out*.

All the functions here behave the way that's described in **d2i\_X509(3)**.

Please note that not all functions in the synopsis are available for all key types. For example, there are no **d2i\_RSAParams()** or **i2d\_RSAParams()**, because the PKCS#1 **RSA** structure doesn't include any key parameters.

**d2i\_TYPEPrivateKey()** and derivatives thereof decode DER encoded **TYPE** private key data organized in a type specific structure.

**d2i\_TYPEPublicKey()** and derivatives thereof decode DER encoded **TYPE** public key data organized in a type specific structure.

**d2i\_TYPEparams()** and derivatives thereof decode DER encoded **TYPE** key parameters organized in a type specific structure.

**d2i\_TYPE\_PUBKEY()** and derivatives thereof decode DER encoded *TYPE* public key data organized in a **SubjectPublicKeyInfo** structure.

**i2d\_TYPEPrivateKey()** and derivatives thereof encode the private key *TYPE* data into a type specific DER encoded structure.

**i2d\_TYPEPublicKey()** and derivatives thereof encode the public key *TYPE* data into a type specific DER encoded structure.

**i2d\_TYPEparams()** and derivatives thereof encode the *TYPE* key parameters data into a type specific DER encoded structure.

**i2d\_TYPE\_PUBKEY()** and derivatives thereof encode the public key *TYPE* data into a DER encoded **SubjectPublicKeyInfo** structure.

For example, **d2i\_RSAPrivateKey()** and **d2i\_RSAPublicKey()** expects the structure defined by PKCS#1. Similarly, **i2d\_RSAPrivateKey()** and **i2d\_RSAPublicKey()** produce DER encoded string organized according to PKCS#1.

## Migration

Migration from the diverse *TYPE*s requires using corresponding new OpenSSL types. For all *TYPE*s described here, the corresponding new type is **EVP\_PKEY**. The rest of this section assumes that this has been done, exactly how to do that is described elsewhere.

There are two migration paths:

- ⊕ Replace `b<d2i_TYPEPrivateKey()>` with **d2i\_PrivateKey(3)**, `b<d2i_TYPEPublicKey()>` with **d2i\_PublicKey(3)**, `b<d2i_TYPEparams()>` with **d2i\_KeyParams(3)**, `b<d2i_TYPE_PUBKEY()>` with **d2i\_PUBKEY(3)**, `b<i2d_TYPEPrivateKey()>` with **i2d\_PrivateKey(3)**, `b<i2d_TYPEPublicKey()>` with **i2d\_PublicKey(3)**, `b<i2d_TYPEparams()>` with **i2d\_KeyParams(3)**, `b<i2d_TYPE_PUBKEY()>` with **i2d\_PUBKEY(3)**. A caveat is that **i2d\_PrivateKey(3)** may output a DER encoded PKCS#8 outermost structure instead of the type specific structure, and that **d2i\_PrivateKey(3)** recognises and unpacks a PKCS#8 structures.
- ⊕ Use **OSSL\_DECODER(3)** and **OSSL\_ENCODER(3)**. How to migrate is described below. All those descriptions assume that the key to be encoded is in the variable *pkey*.

### *Migrating i2d functions to OSSL\_ENCODER*

The exact **OSSL\_ENCODER(3)** output is driven by arguments rather than by function names. The

sample code to get DER encoded output in a type specific structure is uniform, the only things that vary are the selection of what part of the **EVP\_PKEY** should be output, and the structure. The **i2d** functions names can therefore be translated into two variables, *selection* and *structure* as follows:

**i2d\_TYPEPrivateKey()** translates into:

```
int selection = EVP_PKEY_KEYPAIR;
const char *structure = "type-specific";
```

**i2d\_TYPEPublicKey()** translates into:

```
int selection = EVP_PKEY_PUBLIC_KEY;
const char *structure = "type-specific";
```

**i2d\_TYPEparams()** translates into:

```
int selection = EVP_PKEY_PARAMETERS;
const char *structure = "type-specific";
```

**i2d\_TYPE\_PUBKEY()** translates into:

```
int selection = EVP_PKEY_PUBLIC_KEY;
const char *structure = "SubjectPublicKeyInfo";
```

The following sample code does the rest of the work:

```
unsigned char *p = buffer; /* |buffer| is supplied by the caller */
size_t len = buffer_size; /* assumed be the size of |buffer| */
OSSL_ENCODER_CTX *ctx =
    OSSL_ENCODER_CTX_new_for_pkey(pkey, selection, "DER", structure,
                                  NULL, NULL);
if (ctx == NULL) {
    /* fatal error handling */
}
if (OSSL_ENCODER_CTX_get_num_encoders(ctx) == 0) {
    OSSL_ENCODER_CTX_free(ctx);
    /* non-fatal error handling */
}
if (!OSSL_ENCODER_to_data(ctx, &p, &len)) {
    OSSL_ENCODER_CTX_free(ctx);
    /* error handling */
}
OSSL_ENCODER_CTX_free(ctx);
```

## NOTES

The letters **i** and **d** in **i2d\_TYPE()** stand for "internal" (that is, an internal C structure) and "DER" respectively. So **i2d\_TYPE()** converts from internal to DER.

The functions can also understand **BER** forms.

The actual **TYPE** structure passed to **i2d\_TYPE()** must be a valid populated **TYPE** structure -- it **cannot** simply be fed with an empty structure such as that returned by **TYPE\_new()**.

The encoded data is in binary form and may contain embedded zeros. Therefore, any **FILE** pointers or **BIOs** should be opened in binary mode. Functions such as **strlen()** will **not** return the correct length of the encoded structure.

The ways that *\*ppin* and *\*ppout* are incremented after the operation can trap the unwary. See the **WARNINGS** section in **d2i\_X509(3)** for some common errors. The reason for this-auto increment behaviour is to reflect a typical usage of ASN1 functions: after one structure is encoded or decoded another will be processed after it.

The following points about the data types might be useful:

### **DSA\_PUBKEY**

Represents a DSA public key using a **SubjectPublicKeyInfo** structure.

### **DSAPublicKey, DSAPrivateKey**

Use a non-standard OpenSSL format and should be avoided; use **DSA\_PUBKEY**, **PEM\_write\_PrivateKey(3)**, or similar instead.

## RETURN VALUES

**d2i\_TYPE()**, **d2i\_TYPE\_bio()** and **d2i\_TYPE\_fp()** return a valid **TYPE** structure or **NULL** if an error occurs. If the "reuse" capability has been used with a valid structure being passed in via *a*, then the object is freed in the event of error and *\*a* is set to **NULL**.

**i2d\_TYPE()** returns the number of bytes successfully encoded or a negative value if an error occurs.

**i2d\_TYPE\_bio()** and **i2d\_TYPE\_fp()** return 1 for success and 0 if an error occurs.

## SEE ALSO

**OSSL\_ENCODER(3)**, **OSSL\_DECODER(3)**, **d2i\_PrivateKey(3)**, **d2i\_PublicKey(3)**, **d2i\_KeyParams(3)**, **d2i\_PUBKEY(3)**, **i2d\_PrivateKey(3)**, **i2d\_PublicKey(3)**, **i2d\_KeyParams(3)**, **i2d\_PUBKEY(3)**

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