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1 Typedef and constants

The following data type has been defined via typedef.

__complex128: __float128-based complex number

The following macros are defined, which give the numeric limits of the __float128 data type.

FLT128_MAX: largest finite number
FLT128_MIN: smallest positive number with full precision
FLT128_EPSILON: difference between 1 and the next larger representable number
FLT128_DENORM_MIN: smallest positive denormalized number
FLT128_MANT_DIG: number of digits in the mantissa (bit precision)
FLT128_MIN_EXP: maximal negative exponent
FLT128_MAX_EXP: maximal positive exponent
FLT128_DIG: number of decimal digits in the mantissa
FLT128_MIN_10_EXP: maximal negative decimal exponent
FLT128_MAX_10_EXP: maximal positive decimal exponent

The following mathematical constants of type __float128 are defined.

M_Eq: the constant e (Euler’s number)
M_LOG2Eq: binary logarithm of 2
M_LOG10Eq: common, decimal logarithm of 2
M_LN2q: natural logarithm of 2
M_LN10q: natural logarithm of 10
M_PIq: pi
M_PI_2q: pi divided by two
M_PI_4q: pi divided by four
M_1_PIq: one over pi
M_2_PIQ: one over two pi
M_2_SQRTPIq: two over square root of pi
M_SQRT2q: square root of 2
M_SQRT1_2q: one over square root of 2
2 Math Library Routines

The following mathematical functions are available:

- acosq: arc cosine function
- acoshq: inverse hyperbolic cosine function
- asinq: arc sine function
- asinhq: inverse hyperbolic sine function
- atanq: arc tangent function
- atanhq: inverse hyperbolic tangent function
- atan2q: arc tangent function
- cbrtq: cube root function
- ceilq: ceiling value function
- copysignq: copy sign of a number
- coshq: hyperbolic cosine function
- cosq: cosine function
- erfq: error function
- erfcq: complementary error function
- exp2q: base 2 exponential function
- expq: exponential function
- expmq: exponential minus 1 function
- fabsq: absolute value function
- fdimq: positive difference function
- finiteq: check finiteness of value
- floorq: floor value function
- fmaq: fused multiply and add
- fmaxq: determine maximum of two values
- fminq: determine minimum of two values
- fmodq: remainder value function
- frexpq: extract mantissa and exponent
- hypotq: Euclidean distance function
- ilogbq: get exponent of the value
- isinfq: check for infinity
- isnanq: check for not a number
- issignalingq: check for signaling not a number
- j0q: Bessel function of the first kind, first order
- j1q: Bessel function of the first kind, second order
- jnq: Bessel function of the first kind, n-th order
- ldexpq: load exponent of the value
- lgammaq: logarithmic gamma function
- llrintq: round to nearest integer value
- llroundq: round to nearest integer value away from zero
- logbq: get exponent of the value
- logq: natural logarithm function
- log10q: base 10 logarithm function
- log1pq: compute natural logarithm of the value plus one
- log2q: base 2 logarithm function
lrintq: round to nearest integer value
lroundq: round to nearest integer value away from zero
modfq: decompose the floating-point number
nanq: return quiet NaN
nearbyintq: round to nearest integer
nextafterq: next representable floating-point number
powq: power function
remq: remainder function
rempquoq: remainder and part of quotient
rintq: round-to-nearest integral value
roundq: round-to-nearest integral value, return __float128
scalblinq: compute exponent using FLT_RADIX
scalbnq: compute exponent using FLT_RADIX
signbitq: return sign bit
sincosq: calculate sine and cosine simultaneously
sinhq: hyperbolic sine function
sinq: sine function
sqrtq: square root function
tanq: tangent function
tanhq: hyperbolic tangent function
tgammaq: true gamma function
truncq: round to integer, towards zero
y0q: Bessel function of the second kind, first order
y1q: Bessel function of the second kind, second order
ynq: Bessel function of the second kind, n-th order
cabsq complex absolute value function
cargq: calculate the argument
cimagq imaginary part of complex number
crealq: real part of complex number
cacoshq: complex arc hyperbolic cosine function
cacosq: complex arc cosine function
casinhq: complex arc hyperbolic sine function
casinq: complex arc sine function
catanhq: complex arc hyperbolic tangent function
catanq: complex arc tangent function
cosq complex cosine function:
coshq: complex hyperbolic cosine function
cexpq: complex exponential function
**cexpiq**: computes the exponential function of “i” times a real value

**clogq**: complex natural logarithm

**clog10q**: complex base 10 logarithm

**conjg**: complex conjugate function

**cpowq**: complex power function

**cprojq**: project into Riemann Sphere

**csinq**: complex sine function

**csinhq**: complex hyperbolic sine function

**csqrtq**: complex square root

**ctanq**: complex tangent function

**ctanhq**: complex hyperbolic tangent function
3 I/O Library Routines

3.1 strtoflt128 — Convert from string
The function strtoflt128 converts a string into a __float128 number.
Syntax

```
__float128 strtoflt128 (const char *s, char **sp)
```

Arguments:
- `s` input string
- `sp` the address of the next character in the string

The argument `sp` contains, if not NULL, the address of the next character following the parts of the string, which have been read.

Example

```
#include <quadmath.h>

int main ()
{
    __float128 r;
    r = strtoflt128 ("1.2345678", NULL);
    return 0;
}
```

3.2 quadmath_snprintf — Convert to string
The function quadmath_snprintf converts a __float128 floating-point number into a string. It is a specialized alternative to snprintf, where the format string is restricted to a single conversion specifier with Q modifier and conversion specifier e, E, f, F, g, G, a or A, with no extra characters before or after the conversion specifier. The %m$ or *m$ style must not be used in the format.

Syntax

```
int quadmath_snprintf (char *s, size_t size, const char *format, ...
```

Arguments:
- `s` output string
- `size` byte size of the string, including trailing NUL
- `format` conversion specifier string

Note
On some targets when supported by the C library hooks are installed for printf family of functions, so that printf ("%Qe", 1.2Q); etc. works too.

Example

```
#include <quadmath.h>
#include <stdlib.h>
#include <stdio.h>

int main ()
{
    __float128 r;
    int prec = 20;
    int main ()
    {
        __float128 r;
        r = strtoflt128 ("1.2345678", NULL);
        return 0;
    }
```

```
int width = 46;
char buf[128];

r = 2.0q;
r = sqrtq (r);
int n = quadmath_snprintf (buf, sizeof buf, "%+-##.20Qe", width, r);
if ((size_t) n < sizeof buf)
    printf ("%s\n", buf);
    /* Prints: +1.41421356237309504880e+00 */
quadmath_snprintf (buf, sizeof buf, "%Qa", r);
if ((size_t) n < sizeof buf)
    printf ("%s\n", buf);
    /* Prints: 0x1.6a09e667f3bcc908b2fb1366ea96p+0 */
n = quadmath_snprintf (NULL, 0, "%+-#46.*Qe", prec, r);
if (n > -1)
{
    char *str = malloc (n + 1);
    if (str)
    {
        quadmath_snprintf (str, n + 1, "%+-#46.*Qe", prec, r);
        printf("%s\n", str);
        /* Prints: +1.41421356237309504880e+00 */
    }
    free (str);
}
return 0;
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