

Title (en)
HIGH-APERTURE PROJECTION LENS

Title (de)
PROJEKTIONSOBJEKTIV HÖCHSTER APERTUR

Title (fr)
OBJECTIF DE PROJECTION A OUVERTURE EXTREMEMENT ELEVEE

Publication
EP 1483625 A1 20041208 (DE)

Application
EP 02738025 A 20020503

Priority
• DE 10210899 A 20020308
• EP 0204846 W 20020503

Abstract (en)
[origin: US2003174408A1] A purely refractive projection objective suitable for immersion micro-lithography is designed as a single-waist system with five lens groups, in the case of which a first lens group with a negative refracting power, a second lens group with a positive refracting power, a third lens group with a negative refracting power, a fourth lens group with a positive refracting power and a fifth lens group with a positive refracting power are provided. The system aperture is in the region of maximum beam diameter between the fourth and the fifth lens group. Embodiments of projection objectives according to the invention achieve a very high numerical aperture of $NA > 1$ in conjunction with a large image field, and are distinguished by a good optical correction state and moderate overall size. Pattern widths substantially below 100 nm can be resolved when immersion fluids are used between the projection objective and substrate in the case of operating wavelengths below 200 nm.

IPC 1-7
G03F 7/20

IPC 8 full level
G02B 13/24 (2006.01); **G02B 13/14** (2006.01); **G02B 13/18** (2006.01); **G03F 7/20** (2006.01); **H01L 21/027** (2006.01)

CPC (source: EP KR US)
G02B 9/60 (2013.01 - KR); **G02B 13/143** (2013.01 - EP US); **G02B 13/24** (2013.01 - KR); **G03F 7/20** (2013.01 - KR);
G03F 7/70241 (2013.01 - EP US); **G03F 7/70341** (2013.01 - EP US)

Citation (search report)
See references of WO 03077036A1

Designated contracting state (EPC)
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

DOCDB simple family (publication)
US 2003174408 A1 20030918; US 6891596 B2 20050510; AU 2002312872 A1 20030922; AU 2003221490 A1 20030922;
CN 100573222 C 20091223; CN 1639644 A 20050713; DE 10210899 A1 20030918; EP 1483625 A1 20041208; EP 1485760 A1 20041215;
JP 2005519347 A 20050630; JP 2005519348 A 20050630; KR 100991590 B1 20101104; KR 20040099307 A 20041126;
US 2005141098 A1 20050630; US 2005231814 A1 20051020; US 2007188880 A1 20070816; US 7203008 B2 20070410;
US 7312847 B2 20071225; US 7495840 B2 20090224; WO 03077036 A1 20030918; WO 03077037 A1 20030918

DOCDB simple family (application)
US 37980903 A 20030306; AU 2002312872 A 20020503; AU 2003221490 A 20030226; CN 03805575 A 20030226; DE 10210899 A 20020308;
EP 0204846 W 20020503; EP 02738025 A 20020503; EP 0301954 W 20030226; EP 03717197 A 20030226; JP 2003575189 A 20020503;
JP 2003575190 A 20030226; KR 20047014023 A 20030226; US 72344107 A 20070320; US 8560205 A 20050322; US 93532104 A 20040908