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Bis(*p*-bromophenyl)dimethylsilane

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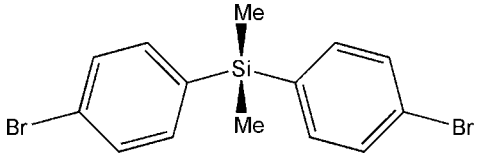
Key indicators: single-crystal X-ray study; T = 298 K; mean σ(C–C) = 0.005 Å; R factor = 0.038; wR factor = 0.099; data-to-parameter ratio = 17.3.

The title compound, $C_{14}H_{14}Br_2Si$, has been used for more than 50 years as a synthon for the preparation of organosilicon polymers, but no structural data for this molecule have been available until now. The compound crystallizes with two crystallographically independent molecules in the asymmetric unit. In both molecules the Si atoms show tetrahedral coordination. The angles between the two benzene rings are 80.6 (2)° and 84.0 (2)°.

Related literature

Bromophenyl-substituted organosilanes are of considerable interest for the preparation of organosilicon polymers (Speck, 1953; Ohshita *et al.*, 1994; Berger *et al.*, 1997; Kwak & Masuda, 2002*a*,*b*). These can be used as functionalized materials such as photoresists, precursors of ceramics, and conducting or photoconducting materials (Ohshita *et al.*, 1994). Furthermore, the title compound has been used as a synthon for the synthesis of the first silicon- and tin-containing paracyclophane (Zobel & Jurkschat, 1998). For related literature, see: Beyer *et al.* (2002); Doi *et al.* (1993); van Walree *et al.* (1995).



Experimental

Crystal data

$C_{14}H_{14}Br_2Si$
M_r = 370.16
Monoclinic, $P2_1/n$
a = 12.4981 (3) Å
b = 14.7956 (3) Å
c = 16.5144 (4) Å
β = 91.208 (1)°
V = 3053.11 (12) Å^3
Z = 8
Mo $K\alpha$ radiation
μ = 5.37 mm^{-1}
T = 298 (2) K
0.35 × 0.26 × 0.22 mm

Data collection

Bruker SMART CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Sheldrick 1996)
T_{min} = 0.205, T_{max} = 0.312
53137 measured reflections
5380 independent reflections
4174 reflections with $I > 2\sigma(I)$
R_{int} = 0.031

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.038
$wR(F^2)$ = 0.099
S = 1.07
5380 reflections
311 parameters
Only H-atom coordinates refined
$\Delta\rho_{max}$ = 0.66 e Å^{-3}
$\Delta\rho_{min}$ = −0.69 e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

Si1—C2	1.852 (4)	Si2—C15	1.850 (4)
Si1—C1	1.858 (4)	Si2—C16	1.859 (4)
Si1—C9	1.873 (3)	Si2—C23	1.874 (3)
Si1—C3	1.877 (3)	Si2—C17	1.876 (3)
C2—Si1—C1	110.4 (2)	C15—Si2—C16	111.3 (2)
C2—Si1—C9	109.7 (2)	C15—Si2—C23	109.7 (2)
C1—Si1—C9	110.1 (2)	C16—Si2—C23	109.8 (2)
C2—Si1—C3	109.9 (2)	C15—Si2—C17	109.9 (2)
C1—Si1—C3	110.5 (2)	C16—Si2—C17	110.2 (2)
C9—Si1—C3	106.2 (1)	C23—Si2—C17	105.8 (1)

Data collection: *SMART* (Bruker, 2004); cell refinement: *SAINT* (Bruker, 2004); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEP-3* (Farrugia, 1997); software used to prepare material for publication: *SHELXL97*.

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: WN2167).

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supplementary materials

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Bis(*p*-bromophenyl)dimethylsilane

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Comment

During our work on dipolar ferrocenylsilanes (Beyer *et al.*, 2002) we have prepared the title compound as a precursor for further syntheses. To our surprise, there were no structural data of the title compound available. The structure of bis(*p*-bromophenyl)dimethylsilicon has been determined to fill this gap.

Fig. 1 shows the molecular structure of the title compound and the atomic labelling scheme. It crystallizes with eight molecules in the unit cell. There are two crystallographically independent molecules in the asymmetric unit. Both silicon atoms are tetrahedrally coordinated. The angles between the benzene rings are contracted to 106.2 (1) (C9—Si1—C3) and 105.8 (1)° (C23—Si2—C17) respectively. The other bond angles at silicon are in the range 109.7 (2) to 111.3 (2)°. The Si—C bonds are in the typical range from 1.85 to 1.88 Å. The angles between the least-squares planes of the benzene rings are 80.6 (2)° for plane(C3—C8)-plane(C9—C14) and 84.0 (2)° for plane(C17—C22)-plane(C23—C28).

Experimental

The preparation of the title compound was performed according to methods described in the literature (Doi *et al.*, 1993; van Walree *et al.*, 1995) by reaction of *p*-dibromobenzene with n-butyllithium in diethyl ether followed by addition of dichlorodimethylsilane.

Refinement

Hydrogen atoms were positioned geometrically and allowed to ride on their parent atoms, with C—H = 0.93 Å for Csp^2 and 0.96 for methyl. U_{iso}(H) = xU_{eq}(C), where x = 1.2 for Csp^2 and 1.5 for methyl.

Figures

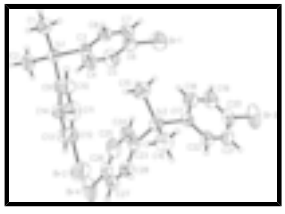


Fig. 1. The structure of the asymmetric unit of the title compound, drawn with 50% probability displacement ellipsoids.

bis(*p*-bromophenyl)dimethylsilane

Crystal data

$C_{14}H_{14}Br_2Si$ F_{000} = 1456

M_r = 370.16	D_x = 1.611 Mg m^{-3}
Monoclinic, $P2_1/n$	Melting point: 348 K
Hall symbol: -P 2yn	Mo $K\alpha$ radiation λ = 0.71073 Å
a = 12.4981 (3) Å	Cell parameters from 6677 reflections
b = 14.7956 (3) Å	μ = 5.37 mm^{-1}
c = 16.5144 (4) Å	T = 298 (2) K
β = 91.208 (1)º	Prism, colourless
V = 3053.11 (12) Å^3	0.35 × 0.26 × 0.22 mm
Z = 8	

Data collection

Bruker SMART CCD area-detector diffractometer	5380 independent reflections
Radiation source: sealed tube	4174 reflections with $I > 2\sigma(I)$
Monochromator: graphite	R_{int} = 0.031
T = 298(2) K	θ_{max} = 25.0º
φ and ω scans	θ_{min} = 1.9º
Absorption correction: multi-scan (SADABS; Sheldrick 1996)	h = −14→14
T_{min} = 0.205, T_{max} = 0.312	k = −17→17
53137 measured reflections	l = −19→19

Refinement

Refinement on F^2	Secondary atom site location: difference Fourier map
Least-squares matrix: full	Hydrogen site location: inferred from neighbouring sites
$R[F^2 > 2\sigma(F^2)]$ = 0.038	Only H-atom coordinates refined
$wR(F^2)$ = 0.099	$w = 1/[\sigma^2(F_o^2) + (0.0431P)^2 + 2.6376P]$ where $P = (F_o^2 + 2F_c^2)/3$
S = 1.07	$(\Delta/\sigma)_{max}$ = 0.001
5380 reflections	$\Delta\rho_{max}$ = 0.66 e Å^{-3}
311 parameters	$\Delta\rho_{min}$ = −0.68 e Å^{-3}
Primary atom site location: structure-invariant direct methods	Extinction correction: none

Special details

Geometry. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > 2\text{sigma}(F^2)$ is used only for calculat-

ing *R*-factors(gt) *etc*. and is not relevant to the choice of reflections for refinement. *R*-factors based on F^2 are statistically about twice as large as those based on F, and R– factors based on ALL data will be even larger.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters ($Å^2$)

	x	*y*	*z*	U_{iso}*/U_{eq}
Si1	0.31077 (7)	0.11971 (6)	0.03855 (5)	0.0470 (2)
Si2	−0.02672 (7)	0.37821 (6)	0.19184 (5)	0.0503 (2)
Br1	0.31205 (5)	0.56124 (3)	0.00621 (3)	0.1027 (2)
Br2	−0.08391 (4)	0.06111 (4)	0.28851 (4)	0.0979 (2)
Br3	−0.04008 (4)	0.82134 (3)	0.20446 (4)	0.1059 (2)
Br4	0.28563 (6)	0.30113 (4)	0.50780 (4)	0.1204 (3)
C1	0.2837 (3)	0.0633 (3)	−0.0603 (2)	0.0642 (9)
H1A	0.3447	0.0698	−0.0941	0.096*
H1B	0.2224	0.0907	−0.0863	0.096*
H1C	0.2698	0.0003	−0.0514	0.096*
C2	0.4368 (3)	0.0766 (3)	0.0852 (2)	0.0669 (10)
H2A	0.4959	0.0934	0.0522	0.100*
H2B	0.4333	0.0119	0.0892	0.100*
H2C	0.4464	0.1021	0.1383	0.100*
C3	0.3194 (2)	0.2454 (2)	0.02488 (18)	0.0462 (7)
C4	0.3785 (3)	0.2994 (3)	0.0782 (3)	0.0730 (11)
H4	0.4196	0.2721	0.1189	0.088*
C5	0.3781 (4)	0.3925 (3)	0.0726 (3)	0.0812 (12)
H5	0.4188	0.4272	0.1087	0.097*
C6	0.3170 (3)	0.4332 (2)	0.0131 (2)	0.0625 (9)
C7	0.2592 (3)	0.3829 (2)	−0.0409 (2)	0.0592 (9)
H7	0.2188	0.4109	−0.0817	0.071*
C8	0.2608 (3)	0.2907 (2)	−0.0350 (2)	0.0546 (8)
H8	0.2211	0.2569	−0.0724	0.066*
C9	0.1972 (3)	0.0994 (2)	0.10845 (19)	0.0474 (7)
C10	0.0953 (3)	0.0740 (3)	0.0818 (2)	0.0618 (9)
H10	0.0827	0.0643	0.0268	0.074*
C11	0.0122 (3)	0.0627 (3)	0.1347 (3)	0.0684 (10)
H11	−0.0554	0.0460	0.1153	0.082*
C12	0.0297 (3)	0.0760 (2)	0.2152 (2)	0.0600 (9)
C13	0.1283 (3)	0.1012 (3)	0.2450 (2)	0.0697 (10)
H13	0.1395	0.1105	0.3003	0.084*
C14	0.2106 (3)	0.1125 (3)	0.1917 (2)	0.0617 (9)
H14	0.2776	0.1294	0.2119	0.074*
C15	0.0339 (4)	0.3369 (3)	0.0975 (2)	0.0783 (12)
H15A	0.0344	0.2720	0.0976	0.117*
H15B	0.1059	0.3589	0.0944	0.117*
H15C	−0.0073	0.3582	0.0517	0.117*
C16	−0.1616 (3)	0.3284 (3)	0.2059 (3)	0.0719 (11)
H16A	−0.2079	0.3457	0.1615	0.108*
H16B	−0.1905	0.3502	0.2557	0.108*
H16C	−0.1560	0.2638	0.2079	0.108*

C17	−0.0353 (3)	0.5048 (2)	0.18988 (19)	0.0492 (7)
C18	0.0364 (3)	0.5578 (3)	0.1472 (3)	0.0690 (10)
H18	0.0867	0.5294	0.1152	0.083*
C19	0.0354 (3)	0.6508 (3)	0.1507 (3)	0.0762 (11)
H19	0.0844	0.6845	0.1217	0.091*
C20	−0.0386 (3)	0.6932 (2)	0.1975 (3)	0.0674 (11)
C21	−0.1122 (3)	0.6443 (3)	0.2393 (2)	0.0652 (10)
H21	−0.1634	0.6734	0.2700	0.078*
C22	−0.1093 (3)	0.5517 (2)	0.2355 (2)	0.0578 (9)
H22	−0.1590	0.5189	0.2646	0.069*
C23	0.0625 (3)	0.3496 (2)	0.2808 (2)	0.0490 (8)
C24	0.1682 (3)	0.3776 (3)	0.2830 (2)	0.0671 (10)
H24	0.1952	0.4073	0.2382	0.080*
C25	0.2352 (3)	0.3630 (3)	0.3493 (3)	0.0783 (12)
H25	0.3060	0.3823	0.3493	0.094*
C26	0.1948 (4)	0.3192 (3)	0.4153 (3)	0.0724 (12)
C27	0.0917 (4)	0.2892 (3)	0.4159 (2)	0.0697 (11)
H27	0.0659	0.2588	0.4608	0.084*
C28	0.0265 (3)	0.3045 (2)	0.3493 (2)	0.0602 (9)
H28	−0.0439	0.2841	0.3498	0.072*

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Si1	0.0492 (5)	0.0458 (5)	0.0459 (5)	0.0050 (4)	−0.0004 (4)	0.0006 (4)
Si2	0.0535 (5)	0.0484 (5)	0.0489 (5)	−0.0004 (4)	−0.0003 (4)	−0.0042 (4)
Br1	0.1552 (5)	0.0477 (2)	0.1055 (4)	−0.0094 (3)	0.0104 (3)	0.0062 (2)
Br2	0.0859 (3)	0.0874 (3)	0.1226 (4)	0.0043 (2)	0.0512 (3)	0.0128 (3)
Br3	0.1000 (4)	0.0501 (2)	0.1655 (6)	0.0063 (2)	−0.0449 (4)	−0.0005 (3)
Br4	0.1704 (6)	0.0775 (3)	0.1100 (4)	0.0387 (3)	−0.0790 (4)	−0.0138 (3)
C1	0.079 (3)	0.058 (2)	0.056 (2)	−0.0001 (19)	0.0043 (18)	−0.0061 (17)
C2	0.057 (2)	0.068 (2)	0.075 (2)	0.0127 (18)	0.0005 (18)	0.011 (2)
C3	0.0475 (17)	0.0485 (18)	0.0425 (16)	0.0016 (14)	0.0011 (13)	−0.0006 (14)
C4	0.084 (3)	0.060 (2)	0.074 (3)	0.000 (2)	−0.030 (2)	0.000 (2)
C5	0.099 (3)	0.059 (2)	0.084 (3)	−0.014 (2)	−0.027 (2)	−0.010 (2)
C6	0.076 (2)	0.0466 (19)	0.066 (2)	−0.0037 (18)	0.012 (2)	0.0054 (17)
C7	0.072 (2)	0.053 (2)	0.052 (2)	0.0019 (18)	−0.0023 (17)	0.0105 (16)
C8	0.063 (2)	0.053 (2)	0.0478 (19)	−0.0013 (16)	−0.0057 (16)	−0.0006 (15)
C9	0.0509 (18)	0.0404 (16)	0.0510 (18)	0.0064 (14)	−0.0016 (14)	0.0000 (14)
C10	0.060 (2)	0.069 (2)	0.056 (2)	−0.0047 (18)	−0.0052 (17)	−0.0042 (18)
C11	0.051 (2)	0.070 (3)	0.084 (3)	−0.0063 (18)	−0.0017 (19)	0.001 (2)
C12	0.057 (2)	0.0478 (19)	0.076 (3)	0.0038 (16)	0.0183 (18)	0.0052 (18)
C13	0.075 (3)	0.080 (3)	0.055 (2)	0.007 (2)	0.0121 (19)	−0.003 (2)
C14	0.055 (2)	0.075 (2)	0.055 (2)	−0.0011 (18)	−0.0007 (16)	−0.0057 (18)
C15	0.094 (3)	0.076 (3)	0.065 (2)	0.004 (2)	0.010 (2)	−0.016 (2)
C16	0.061 (2)	0.075 (3)	0.079 (3)	−0.015 (2)	−0.0077 (19)	−0.006 (2)
C17	0.0486 (18)	0.0526 (19)	0.0459 (17)	0.0021 (15)	−0.0067 (14)	0.0031 (15)
C18	0.065 (2)	0.061 (2)	0.081 (3)	0.0014 (19)	0.013 (2)	0.004 (2)

C19	0.073 (3)	0.061 (2)	0.095 (3)	−0.009 (2)	0.001 (2)	0.016 (2)
C20	0.067 (2)	0.048 (2)	0.086 (3)	0.0087 (18)	−0.030 (2)	0.0026 (19)
C21	0.063 (2)	0.059 (2)	0.073 (2)	0.0178 (19)	−0.0074 (19)	−0.0067 (19)
C22	0.057 (2)	0.060 (2)	0.056 (2)	0.0080 (17)	−0.0048 (16)	0.0040 (17)
C23	0.0533 (19)	0.0374 (16)	0.0563 (19)	0.0044 (14)	0.0010 (15)	−0.0022 (14)
C24	0.060 (2)	0.063 (2)	0.078 (3)	−0.0062 (18)	−0.0039 (19)	0.014 (2)
C25	0.067 (2)	0.062 (2)	0.106 (3)	−0.002 (2)	−0.023 (2)	0.003 (2)
C26	0.094 (3)	0.047 (2)	0.075 (3)	0.024 (2)	−0.029 (2)	−0.0076 (19)
C27	0.096 (3)	0.054 (2)	0.059 (2)	0.017 (2)	0.001 (2)	0.0072 (18)
C28	0.063 (2)	0.053 (2)	0.065 (2)	0.0066 (17)	0.0064 (18)	0.0007 (18)

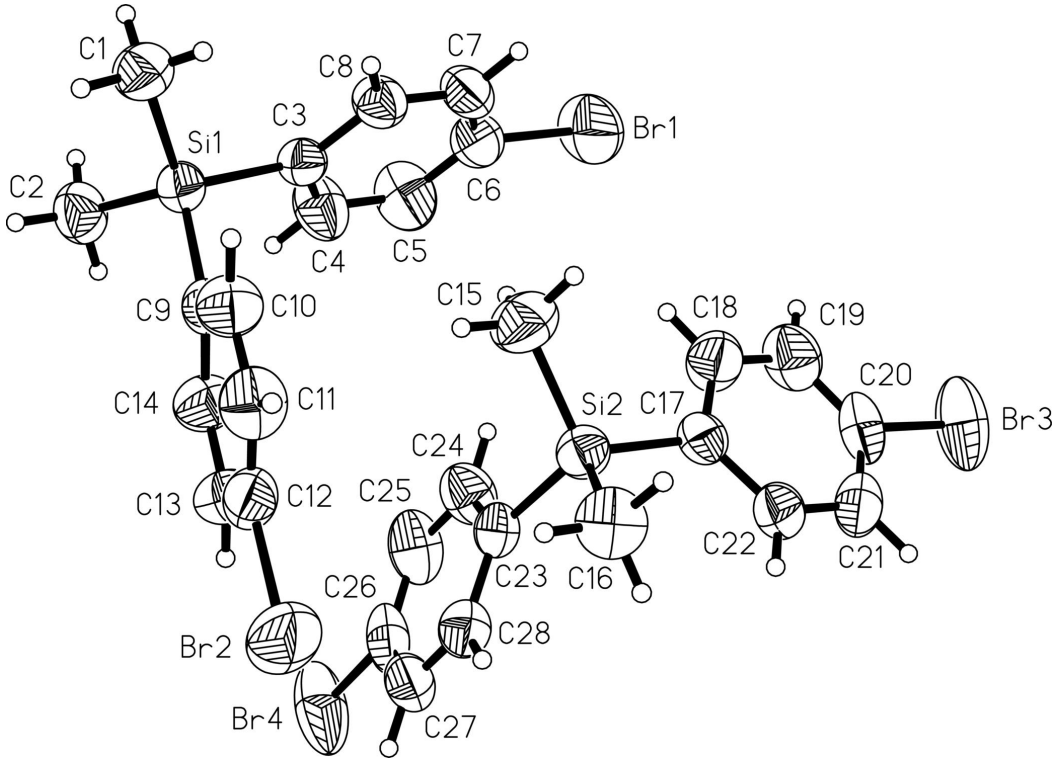
Geometric parameters (Å, °)

Si1—C2	1.852 (4)	C11—C12	1.356 (6)
Si1—C1	1.858 (4)	C11—H11	0.9300
Si1—C9	1.873 (3)	C12—C13	1.369 (6)
Si1—C3	1.877 (3)	C13—C14	1.379 (5)
Si2—C15	1.850 (4)	C13—H13	0.9300
Si2—C16	1.859 (4)	C14—H14	0.9300
Si2—C23	1.874 (3)	C15—H15A	0.9600
Si2—C17	1.876 (3)	C15—H15B	0.9600
Br1—C6	1.899 (4)	C15—H15C	0.9600
Br2—C12	1.899 (3)	C16—H16A	0.9600
Br3—C20	1.900 (4)	C16—H16B	0.9600
Br4—C26	1.903 (4)	C16—H16C	0.9600
C1—H1A	0.9600	C17—C22	1.390 (5)
C1—H1B	0.9600	C17—C18	1.394 (5)
C1—H1C	0.9600	C18—C19	1.378 (6)
C2—H2A	0.9600	C18—H18	0.9300
C2—H2B	0.9600	C19—C20	1.369 (6)
C2—H2C	0.9600	C19—H19	0.9300
C3—C8	1.389 (4)	C20—C21	1.369 (6)
C3—C4	1.390 (5)	C21—C22	1.372 (5)
C4—C5	1.380 (6)	C21—H21	0.9300
C4—H4	0.9300	C22—H22	0.9300
C5—C6	1.371 (6)	C23—C24	1.384 (5)
C5—H5	0.9300	C23—C28	1.397 (5)
C6—C7	1.357 (5)	C24—C25	1.381 (6)
C7—C8	1.368 (5)	C24—H24	0.9300
C7—H7	0.9300	C25—C26	1.373 (6)
C8—H8	0.9300	C25—H25	0.9300
C9—C10	1.390 (5)	C26—C27	1.363 (6)
C9—C14	1.394 (5)	C27—C28	1.374 (5)
C10—C11	1.381 (5)	C27—H27	0.9300
C10—H10	0.9300	C28—H28	0.9300
C2—Si1—C1	110.4 (2)	C12—C13—C14	118.7 (4)
C2—Si1—C9	109.7 (2)	C12—C13—H13	120.6
C1—Si1—C9	110.1 (2)	C14—C13—H13	120.6
C2—Si1—C3	109.9 (2)	C13—C14—C9	122.5 (4)

C1—Si1—C3	110.5 (2)	C13—C14—H14	118.8
C9—Si1—C3	106.2 (1)	C9—C14—H14	118.8
C15—Si2—C16	111.3 (2)	Si2—C15—H15A	109.5
C15—Si2—C23	109.7 (2)	Si2—C15—H15B	109.5
C16—Si2—C23	109.8 (2)	H15A—C15—H15B	109.5
C15—Si2—C17	109.9 (2)	Si2—C15—H15C	109.5
C16—Si2—C17	110.2 (2)	H15A—C15—H15C	109.5
C23—Si2—C17	105.8 (1)	H15B—C15—H15C	109.5
Si1—C1—H1A	109.5	Si2—C16—H16A	109.5
Si1—C1—H1B	109.5	Si2—C16—H16B	109.5
H1A—C1—H1B	109.5	H16A—C16—H16B	109.5
Si1—C1—H1C	109.5	Si2—C16—H16C	109.5
H1A—C1—H1C	109.5	H16A—C16—H16C	109.5
H1B—C1—H1C	109.5	H16B—C16—H16C	109.5
Si1—C2—H2A	109.5	C22—C17—C18	115.8 (3)
Si1—C2—H2B	109.5	C22—C17—Si2	121.8 (3)
H2A—C2—H2B	109.5	C18—C17—Si2	122.2 (3)
Si1—C2—H2C	109.5	C19—C18—C17	122.3 (4)
H2A—C2—H2C	109.5	C19—C18—H18	118.9
H2B—C2—H2C	109.5	C17—C18—H18	118.9
C8—C3—C4	116.0 (3)	C20—C19—C18	119.3 (4)
C8—C3—Si1	122.1 (2)	C20—C19—H19	120.4
C4—C3—Si1	121.7 (3)	C18—C19—H19	120.4
C5—C4—C3	122.0 (4)	C19—C20—C21	120.8 (4)
C5—C4—H4	119.0	C19—C20—Br3	119.9 (3)
C3—C4—H4	119.0	C21—C20—Br3	119.3 (3)
C6—C5—C4	119.2 (4)	C20—C21—C22	119.1 (4)
C6—C5—H5	120.4	C20—C21—H21	120.5
C4—C5—H5	120.4	C22—C21—H21	120.5
C7—C6—C5	120.7 (3)	C21—C22—C17	122.8 (4)
C7—C6—Br1	119.5 (3)	C21—C22—H22	118.6
C5—C6—Br1	119.8 (3)	C17—C22—H22	118.6
C6—C7—C8	119.5 (3)	C24—C23—C28	116.5 (3)
C6—C7—H7	120.2	C24—C23—Si2	120.4 (3)
C8—C7—H7	120.2	C28—C23—Si2	123.1 (3)
C7—C8—C3	122.6 (3)	C25—C24—C23	122.4 (4)
C7—C8—H8	118.7	C25—C24—H24	118.8
C3—C8—H8	118.7	C23—C24—H24	118.8
C10—C9—C14	116.1 (3)	C26—C25—C24	118.5 (4)
C10—C9—Si1	123.4 (3)	C26—C25—H25	120.8
C14—C9—Si1	120.5 (3)	C24—C25—H25	120.8
C11—C10—C9	121.9 (3)	C27—C26—C25	121.5 (4)
C11—C10—H10	119.0	C27—C26—Br4	119.8 (4)
C9—C10—H10	119.0	C25—C26—Br4	118.7 (4)
C12—C11—C10	119.6 (4)	C26—C27—C28	119.0 (4)
C12—C11—H11	120.2	C26—C27—H27	120.5
C10—C11—H11	120.2	C28—C27—H27	120.5
C11—C12—C13	121.2 (3)	C27—C28—C23	122.1 (4)
C11—C12—Br2	120.0 (3)	C27—C28—H28	119.0

C13—C12—Br2	118.8 (3)	C23—C28—H28	119.0
C2—Si1—C3—C8	153.4 (3)	C15—Si2—C17—C22	156.1 (3)
C1—Si1—C3—C8	31.3 (3)	C16—Si2—C17—C22	33.1 (3)
C9—Si1—C3—C8	−88.0 (3)	C23—Si2—C17—C22	−85.5 (3)
C2—Si1—C3—C4	−31.8 (3)	C15—Si2—C17—C18	−28.4 (4)
C1—Si1—C3—C4	−153.9 (3)	C16—Si2—C17—C18	−151.3 (3)
C9—Si1—C3—C4	86.8 (3)	C23—Si2—C17—C18	90.0 (3)
C8—C3—C4—C5	0.6 (6)	C22—C17—C18—C19	1.0 (6)
Si1—C3—C4—C5	−174.5 (4)	Si2—C17—C18—C19	−174.8 (3)
C3—C4—C5—C6	0.6 (7)	C17—C18—C19—C20	−0.2 (7)
C4—C5—C6—C7	−1.4 (7)	C18—C19—C20—C21	−1.0 (6)
C4—C5—C6—Br1	178.2 (3)	C18—C19—C20—Br3	179.1 (3)
C5—C6—C7—C8	1.0 (6)	C19—C20—C21—C22	1.5 (6)
Br1—C6—C7—C8	−178.6 (3)	Br3—C20—C21—C22	−178.6 (3)
C6—C7—C8—C3	0.2 (6)	C20—C21—C22—C17	−0.8 (6)
C4—C3—C8—C7	−1.1 (5)	C18—C17—C22—C21	−0.4 (5)
Si1—C3—C8—C7	174.0 (3)	Si2—C17—C22—C21	175.4 (3)
C2—Si1—C9—C10	−141.8 (3)	C15—Si2—C23—C24	55.8 (3)
C1—Si1—C9—C10	−20.1 (3)	C16—Si2—C23—C24	178.4 (3)
C3—Si1—C9—C10	99.4 (3)	C17—Si2—C23—C24	−62.7 (3)
C2—Si1—C9—C14	40.4 (3)	C15—Si2—C23—C28	−127.9 (3)
C1—Si1—C9—C14	162.0 (3)	C16—Si2—C23—C28	−5.3 (3)
C3—Si1—C9—C14	−78.4 (3)	C17—Si2—C23—C28	113.7 (3)
C14—C9—C10—C11	0.3 (5)	C28—C23—C24—C25	−0.6 (6)
Si1—C9—C10—C11	−177.6 (3)	Si2—C23—C24—C25	176.0 (3)
C9—C10—C11—C12	−0.5 (6)	C23—C24—C25—C26	−0.2 (6)
C10—C11—C12—C13	0.5 (6)	C24—C25—C26—C27	1.0 (6)
C10—C11—C12—Br2	179.8 (3)	C24—C25—C26—Br4	−178.6 (3)
C11—C12—C13—C14	−0.4 (6)	C25—C26—C27—C28	−1.0 (6)
Br2—C12—C13—C14	−179.6 (3)	Br4—C26—C27—C28	178.6 (3)
C12—C13—C14—C9	0.2 (6)	C26—C27—C28—C23	0.2 (5)
C10—C9—C14—C13	−0.1 (5)	C24—C23—C28—C27	0.6 (5)
Si1—C9—C14—C13	177.9 (3)	Si2—C23—C28—C27	−175.9 (3)

Fig. 1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