Electronic Supplementary Information

Effect of Chlorine Substitution Position of End-group on Intermolecular Interaction and Photovoltaic Performance of Small Molecule Acceptors

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Methods

Materials and synthesis: All chemicals and solvents were purchased from Innochem, J&K, Alfa Aesar and TCI Chemical Co. respectively. The solvents do not need to degas in all the reactions, and the reactions all performed under a nitrogen atmosphere. Compound MO-IDT-CHO, LY-CHO and N3-CHO were synthesized according to the procedures reported in the literatures¹⁻³. The synthetic routes of MO-IDIC-Cl-1,MO-IDIC-Cl-2, LY-Cl-1, LY-Cl-2, N3-Cl-1 and N3-Cl-2 were shown in Fig. S1 and detailed synthesis processes are described in the following.

Synthesis of MO-IDIC-Cl-1 (or Cl-2): Compound MO-IDT-CHO (143 mg, 0.2 mmol) and compound Cl-1 or Cl-2 (300 mg, 1.4 mmol) were dissolved in CHCl₃ (25 mL) under a nitrogen atmosphere. 0.6 ml pyridine was added and refluxed for 12 h. Then, the mixture was poured into water (100 mL) and extracted with CHCl₃ (2×100 mL). The organic layer was washed with water, and then dried over MgSO₄. After removing the solvent, the residue was purified using column chromatography on silica gel employing petroleum ether/CHCl₃ (1:4) as an eluent, yielding a dark blue solid MO-IDIC-Cl-1 (or Cl-2).

MO-IDIC-Cl-1 (209 mg, 92%) ¹H NMR (400 MHz, CDCl₃) δ 8.97 (s, 2H), 8.65 (d, *J* = 8.5 Hz, 2H), 7.89 (d, *J* = 1.8 Hz, 2H), 7.75 (s, 2H), 7.71 (dd, *J* = 8.5, 1.9 Hz, 2H), 4.13 (s, 6H), 2.38-2.06 (m, 8H), 1.21-1.03 (m, 24H), 0.80-0.72 (m, 20H). ¹³C NMR (101 MHz, CDCl₃) δ 186.78, 159.59, 157.52, 156.79, 148.25, 148.00, 142.28, 141.29, 138.78, 138.49, 138.04, 137.17, 134.87, 134.35, 126.50, 123.89, 121.83, 114.65, 69.12, 61.95, 56.10, 38.05, 31.57, 29.46, 24.47, 22.52, 13.95. HRMS (TOF) m/z calcd for [M+H]⁺ C₆₈H₆₉Cl₂N₄O₄S₂ 1139.4115, found 1139.4131.

MO-IDIC-Cl-2 (204 mg, 90%) ¹H NMR (300 MHz, CDCl₃) δ 8.97 (s, 2H), 8.68 (s, 2H), 7.88 (d, J = 8.0 Hz, 2H), 7.77-7.67 (m, 4H), 4.13 (s, 6H), 2.41-2.03 (m, 8H), 1.21-1.03 (m, 24H), 0.80-0.72 (m, 20H). ¹³C NMR (75 MHz, CDCl₃) δ 186.93, 159.23, 157.48, 156.91, 148.22, 147.97, 142.26, 141.75, 141.23, 138.72, 137.21, 135.13, 134.57, 134.35, 125.40, 124.71, 121.80, 114.53, 114.33, 69.66, 61.95, 56.06,

38.04, 31.57, 29.46, 24.45, 22.53, 13.97. HRMS (TOF) m/z calcd for [M+H]⁺C₆₈H₆₉Cl₂N₄O₄S₂1139.4133, found 1139.4131

Synthesis of LY-Cl-1 (or Cl-2): Compound LY-CHO (205 mg, 0.2 mmol) and compound Cl-1 or Cl-2 (300 mg, 1.4 mmol) were dissolved in $CHCl_3$ (25 mL) under a nitrogen atmosphere. 0.6 ml pyridine was added and refluxed for 12 h. Then, the mixture was poured into water (100 mL) and extracted with $CHCl_3$ (2 × 100 mL). The organic layer was washed with water, and then dried over MgSO₄. After removing the solvent, the residue was purified using column chromatography on silica gel employing petroleum ether/CHCl₃ (1:4) as an eluent, yielding a dark solid LY-Cl-1 (or Cl-2)

LY-Cl-1 (257 mg, 89%) ¹H NMR (400 MHz, CDCl₃) δ 9.18 (s, 2H), 8.65 (d, J = 8.5 Hz, 2H), 7.88 (s, 2H), 7.70 (d, J = 8.7 Hz, 2H), 4.78 (d, J = 7.5 Hz, 4H), 3.23 (t, J = 7.5 Hz, 4H), 2.10 (s, 2H), 1.87 (d, J = 6.8 Hz, 4H), 1.58-0.92 (m, 48H), 0.91-0.55 (m, 18H). ¹³C NMR (101 MHz, CDCl₃) δ 187.14, 159.92, 153.69, 147.56, 145.13, 141.00, 138.46, 138.15, 137.78, 135.79, 135.62, 134.76, 133.85, 133.42, 130.49, 126.41, 123.72, 120.44, 115.25, 114.89, 113.58, 68.40, 55.68, 40.41, 31.92, 31.22, 29.83, 29.65, 29.63, 29.52, 29.46, 29.34, 27.67, 23.29, 22.80, 22.69, 14.11, 13.73, 10.25. HRMS (TOF) m/z calcd for [M]⁺ C₈₂H₈₈Cl₂N₈O₂S₅ 1446.5006, found 1446.5005.

LY-Cl-2 (271 mg, 94%) ¹H NMR (400 MHz, CDCl₃) δ 9.15 (s, 2H), 8.66 (s, 2H), 7.88 (d, *J* = 7.9 Hz, 2H), 7.71 (d, *J* = 7.9 Hz, 2H), 4.78 (d, *J* = 6.2 Hz, 4H), 3.22 (t, *J* = 7.5 Hz, 4H), 2.12 (s, 2H), 1.87 (d, *J* = 6.6 Hz, 4H), 1.58-0.95 (m, 48H), 0.91-0.61 (m, 18H). ¹³C NMR (101 MHz, CDCl₃) δ 187.31, 159.47, 153.66, 147.53, 145.13, 141.67, 141.35, 137.84, 135.87, 135.50, 135.10, 134.31, 133.77, 133.41, 130.41, 125.32, 124.52, 120.42, 115.14, 113.60, 68.92, 55.68, 40.37, 31.92, 31.20, 29.83, 29.65, 29.63, 29.52, 29.46, 29.35, 27.69, 23.26, 22.83, 22.69, 14.12, 13.73, 10.26. HRMS (TOF) m/z calcd for [M]⁺ C₈₂H₈₈Cl₂N₈O₂S₅1446.5006, found 1446.5005.

Synthesis of N3-Cl-1 (or Cl-2): Compound N3-CHO (211 mg, 0.2 mmol) and compound Cl-1 or Cl-2 (300 mg, 1.4 mmol) were dissolved in CHCl₃ (25 mL) under a

nitrogen atmosphere. 0.6 ml pyridine was added and refluxed for 12 h. Then, the mixture was poured into water (100 mL) and extracted with $CHCl_3$ (2 × 100 mL). The organic layer was washed with water, and then dried over MgSO₄. After removing the solvent, the residue was purified using column chromatography on silica gel employing petroleum ether/CHCl₃ (1:4) as an eluent, yielding a dark solid N3-Cl-1 (or Cl-2).

N3-Cl-1 (271 mg, 92%) ¹H NMR (400 MHz, CDCl₃) δ 8.74 (s, 2H), 8.45 (d, *J* = 8.4 Hz, 2H), 7.70 (s, 2H), 7.46 (d, *J* = 8.5 Hz, 2H), 4.69 (s, 4H), 2.93 (t *J* = 6.7 Hz, 4H), 1.96 (s, 4H), 1.79-1.65 (m, 4H), 1.48-1.19 (m, 50H), 0.89-0.75 (m, 18H).¹³C NMR (101 MHz, CDCl₃) δ 185.97, 158.05, 152.58, 146.21, 144.38, 140.16, 137.43, 137.08, 136.43, 133.87, 133.70, 132.35, 131.82, 129.95, 125.46, 122.72, 119.25, 114.32, 114.11, 112.75, 67.75, 49.52, 36.74, 34.79, 32.22, 31.30, 30.96, 30.33, 29.17, 29.10, 29.02, 29.00, 28.89, 28.81, 28.72, 28.38, 25.23, 22.44, 22.07, 22.02, 13.50, 10.16. HRMS (TOF) m/z calcd for [M]⁺ C₈₄H₉₂Cl₂N₈O₂S₅1474.5324, found 1474.5318.

N3-Cl-2 (274 mg, 93%) ¹H NMR (400 MHz, CDCl₃) δ 8.70 (s, 2H), 8.49 (s, 2H), 7.74 (d, J = 7.9 Hz, 2H), 7.56 (d, J = 8.8 Hz, 2H), 4.71 (s, 4H), 2.99 (t, J = 7.6 Hz, 4H), 1.93 (d, J = 6.2 Hz, 4H), 1.80-1.67 (m, 4H), 1.46-1.15 (m, 50H), 0.86-0.79 (m, 18H).¹³C NMR (101 MHz, CDCl₃) δ 186.25, 157.70, 152.83, 146.26, 144.45, 140.76, 140.35, 136.59, 134.10, 134.00, 133.78, 133.41, 132.44, 132.04, 129.86, 124.46, 123.38, 119.31, 114.20, 113.80, 112.83, 68.27, 49.62, 36.70, 34.66, 32.11, 31.30, 30.96, 30.30, 29.20, 29.03, 29.01, 28.90, 28.82, 28.72, 28.25, 25.18, 22.36, 22.07, 13.50, 13.45, 10.13. HRMS (TOF) m/z calcd for [M]⁺ C₈₄H₉₂Cl₂N₈O₂S₅1474.5324, found 1446.5318.

Measurements: ¹H NMR spectra were measured on a Bruker DMX-400 spectrometer with *d*-chloroform as the solvent and trimethylsilane as the internal reference. UV-visible absorption spectra were measured on a Hitachi U-3010 UV-vis spectrophotometer. Mass spectra were recorded on a Shimadzu spectrometer. UV-vis absorption spectra of active layers of the all PSCs were measured on a Hitachi U-3010 UV-vis spectrophotometer. The electrochemical cyclic voltammetry was performed on a Zahner IM6e Electrochemical Workstation, in an acetonitrile solution of 0.1 mol/L n-Bu₄NPF₆ at a potential scan rate of 100 mV/s with an Ag/AgCl reference electrode and a platinum wire counter electrode. The film morphology was measured using an atomic force microscope (AFM, SPA-400) using the tapping mode.

Device fabrication and characterization: The PSCs were fabricated with a structure of ITO/PEDOT: PSS (40 nm)/active layer/PDINO/cathode. A thin layer of PEDOT: PSS was deposited through spin-coating on precleaned ITO-coated glass from a PEDOT: PSS aqueous solution (Baytron P VP AI 4083 from H. C. Starck) at 4000 rpm and dried subsequently at 150 °C for 15 min in air. Then the device was transferred to a nitrogen glove box, where the active blend layer of polymers and acceptors was spin-coated from its chloroform solution onto the PEDOT: PSS layer under a spin-coating rate of 3000 rpm. After spin-coating, the active layers were annealed at 110 °C or 100 °C for 5 min for the devices with thermal annealing treatment. The thickness of the active layers is ca. 110 nm. Then methanol solution of PDINO at a concentration of 1.0 mg mL⁻¹ was deposited atop the active layer at 3000 rpm for 30 s to afford a PDINO cathode buffer layer with thickness of ca. 10 nm. Finally, top Al electrode was deposited in vacuum onto the cathode buffer layer at a pressure of ca. 5.0×10^{-5} Pa. The active area of the device was 4.7 mm². The current density-voltage (J-V) characteristics of the PSCs were measured in glovebox on a computer-controlled Keithley 2450 Source-Measure Unit. Oriel Sol3A Class AAA Solar Simulator (model, Newport 94023A) with a 450 W xenon lamp and an air mass (AM) 1.5 filter was used as the light source. The light intensity was calibrated to 100 mW cm⁻² by a Newport Oriel 91150V reference cell. The input photon to converted current efficiency (IPCE) was measured by Solar Cell Spectral Response Measurement System QE-R3-011 (Enli Technology Co., Ltd., Taiwan). The light intensity at each wavelength was calibrated with a standard single-crystal Si photovoltaic cell.

Mobility Measurements: Hole and electron mobilities were measured using the the space charge limited current (SCLC) method. Device structures are ITO/PEDOT:PSS/donor: acceptor (1:1, w/w) or (1:1.5 w/w)/Au for hole-only devices

and ITO/ZnO/donor: acceptor (1: 1, w/w) or (1:1.5 w/w) /PDINO/Al for electron-only devices. The SCLC mobilities were calculated by MOTT-Gurney equation:

$$J = \frac{9\varepsilon_{\rm r}\varepsilon_0\mu V^2}{8L^3} \tag{1}$$

Where *J* is the current density, ε_r is the relative dieletiric constant of active layer material usually 2-4 for organic semiconductor, herein we use a relative dielectric constant of 4, ε_0 is the permittivity of empty space, μ is the mobility of hole or electron and L is the thickness of the active layer, *V* is the internal voltage in the device, and $V = V_{app}-V_{bi}$, where V_{app} is the voltage applied to the device, and V_{bi} is the built-in voltage resulting from the relative work function difference between the two electrodes (in the hole-only and the electron-only devices, the V_{bi} values are 0.2 V and 0V respectively).

DSC measurements. Neat materials were dissolved in chloroform and stirred overnight at 50 °C. The solution was then drop cast on a precleaned glass substrate and kept under a nitrogen atmosphere for 48 h to remove the residual solvents. DSC heat-cool-heat measurements were carried out at a heating/cooling rate of 10 °C/min using a TA Instrument Discovery Series.

GIWAXS Characterization: Grazing-incidence wide-angle X-ray scattering (GIWAXS) measurements were conducted at Advanced Light Source (ALS), Lawrence Berkeley National Laboratory, Berkeley, CA at the beamline 7.3.3. Data was acquired at the critical angle (0.13^{0}) of the film with a hard X-ray energy of 10 keV. X-ray irradiation time was 10-30 s, dependent on the saturation level of the detector. Beam center was calibrated using AgB powder and the sample-to-detector distance was about 330 mm. The π - π coherence lengths (*L*) are estimated based on the Scherrer Equation (*L*= 2π K/FWHM), where K is the shape factor (here we use 0.9), and FWHM is the full width at half maximum of the (010) diffraction peaks.



Fig. S1. Synthetic routes of MO-IDIC-Cl-1, MO-IDIC-Cl-2, LY-Cl-1, LY-Cl-2, N3-Cl-1 and N3-Cl-2.



Fig. S2. Molecular structures of polymer donors



Fig. S3. Cyclic voltammograms of (a) MO-IDIC-Cl1 and MO-IDIC-Cl2, (b) LY-Cl1 and LY-Cl2, (c) N3-Cl1 and N3-Cl2, (d) ferrocene/ferrocenium (Fc/Fc⁺)



Fig. S4. 2D GIWAXS patterns of (a) PTQ10, (b) PM6 and (c) PL1 film; Line cuts of the GIWAXS of corresponding donors in (d) out of plane direction and (e) in plane direction. Line plots offset for clarity.



Fig. S5. Crystal structures of MO-IDIC-Cl-1, MO-IDIC-Cl-2, LY-Cl-1 and LY-Cl-2.



Fig. S6. The H-bonding between (a) MO-IDIC-Cl-1, (b) LY-Cl-1 and (c) LY-Cl-2.



Fig. S7. AFM images of the corresponding donors: acceptors blend films



Fig. S8. $J_{1/2} \sim (V_{appl} - V_{bi} - V_s)$ characteristics of the electron-only devices based on the neat films of acceptors. Solid lines are the fitting lines of the data.



Fig. S9. $J_{1/2} \sim (V_{appl} - V_{bi} - V_s)$ characteristics of the charge carrier mobilities of the corresponding blend films. Solid lines are the fitting lines of the data.





Fig. S12. ¹H NMR spectrum of Cl-2



210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

Fig. S13.¹³C NMR spectrum of Cl-2











Fig. S18. ¹H NMR spectrum of LY-Cl-1







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Fig. S24. ¹H NMR spectrum of N3-Cl-2



Table S1. Physicochemical properties and electronic energy levels of the SMAs.

	$\lambda_{max}{}^a$	$\lambda_{\max}{}^b$	$\lambda_{ ext{edge}}{}^{b}$	$E_{\rm g}^{{\rm opt}c}$	E_{HOMO}^d	E_{LUMO}^{d}
	(nm)	(nm)	(nm)	(eV)	(eV)	(eV)
MO-IDIC-Cl-1	679	740	798	1.55	-5.80	-3.91
MO-IDIC-Cl-2	682	746	803	1.54	-5.79	-3.92
LY-Cl-1	730	816	893	1.39	-5.66	-3.82
LY-Cl-2	736	829	914	1.36	-5.61	-3.84
N3-Cl-1	731	811	906	1.37	-5.64	-3.78
N3-C1-2	737	838	929	1.33	-5.58	-3.80

^{*a*}Absorption of the SMAs solutions. ^{*b*}Absorption of the SMAs films. ^{*c*} Calculated from the absorption edge of the SMA films: $E_{\rm g}^{\rm opt} = 1240/\lambda_{\rm edge}$. ^{*d*} Calculated according to the equation $E_{\rm LUMO/HOMO} = -e (\varphi_{\rm red/ox} + 4.36) (eV)$

	$\mu_{\rm h}~({\rm cm}^2~{ m V}^{-1}~{ m s}^{-1}$)	$\mu_{ m e}~(m cm^2~V^{-1}~s^{-1}$)
MO-IDIC-Cl-1	-	5.11×10^{-4}
MO-IDIC-Cl-2	-	7.31×10^{-4}
LY-Cl-1	-	4.56×10^{-4}
LY-Cl-2	-	7.08×10^{-4}
N3-Cl-1	-	5.75×10^{-4}
N3-C1-2	-	1.48×10^{-3}
PTQ10:MO-IDIC-Cl-1	1.08×10^{-4}	4.04×10^{-4}
PTQ10:MO-IDIC-Cl-2	1.81×10^{-4}	7.32×10^{-4}
PM6:LY-Cl-1	2.12×10^{-4}	7.25×10^{-4}
PM6:LY-Cl-2	2.57×10^{-4}	1.02×10^{-3}
PL1:N3-Cl-1	2.62×10^{-4}	6.16×10^{-4}
PL1:N3-Cl-2	3.80×10^{-4}	9.19×10^{-4}

Table S2. Charge carrier mobilities of the acceptors and their corresponding PSCs.

Table S3. Crystal data and structure refinement for MO-IDIC-Cl-1, MO-IDIC-Cl-2,LY-Cl-1 and LY-Cl-2.

Identification code	MO-IDIC-C	MO-IDIC-C	LY-Cl-1	LY-Cl-2	
	l-1	l-2			
Empirical formula	$C_{68}H_{68}Cl_2N_4$	$C_{68}H_{68}Cl_2N_4$	$C_{82}H_{88}Cl_2N_8$	$C_{82}H_{88}Cl_2N_8$	
	O_4S_2	O_4S_2	O_2S_5	O_2S_5	
CCDC number					
Formula weight	1140.28	1140.28	1448.8	1448.8	
Temperature/K	149.99(10)	149.99(10)	150.00(10)	150.00(10)	
Crystal system	triclinic	triclinic	triclinic	triclinic	
Space group	P-1	P-1	P-1	P-1	
a/Å	13.3351(4)	14.6444(12)	14.699(2)	13.6375(6)	
b/Å	16.6987(4)	15.9434(16)	17.173(3)	15.3980(5)	
c/Å	17.3392(3)	17.9860(11)	17.727(2)	19.4824(6)	
α/°	88.307(2)	106.356(7)	65.789(14)	105.241(3)	
β/°	76.712(2)	113.691(7)	65.996(13)	94.313(4)	
γ/°	82.866(2)	95.799(8)	72.836(14)	99.330(3)	
Volume/Å ³	3728.61(16)	3578.6(6)	3683.8(11)	3865.1(3)	

Ζ	2	2	2	2
$\rho_{calc}g/cm^3$	1.016	1.058	1.306	1.245
μ/mm ⁻¹	1.635	1.704	2.538	2.419
F(000)	1204	1204	1532	1532
Crystal size/mm ³	0.05 imes 0.01 imes	0.12 imes 0.08 imes	0.12 imes 0.06 imes	0.08 imes 0.06 imes
	0.01	0.06	0.04	0.04
Radiation	$CuK\alpha (\lambda =$	$CuK\alpha (\lambda =$	$CuK\alpha (\lambda =$	$CuK\alpha$ ($\lambda =$
	1.54184)	1.54184)	1.54184)	1.54184)
20 range for data	5.236 to	5.736 to	5.71 to	6.058 to
collection/°	134.138	134.156	147.826	147.87
Index ranges	$-15 \le h \le 15$,	$-16 \le h \le 17$,	$-18 \le h \le 17$,	$-16 \le h \le 11$,
	$-19 \le k \le 19$,	$-19 \le k \le 18$,	$-17 \le k \le 21$,	$-19 \le k \le 17$,
	$-20 \le l \le 18$	$-21 \le 1 \le 15$	$-16 \le 1 \le 22$	$-23 \le l \le 24$
Reflections collected	36794	31592	37726	40074
Independent	$13037 [R_{int} =$	$12454 [R_{int} =$	$13864 [R_{int} =$	$14686 [R_{int} =$
reflections	0.0375,	0.0615,	0.1741,	0.0864,
	$R_{sigma} =$	$R_{sigma} =$	$R_{sigma} =$	$\mathbf{R}_{sigma} =$
	0.0472]	0.0672]	0.2686]	0.1197]
Data/restraints/para	13037/48/72	12454/174/7	13864/36/89	14686/97/89
meters	7	22	8	8
Goodness-of-fit on F ²	1.049	1.275	0.963	0.986
Final R indexes	$R_1 = 0.0889,$	$R_1 = 0.2023,$	$R_1 = 0.1302,$	$R_1 = 0.0961,$
[I>=2σ (I)]	$wR_2 =$	$wR_2 =$	$wR_2 =$	$wR_2 =$
	0.2740	0.5001	0.3220	0.2539
Final R indexes [all	$R_1 = 0.1041,$	$R_1 = 0.2605,$	$R_1 = 0.3262,$	$R_1 = 0.1814,$
data]	$wR_2 =$	$wR_2 =$	$wR_2 =$	$wR_2 =$
	0.2882	0.5666	0.4378	0.3134
Largest diff.	1.03/-0.88	1.62/-0.75	0.46/-0.35	1.19/-0.46
peak/hole / e Å ⁻³				

Table S4. Photovoltaic Performance Parameters of the PSCs Based on Corresponding Donors: Acceptors under the Illumination of AM1.5G, 100 mW cm⁻²

Acceptor ^a	Donor	$V_{ m oc}$	$J_{ m sc}$	FF	PCE^b
		(V)	$(mA cm^{-2})$	(%)	(%)
MO-IDIC-Cl	PTQ10	0.88	18.88	73.3	12.17
LY-Cl	PM6	0.89	24.10	68.8	14.75
N3-Cl	PL1	0.86	24.75	74.6	15.88

 a These acceptors use unseparated IC-Cl as the terminal group. b With thermal annealing at 100 °C for 5 min.

References:

- X. Li, F. Pan, C. Sun, M. Zhang, Z. Wang, J. Du, J. Wang, M. Xiao, L. Xue, Z. G. Zhang, C. Zhang, F. Liu and Y. Li, *Nat. commun.*, 2019, **10**, 519.
- J. Yuan, Y. Zhang, L. Zhou, G. Zhang, H.-L. Yip, T.-K. Lau, X. Lu, C. Zhu, H. Peng, P. A. Johnson, M. Leclerc, Y. Cao, J. Ulanski and Y. Li, Y. Zou, *Joule*, 2019, 3, 1140-1151
- 3. K. Jiang, Q. Wei, J. Y. L. Lai, Z. Peng, H. K. Kim, J. Yuan, L. Ye, H. Ade, Y. Zou and H. Yan, *Joule*, 2019, **3**, 3020-3033.