Supporting Information for

Gate bias modulation towards organic electrochemical transistors with ultra-high cycling stability

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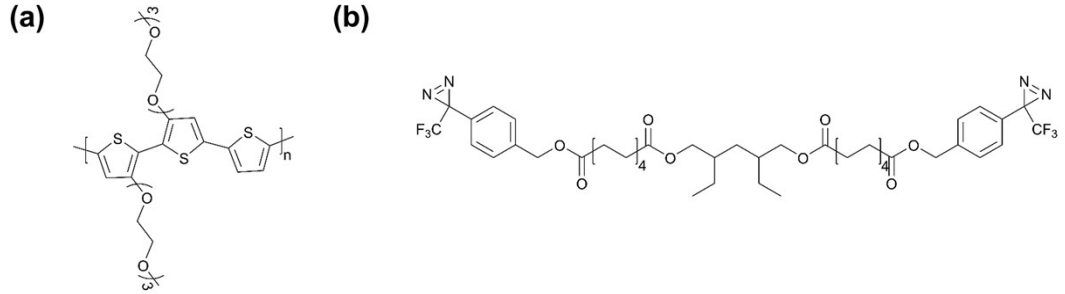

Figure S1. Chemical structures of (a) p(g2T-T) and (b) DtFDA.

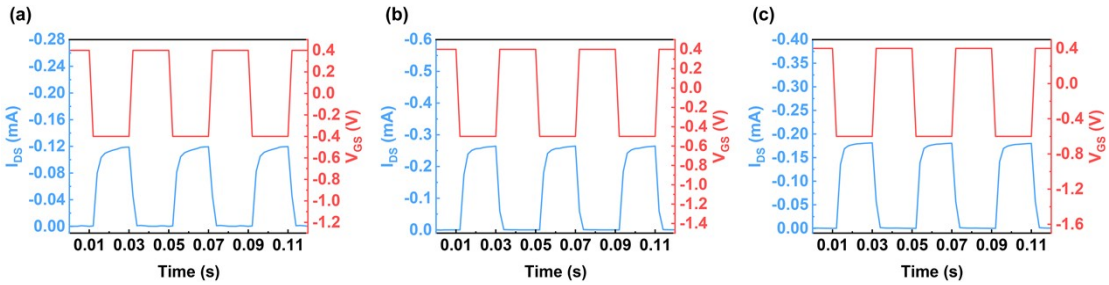

Figure S2. Applied square wave of V_G and corresponding I_D under different V_G pulses (V_G square pulse of 25 Hz, V_D = -0.1 V): (a) V_G from +0.4 V to -0.4 V, (b) V_G from +0.4 V to -0.5 V and (c) V_G from +0.4 V to -0.6 V.

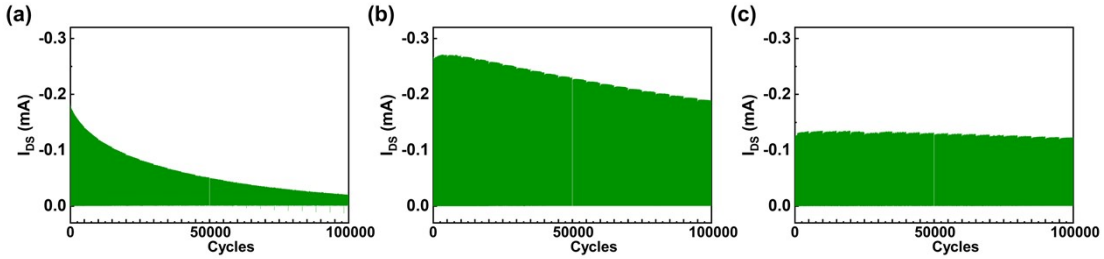

Figure S3. Change of I_D over time of planar p(g2T-T): DtFDA OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = -0.1 V): (a) V_G from +0.4 V to -0.6 V, (b) V_G from +0.4 V to -0.5 V and (c) V_G from +0.4 V to -0.4 V.

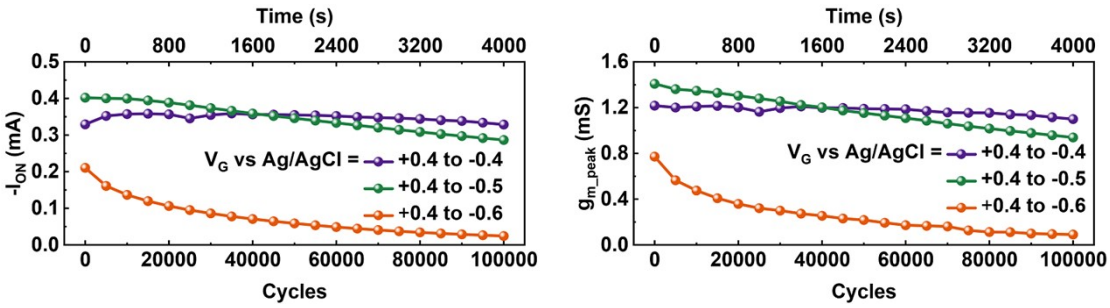

Figure S4. Change of (a) I_{ON} and (b) g_{m_peak} over time of planar p(g2T-T): DtFDA OECTs under different V_G pulse ranges (V_G square pulse of 25 Hz, V_D = -0.1 V).

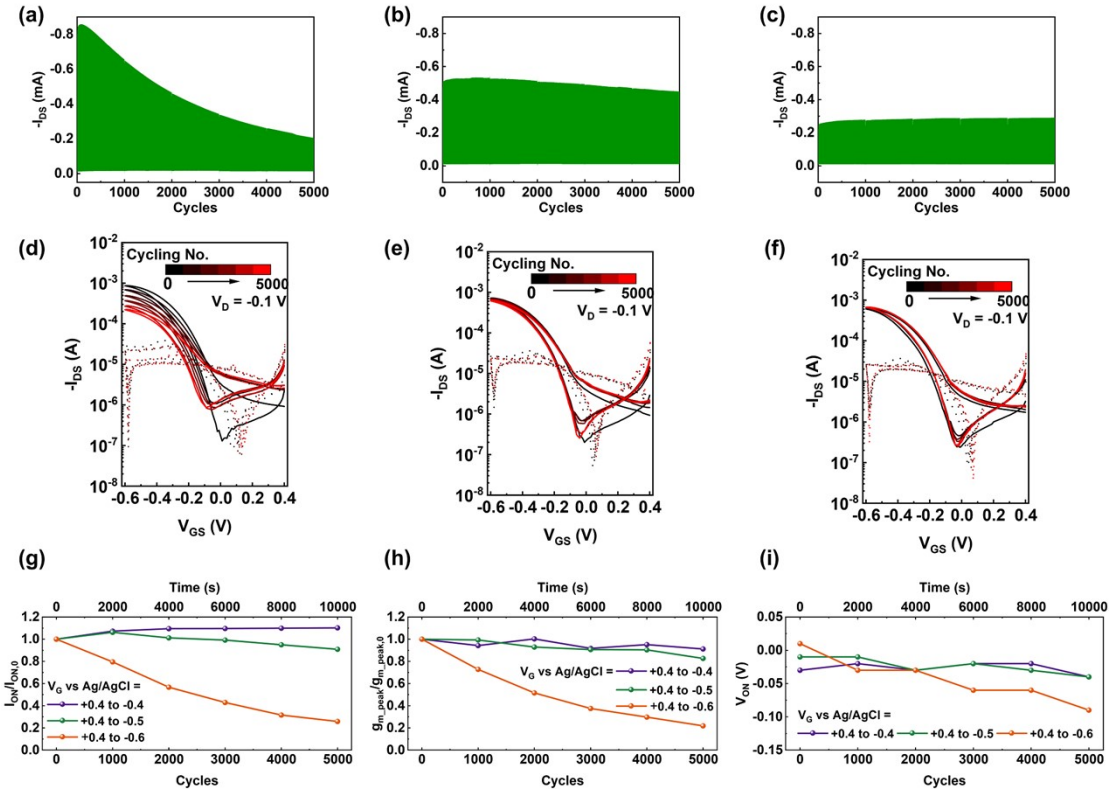

Figure S5. (a)-(c) Change of I_D over time of planar pure p(g2T-T) OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = -0.1 V): (a) V_G from +0.4 V to -0.6 V, (b) V_G from +0.4 V to -0.5 V and (c) V_G from +0.4 V to -0.4 V. (d)-(f) Transfer characteristics of p-type planar OECTs with pure p(g2T-T) during the cycling stability measurements with the V_G switches from (d) +0.4 V to -0.6 V, (e) +0.4 V to -0.5 V and (f) +0.4 V to -0.4 V. (g)-(i) Decay trends of (g) I_{ON}, (h) g_{m_peak} and (i) V_{ON} of planar OECTs based only p(g2T-T).

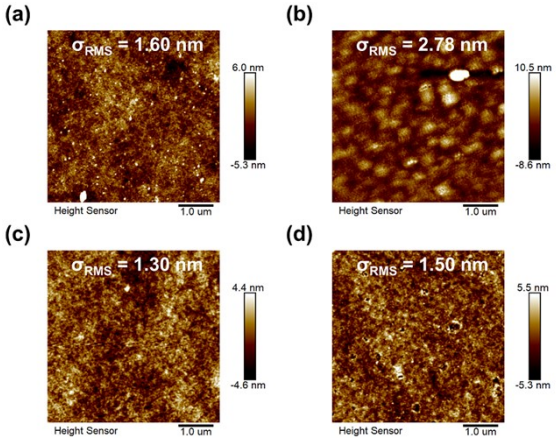

Figure S6. (a)-(b) AFM images of p(g2T-T): DtFDA film on source electrode (a) before and (b) after cycling stability measurement. (c)-(d) AFM images of the semiconductor film on drain electrode (c) before and (d) after cycling stability measurement.

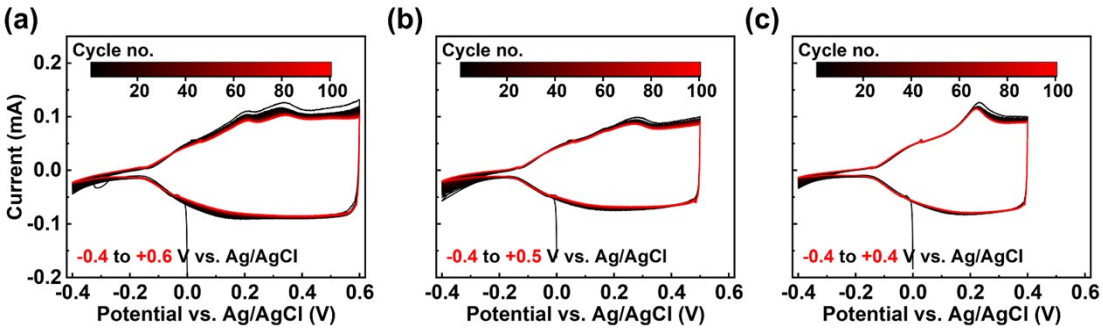

Figure S7. Cyclic voltammograms of the of the films cast from pure p(g2T-T) with voltage steps of 1 mV (a) from -0.4 V to +0.6 V, (b) from -0.4 V to +0.5 V and (c) from -0.4 V to +0.4 V.

Figure S8. Changes in the morphology of the film in glass based planar OECT during long-term cycling stability testing.

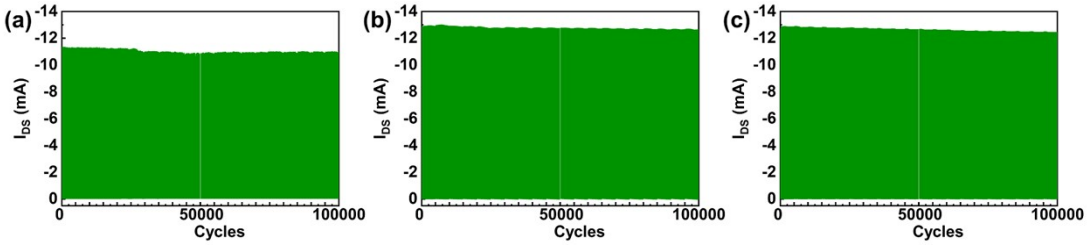

Figure S9. Change of I_D over time of vertical p(g2T-T): DtFDA OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = -0.1 V): (a) +0.4 V to -0.6 V; (b) +0.4 V to -0.5 V; (c) +0.4 V to -0.4 V.

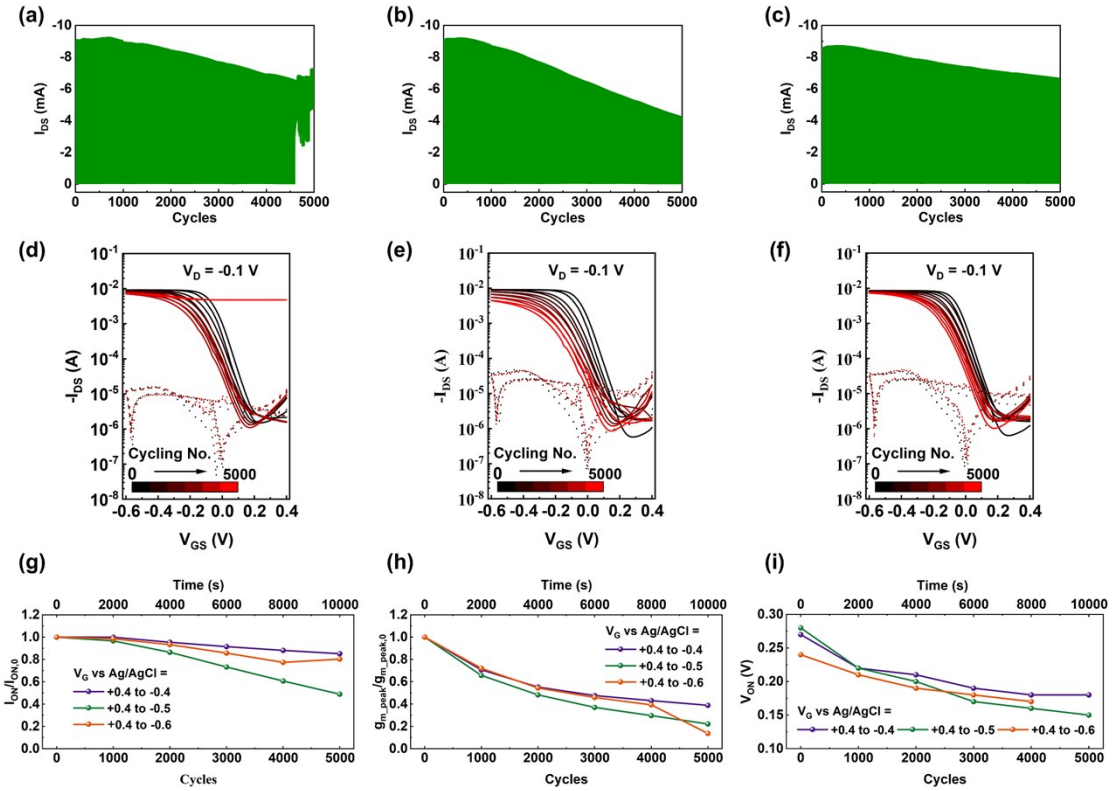

Figure S10. (a)-(c) Change of I_D over time of vertical pure p(g2T-T) OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = -0.1 V): (a) +0.4 V to -0.6 V, (b) +0.4 V to -0.5 V and (c) +0.4 V to -0.4 V. (d)-(f) Transfer characteristics of p-type planar OECTs with pure p(g2T-T) during the cycling stability measurements with the V_G switches from (d) +0.4 V to -0.6 V, (e) +0.4 V to -0.5 V and (f) +0.4 V to -0.4 V. (g)-(j) Decay trends of (g) I_{ON}, (h) I_{OFF}, (i) g_{m_peak} and (j) V_{ON}.

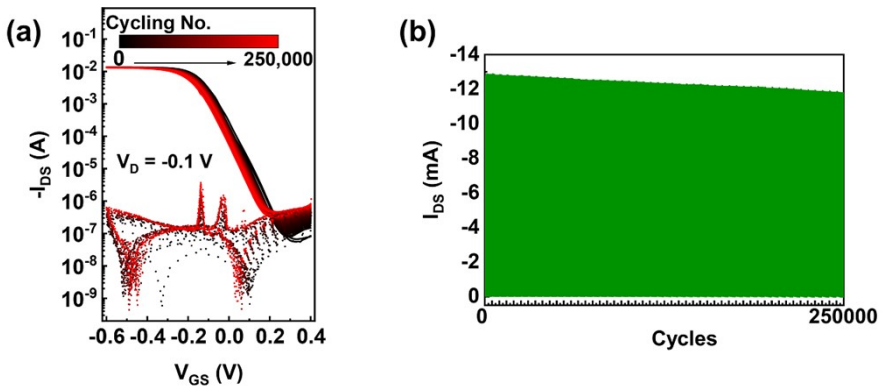

Figure S11. (a) Transfer characteristics of vertical p(g2T-T): DtFDA OECT during the cycling stability measurements with the V_G switches from -0.4 V to +0.4 V. (b) Change of I_D over time of vertical p(g2T-T): DtFDA OECT with V_G switches from -0.4 V to +0.4 V (V_G square pulse of 25 Hz, V_D = -0.1 V).

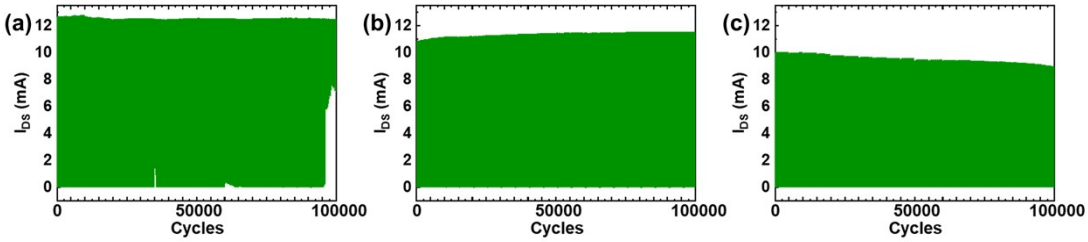

Figure S12. Change of I_D over time of vertical Homo-gDPP: DtFDA OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = 0.1 V): (a) 0 V to +0.9 V, (b) 0 V to +0.8 V and (c) 0 V to +0.7 V.

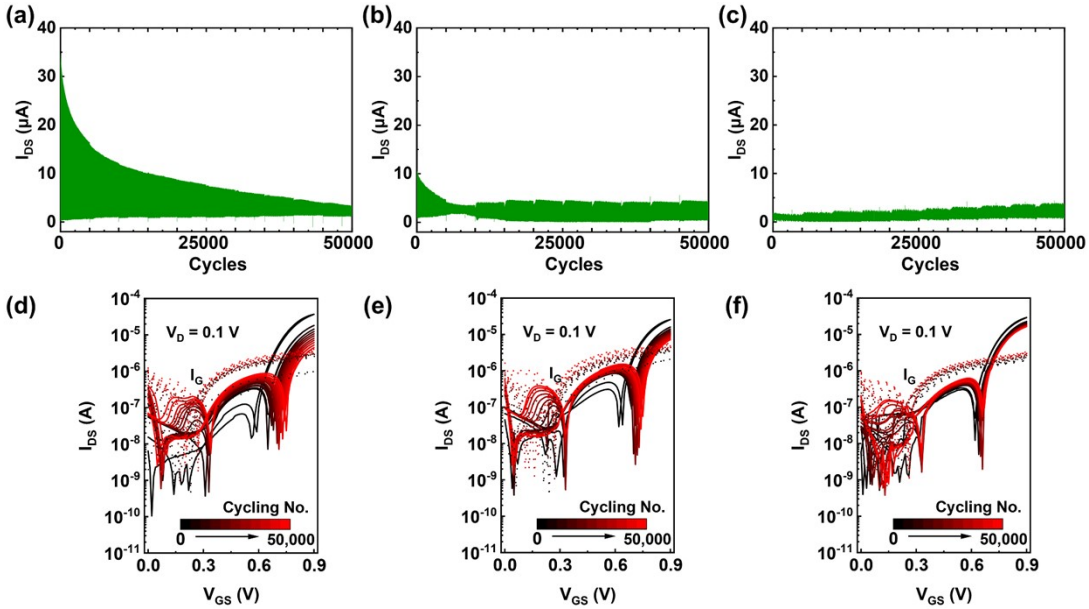

Figure S13. (a)-(c) Change of I_D over time of planar Homo-gDPP: DtFDA OECTs under different V_G pulses (V_G square pulse of 25 Hz, V_D = 0.1 V): (a) V_G from 0 V to +0.9 V, (b) V_G from 0 V to +0.8 V and (c) V_G from 0 V to +0.7 V. (d)-(f) Transfer characteristics of n-type planar OECTs with Homo-gDPP: DtFDA mixture during the cycling stability measurements with the V_G switches from (d) 0 V to +0.9 V, (e) 0 V to +0.8 V and (f) 0 V to +0.7 V.