Supplementary Information

High Transconductance Organic Electrochemical Transistors

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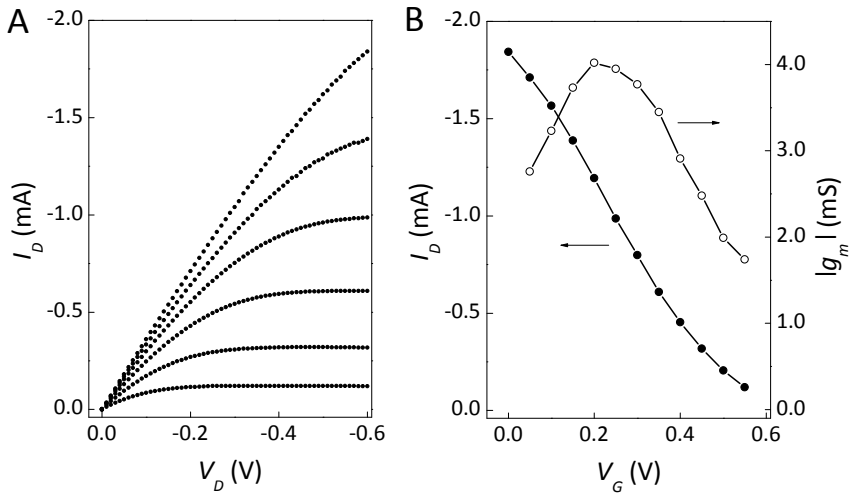
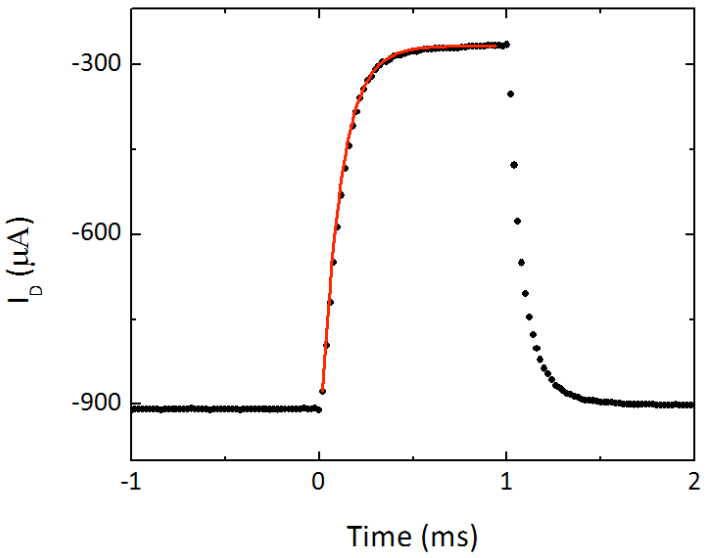
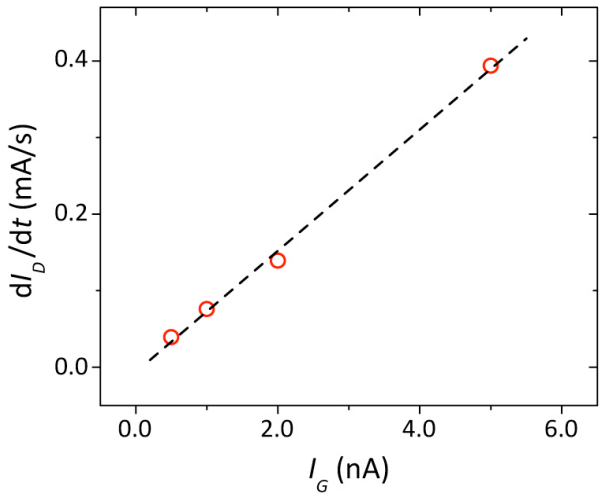


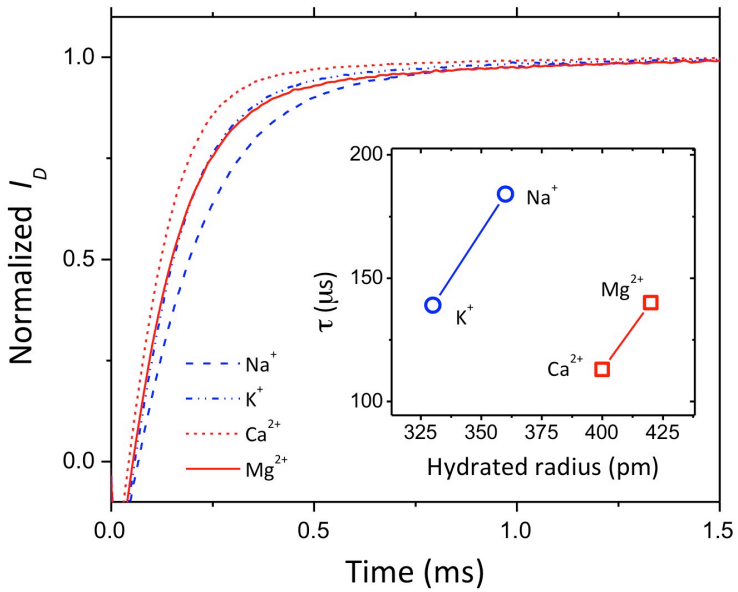
Supplementary Figure S1: **Electrical characteristics of the best performing OECT. (A)** Output characteristics for V_G varying from 0 V (top curve) to +0.5 V with a step of +0.1 V (bottom curve). **(B)** Transfer curve for V_D = -0.6 V, and the associated transconductance. The device had L=10 μm and W=10 μm.



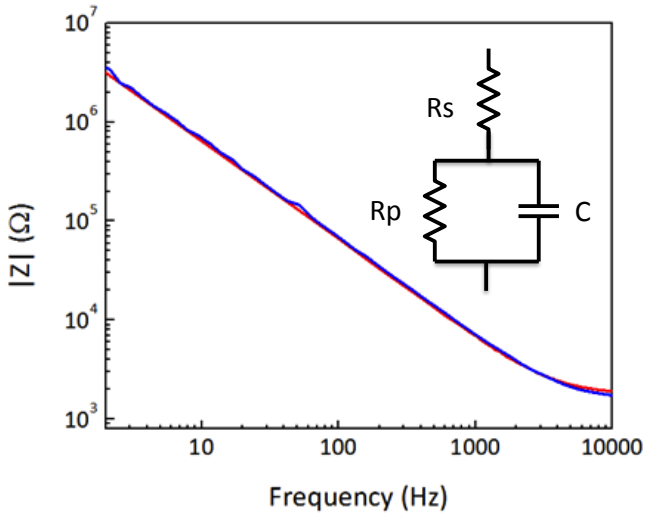
Supplementary Figure S2: Temporal response of the drain current. A 0.5 V pulse was applied at the gate, while the drain voltage was -0.4 V. The data are from the OECT whose characteristics are shown in Fig. 2. The line is a fit to an exponential decay with a time constant of 102 μs.



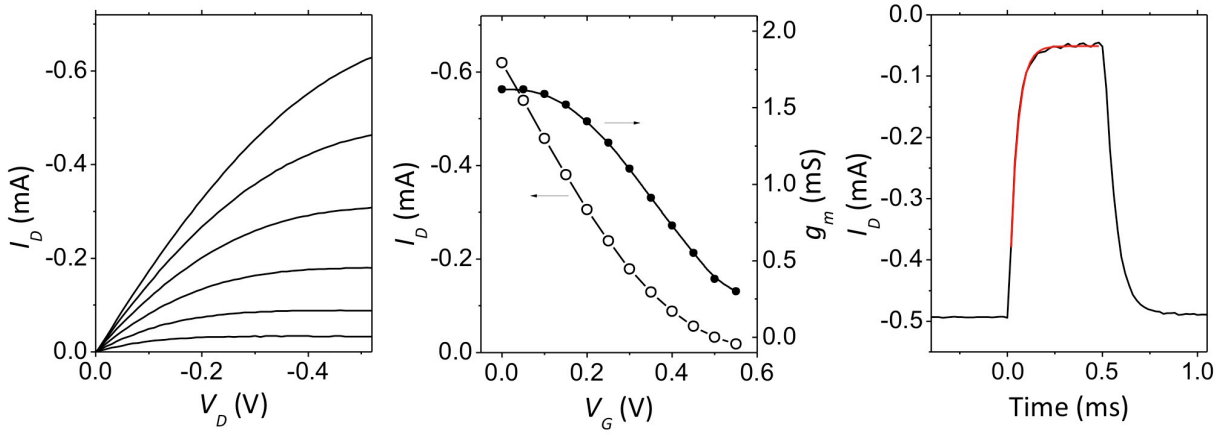
Supplementary Figure S3: Time derivative of drain current as a function of gate current. The line is a fit to the Eq. (1). The data are from the OECT whose characteristics are shown in Fig. 2. The drain voltage was -0.4 V.



Supplementary Figure S4: Response time of the OECTs for different ions in the electrolyte. The normalized drain current response of an OECT with *L*=6 μm, *W*=15 μm and *d*= 200 nm with aqueous electrolyte of 100 mM of NaCl, KCl, $CaCl_2$, and $MgCl_2$. A 0.5 V pulse was applied at the gate, while the drain voltage was -0.4 V. The inset shows the extracted single exponential time constant as a function of the hydrated ionic radius of the ions. For both the monovalent (blue) and divalent (red) cations, the larger the hydrated ionic radius, the larger the time constant. Also, divalent ions result in a faster device response than monovalent ones of similar hydrated radius.



Supplementary Figure S5: Frequency dependence of the OECT channel/electrolyte interface. The data are shown in blue and fit to an equivalent circuit model in red. The data are from the OECT whose characteristics are shown in Fig. 2. The inset shows the equivalent circuit. The fit gave R_p=18 MΩ, R_s=1.8 kΩ, and C=150 nF.



Supplementary Figure S6: Electrical characteristics of thin device. An OECT with a PEDOT:PSS film of ~100 nm showed a slightly reduced transconductance (g_m=1.6 mS), but a faster response time (τ~39 µs). **(A)** Output characteristics, **(B)** transfer characteristics for a drain voltage of -0.5 V, and **(C)** time response to a gate voltage pulse of 0.5 V, with a drain voltage of -0.4 V. The red line is the fit used to extract the time constant.