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Supplementary Information

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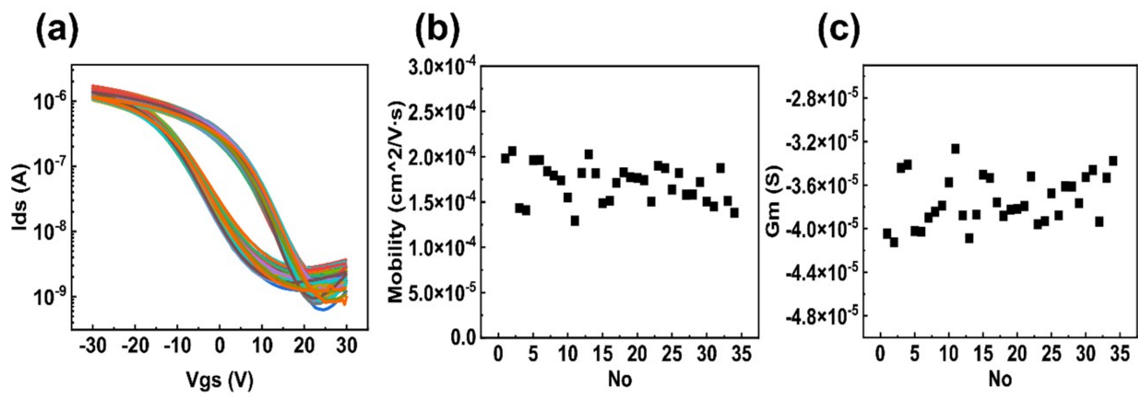

Figure S1: (a) All the transfer curves used in Figure 2, (b) Statistical distribution histograms of mobilities, (c) transconductance (g_m) of devices in (a).

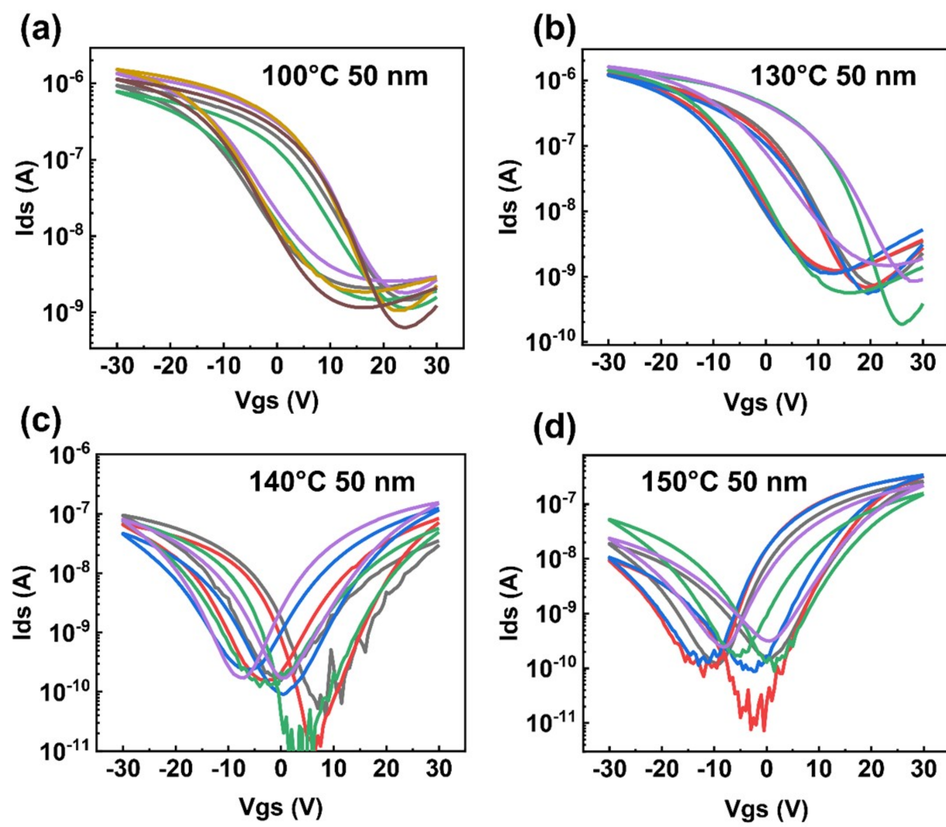

Figure S2: All the transfer characteristics after 50 nm Al_2O_3 deposition mentioned in Figure 1 at coating temperatures of (a) 100 ℃, (b) 130 ℃, (c) 140 ℃, and (d) 150 ℃, respectively.

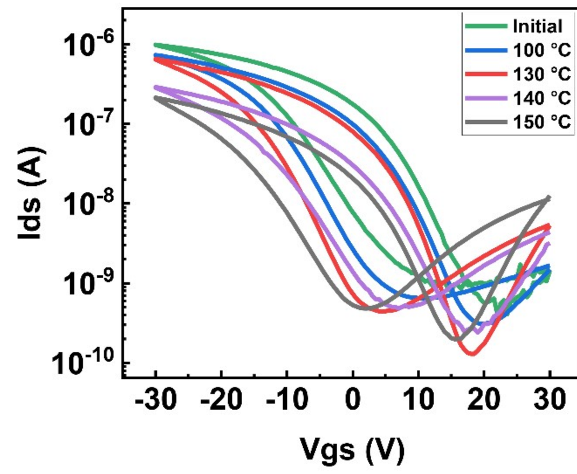

Figure S3: The curing temperature effect to the device performance in ALD chamber.

Table S1. Electrical parameters of the p-type and n-type TFTs fabricated under different ALD conditions.

DEVICE TYPE	ALD DEPOSITION CONDITION	MOBILITY (CM^2/VS)	I_{ON}/I_{OFF}	V_{TH} (V)	TRANSCONDUCTANCE (S)
P-type	100 °C, 50 nm	$9.75*10^{-5}$-$1.97*10^{-4}$	$6.41*10^{2}$-$1.78*10^{3}$	14.4 ± 1.5	-3.43 ± $0.87*10^{-5}$
P-type	130 °C, 50 nm	$1.12*10^{-4}$-$1.54*10^{-4}$	$1.65*10^{3}$-$7.67*10^{3}$	15.4 ± 5	-3.31 ± $0.26*10^{-5}$
N-type	150 °C, 50 nm	$2.47*10^{-6}$-$9.45*10^{-6}$	$7.02*10^{2}$-$3.79*10^{3}$	-17.2 ± 1.2	-6.67 ± $2.15*10^{-6}$
N-type	140 °C, 200 nm	$1.13*10^{-6}$-$3.35*10^{-6}$	$3.19*10^{3}$-$5.26*10^{3}$	-21 ± 6	-4.1 ± $1.1*10^{-5}$

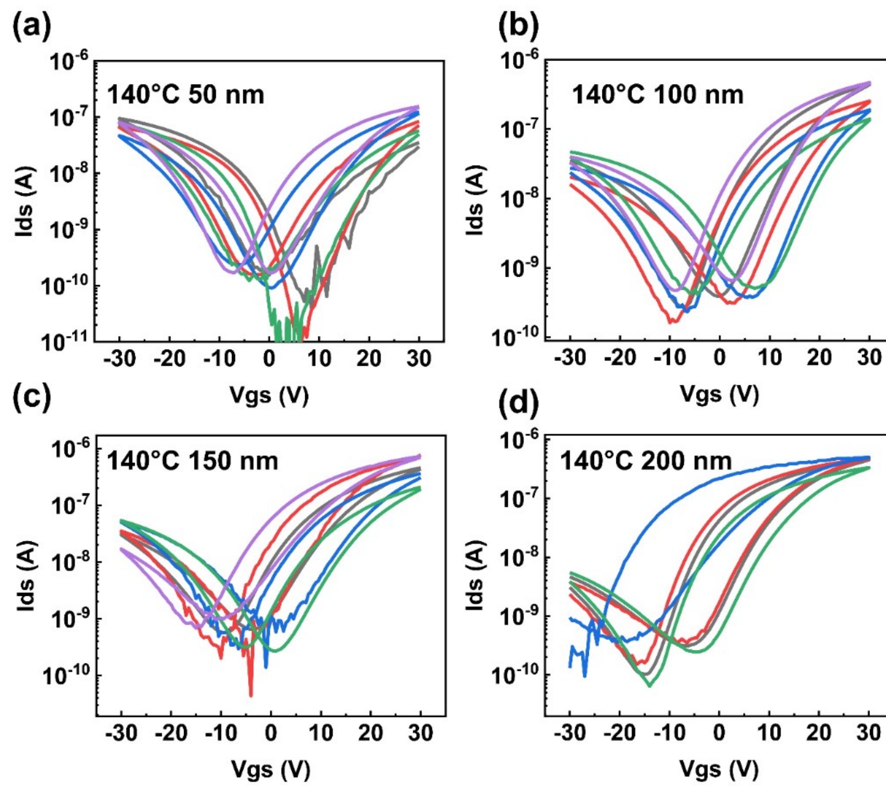

Figure S4: All the transfer characteristics after 140 °C Al_2O_3 deposition mentioned in Figure 1 at a coating thickness of (a) 50 nm, (b) 100 nm, (c) 150 nm, and (d) 200 nm, respectively.

Figure S5: The curing time effect to the device performance in ALD chamber.

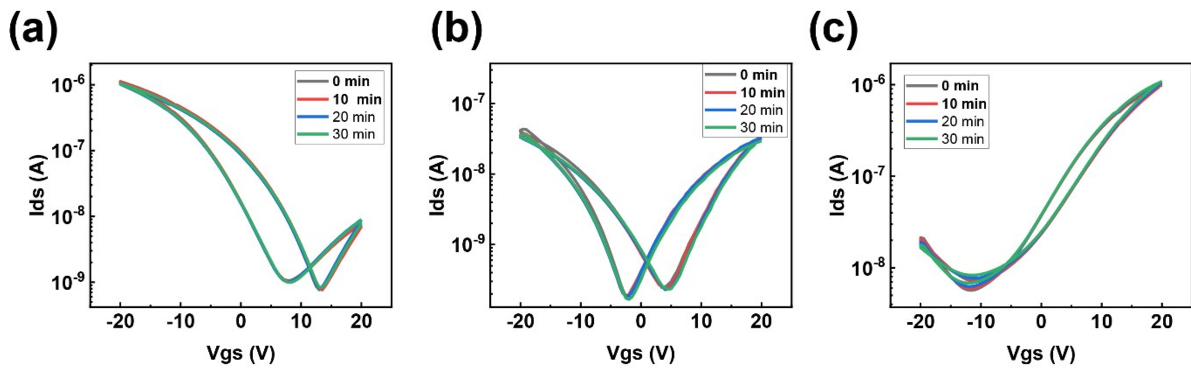

Figure S6. The stability test of (a) p-type, (b) ambipolar type, (c) n-type device under biasing voltage (Vgs=20 V).

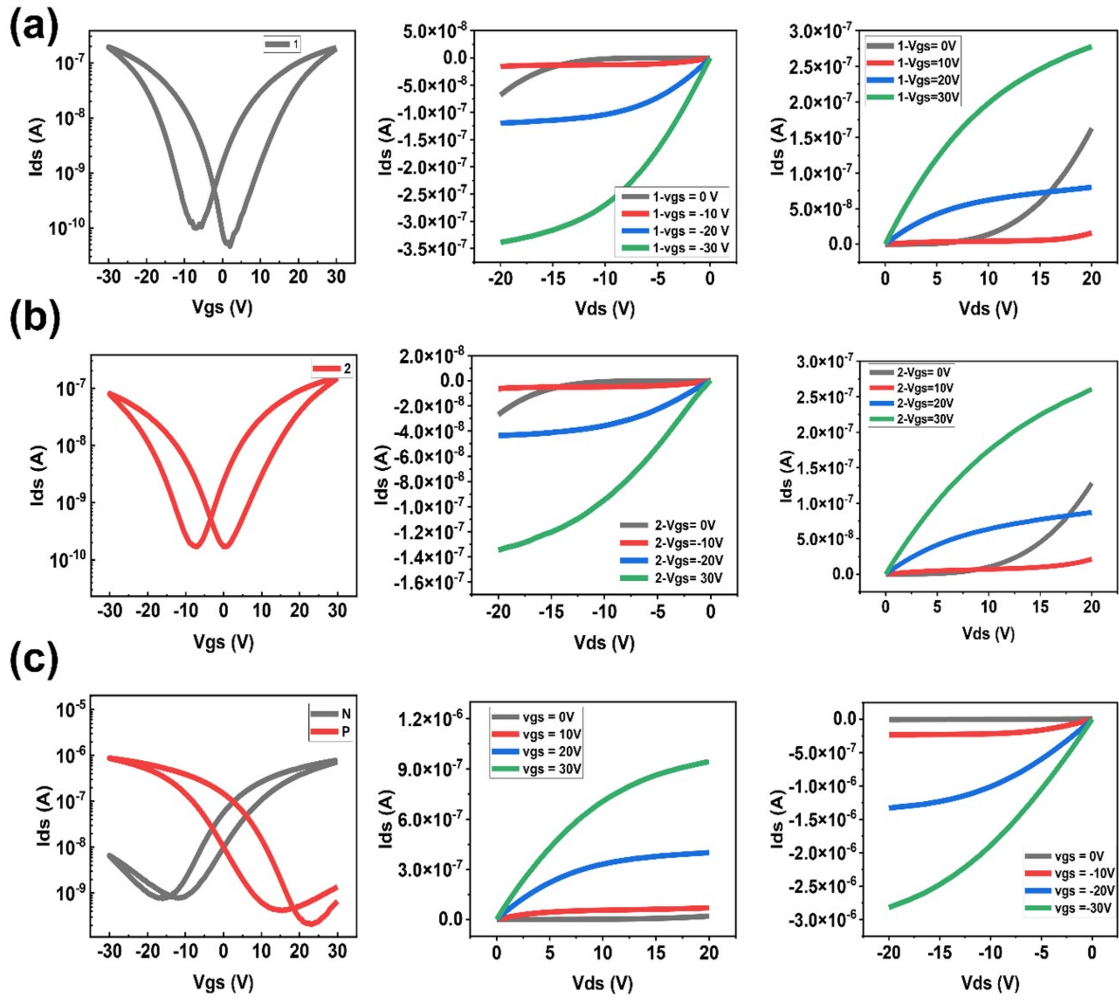

Figure S7: (a) Transfer curve (left) and output curve (middle: p-type, right: n-type) of (a) M1 and M2 in Figure 4 (d). (c) Transfer curve (left) (middle: p-type, right: n-type) in Figure 4 (g).