

Table S1. Thermal expansion coefficients α of substrate materials and κ -Br at room temperature.

	Si	Nb-doped SrTiO ₃ (STO)	CaF ₂	κ -Br
$\alpha/\text{ppm K}^{-1}$	2	11	19	30–60 (in-plane)[S1]

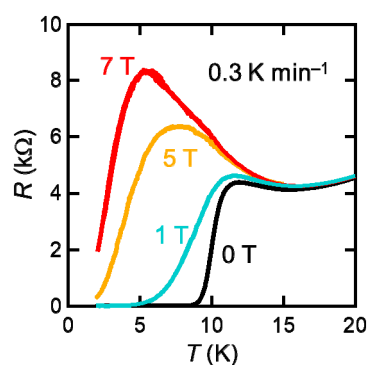


Figure S1. Low-temperature resistance of **device1** under magnetic field. The cooling rate is 0.3 K min^{-1} . Insulating behavior under strong magnetic field indicates that the ground state of **device1** is not full SC phase but PSC phase where SC state is mixed with Mott insulating state.

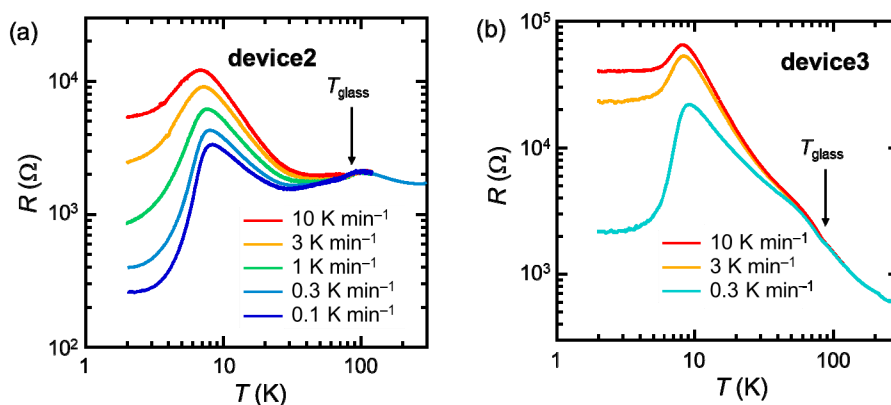


Figure S2. Temperature dependence of resistance in **device2** (a) and **device3** (b) at different cooling rate. Cooling rate was controlled at 120 or 100 K. Resistance difference was observed below $\sim 80 \text{ K}$, attributed to glass transition of terminal ethylene group of BEDT-TTF in κ -Br.

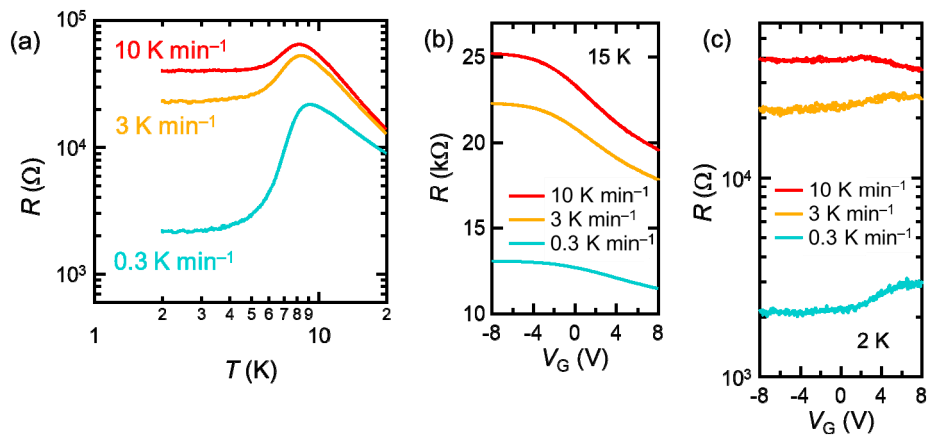


Figure S3. Cooling-rate dependence of low-temperature resistance (a) and FET properties above T_c (b) and below T_c (c) in **device3**. Only n-type behavior was observed above T_c (b) and field effect polarity changed below T_c by cooling rate difference (c).

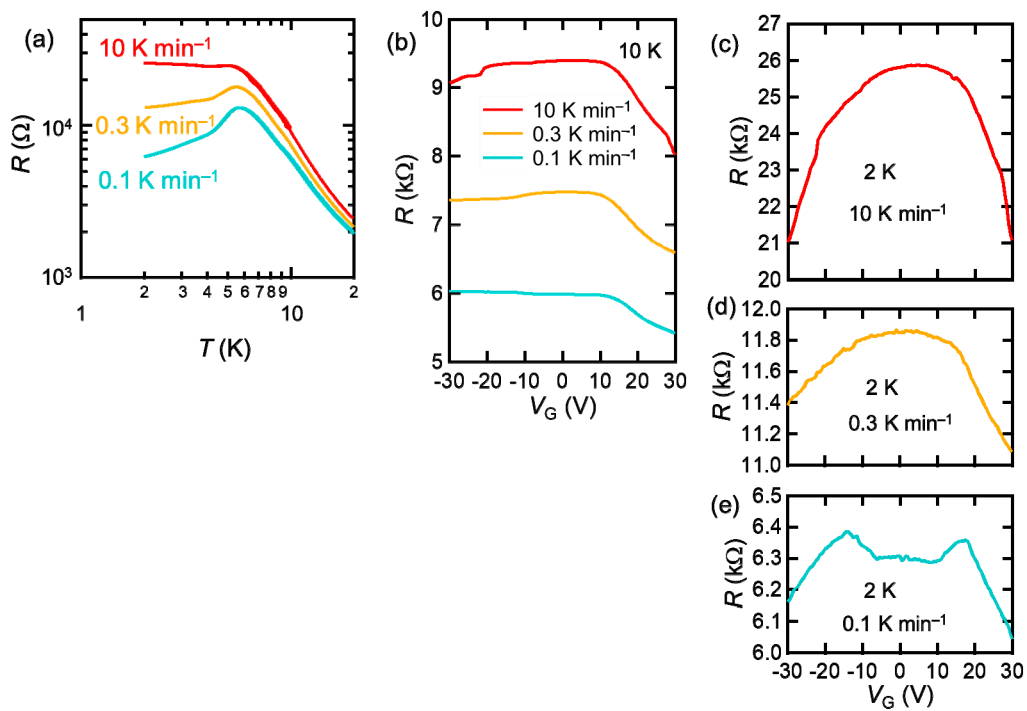


Figure S4. Cooling-rate dependence of low-temperature resistance (a) and FET properties above T_c (b) and below T_c (c)–(e) in **device4**. We observed ambipolar behavior typical to Mott FET (b)–(d) and field effect derived from small intrinsic SC portion in the half-filled state (e).

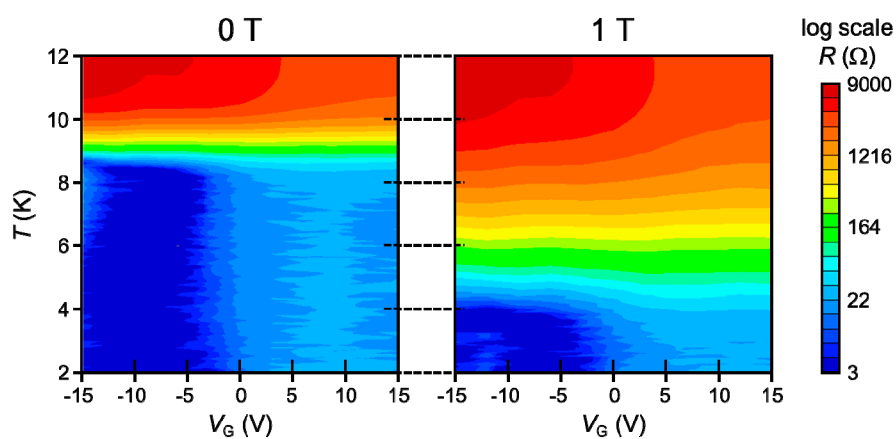


Figure S5. Color plots of resistance of **device1** below 12 K against V_G and temperature at cooling rates of 0.3 K min^{-1} at 0 T (left) and 1 T (right).

Supplementary References

- S1. Kund, M.; Muller, H.; Biberacher, W.; Andres, K.; Saito, G. Anomalous thermal expansion of the organic superconductor κ -(BEDT-TTF) $_2$ Cu[N(CN) $_2$]Br. *Physica B* **1993**, *191*, 274–280.



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