We have developed SUIM, a dedicated X-ray camera for observing the upper atmosphere at altitudes of ~60–110 km. SUIM was launched in May 2026 and will be installed outside the International Space Station. By measuring the cosmic X-ray background transmitted through the atmosphere, SUIM aims to determine the atmospheric density profile from the absorption column density at each altitude. The camera consists of a slit collimator and two X-ray SOI-CMOS detectors called XRPIX. Each pixel is equipped with a trigger circuit, enabling event-driven readout in which only an 8 x 8-pixel region surrounding the triggered pixel is read out. This mode enables a shorter effective exposure time, thereby reducing the amount of dark charge accumulated during each exposure. The pinned depleted diode structure also suppresses dark charge generation, enabling high spectroscopic performance even at room temperature. SUIM may operate at temperatures exceeding 60° C owing to the limited radiative cooling capability of its host platform. In this study, we investigated the X-ray response of a spare SUIM unit at elevated temperatures using a 241Am source. From −30° C to 30° C, the energy resolution (ΔE/E; FWHM) at 13.9 keV remained nearly constant at ~16%. Above 35° C, it gradually degraded with increasing temperature, reaching 20% at 70° C. The dark current, estimated from the pedestal increase per unit exposure time, increased sharply above 35° C and exhibited an activation energy of ~1 eV. These results indicate that diffusion dark current contributed to the degradation in energy resolution. X-ray signals remained detectable at 70° C, confirming the feasibility of SUIM observations at elevated temperatures.