Latches and Flip-Flops

- Euler paths for transmission gate latch

$$\overline{LD} - LD - \overline{Q} - M$$

$$LD - \overline{LD} - \overline{Q} - M$$

8002
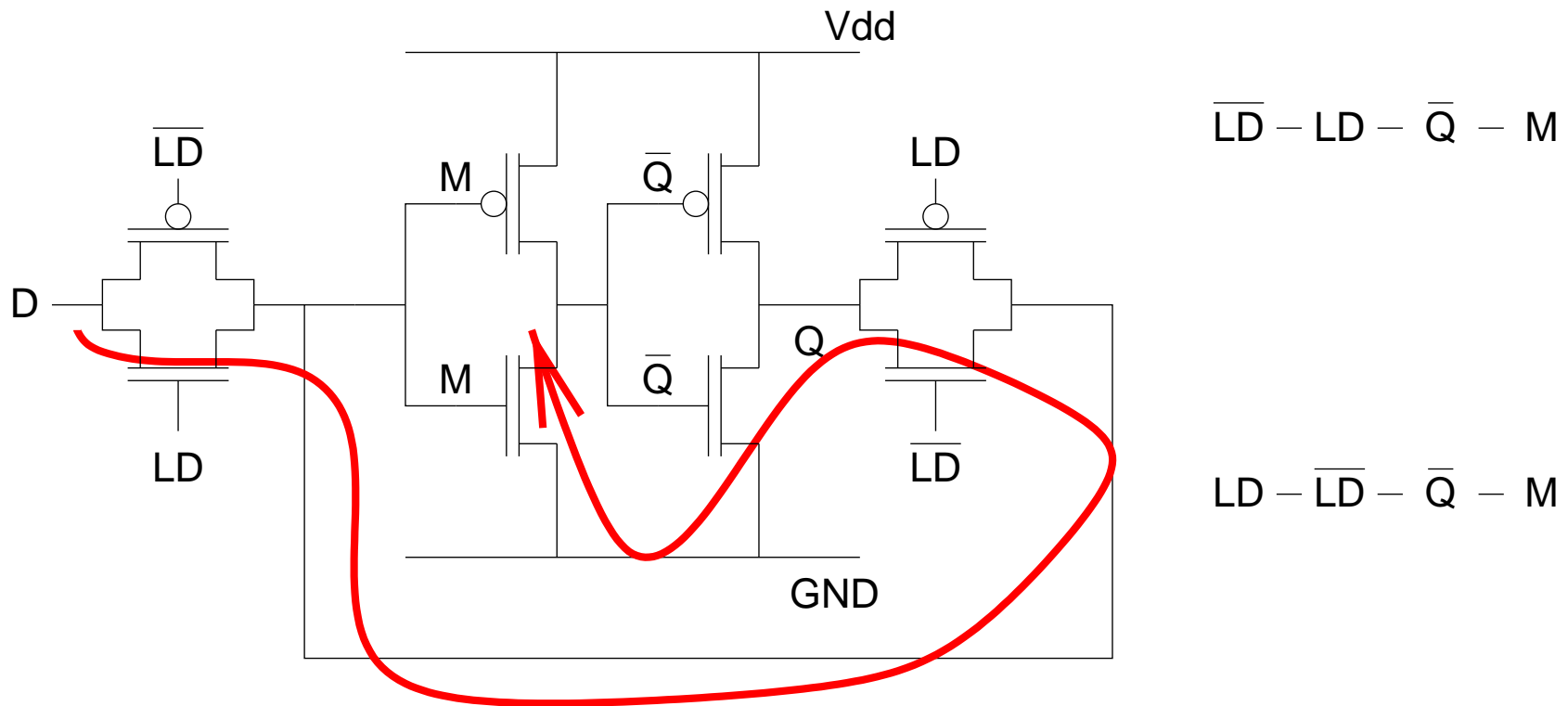
Latches and Flip-Flops

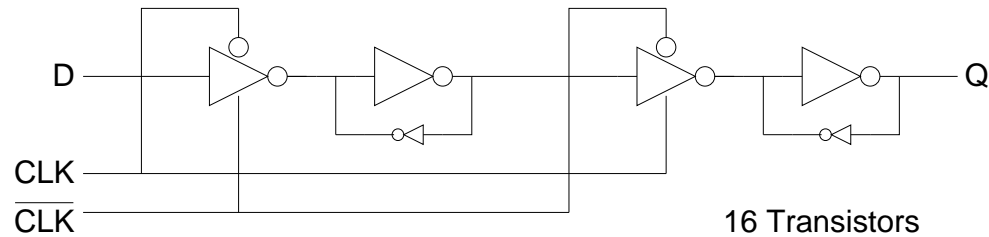- Euler paths for tristate inverter based latch

$$D - \overline{LD} - LD - Q - \overline{Q}$$
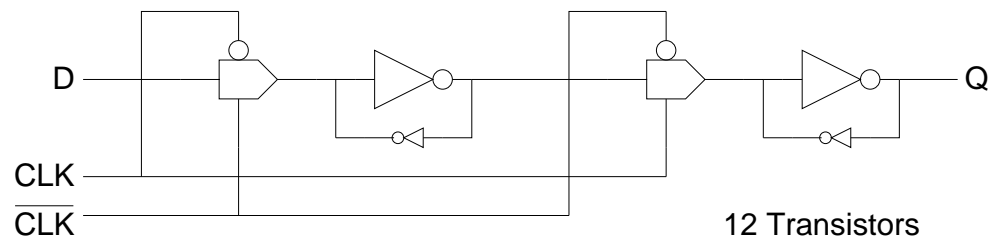
$$D - LD - \overline{LD} - Q - \overline{Q}$$

8003
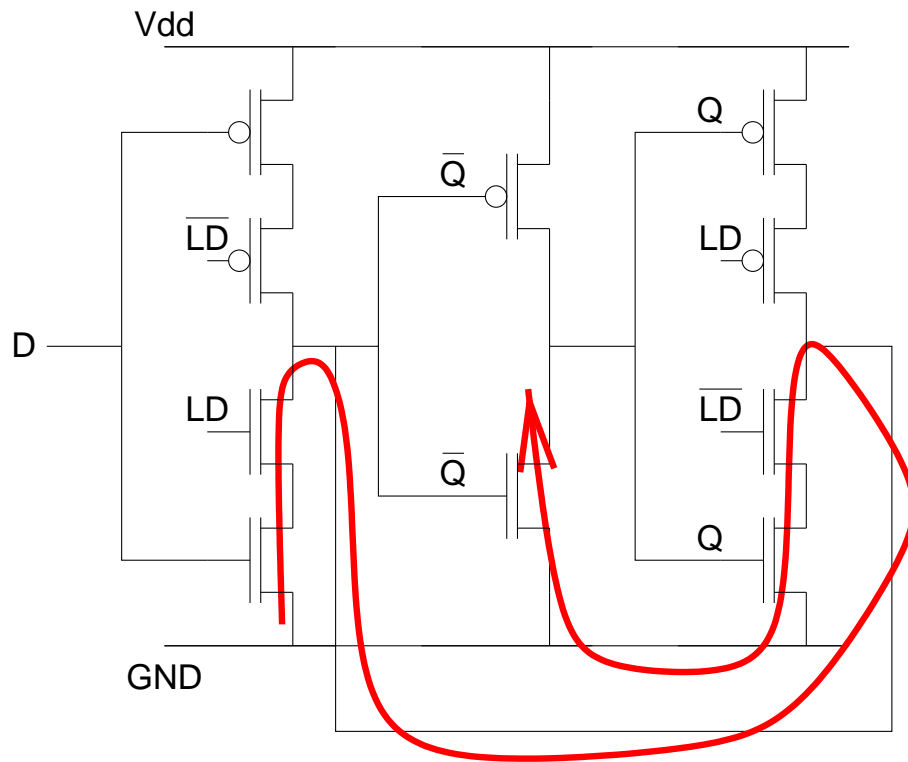
Latches and Flip-Flops

- Tristate inverter implementation based on "Jamb" latches

D ──────── ... ──────── Q

CLK
$\overline{\text{CLK}}$ 16 Transistors

    – the tristate inverter must be strong enough to override the weak inverter

- Transmission gate implementation based on "Jamb" latches

D ──────── ... ──────── Q

CLK
$\overline{\text{CLK}}$ 12 Transistors

    – this is less useful since its functionality depends on the drive strength at D

Latches and Flip-Flops

- Euler paths for master slave D type

$$CLK - \overline{CLK} - N - M - \overline{CLK} - CLK - Q - \overline{Q}$$

$$\overline{CLK} - CLK - N - M - CLK - \overline{CLK} - Q - \overline{Q}$$

8007
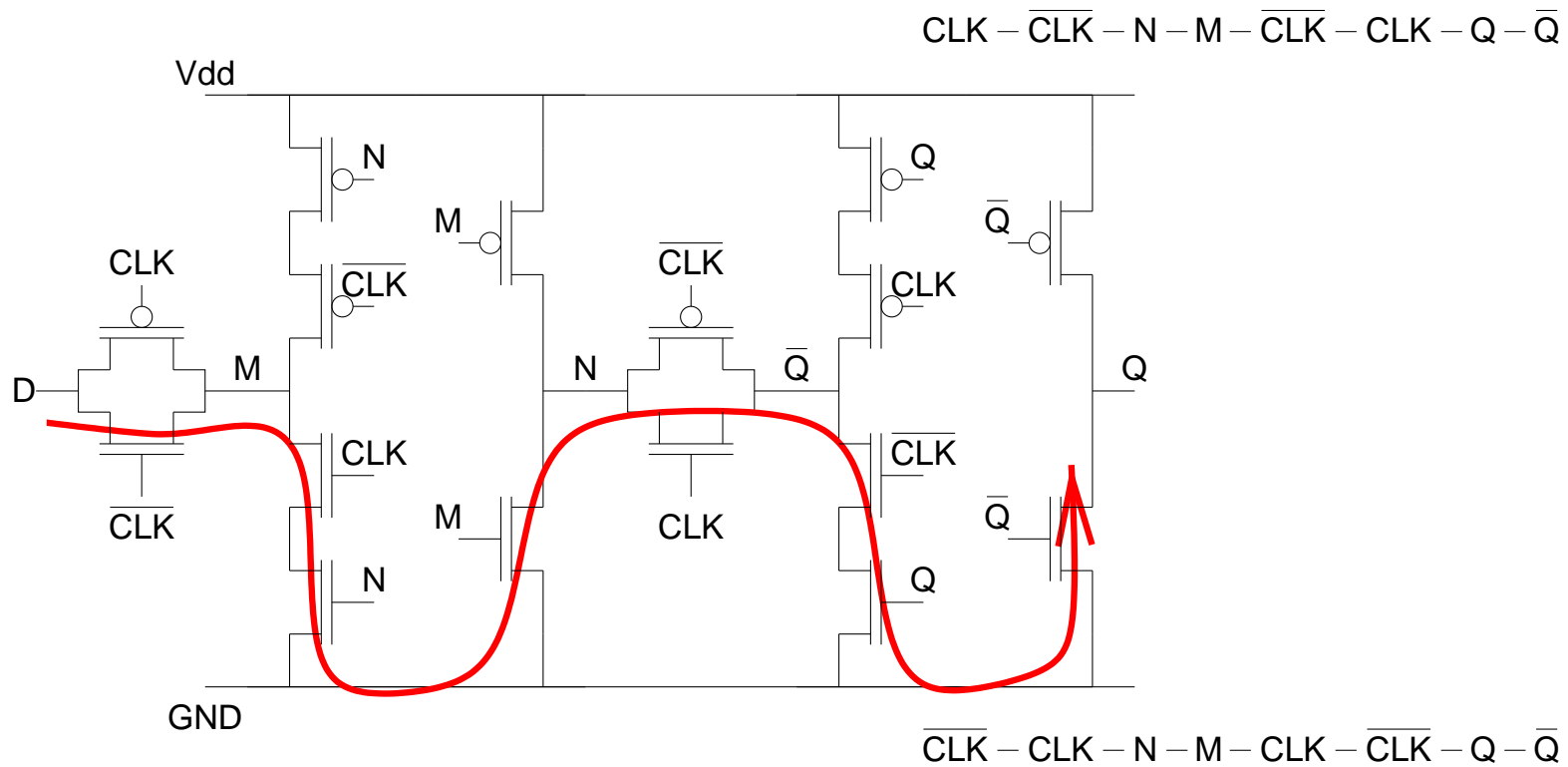
Latches and Flip-Flops

- Partial Euler paths for edge triggered D type