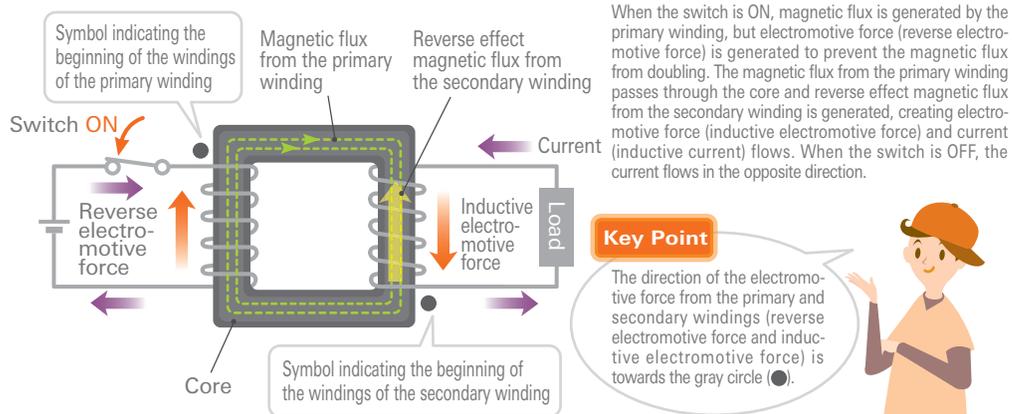


Basic Circuits of Insulation Type DC-DC Converters

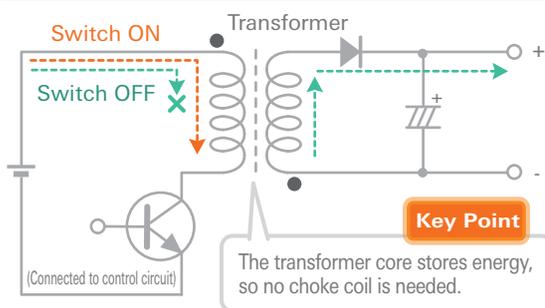
Insulation type DC-DC converters actively use transformers and support high output power. Understanding the basic principles and core circuits will deepen your understanding.

<Principles of Transformers and Direction of Electromotive Force>



Flyback Converter

Low and Medium Output Power Types

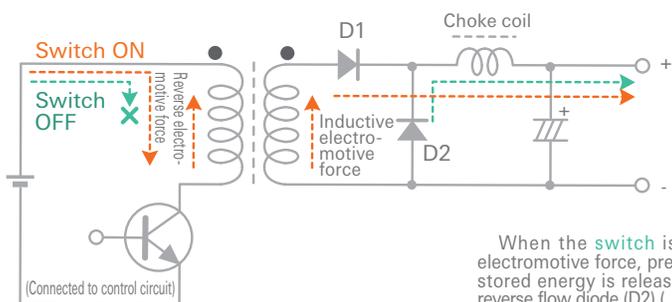


When the **switch** is ON, current flows in the primary winding () and the core is magnetized from the generated magnetic flux (energy storage). The direction of the diode is reversed, so no inductive current flows through the secondary winding.

When the **switch** is OFF, the energy accumulated in the core is released and current flows through the diode (). The transformer coil plays a role similar to that of the choke coil.

Forward Converter (Single-switching type)

Medium Output Power Type

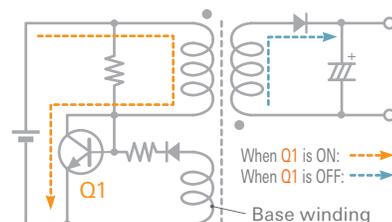


When the **switch** is ON, electromotive force (reverse electromotive force and inductive electromotive force) is generated in the primary and secondary windings as a result of the transformer principle and current flows through the diode (D1) (). At this time, energy is stored in the choke coil.

When the **switch** is OFF, the choke coil generates electromotive force, preventing changes in the current, the stored energy is released, and current flows through the reverse flow diode (D2) ().

RCC Type (self-exciting flyback converter)

Low Output Power Types

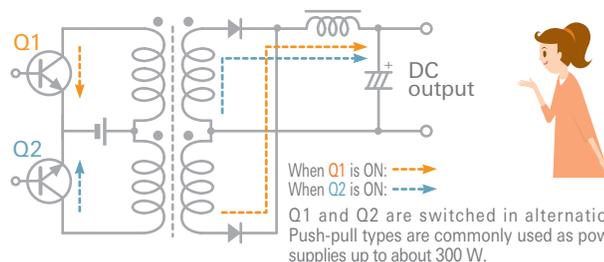


When Q1 is ON as a result of the base current from the base winding, collector current flows. When the base current is insufficient and Q1 is OFF, current flows on the secondary side. The converter is a self-exciting type that performs this operation repeatedly. It requires only a small number of components and can be used as a simple, low output power power supply.

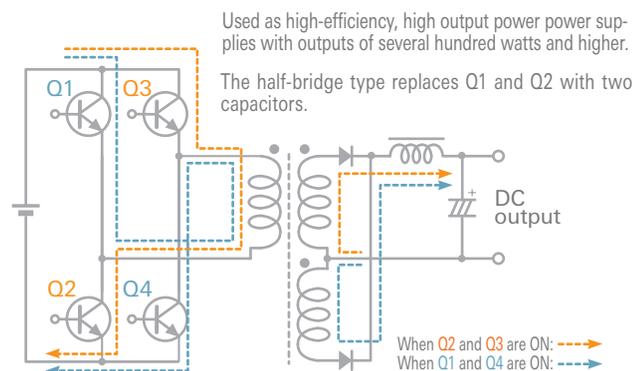
*A gap is placed in the transformer core to prevent magnetic saturation (See page 19).
*RCC : Ringing Choke Converter

Medium to high output power types use multiple switching devices which makes the circuit configuration more complex but enables higher efficiency, lower noise, and advanced functionality.

Push-Pull Type Medium to High Output Power Types



Full-Bridge Type Medium to High Output Power Types

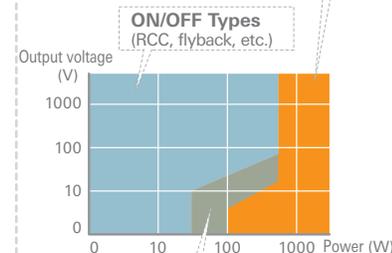


ON/ON Types and ON/OFF Types

DC-DC converters are available in ON/ON types that output energy when the switching elements are on and ON/OFF types that output energy when the switching elements are off.

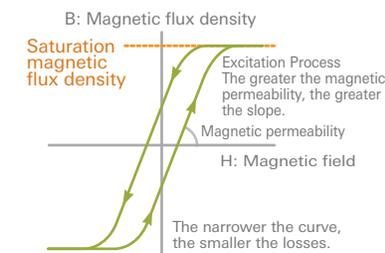
Types by Output Voltage and Power

ON/ON Types
(Multi-switching types: Push-pull, half-bridge, full-bridge, etc.)



ON/OFF Types & ON/ON Types
(single-switching forward, etc.)

B-H Curves of Magnetic Cores



Comparison of Performance of Core Types

| | Silicon | Ferrite | Amorphous |
|--------------------------|------------|------------|------------|
| Magnetic permeability | Acceptable | Good | Excellent |
| Saturation magnetization | Excellent | Acceptable | Acceptable |
| Iron losses | Poor | Excellent | Excellent |
| Manufacturing cost | Acceptable | Excellent | Poor |