



Working Together for a Greener Society

Future of Power Electronics and the Earth



Fully Digital-controlled Power Supply Control IC with
Interleaved Totem-pole Bridgeless PFC Circuit

MD6753



■ Description

The MD6753 is a fully digital-controlled power supply IC that controls interleaved totem-pole bridgeless PFC. Interleaving control in the critical conduction mode reduces input/output ripple current and switching loss, and the IC can achieve high-efficient, yet low-noise power systems.

■ Applications

For devices requiring high power supplies such as:

- Audiovisual Equipment
- Office Automation Equipment
(e.g., Server, Multifunction Printer)
- Industrial Equipment
- Communication Equipment

Package
SOP28



Pb-free
(RoHS compliant)

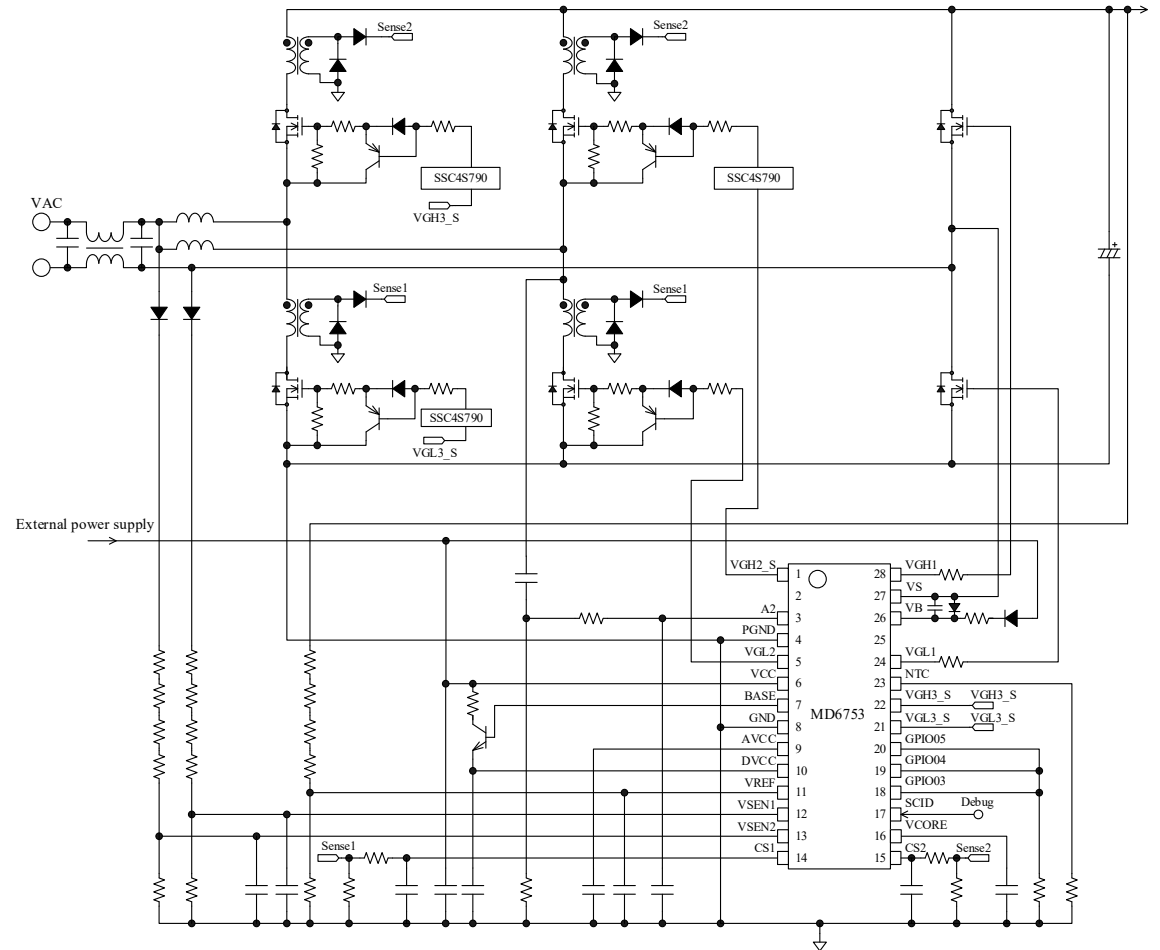
Product Features

The MD6753 combines interleaved totem-pole control and bridgeless PFC circuit to achieve complex control using full digital control. The critical conduction mode control and synchronous rectification operation achieve low-noise and high-efficient circuit.

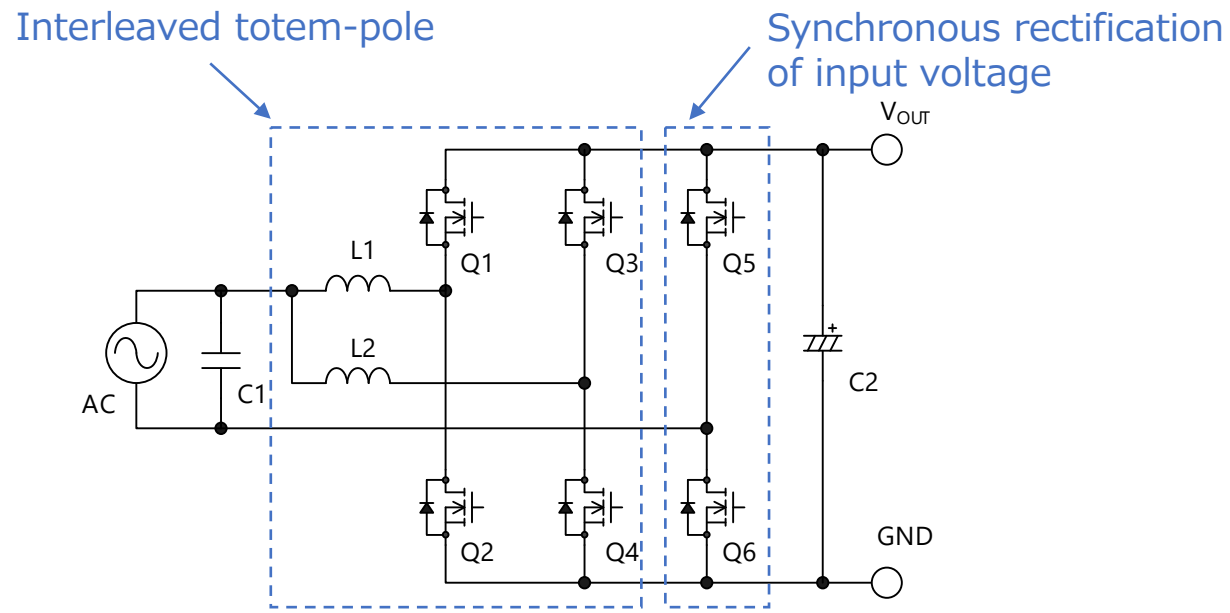
Features

- Fully Digital-controlled PFC Circuit
- Interleaved Totem-pole Control
- Critical Conduction Mode (CRM) Control
- Bridgeless PFC Circuit
- Soft Start
- High Efficiency Achieved by Synchronous Rectification and Intermittent Operation at Light Load
- Protections Include:
 - AC Power Supply Input Off-state Detection
 - PFC Output Undervoltage Protection (PFC_UVP)
 - PFC Output Overvoltage Protection (PFC_OVP)
 - PFC Overcurrent Protection (PFC_OCP)
 - PFC Overload Protection (PFC_OLP)
 - AC Regeneration Side High-side Driver Undervoltage Lockout
 - VCC Pin Overvoltage Protection (VCC_OVP)
 - Thermal Shutdown (TSD)

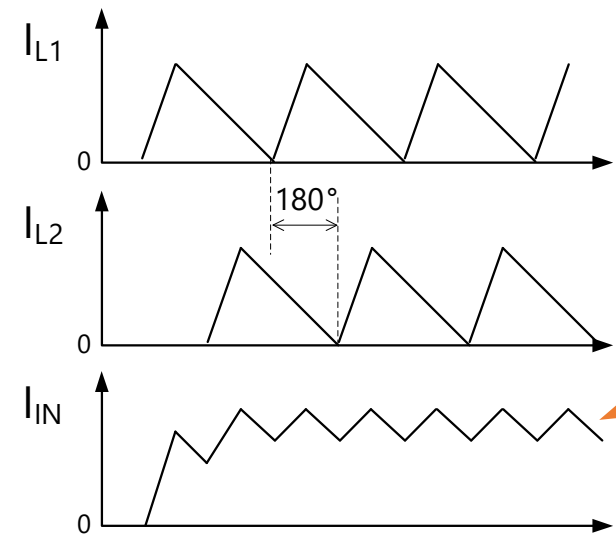
Typical Application



To support higher power applications, the MD6753 has a PFC circuit that combines a totem pole PFC where two power MOSFETs are connected in series and the interleaved operation that uses two of the same circuits in parallel. The MD6753 employs an interleaved control that shifts the phase of two PFC circuits by 180 degrees to make them operate the same. In this control, the input current I_{IN} is the sum of the currents flowing through the two inductors, L1 and L2, suppressing the input/output current ripple. This simplifies the input filter and reduces the heat generation of the output electrolytic capacitor, resulting in a smaller capacitor. Synchronously rectifying the input voltage with Q5 and Q6 removes the diodes from the power line and improves circuit efficiency.



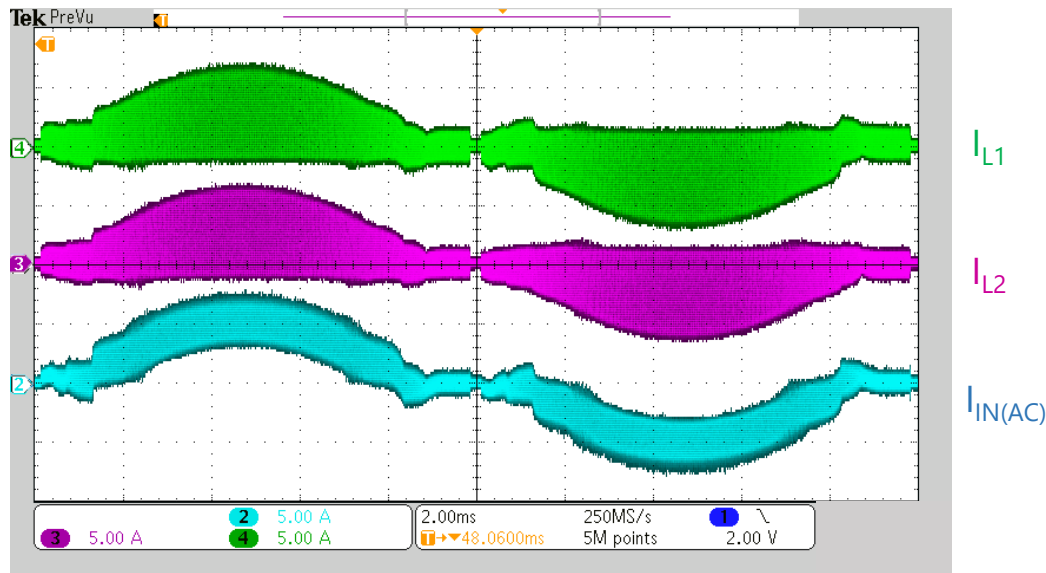
Interleaved Totem-pole Bridgeless PFC Circuit



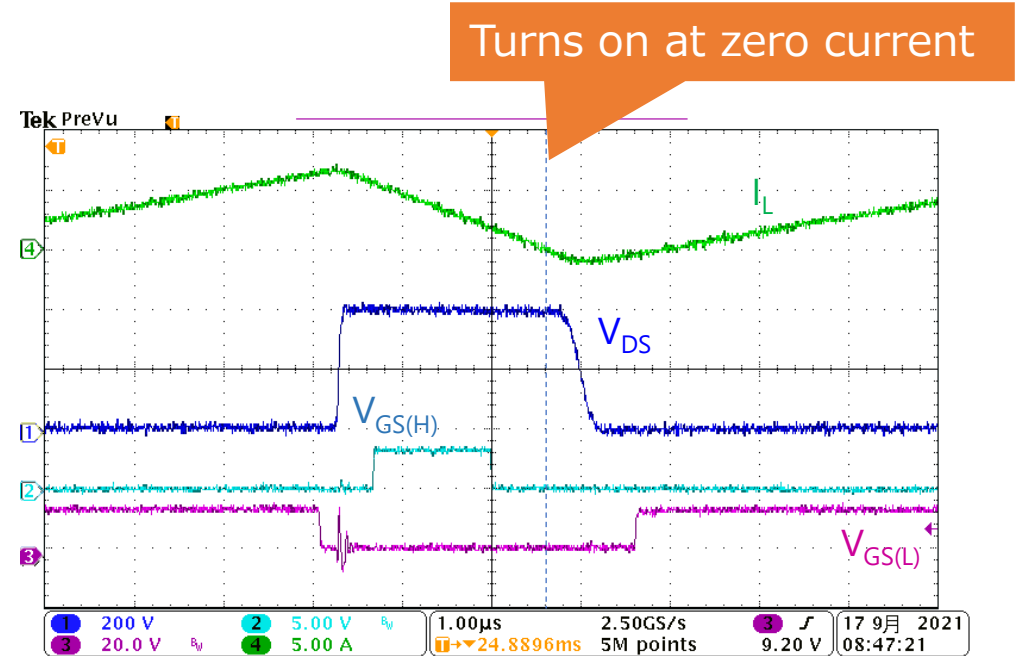
Suppressing current ripple results in the downsized output capacitor, C2.

Interleaved Circuit Operational Waveforms

The totem-pole PFC has only a line filter to remove high-frequency noise. This makes high-frequency noise suppression more difficult than with a normal boost PFC. To suppress high-frequency noise generation, the MD6753 employs the CRM PFC, which turns on the power MOSFET at the timing when the inductor current is zero, resulting in lower switching loss as well as noise. Moreover, the IC improves circuit efficiency under all load ranges by synchronous rectification operation and intermittent operation at light load. These complex controls are achieved digitally.



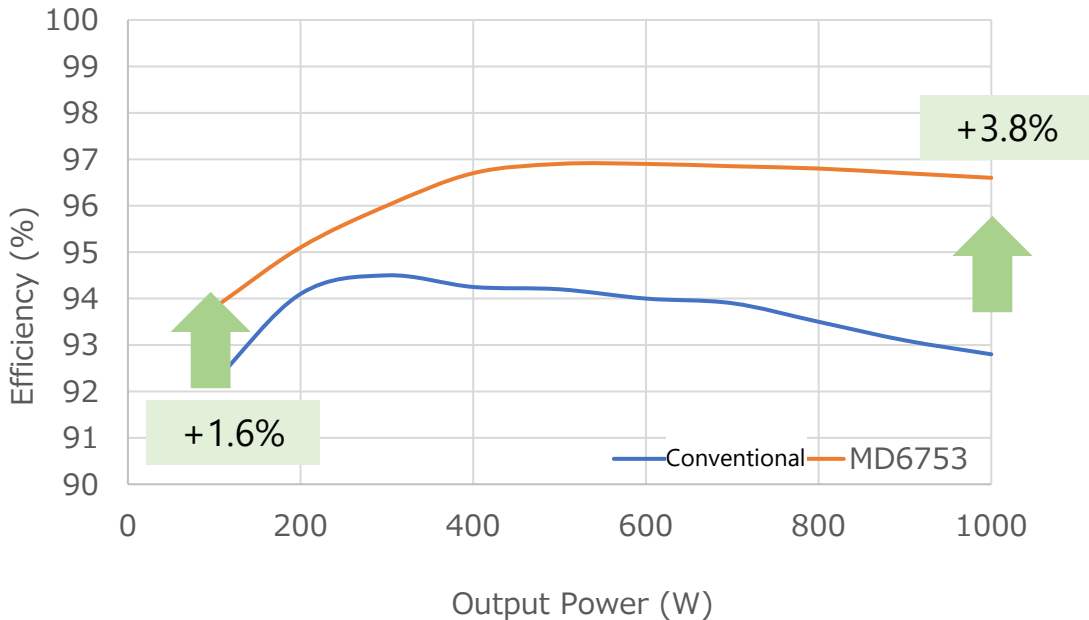
Totem-pole CRM PFC Operational Waveforms (100 VAC)



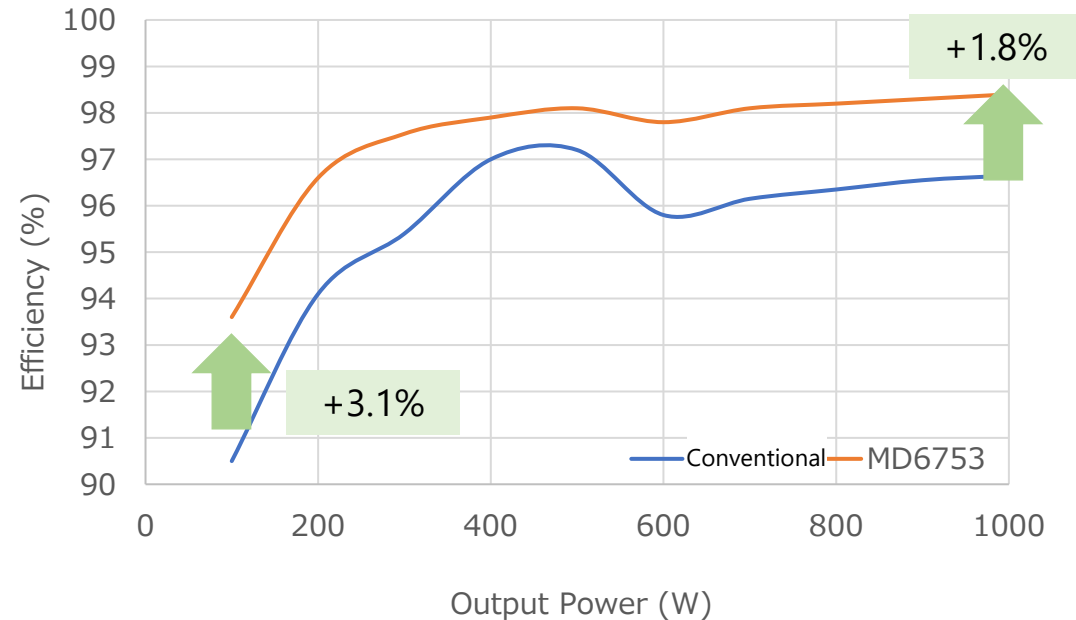
CRM Operational Waveforms (100 VAC)

The following graphs represent the load regulation (PFC stage output of 400 V and power supply of 2.5 A). High conversion efficiency is shown in both 110 VAC and 230 VAC input conditions. Compared to our conventional interleaved PFC with equivalent components, the efficiency is improved under all load ranges.

Load Regulation ($V_{IN} = 110 \text{ VAC}$)



Load Regulation ($V_{IN} = 230 \text{ VAC}$)



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