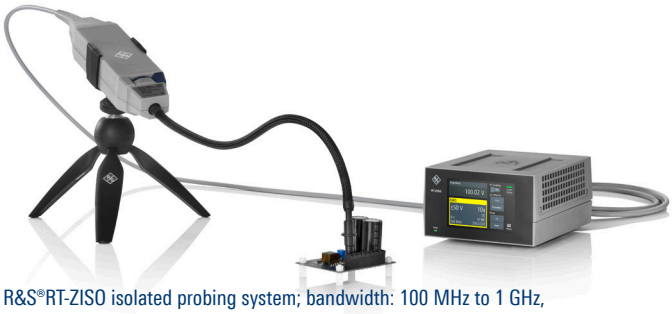
ACCURATE DOUBLE PULSE TESTING WITH THE R&S®RT-ZISO ISOLATED PROBING SYSTEM

The double pulse testing (DPT) is crucial to evaluating the switching behavior for metal oxide semiconductor field effect transistors (MOSFET), insulated gate bipolar transistors (IGBT) and wide bandgap (WBG) power semiconductor devices. The slew rate of switching devices is increasing, especially on high-side power transistor where referencing switch nodes creates a fast common-mode environment. Conventional high-voltage differential probes have difficulties obtaining a good measurement with their limited common-mode rejection ratio at higher frequencies.



R&S®RT-ZISO isolated probing system; bandwidth: 100 MHz to 1 GHz, input range: ±3000 V, CM range: ±60 kV, CMRR at 1 GHz: 90 dB, highest sensitivity range: ±20 mV

Your task

When evaluating power transistor characteristics to accurately measure fast switching transients, analyze dynamic on-resistance and switching losses while managing high-voltage differentials and common-mode (CM) noise on a DPT setup, traditional probing methods struggle to find the necessary combination of safety, accuracy and bandwidth, especially with wide bandgap semiconductors. High-side measurements on gate-source where the switch node is toggled by low-side transistors result in fast changing common-mode voltage. Conventional high-voltage differential probes with long 4 mm banana test leads are highly susceptible to noise. Engineers need a solution that overcomes such limitations for precise measurements with higher frequency common-mode rejection ratios (CMRR).

Rohde&Schwarz solution

The R&S®RT-ZISO isolated probing system is designed and engineered to tackle such measurement challenges. Optical isolation helps suppress CM noise by limiting the return path towards measurement devices. The new coaxial probing approach lets the shielded probe tips channel fast CM noise back to the source for minimal disturbance of the measured signal giving the probe an excellent CMRR. Conventional high-voltage differential probes typically have a CMRR of 20 dB to 25 dB at up to 400 MHz bandwidth. The screenshots below show in detail how transistor gate charging effects are determined with the R&S®RT-ZISO.



Details in transistor gate charging, reveals detail hidden by CMRR noise on the R&S®RT-ZHD07 differential high-voltage probe (left side, in blue) compared to the R&S®RT-ZISO (right side, in green)

ROHDE&SCHWARZ
Make ideas real

CMRR considerations on DPT setup

When measuring fast power devices on a DPT setup, the R&S®RT-ZISO isolated probing system helps suppress CM noise and reveal true measurements. A good CMRR is only possible if the measurement path has minimal insertion inductance. While square pin and wide square sockets are available as probe tips, the connection to the DUT and signal routing would induce much lower CMRR at high frequencies relative to coaxial tips. Appropriate connectors need to be designed and attention paid to the routing. Consulting DPT experts can be a big help here.

PE-Systems GmbH helps provide DPT solutions to users around the world, with design services and system integration of modular DPT testers. The modular fixtures help minimize parasitic effects and ensure top signal performance with the R&S®RT-ZISO for MMCX connector designs. Experience and know-how are crucial to accurate and repeatable results.

The probe is also suitable for shunt current sensing thanks to its low noise and high sensitivity of ±20 mV. PE-Systems adopted a MMCX surface mount shunt with minimal insertion inductance and high bandwidth for accurate current measurements.

Beyond electrical performance on DPT setup

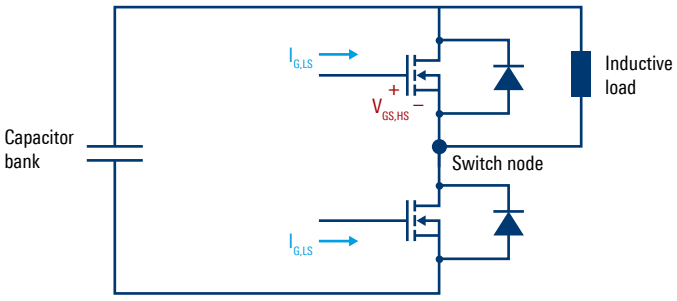
DPT demands mechanical versatility and environmental setups. High-voltage and current testing are conducted in safety enclosures, where equipment and probes are confined to limited spaces. Thermal conditioning requirements and complex gate drivers in modular setups demand careful placement of instruments and probes.

The R&S®RT-ZISO has long, formable probe tips and a probe holder bracket compatible with common tripod and camera mounts for easy setup customization. The formable tips retain their shapes, exerting minimal force on connectors to extend their lifespan. Test instruments need to be kept at a safe distance or shielded to minimize disturbance when working with high-frequency common-mode signals.

Modular DPT testers from PE-Systems support the MXO 5C oscilloscopes and the long 10-meter fiber cable of the R&S®RT-ZISO. PE-Systems DPT testers can also be operated remotely via software, letting equipment and probes be controlled from a safe distance.

Double pulse testing setup with DUT on the high side

The gate measurement observes switch node toggling as a common signal.





PE-Systems GmbH double pulse tester with integrated rack system test setup, gate drivers, measurement instruments in an easy-access safety enclosure; it readily supports customization with thermal stream and component pick-and-place

Summary

DPT for next generation power components requires an enhanced CMRR for high frequencies and voltage ranges. The R&S®RT-ZISO isolated probing system is specifically designed to meet these needs. When combined with DPT testing solutions from PE Systems, the probes offer expanded capabilities for accurate measurements in noisy environments and fast shunt current sensing.

As the demand for precision and robustness grows, expertise in designing for testing and specialized test setups becomes crucial. The Rohde&Schwarz and PE-Systems solution provides a comprehensive answer to your measurement requirements.

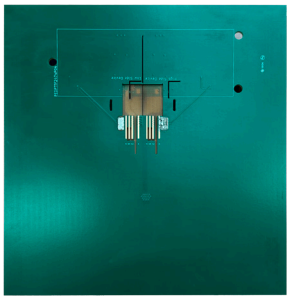
MXO 5C: 4-channel model



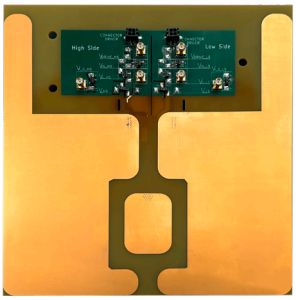
MXO 5C: 8-channel model



PE-Systems GmbH DPT test fixture



PE-Systems GmbH DPT test fixture



PE-Systems GmbH universal gate driver



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PD 3673.3804.92 | Version 01.00 | July 2026 (ch)
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