CoolMOS™ C6
The New Reference in the HV MOS market

Dianyuan Forum
14th November 2009

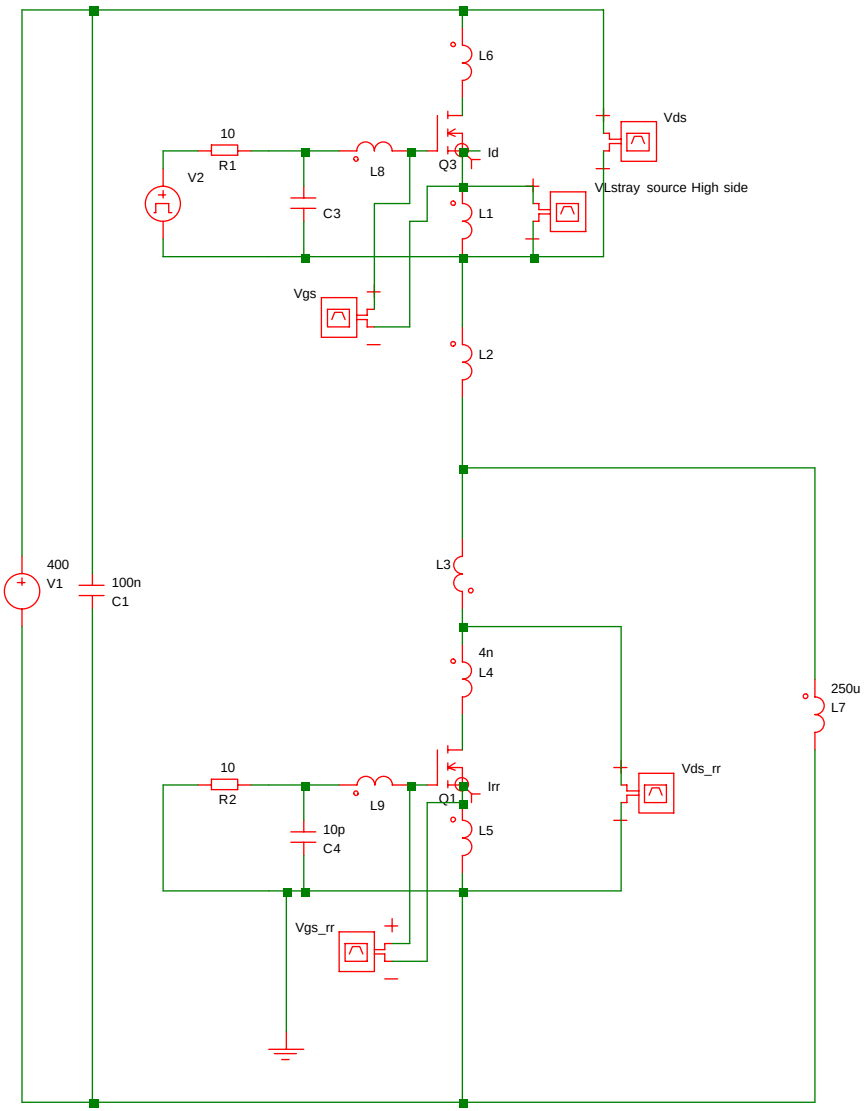
Never stop thinking

CoolMOS™ C6 Features

Product Characteristics	Value for SMPS Designer
High commutation ruggedness. Lower Reverse Recovery Charges (Qrr).	Easy apply in hardswitching and applicable for some resonant topology.
Best Figure-of-Merit Ron*Eoss and good FoM Ron*Qoss.	Improve light load efficiency and minimal impact to resonant tank design. Excellent Efficiency Performance of most competitors.
Self-limiting di/dt and dv/dt in overload conditions. Textbook like switching waveform even in high peak current conditions. Optimized Gate Drive Resistor (Rg internal).	Easy adoption in any existing design.
Broadest Range of $R_{DS(on)}$ Selection.	Fit from Kilo Watt Server power to ten's watt of adaptor.

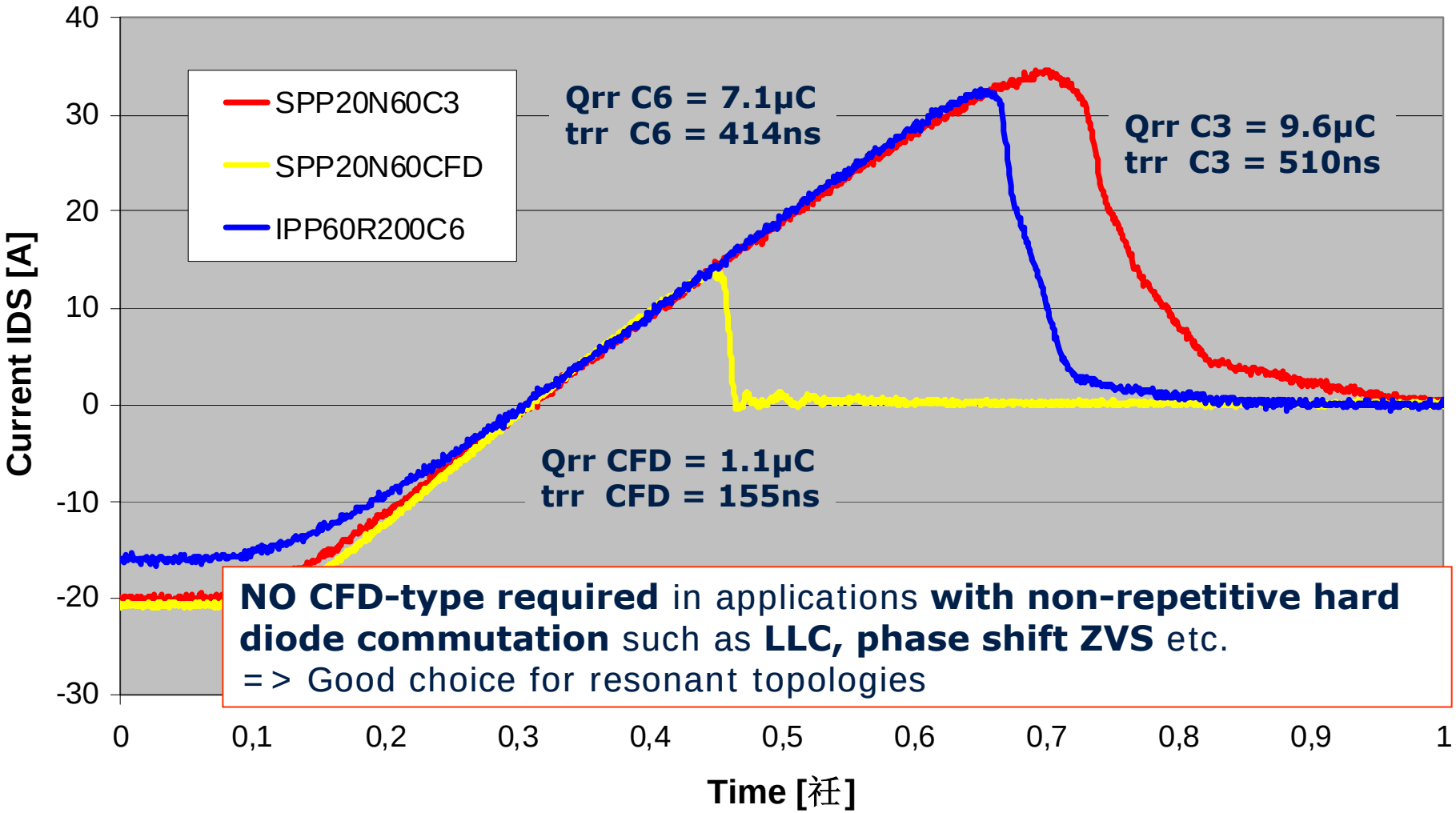
Contents:

Simplified test circuit body diode behavior in hard commutation



- Turn on High side switch
  - Choke will be charged depended on ontime high side switch
- Turn off High side switch
  - Current will be circulating in the freewheeling (Choke and Low side switch)
- Turn On High Side Switch
  - Step into hard commutation on body diode Low side Switch

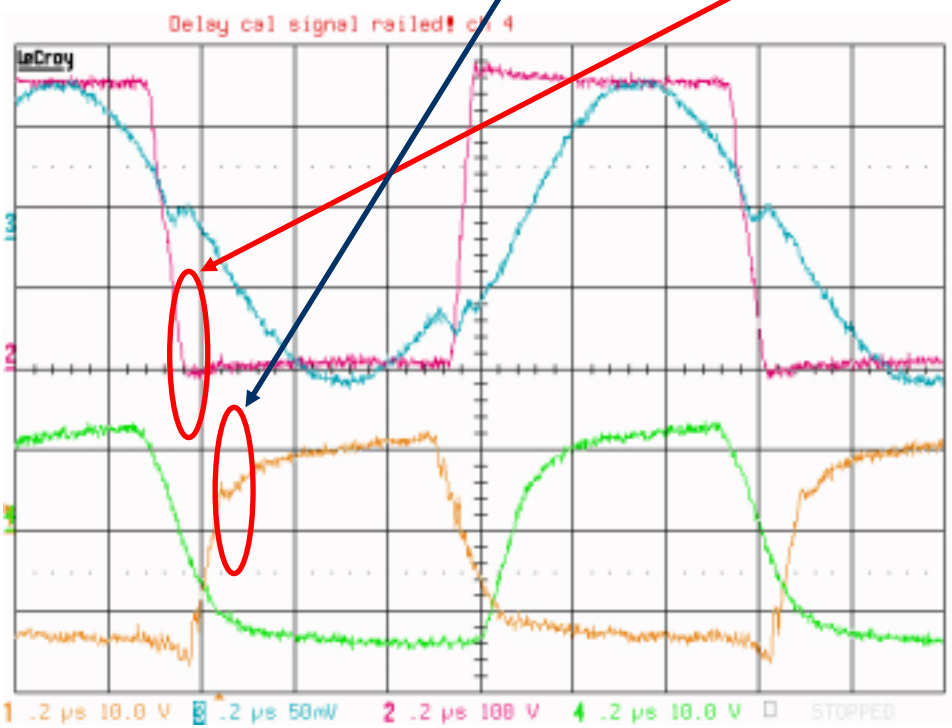
Hard commutation of body diode: **C6** shows less reverse recovery charge than **C3** and better softness than **CFD**



NO CFD-type required in applications **with non-repetitive hard diode commutation** such as **LLC, phase shift ZVS** etc.
=> Good choice for resonant topologies

What is soft switching?

- The drain source voltage reaches zero before the gate of the low side MOSFET turns on



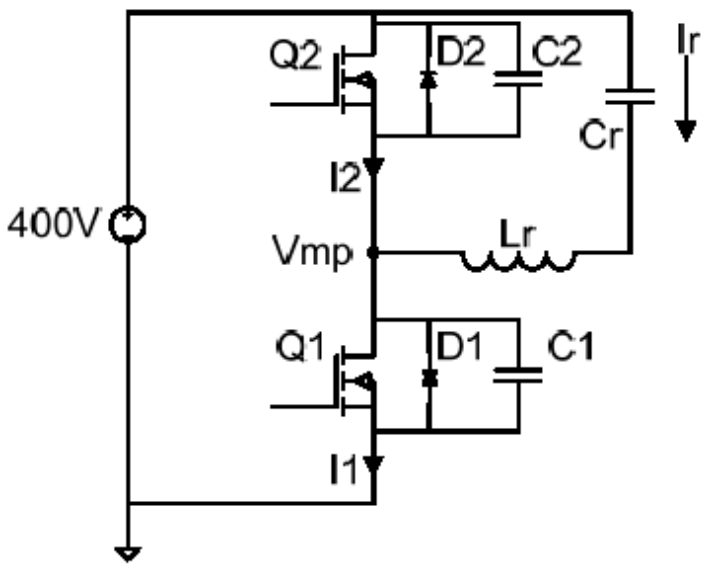
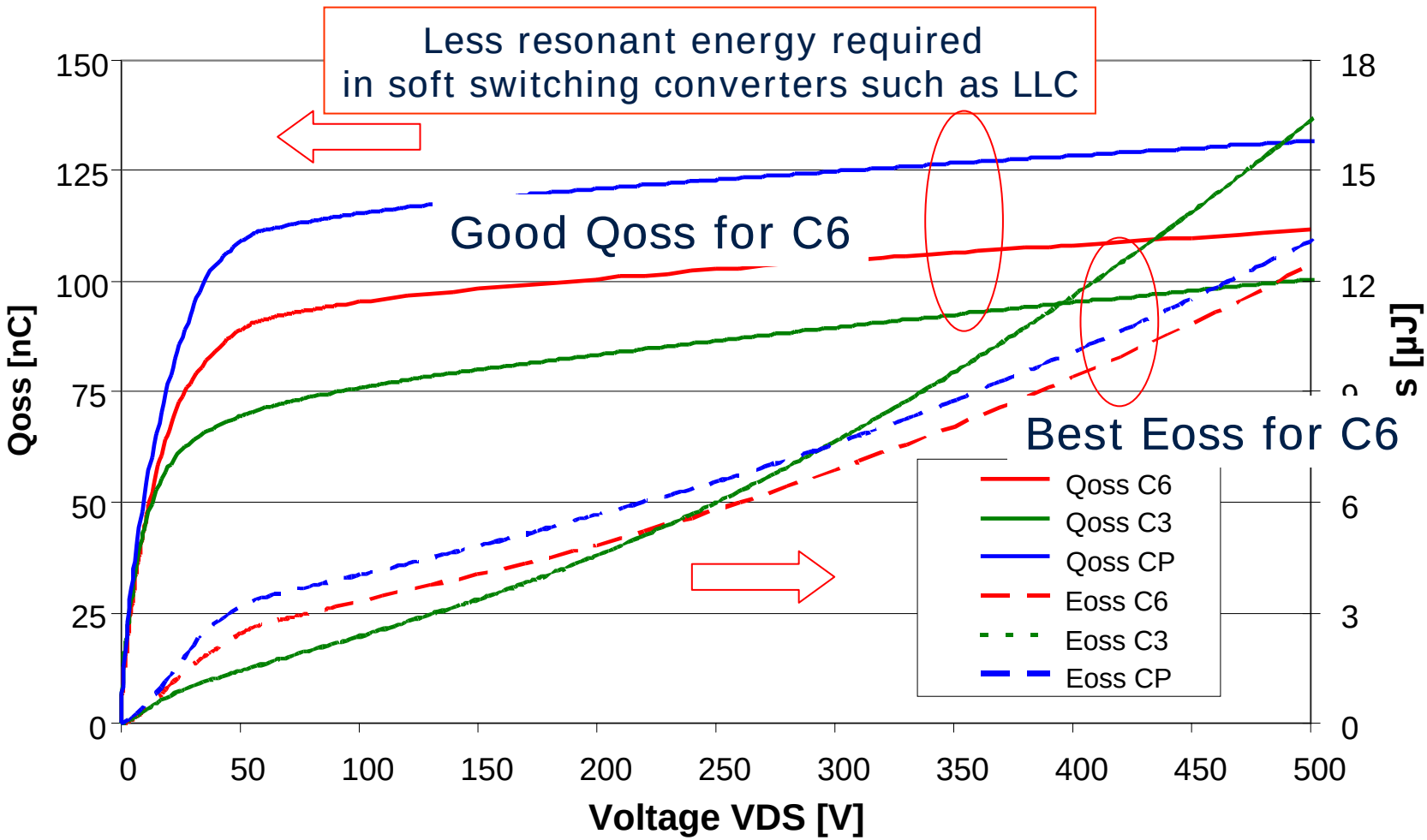


Fig. 5a, Device Tester Circuit

Pri Current Low Side Gate High Side Gate Vmp

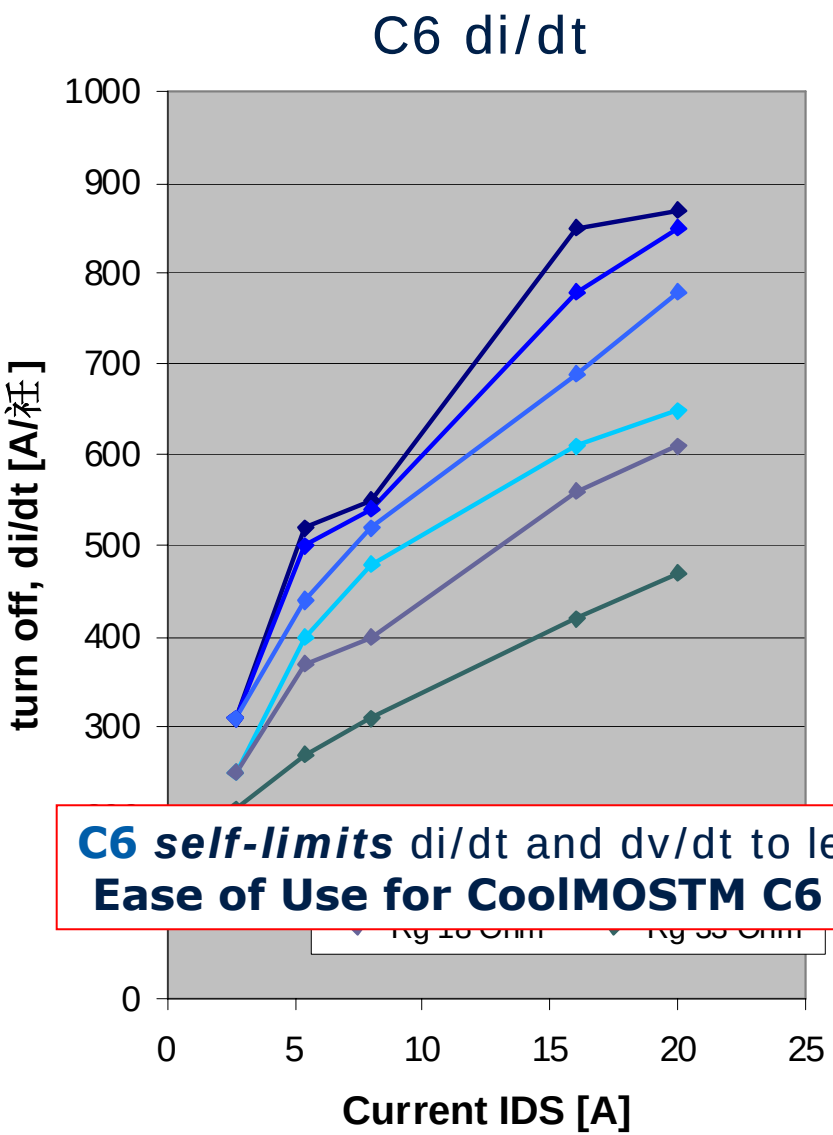
Contents:

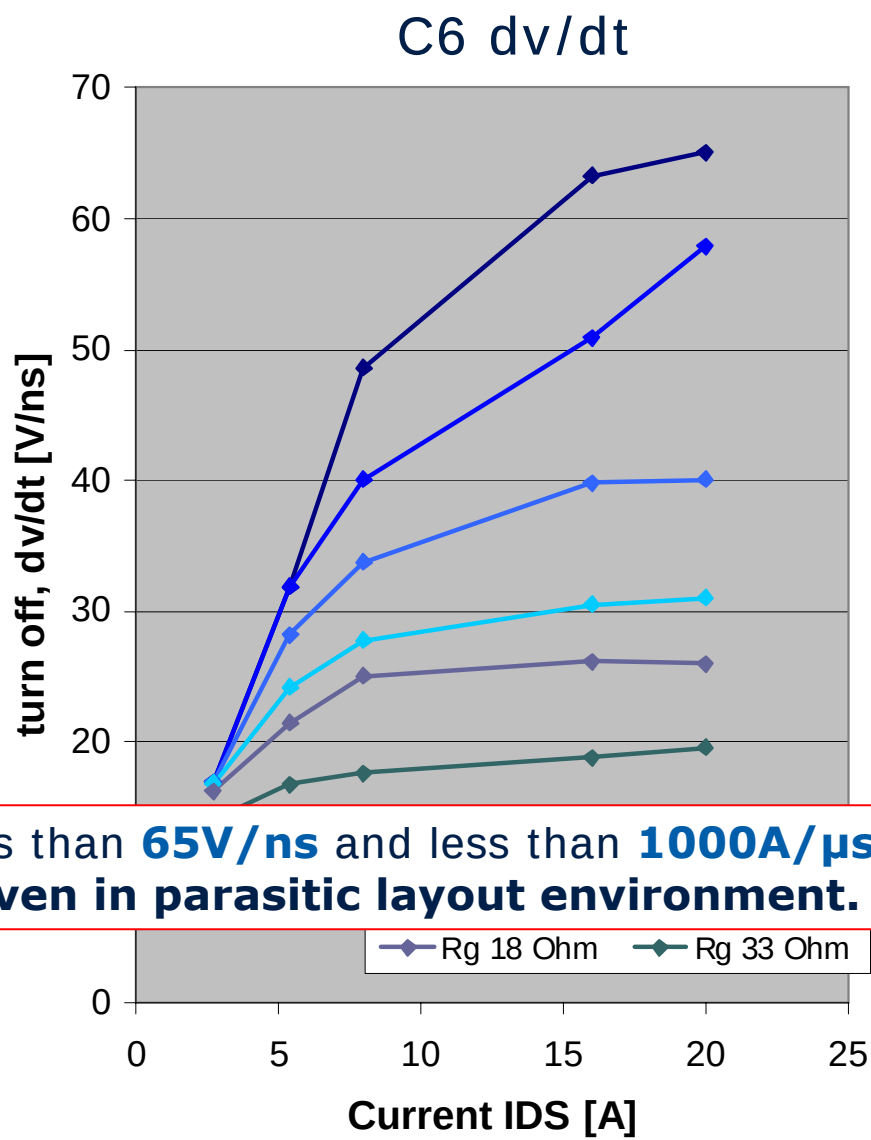
C6 shows the best Figure-of-Merit Ron*Eoss and good FoM Ron*Qoss



CoolMOSTM C6 does not show excessive dv/dt or di/dt!

VDS=400V, Tj=125°C, RDSon 190 mOhm



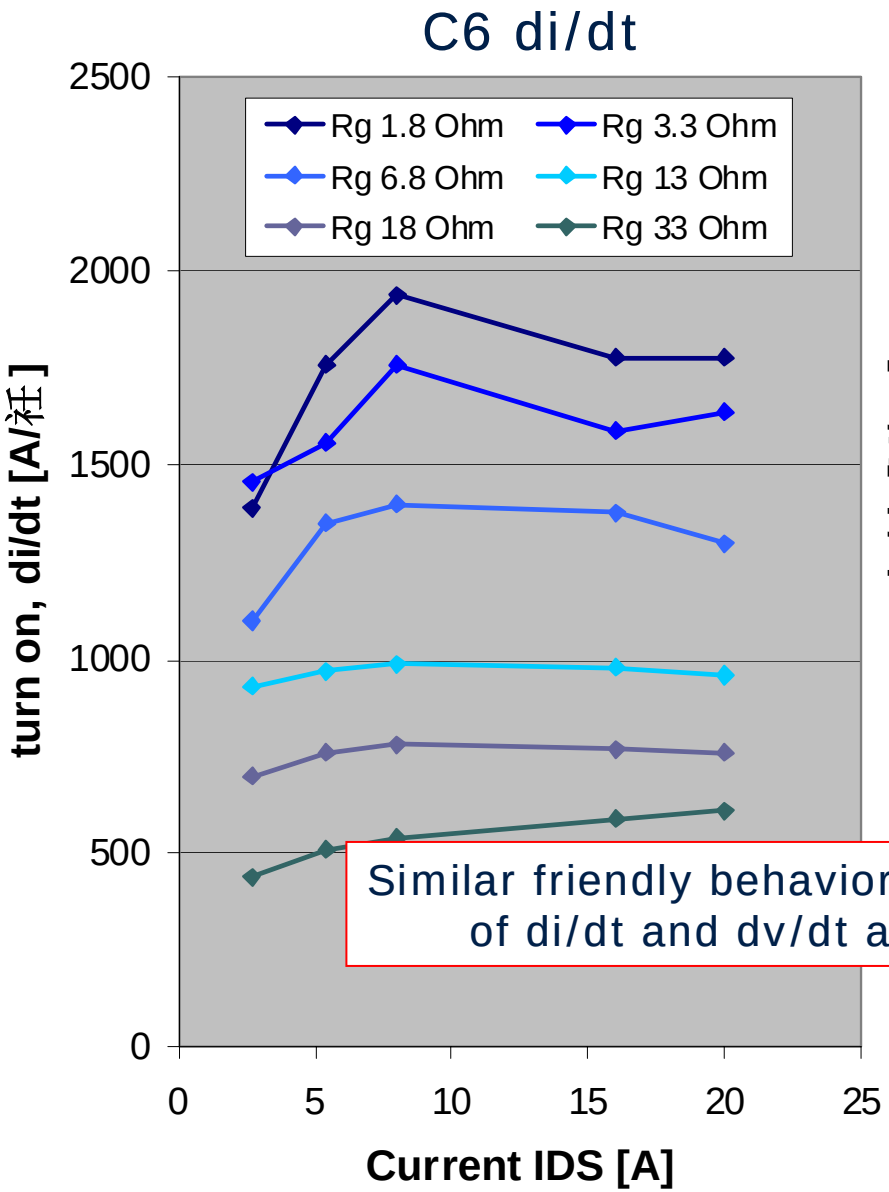


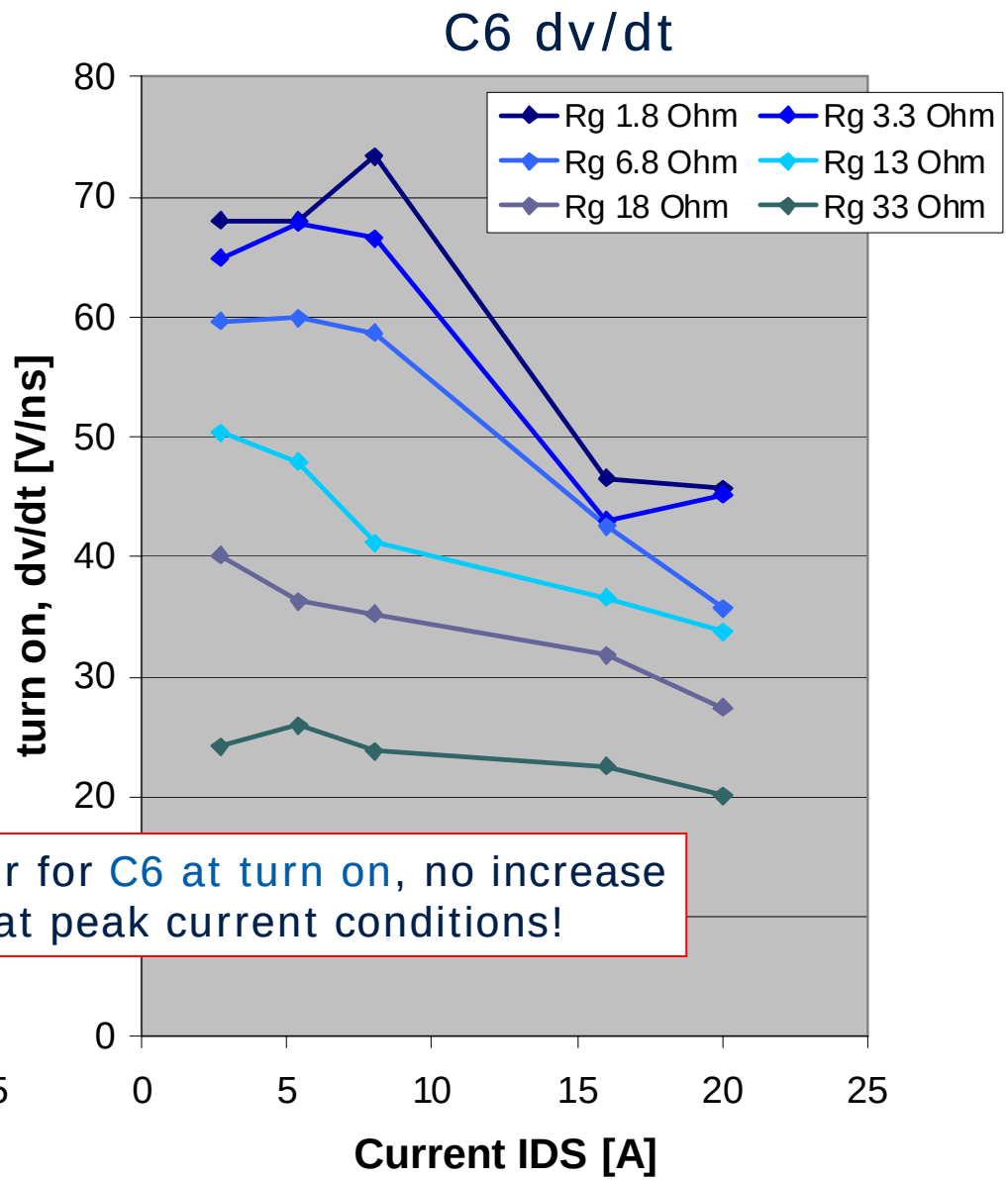
C6 *self-limits* di/dt and dv/dt to less than **65V/ns** and less than **1000A/µs**

Ease of Use for CoolMOSTM C6 even in parasitic layout environment.

Similar self-limiting behavior of C6 at turn-on as well...

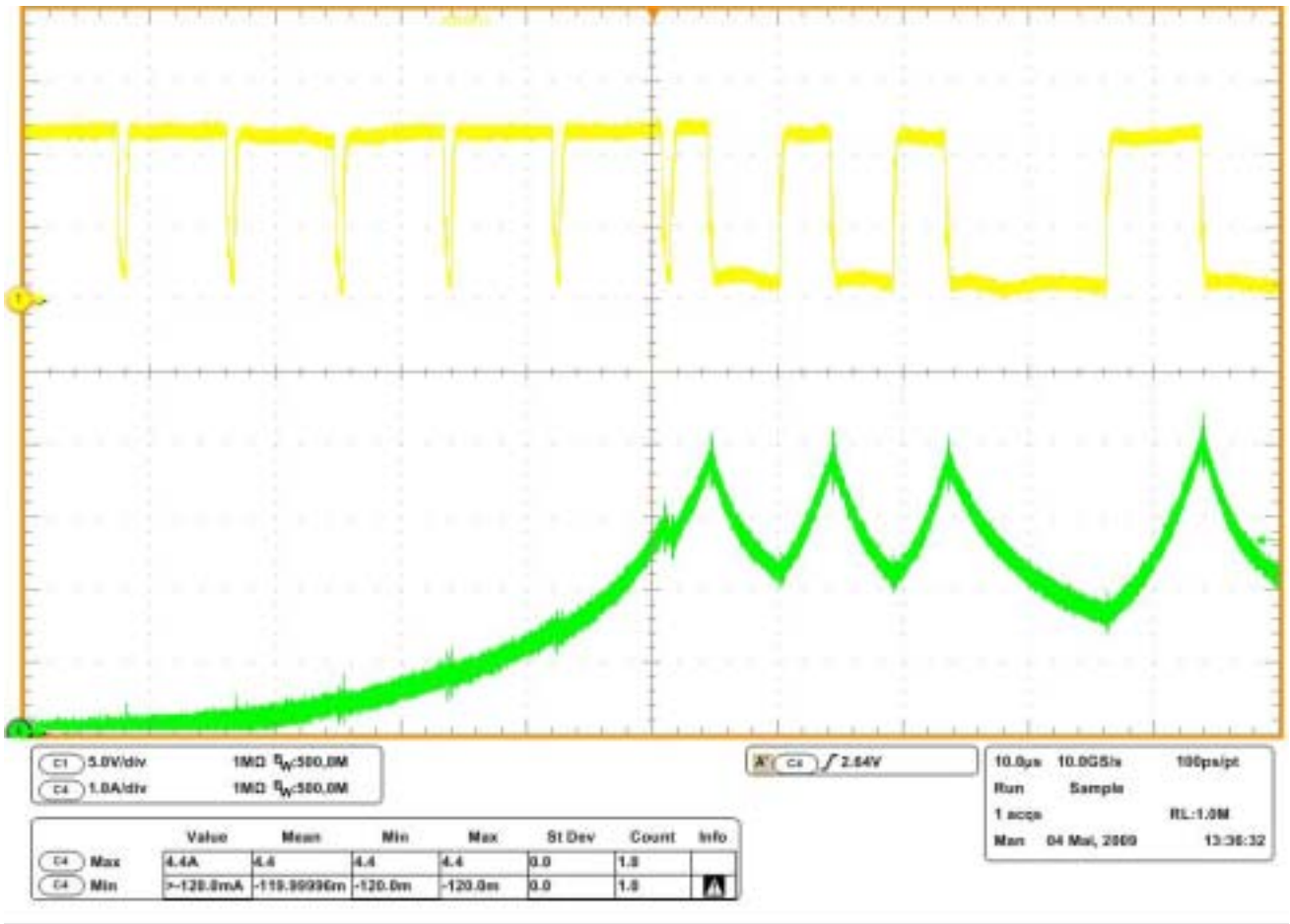
VDS=400V, Tj=125°C, RDSon 190 mOhm





Similar friendly behavior for C6 at turn on, no increase of di/dt and dv/dt at peak current conditions!

Switching behavior in peak current conditions: **C6** shows immaculate behavior…

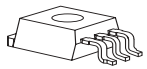
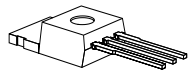
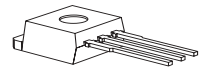
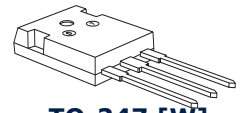


- Start up behavior of CoolMOSTM C6 at very high peak current condition during AC cycle drop out.

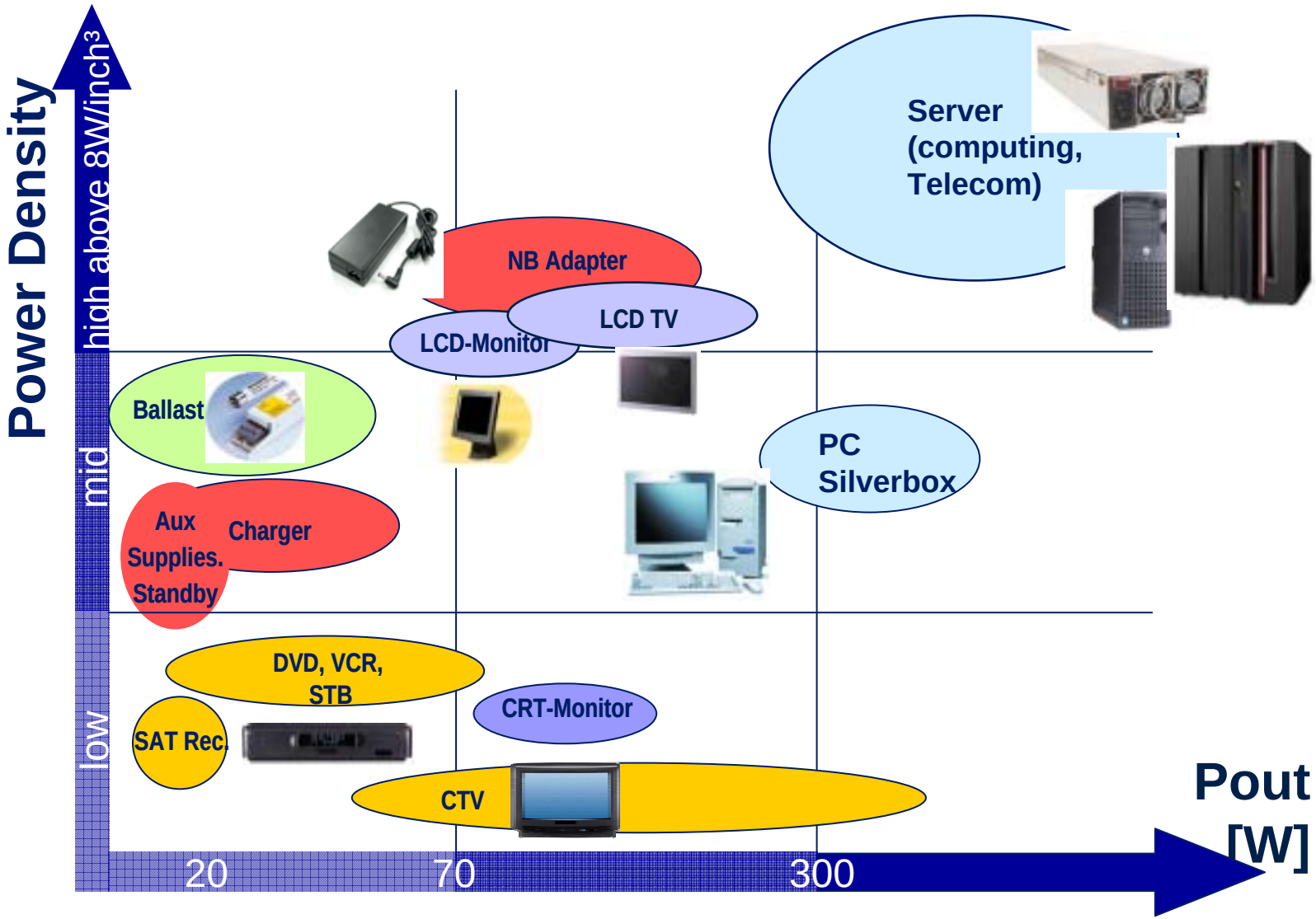
Contents:

Superior Solutions from Superior Power Semiconductors

CoolMOS™ C6 600V Portfolio

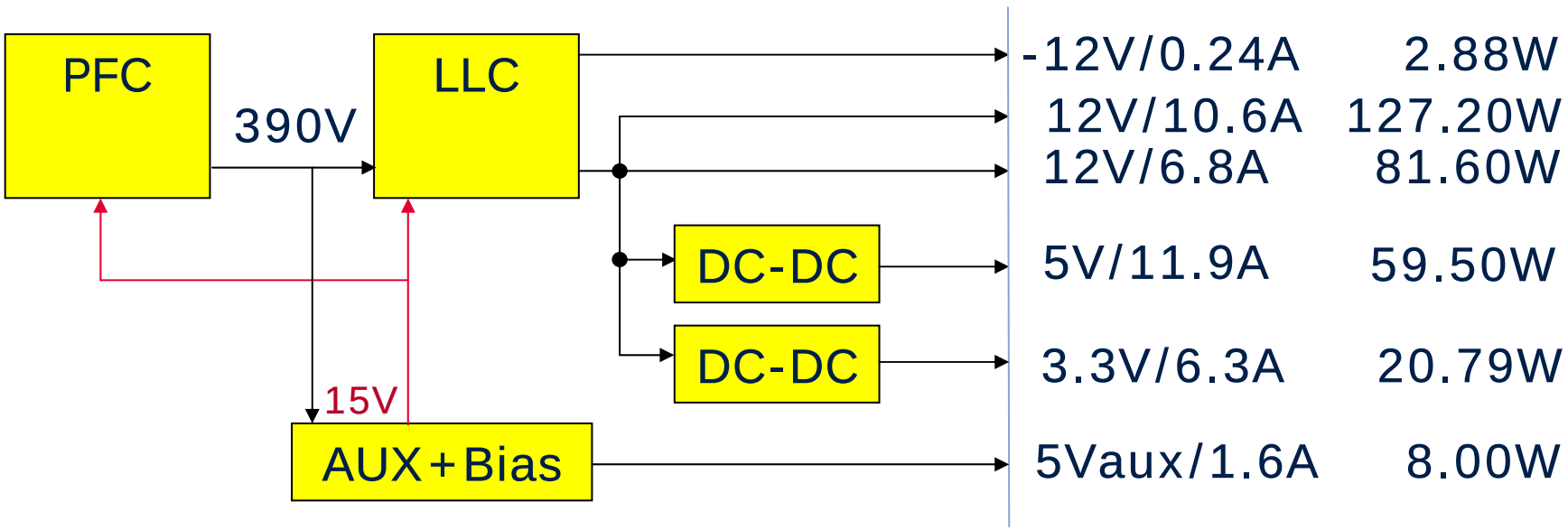
	 TO-252 D-Pak [D]	 TO-263 D²PAK [B]	 TO-220 [P]	 TO-220 Fullpak [A]	 TO-262 I²-PAK [I]	 TO-247 [W]
3.3 Ω 1.8 A	IPD60R3k3C6					
2 Ω 2.5 A	IPD60R2k0C6					
1.4 Ω 3.2 A	IPD60R1k4C6		IPP60R1k4C6			
0.95 Ω 4.5 A	IPD60R950C6	IPB60R950C6	IPP60R950C6	IPA60R950C6		
0.75 Ω 6.2 A	IPD60R750C6		IPP60R750C6			
0.6 Ω 7.3 A	IPD60R600C6	IPB60R600C6	IPP60R600C6	IPA60R600C6		
0.52 Ω 8 A	IPD60R520C6		IPP60R520C6	IPA60R520C6		
0.45 Ω 9.5 A	IPD60R450C6		IPP60R450C6	IPA60R450C6		
0.38 Ω 11 A	IPD60R380C6	IPB60R380C6	IPP60R380C6	IPA60R380C6	IPI60R380C6	
0.28 Ω 15 A		IPB60R280C6	IPP60R280C6	IPA60R280C6	IPI60R280C6	IPW60R280C6
0.19 Ω 20 A		IPB60R190C6	IPP60R190C6	IPA60R190C6	IPI60R190C6	IPW60R190C6
0.16 Ω 24 A		IPB60R160C6	IPP60R160C6	IPA60R160C6		IPW60R160C6
0.125 Ω 30 A			IPP60R125C6	IPA60R125C6		IPW60R125C6
0.099 Ω 35 A		IPB60R099C6	IPP60R099C6	IPA60R099C6		IPW60R099C6
0.07 Ω 47 A						IPW60R070C6

CoolMOS™ C6 Target Applications…
… Virtually all



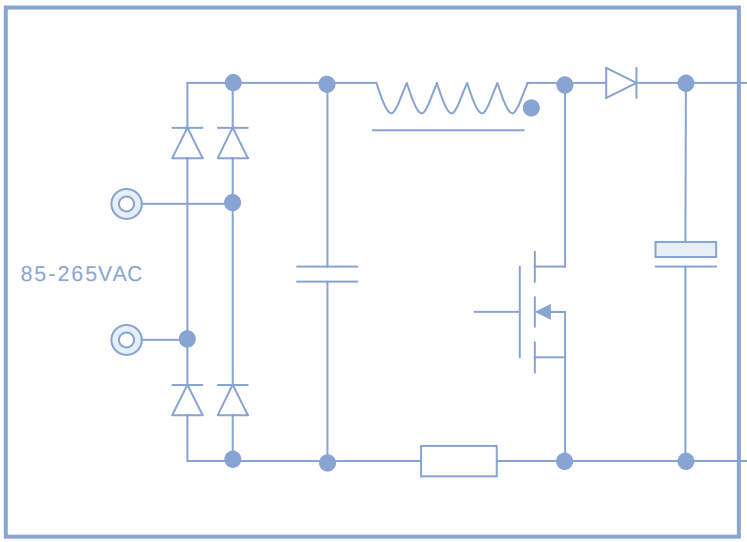
Contents:

80+ Gold standard 300W ATX PSU

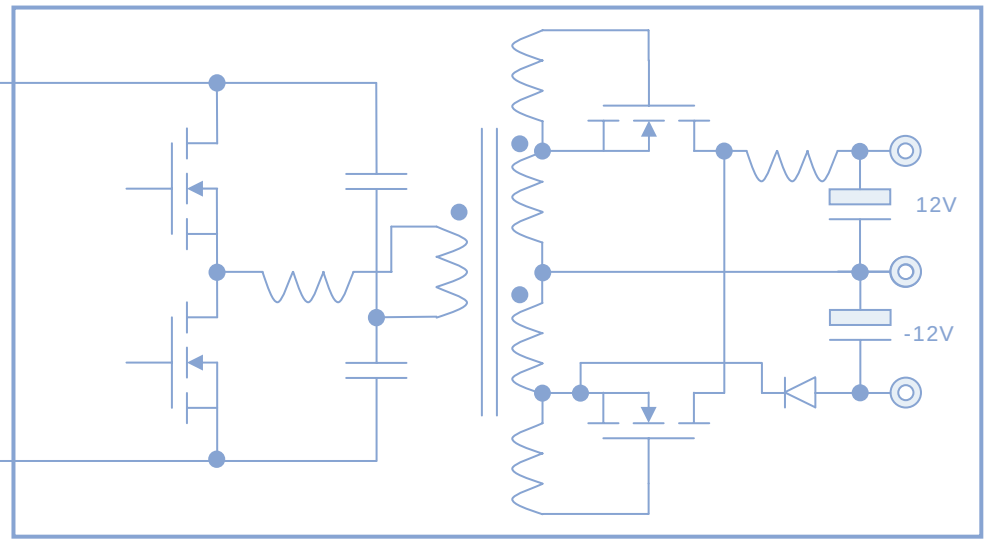


Used Topologies

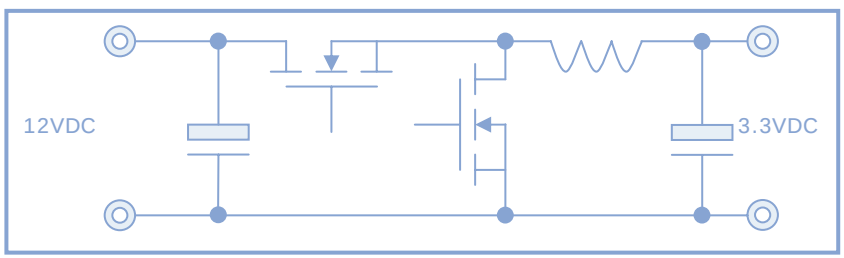
CCM PFC 64kHz



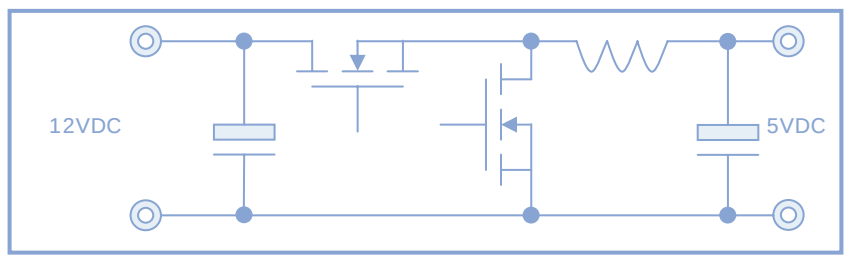
LLC 100kHz



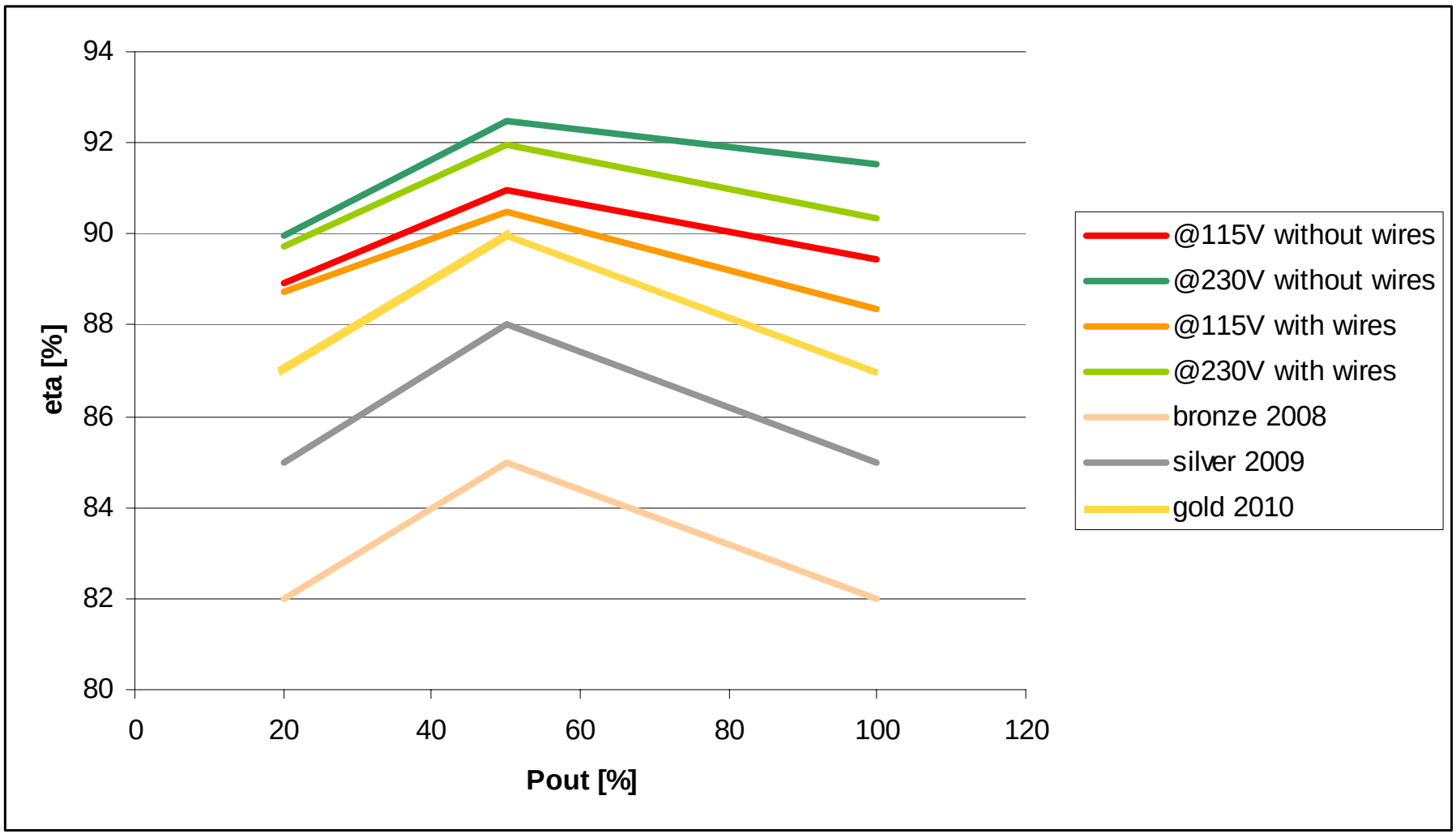
3V3 BUCK 80kHZ



5V BUCK 100kHZ



IFXs ATX demonstrator shows performance above **80+ gold**



Used Infineon Semiconductors

■ PFC stage	1 x IPP60R199CP	
	1 x IDT05S60C	SiC diode
	1 x ICE2PCS02G	PFC controller
■ LLC stages	2 x IPP60R190C6	
	2 x IPP037N60L	Sync rectifier
	1 x 2ED020I12-FI	Half Bridge driver
	1 x ICE1HS01G	LLC controller
■ BUCK stages	2 x BSC042N30LS	
	2 x BSC050N30LS	
■ Flyback stage	1 x ICE3AR2280JZ	Flyback controller
■ Fan controller	1 x TDA21801	Fan controller

Contents:

CoolMOS™ C6 - the new reference in the HV MOS market

- Due to the good hard communtation performance, CoolMOS™ C6 is drawing signification attention to resoanant topology such as LLC converter.
- Optimized internal gate dirve resistor to further enhance the switching characterisitc.
- Reduction of external Rg is required to utilize full potential of this technology.
- CoolMOS™ C6 is develop to cover a broad range of application.
- CoolMOS™ C6 offers the opportunity of super junction device be able to used in consumer product.

Never stop thinking