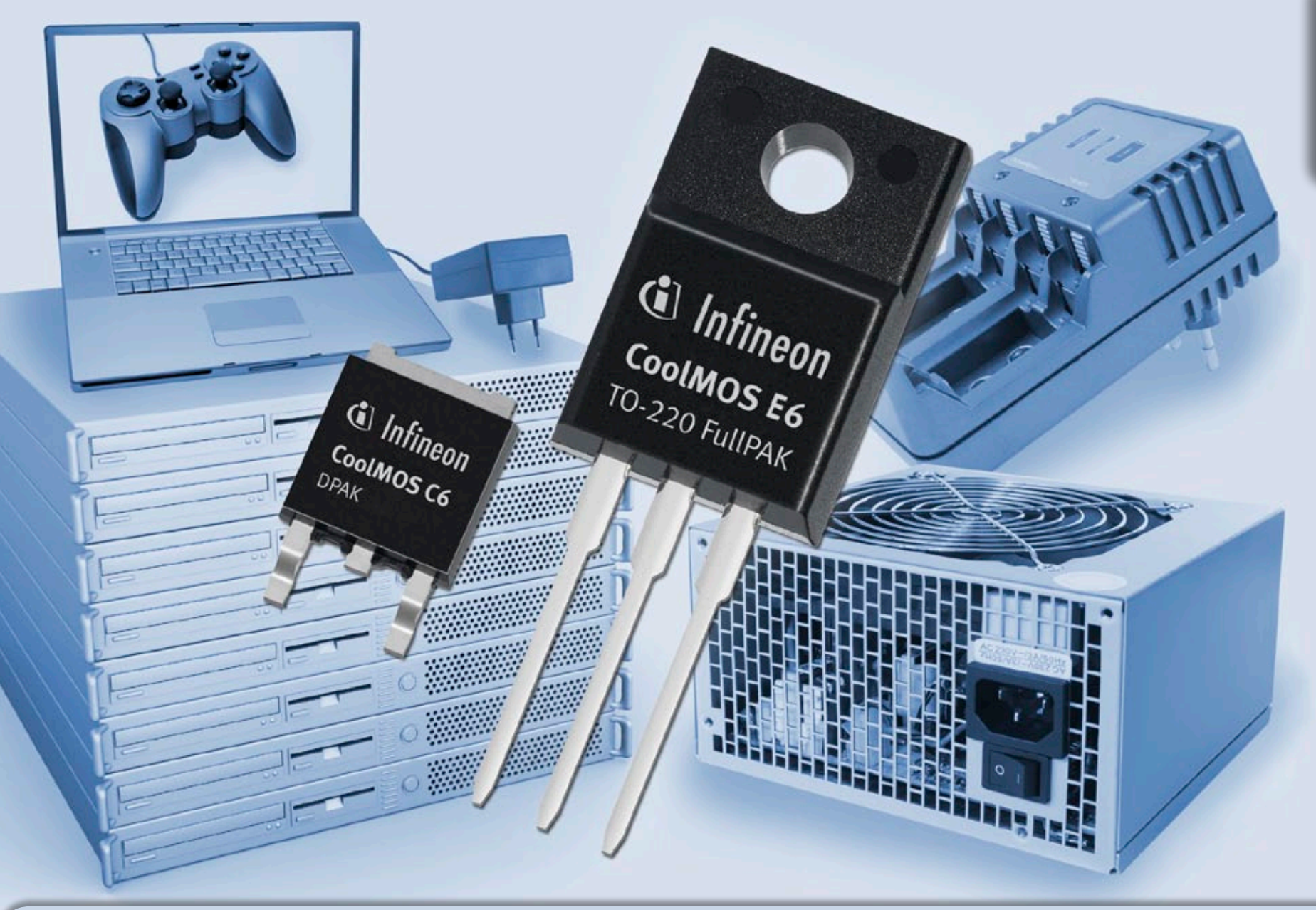


CoolMOS™ New Generation 600V & 650 V C6/E6 replacements for C3

CoolMOS™ 600V C6/E6 replacements for C3

$R_{DS(on)}$	TO-252 DPAK		TO-263 D²PAK		TO-220		TO-220 FullPAK		TO-262 I²PAK		TO-247	
	C3 Original	C6/E6 Replacement	C3 Original	C6 Replacement	C3 Original	C6/E6 Replacement	C3 Original	C6 /E6 Replacement	C3 Original	C6 Replacement	C3 Original	C6/E6 Replacement
3.3 Ω	SPD02N60C3	IPD60R3k3C6										
1.4 Ω	SPD03N60C3	IPD60R1k4C6			SPP03N60C3	IPP60R1k4C6						
0.95 Ω	SPD04N60C3	IPD60R950C6	SPB03N60C3	IPB60R950C6	SPP04N60C3	IPP60R950C6	SPA04N60C3	IPA60R950C6				
0.60 Ω	SPD07N60C3	IPD60R600E6	SPB07N60C3	IPB60R600C6	SPP07N60C3	IPP60R600E6	SPA07N60C3	IPA60R600E6				
0.38 Ω	SPD11N60C3	IPD60R380C6	SPB11N60C3	IPB60R380C6	SPP11N60C3	IPP60R380E6	SPA11N60C3	IPA60R380E6	SPI11N60C3	IPI60R380C6		
0.28 Ω			SPB15N60C3	IPB60R280C6	SPP15N60C3	IPP60R280E6	SPA15N60C3	IPA60R280E6	SPI15N60C3	IPI60R280C6	SPW15N60C3	IPW60R280E6
0.19 Ω			SPB20N60C3	IPB60R190C6	SPP20N60C3	IPP60R190E6	SPA20N60C3	IPA60R190E6	SPI20N60C3	IPI60R190C6	SPW20N60C3	IPW60R190E6
0.16 Ω			SPB24N60C3	IPB60R160C6	SPP24N60C3	IPP60R160C6	SPA24N60C3	IPA60R160C6			SPW24N60C3	IPW60R160C6
0.10 Ω											SPW35N60C3	IPW60R099C6
0.07 Ω											SPW47N60C3	IPW60R070C6

CoolMOS™ 650V C6/E6 replacements for C3

$R_{DS(on)}$	TO-220		TO-220 FullPAK		TO-262 I²PAK		TO-247	
	C3 Original	E6 Replacement	C3 Original	E6 Replacement	C3 Original	C6 Replacement	C3 Original	C6 Replacement
0.60 Ω	SPP07N65C3	IPP65R600E6	SPA07N65C3	IPA65R600E6	SPI07N65C3	IPI65R600C6		
0.38 Ω	SPP11N65C3	IPP65R380E6	SPA11N65C3	IPA65R380E6	SPI11N65C3	IPI65R380C6		
0.28 Ω	SPP15N65C3	IPP65R280E6	SPA15N65C3	IPA65R280E6	SPI15N65C3	IPI65R280C6		
0.19 Ω	SPP20N65C3	IPP65R190E6	SPA20N65C3	IPA65R190E6	SPI20N65C3	IPI65R190C6	SPW20N65C3	IPW65R190C6
0.07 Ω							SPW47N65C3	IPW65R070C6 [1]

[1] Available Q4 2011

Order Number: B152-H9581-X-X-7600-DB2011-0011
Date: 08/2011

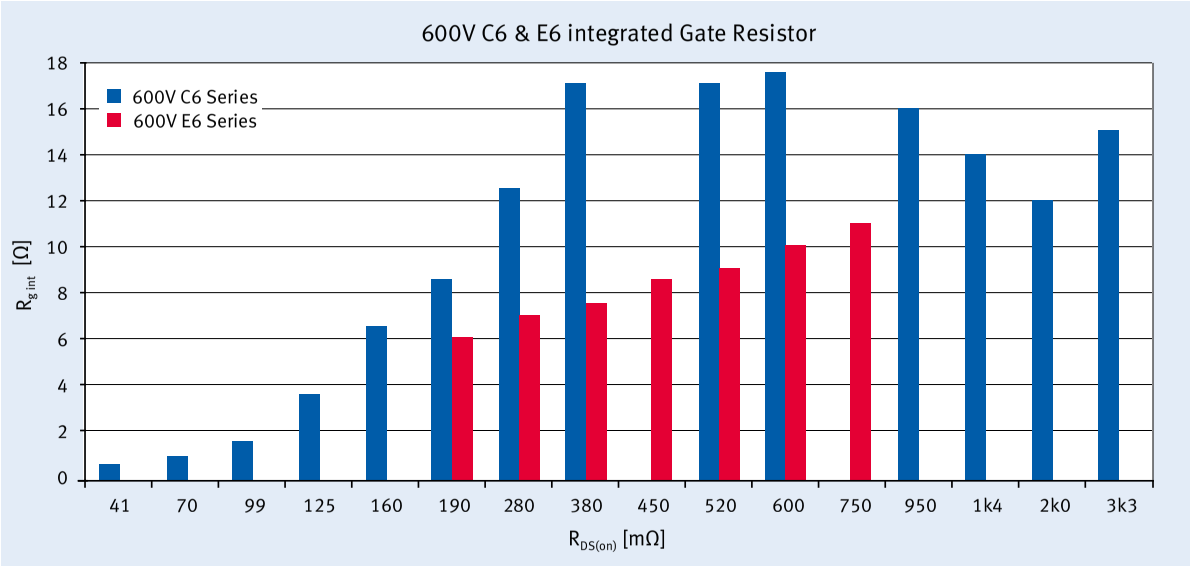
C6/E6 technology

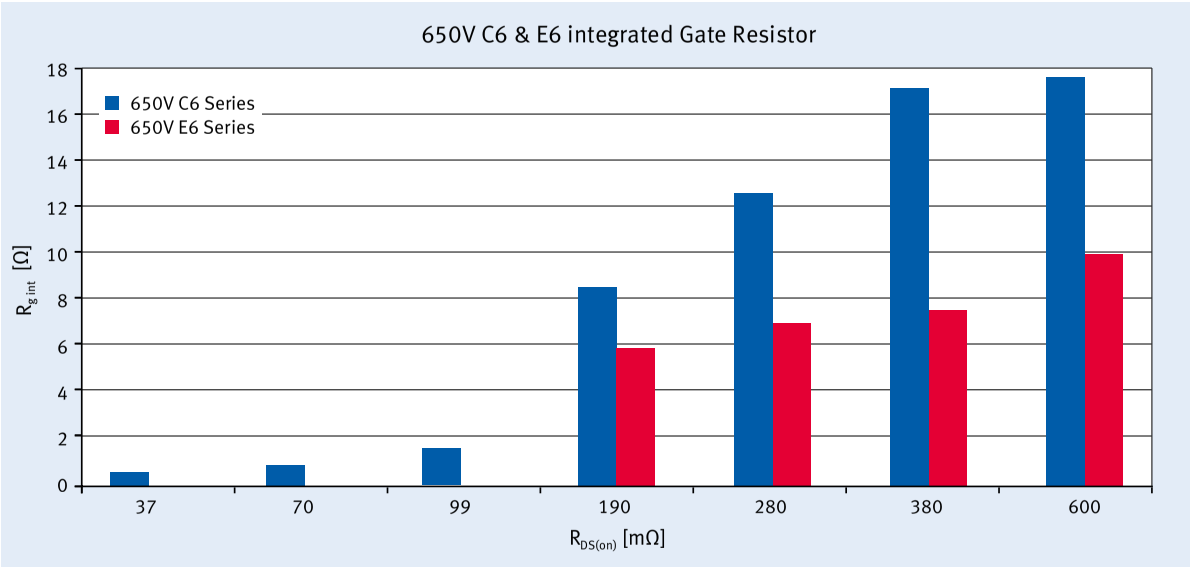
What is the Difference between the CoolMOS™ C6 & E6 series?

The C6 and E6 are exactly the same technology, but with a different integrated resistor value. Please see charts for details.

The C6 series was first launched and optimized for ease of use, however for certain Discontinuous Conduction Mode (DCM) applications it was realized that increasing pressures on efficiency required an improvement. By carefully reducing the integrated gate resistor value will improve efficiency in these applications.

The E6 only covers a smaller range of parts as its specifically targeted for the above application, where there is no E6 range the C6 has already been fully optimized in terms of ease of use and efficiency.



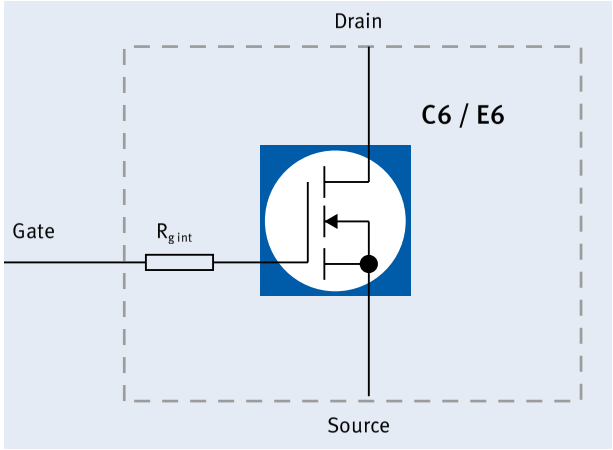


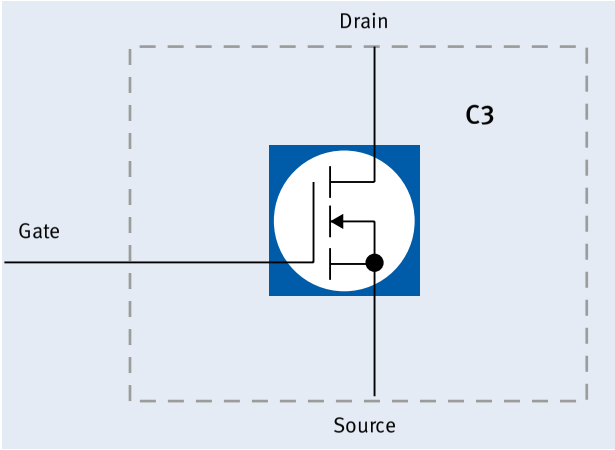
What is the Difference between the CoolMOS™ C3 & C6/E6 series?

CoolMOS™ C6/E6 series was designed as a direct replacement for the well established C3 series of CoolMOS™. The series are both designed as a general easy to use part, but improvements have also been made for the C6/E6 on the earlier C3 series.

So what are the differences:

- Better light load efficiency due to:
  - Lower Gate Charge value (Q_g) (see table for example)
  - Energy stored in the output capacitance, as this parameter, is decisive for the efficiency in high line or light load conditions E_{oss} (see table for example)
- Improved body diode control for use in hard commutation applications (i.e resonant topologies)
- Ease of driving the MOSFET by use of an integrated gate resistor
- More attractive price points



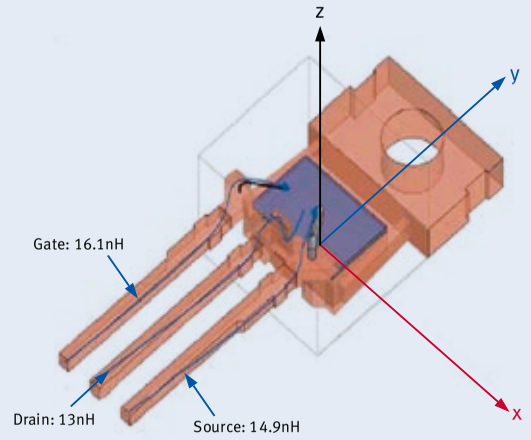


Specification	Symbol	IPW60R190C6	SPW20N60C3	Benefits
On-state resistance: maximum rating, 25 °C	$R_{DS(on)}$	190 mΩ	190 mΩ	-
Total Gate charge	Q_g	58 nC	87 nC	improves low load efficiency
Energy stored in output: capacitance @ 400V	E_{OSS}	5 µJ	10 µJ	Improves efficiency in hard switching applications
Body diode, reverse recovery charge	Q_{rr}	7 µC	11 µC	Improved body diode for soft switching applications
Body diode, di/dt	dI_f/dt	1400 A/µs	500 A/µs	

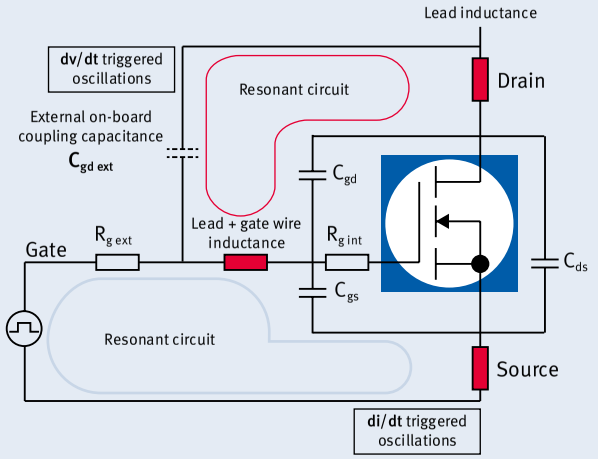
Ease of Use with integrated gate resistor:

- Helps self limiting di/dt and dv/dt behavior, beneficial in EMI and voltage overshoot.
- Reduces parasitic effects due to package and board layout. (see picture)
  - By adding in an integrated gate resistor this helps damp out resonant effects due to inherent package construction or board layout. This is more effective than an external gate resistor due to its positioning closer to the gate.

Disassembling a MOSFET package parasitics – TO-220



Parasitic L C influence: Damping effect of $R_{g\,int}$



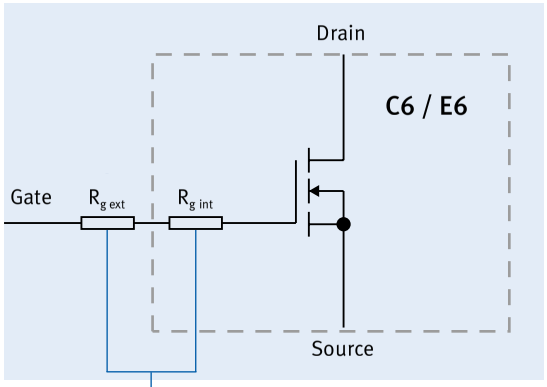
C3 vs. E6 efficiency comparison in a CCM-PFC stage → 190mΩ @ 130kHz

Gate Charge and Integrated Gate Resistor

CoolMOS™ C6 comes with an integrated gate resistor in order to achieve self-limiting di/dt and dv/dt characteristics. This integrated R_g allows fast turn on and turn off at normal operating current conditions but limits the di/dt and dv/dt in case of peak current conditions. This helps to improve performance in hard commutation applications (i.e. resonant topologies).

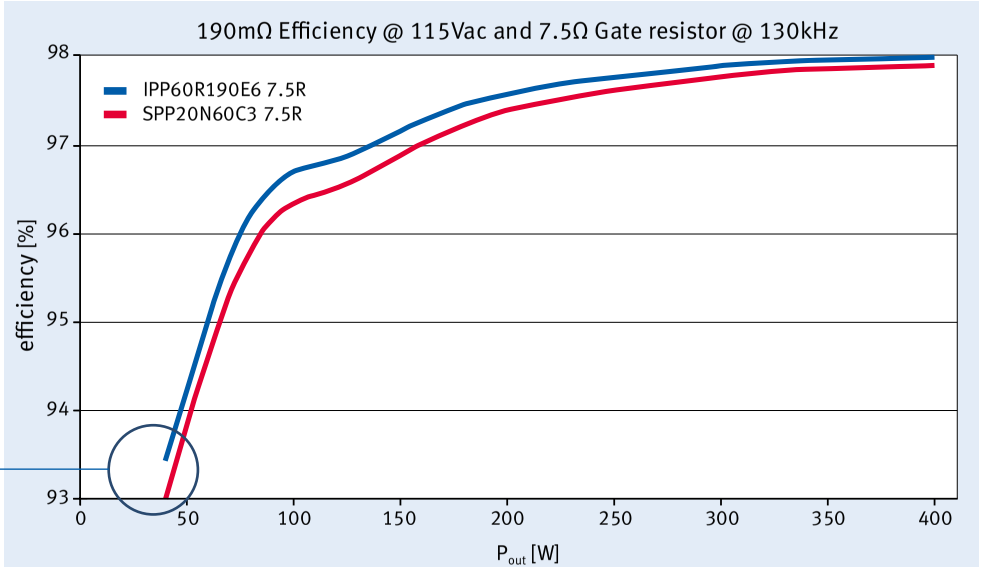
Due to low gate charge plus integrated gate resistors the gate current is relatively low; hence the use of low cost gate drivers is therefore possible.

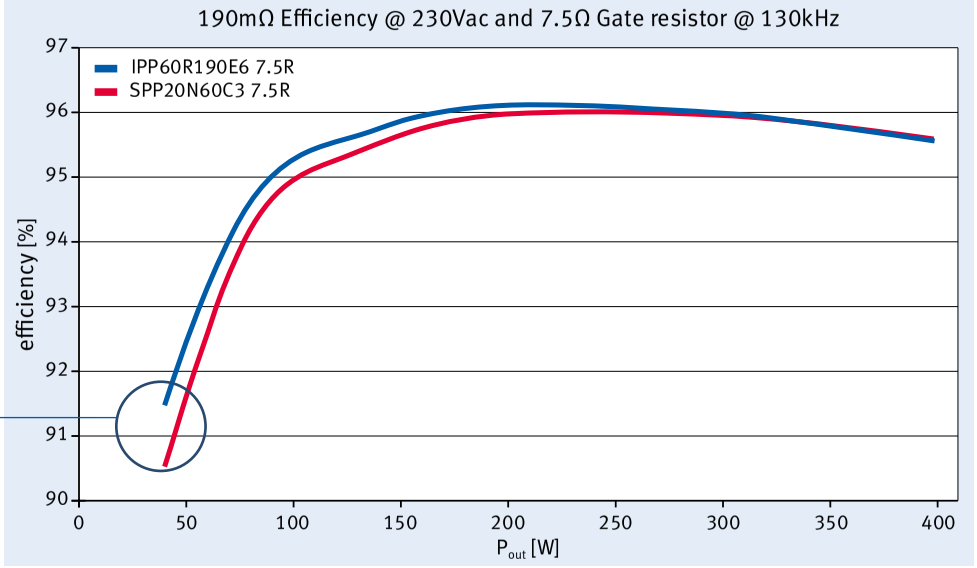
In combination with a relatively low total gate charge the losses dissipated in the driver are considerably lower as well. We recommand to use very small external gate resistors to achieve optimum efficiency across a wide range of load conditions.



Carefully choosing $R_{g\,ext}$ with $R_{g\,int}$ will give best efficiency

Significant light load efficiency improvement with E6 can then also be achieved compared to C3 due to the improved Q_g and Eoss values; as seen in example device table.





For further information please visit our website: www.infineon.com/c6e6