

How to select the right CoolMOS type

The selection of a right CoolMOS type for the particular design is a very complicated issue, that requires a multiple iteration approach. You can find detailed guidelines for this process in the **Fehler! Verweisquelle konnte nicht gefunden werden.**

These estimations were done on the basis of numerous measurements and theoretical analysis. The common design parameters for all topologies are:

Junction temperature of CoolMOS is 110°C,

Ambient temperature is 60°C.

The estimation includes three cooling conditions:

1. CoolMOS is operated without any external cooling. The heat dissipates only through the package itself.
2. CoolMOS SMD version device is on 50mm × 50mm × 1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70um thick) copper area for drain connection. PCB is vertical without blown air.
3. CoolMOS is operated on an external heat sink with thermal resistance of 10K/W.

The information presented here can help to make the pre-selection of the CoolMOS type and should not be considered as final design optimization.

1.1 Flyback Converter

The design parameters for the discontinuous current mode flyback converter are:

Input DC voltage is 380 volts, output voltage of the converter is 12 volts, reflected flyback voltage is 100 volts, ambient temperature is 60°C and junction temperature of CoolMOS is 110°C.

1.1.1 No external cooling

f [kHz]	Pout [W]			
	30	50	75	100
60	SPU03N60S5	SPP07N60S5	SPP11N60C2	
75	SPU03N60S5	SPP07N60C2		
100	SPU03N60S5	SPP07N60C2		
125	SPU04N60S5			
150	SPP07N60C2			
175	SPP07N60C2			
200				

Table 1: Recommended CoolMOS types

(CoolMOS is operated with no external heat sink, just stand-alone package. The thermal resistance is specified in the datasheet.)

1.1.2 SMD cooling

f [kHz]	Pout [W]					
	30	50	75	100	125	150
60	SPD03N60S5	SPD03N60S5	SPB07N60S5	SPB11N60C2	SPB20N60C2	
75	SPD03N60S5	SPD03N60S5	SPB07N60S5	SPB11N60C2	SPB20N60C2	
100	SPD03N60S5	SPB07N60S5	SPB07N60C2	SPB20N60C2		
		SPD04N60C2				
125	SPD03N60S5	SPB07N60S5	SPB07N60C2			
150	SPD03N60S5	SPB07N60C2	SPB11N60C2			
175	SPD03N60S5	SPB07N60C2				
200	SPD04N60S5	SPB07N60C2				

Table 2: Recommended CoolMOS types

(CoolMOS SMD version device uses the PCB copper area as heat sink. Thermal resistance is specified in the datasheet.)

1.1.3 External heat sink

f [kHz]	Pout [W]									
	30	50	75	100	125	150	175	200	225	250
60	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP07N60S5	SPP11N60S5	SPP20N60S5	SPP20N60S5	SPP20N60C2	SPP20N60C2
					SPP04N60C2	SPP07N60C2	SPP11N60C2	SPP11N60C2		
75	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP07N60S5	SPP20N60S5	SPP20N60S5	SPP20N60C2	SPP20N60C2	SPP20N60C2
				SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP11N60C2			
100	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP11N60S5	SPP20N60S5	SPP11N60C2	SPP20N60C2	SPP20N60C2	SPP20N60C2
				SPP04N60C2	SPP07N60C2	SPP11N60C2				
125	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP07N60S5	SPP20N60S5	SPP11N60C2	SPP20N60C2	SPP20N60C2	SPP20N60C2	
				SPP04N60C2	SPP07N60C2					
150	SPP03N60S5	SPP03N60S5	SPP03N60S5	SPP11N60S5	SPP20N60S5	SPP11N60C2	SPP20N60C2	SPP20N60C2		
				SPP07N60C2	SPP07N60C2					
175	SPP03N60S5	SPP03N60S5	SPP03N60S5	SPP20N60S5	SPP11N60C2	SPP11N60C2	SPP20N60C2			
				SPP07N60C2						
200	SPP03N60S5	SPP03N60S5	SPP03N60S5	SPP07N60C2	SPP11N60C2	SPP11N60C2				

Table 3: Recommended CoolMOS types

(CoolMOS is mounted on the external heat sink with the thermal resistance of 10K/W.)

1.2 Boost Converter (PFC)

The design parameters for the continuous-current mode boost converter (PFC) are:

Low AC input voltage is 100 volts, output DC voltage of the converter is 380 volts, ambient temperature is 60°C and junction temperature of CoolMOS is 110°C. Please note, that the total power losses in the MOSFET depend very strongly on the boost diode which is used. Due to this fact, this recommendation has been made using the assumption that the boost diode power losses are 50% of the conduction power losses of MOSFET.

Pout, [W]	Recommended Device	
	SMD cooling	External heat sink
50	SPD04N60C2	SPP02N60S5
100	SPB20N60C2	SPP04N60C2
150		SPP11N60C2
200		SPP20N60C2
250		SPP20N60C2
300		SPW47N60C2

Table 4: Recommended CoolMOS types

1.3 Single Transistor Forward Converter

The design parameters for the continuous-current mode single transistor forward converter are:

Input DC voltage is 380 volts, output voltage of the converter is 12 volts, ambient temperature is 60°C and junction temperature of CoolMOS is 110°C.

Pout, [W]	Recommended Device	
	SMD cooling	External heat sink
70	SPD06N80C2	SPP06N80C2
100	SPB17N80C2	SPP06N80C2
200		SPP06N80C2
300		SPP17N80C2

Table 5: Recommended CoolMOS types

1.4 Two Transistor Forward Converter

The design parameters for the continuous-current mode two transistor forward converter are:

Input DC voltage is 380 volts, output voltage of the converter is 12 volts, ambient temperature is 60°C and junction temperature of CoolMOS is 110°C.

1.4.1 No external cooling

f [kHz]	Pout [W]			
	30	50	75	100
60	SPU03N60S5	SPU03N60S5	SPP07N60C2	
75	SPU03N60S5	SPU04N60C2	SPP07N60C2	
100	SPU03N60S5	SPP07N60C2		
125	SPU03N60S5	SPP07N60C2		
150	SPU04N60C2			
175	SPP07N60C2			
200				

Table 6: Recommended CoolMOS types

(CoolMOS is operated with no external heat sink, just stand alone package. The thermal resistance is specified in the datasheet.)

1.4.2 SMD cooling

f [kHz]	Pout [W]						
	30	50	75	100	125	150	175
60	SPD03N60S5	SPD03N60S5	SPD04N60S5	SPB07N60S5	SPB07N60C2	SPB11N60C2	
75	SPD03N60S5	SPD03N60S5	SPB07N60S5 SPD04N60C2	SPB07N60S5	SPB07N60C2		
100	SPD03N60S5	SPD03N60S5	SPB07N60S5	SPB07N60C2			
125	SPD03N60S5	SPD04N60S5	SPB07N60C2				
150	SPD03N60S5	SPB07N60S5 SPD04N60C2	SPB07N60C2				
175	SPD03N60S5	SPB07N60C2	SPB07N60C2				
200	SPD03N60S5	SPB07N60C2					

Table 7: Recommended CoolMOS types

(CoolMOS SMD version device uses the PCB copper area as heat sink. Thermal resistance is specified in the datasheet.)

1.4.3 External heat sink

f [kHz]	Pout [W]									
	30	50	75	100	125	150	175	200	225	250
60	SPP02N60S5	SPP02N60S5	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP07N60S5	SPP11N60S5	SPP20N60S5
							SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP07N60C2
75	SPP02N60S5	SPP02N60S5	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP04N60S5	SPP07N60S5	SPP11N60S5	SPP20N60S5	SPP20N60S5
						SPP04N60C2	SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP11N60C2
100	SPP02N60S5	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP07N60S5	SPP20N60S5	SPP20N60S5	SPP11N60C2
						SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP20N60C2	SPP11N60C2
125	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP11N60S5	SPP20N60S5	SPP07N60C2	SPP11N60C2	SPP11N60C2
					SPP04N60C2	SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP11N60C2	SPP11N60C2
150	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP04N60S5	SPP20N60S5	SPP07N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2
					SPP04N60C2	SPP07N60C2	SPP07N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2
175	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP03N60S5	SPP20N60S5	SPP07N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2	
					SPP04N60C2	SPP07N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2	
200	SPP02N60S5	SPP02N60S5	SPP03N60S5	SPP04N60S5	SPP07N60C2	SPP07N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2	
					SPP04N60C2	SPP04N60C2	SPP11N60C2	SPP11N60C2	SPP11N60C2	

Table 8: Recommended CoolMOS types
(CoolMOS is mounted on the external heat sink with the thermal resistance of 10K/W.)

1.5 Full “H” Bridge Converter

We do not recommend to use CoolMOS transistors in hard switching PWM full bridge converter with re-circulating current (such as motor drives) without additional freewheeling diodes. The poor switching behavior of the MOSFETs body diode can lead to high power losses in this circuit. In conventional H-Bridge power supplies, where the body diode only clamps leakage inductance energy, performance will be satisfactory, and selection similar as for the Full Bridge ZVT converter. For new designs, the ZVT converter is recommended.

1.6 Full Bridge ZVT Converter

CoolMOS is very attractive device for full bridge Zero Voltage Transition topology due to its very low on-state resistance and strongly non linear output capacitance. Table 9 shows the CoolMOS recommended devices to be used in this complicated topology with external heat sink.

Pout, [W]	Recommended Device
	External heat sink
500...1000	SPP11N60C2
1000...2000	SPP20N60C2
2000...3000	SPW47N60C2

Table 9: Recommended CoolMOS devices

For questions on technology, delivery and prices please contact the Infineon Technologies Offices in Germany or the Infineon Technologies Companies and Representatives worldwide: see the address list on the last page or our webpage at

<http://www.infineon.com>

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