MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ C7

600V CoolMOS™ C7 Power Transistor
IPP60R060C7

Data Sheet

Rev. 2.0
Final

Power Management & Multimarket

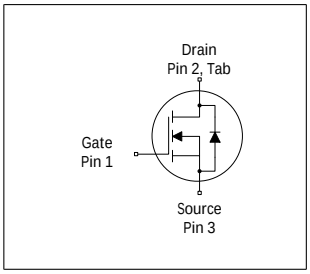
1 Description

TO-220

CoolMOS™ C7 is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies.

600V CoolMOS™ C7 series combines the experience of the leading SJ MOSFET supplier with high class innovation.

The 600V C7 is the first technology ever with $R_{DS(on)}$*A below 1Ohm*mm².



Features

- Suitable for hard and soft switching (PFC and high performance LLC)
- Increased MOSFET dv/dt ruggedness to 120V/ns
- Increased efficiency due to best in class FOM $R_{DS(on)}$*E_{oss} and $R_{DS(on)}$*Q_g
- Best in class $R_{DS(on)}$ /package
- Qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)

Benefits

- Increased economies of scale by use in PFC and PWM topologies in the application
- Higher dv/dt limit enables faster switching leading to higher efficiency
- Enabling higher system efficiency by lower switching losses
- Increased power density solutions due to smaller packages
- Suitable for applications such as server, telecom and solar
- Higher switching frequencies possible without loss in efficiency due to low Eoss and Qg

Applications

PFC stages and PWM stages (TTF, LLC) for high power/performance SMPS e.g. Computing, Server, Telecom, UPS and Solar.

Please note: For MOSFET paralleling the use of ferrite beads on the gate or separate totem poles is generally recommended.

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	60	mΩ
$Q_{g.typ}$	68	nC
$I_{D,pulse}$	135	A
$I_{D,continuous}$ @ T_j<150°C	54	A
E_{oss}@400V	8.1	µJ
Body diode di/dt	420	A/µs

Type / Ordering Code	Package	Marking	Related Links
IPP60R060C7	PG-TO 220	60C7060	see Appendix A

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2 Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D	- -	- -	35 22	A	T_C=25°C T_C=100°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	135	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	159	mJ	I_D=6.4A; V_{DD}=50V; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	0.80	mJ	I_D=6.4A; V_{DD}=50V; see table 10
Avalanche current, single pulse	I_{AS}	-	-	6.4	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	120	V/ns	V_{DS}=0...400V
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC (f>1 Hz)
Power dissipation	P_{tot}	-	-	162	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	°C	-
Operating junction temperature	T_j	-55	-	150	°C	-
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S	-	-	35	A	T_C=25°C
Diode pulse current[2]	$I_{S,pulse}$	-	-	135	A	T_C=25°C
Reverse diode dv/dt[3]	dv/dt	-	-	20	V/ns	V_{DS}=0...400V, I_{SD}<=9.9A, T_j=25°C see table 8
Maximum diode commutation speed	di_f/dt	-	-	420	A/µs	V_{DS}=0...400V, I_{SD}<=9.9A, T_j=25°C see table 8
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms}, T_C=25°C, t=1min

[1] Limited by $T_{j\,max}$.
[2] Pulse width t_p limited by $T_{j,max}$
[3] Identical low side and high side switch

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.772	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	leaded
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	-	°C/W	n.a.
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6mm (0.063 in.) from case for 10s

4 Electrical characteristics

at T_j=25°C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	600	-	-	V	V_{GS}=0V, I_D=1mA
Gate threshold voltage	$V_{(GS)th}$	3	3.5	4	V	V_{DS}=V_{GS}, I_D=0.8mA
Zero gate voltage drain current	I_{DSS}	- -	- 10	1 -	µA	V_{DS}=600, V_{GS}=0V, T_j=25°C V_{DS}=600, V_{GS}=0V, T_j=150°C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.052 0.115	0.060 -	Ω	V_{GS}=10V, I_D=15.9A, T_j=25°C V_{GS}=10V, I_D=15.9A, T_j=150°C
Gate resistance	R_G	-	0.8	-	Ω	f=1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	2850	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Output capacitance	C_{oss}	-	54	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Effective output capacitance, energy related[1)]	$C_{o(er)}$	-	101	-	pF	V_{GS}=0V, V_{DS}=0...400V
Effective output capacitance, time related[2)]	$C_{o(tr)}$	-	1050	-	pF	I_D=constant, V_{GS}=0V, V_{DS}=0...400V
Turn-on delay time	$t_{d(on)}$	-	15.5	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=15.9A, R_G=3.3Ω; see table 9
Rise time	t_r	-	11	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=15.9A, R_G=3.3Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	79	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=15.9A, R_G=3.3Ω; see table 9
Fall time	t_f	-	4	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=15.9A, R_G=3.3Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	14	-	nC	V_{DD}=400V, I_D=15.9A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	23	-	nC	V_{DD}=400V, I_D=15.9A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	68	-	nC	V_{DD}=400V, I_D=15.9A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	5.0	-	V	V_{DD}=400V, I_D=15.9A, V_{GS}=0 to 10V

[1)] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V
[2)] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.9	-	V	V_{GS}=0V, I_F=15.9A, T_j=25°C
Reverse recovery time	t_{rr}	-	390	-	ns	V_R=400V, I_F=15.9A, di_F/dt=100A/µs; see table 8
Reverse recovery charge	Q_{rr}	-	6	-	µC	V_R=400V, I_F=15.9A, di_F/dt=100A/µs; see table 8
Peak reverse recovery current	I_{rrm}	-	32	-	A	V_R=400V, I_F=15.9A, di_F/dt=100A/µs; see table 8

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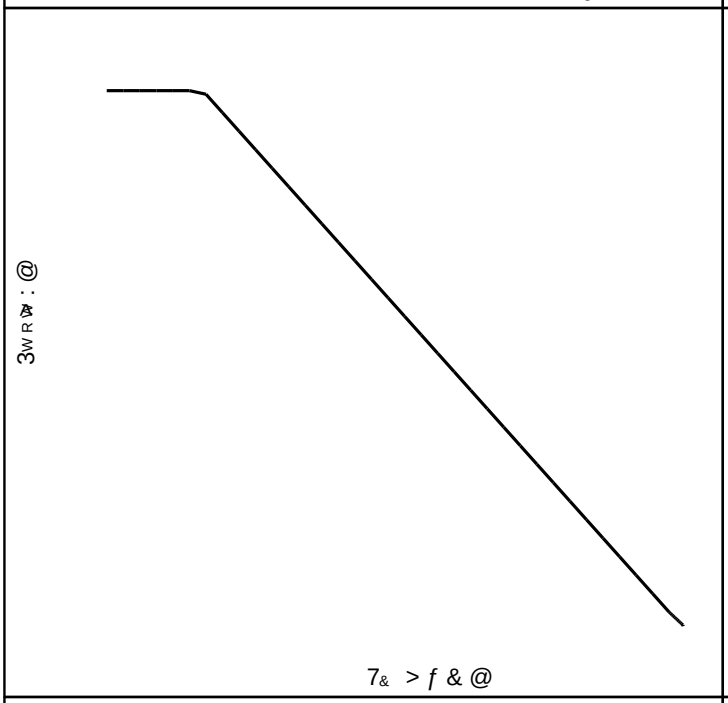

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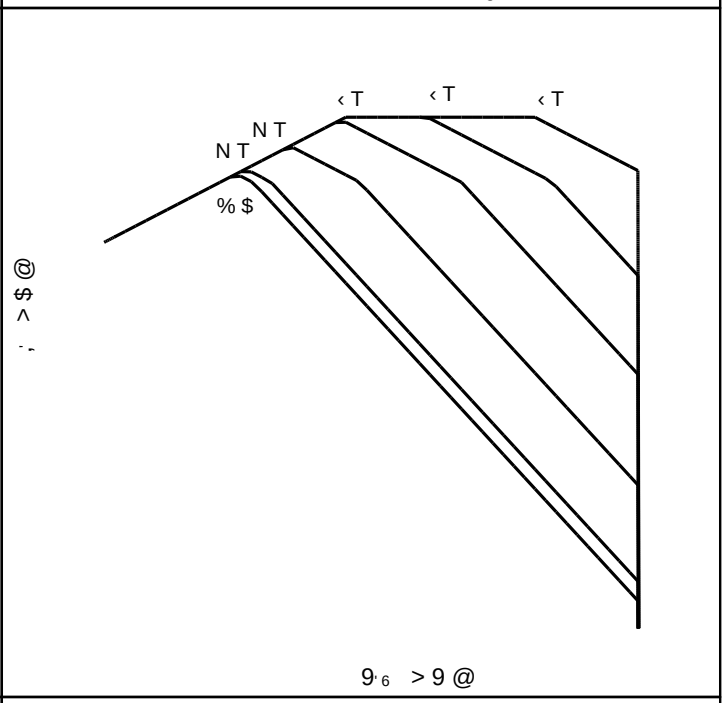

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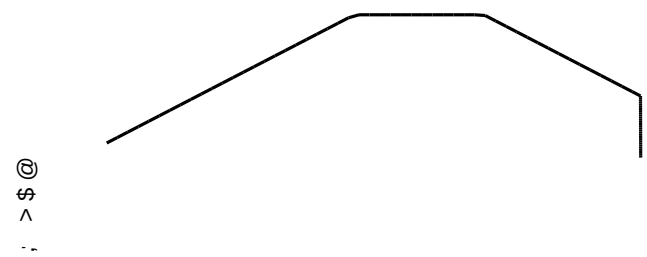

Revision History

IPP60R060C7

Revision: 2015-11-30, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2015-11-30	Release of final version

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erratum@infineon.com

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