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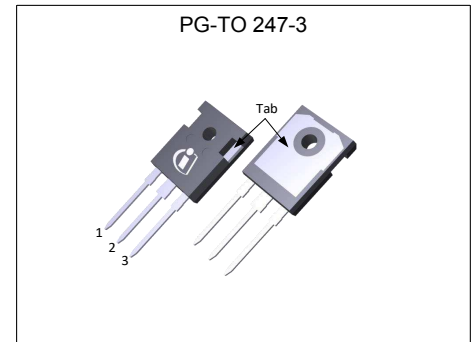
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MOSFET

650V CoolMOS™ CFD7 SJ Power Device

The latest 650 V CoolMOS™ CFD7 extends the voltage class offering of the CFD7 family and is a successor to the 650 V CoolMOS™ CFD2. Resulting from improved switching performance and excellent thermal behavior, 650 V CoolMOS™ CFD7 offers highest efficiency in resonant switching topologies, such as LLC and phase-shift-full-bridge (ZVS). As part of Infineon's fast body diode portfolio, this new product series blends all advantages of a fast switching technology together with superior hard commutation robustness. The CoolMOS™ CFD7 technology meets highest efficiency and reliability standards and furthermore supports high power density solutions.



Features

- Ultra-fast body diode
- 650V break down voltage
- Best-in-class $R_{DS(on)}$
- Reduced switching losses
- Low $R_{DS(on)}$ dependency over temperature

Benefits

- Excellent hard commutation ruggedness
- Extra safety margin for designs with increased bus voltage
- Enabling increased power density solutions
- Outstanding light load efficiency in industrial SMPS applications
- Improved full load efficiency in industrial SMPS applications
- Price competitiveness over previous CoolMOS™ families

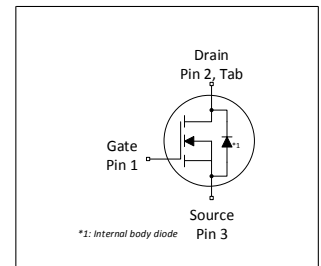
Potential applications

Suitable for Soft Switching topologies
Optimized for phase-shift full-bridge (ZVS), LLC Applications – Server, Telecom, EV Charging, Solar

Product validation

Fully qualified according to JEDEC for Industrial Applications

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



RoHS

Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(on),max}$	18	mΩ
$Q_{g,typ}$	234	nC
$I_{D,pulse}$	495	A
$E_{oss} @ 400V$	31.6	μJ
Body diode di_F/dt	1300	A/μs

Type / Ordering Code	Package	Marking	Related Links
IPW65R018CFD7	PG-TO247-3	65R018F7	see Appendix A

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1 Maximum ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	106 67	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	495	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	582	mJ	$I_D=8.3\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	2.91	mJ	$I_D=8.3\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche current, single pulse	I_{AS}	-	-	8.3	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	120	V/ns	$V_{DS}=0\dots400\text{V}$
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC ($f>1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	446	W	$T_C=25^\circ\text{C}$
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	-
Operating junction temperature	T_j	-55	-	150	$^\circ\text{C}$	-
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous diode forward current ¹⁾	I_S	-	-	106	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	495	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt	-	-	70	V/ns	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 58\text{A}$, $T_j=25^\circ\text{C}$ see table 8
Maximum diode commutation speed	di _F /dt	-	-	1300	A/ μs	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 58\text{A}$, $T_j=25^\circ\text{C}$ see table 8
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms} , $T_C=25^\circ\text{C}$, $t=1\text{min}$

¹⁾ Limited by $T_{j,max}$.

²⁾ Pulse width t_p limited by $T_{j,max}$

³⁾ Identical low side and high side switch with identical R_θ

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.28	°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

3 Electrical characteristics
 at $T_j=25^\circ\text{C}$, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	650	-	-	V	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{(GS)th}$	3.5	4	4.5	V	$V_{DS}=V_{GS}, I_D=2.91mA$
Zero gate voltage drain current ¹⁾	I_{DSS}	-	-	1	μA	$V_{DS}=650V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=650V, V_{GS}=0V, T_j=125^\circ C$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.015	0.018	Ω	$V_{GS}=10V, I_D=58.2A, T_j=25^\circ C$ $V_{GS}=10V, I_D=58.2A, T_j=150^\circ C$
Gate resistance	R_G	-	2.7	-	Ω	$f=1MHz, \text{open drain}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	11659	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Output capacitance	C_{oss}	-	167	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Effective output capacitance, energy related ²⁾	$C_{o(er)}$	-	396	-	pF	$V_{GS}=0V, V_{DS}=0...400V$
Effective output capacitance, time related ³⁾	$C_{o(tr)}$	-	4144	-	pF	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0...400V$
Turn-on delay time	$t_{d(on)}$	-	56	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=58.2A,$ $R_G=1.8\Omega; \text{see table 9}$
Rise time	t_r	-	19	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=58.2A,$ $R_G=1.8\Omega; \text{see table 9}$
Turn-off delay time	$t_{d(off)}$	-	198	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=58.2A,$ $R_G=1.8\Omega; \text{see table 9}$
Fall time	t_f	-	6	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=58.2A,$ $R_G=1.8\Omega; \text{see table 9}$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{GS}	-	67	-	nC	$V_{DD}=400V, I_D=58.2A, V_{GS}=0 \text{ to } 10V$
Gate to drain charge	Q_{Gd}	-	71	-	nC	$V_{DD}=400V, I_D=58.2A, V_{GS}=0 \text{ to } 10V$
Gate charge total	Q_g	-	234	-	nC	$V_{DD}=400V, I_D=58.2A, V_{GS}=0 \text{ to } 10V$
Gate plateau voltage	$V_{plateau}$	-	5.8	-	V	$V_{DD}=400V, I_D=58.2A, V_{GS}=0 \text{ to } 10V$

¹⁾ Maximum specification is defined by calculated six sigma upper confidence bound

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

³⁾ $C_{o(tr)}$ 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}	-	1.0	-	V	$V_{GS}=0V, I_F=58.2A, T_j=25^{\circ}C$
Reverse recovery time	t_{rr}	-	236	354	ns	$V_R=400V, I_F=58.2A, di_F/dt=100A/\mu s$; see table 8
Reverse recovery charge	Q_{rr}	-	2.30	4.60	μC	$V_R=400V, I_F=58.2A, di_F/dt=100A/\mu s$; see table 8
Peak reverse recovery current	I_{rrm}	-	15.0	-	A	$V_R=400V, I_F=58.2A, di_F/dt=100A/\mu s$; see table 8

4 Electrical characteristics diagrams

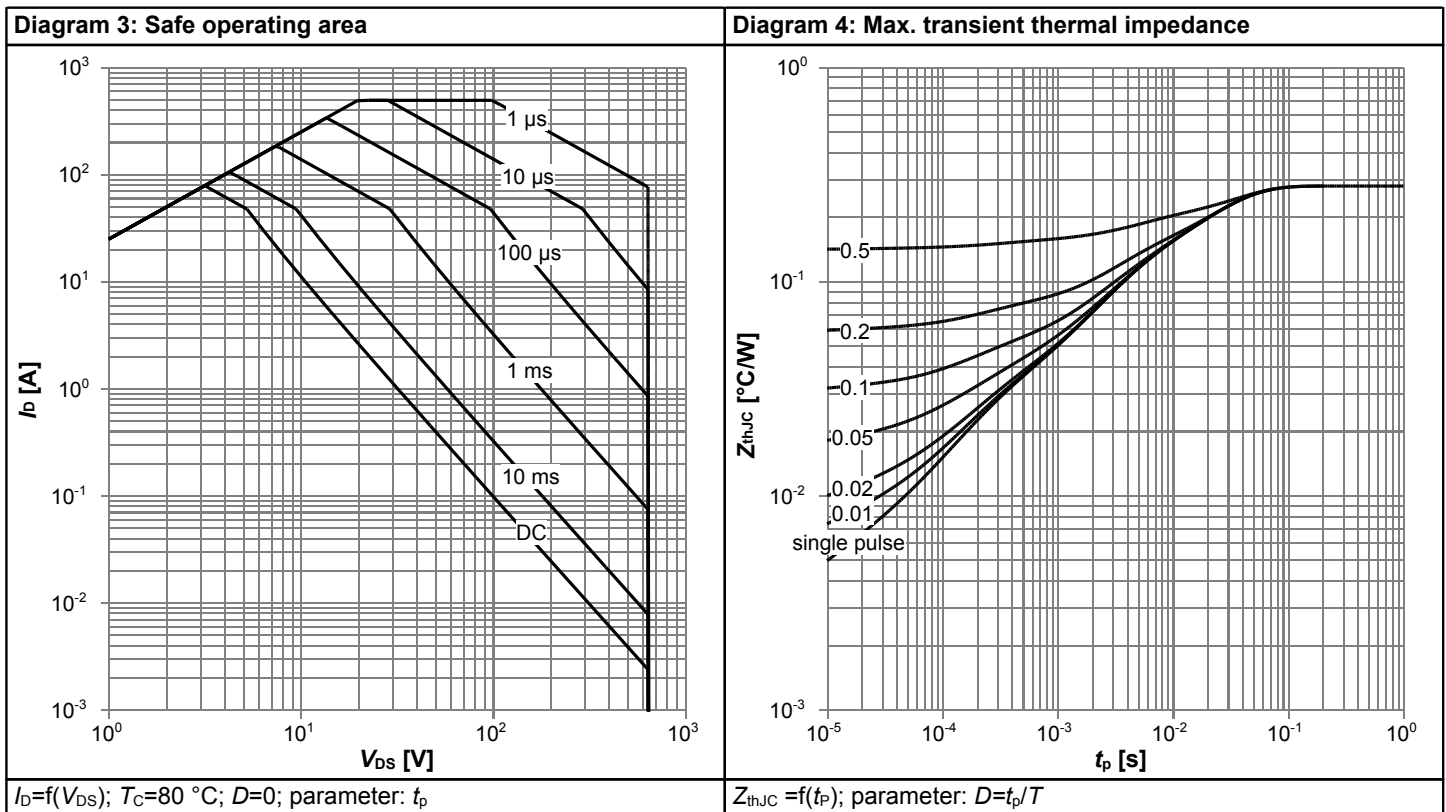
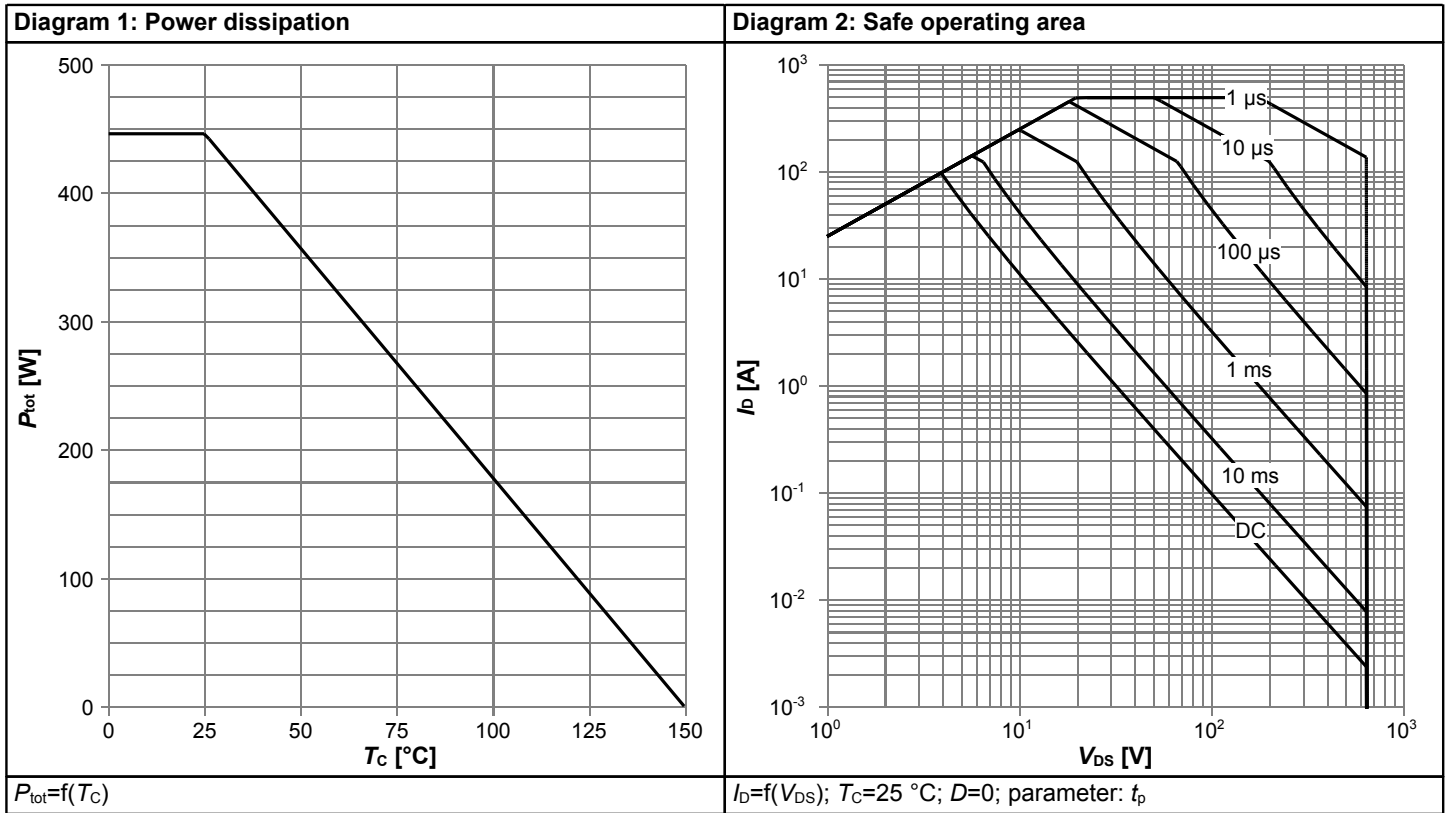
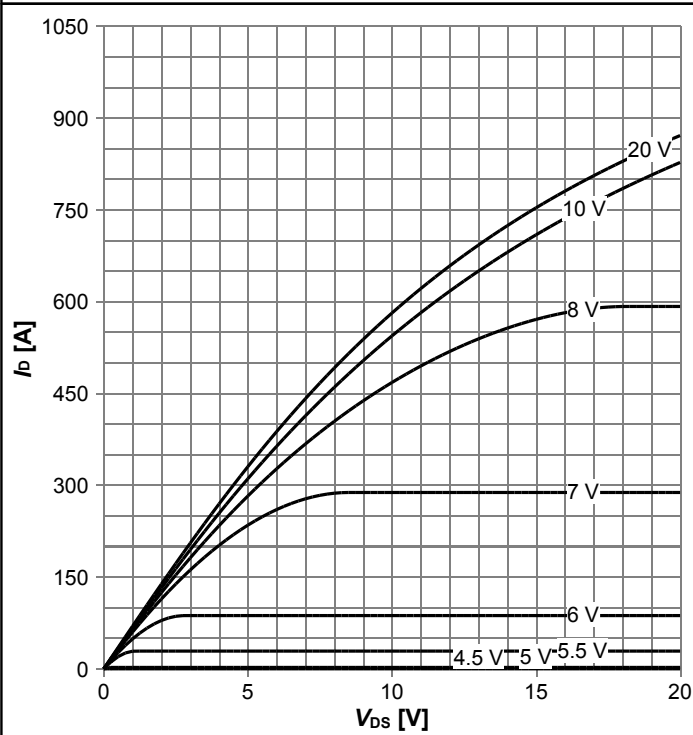
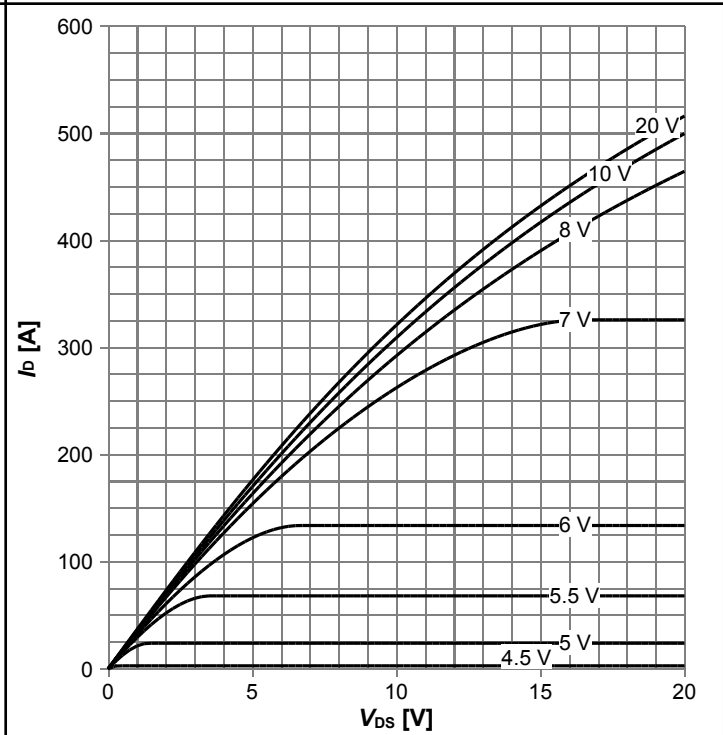


Diagram 5: Typ. output characteristics



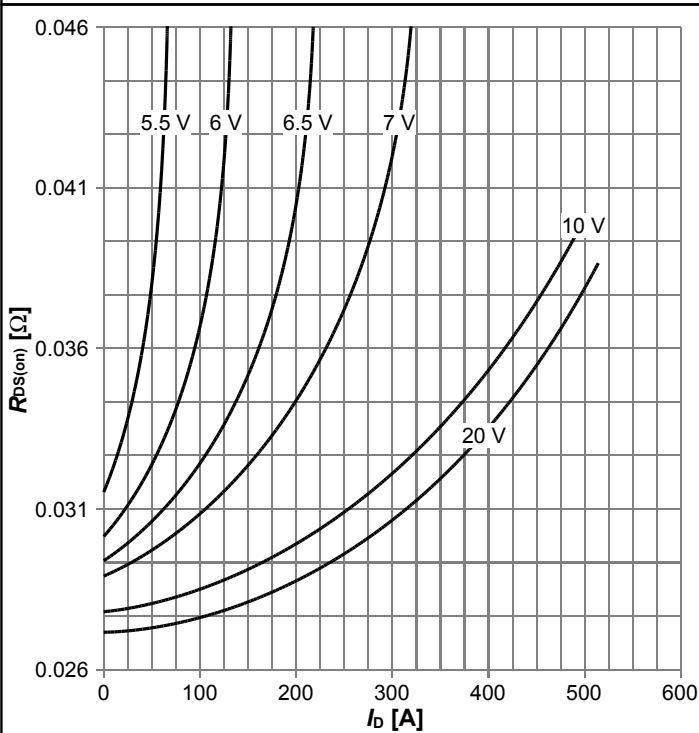
$I_D=f(V_{DS}); T_j=25\text{ °C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. output characteristics



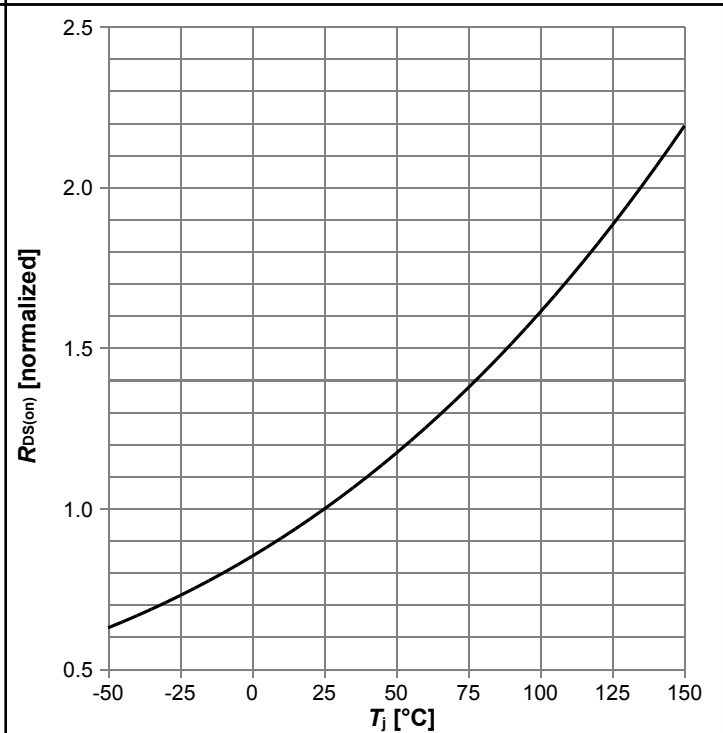
$I_D=f(V_{DS}); T_j=125\text{ °C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. drain-source on-state resistance



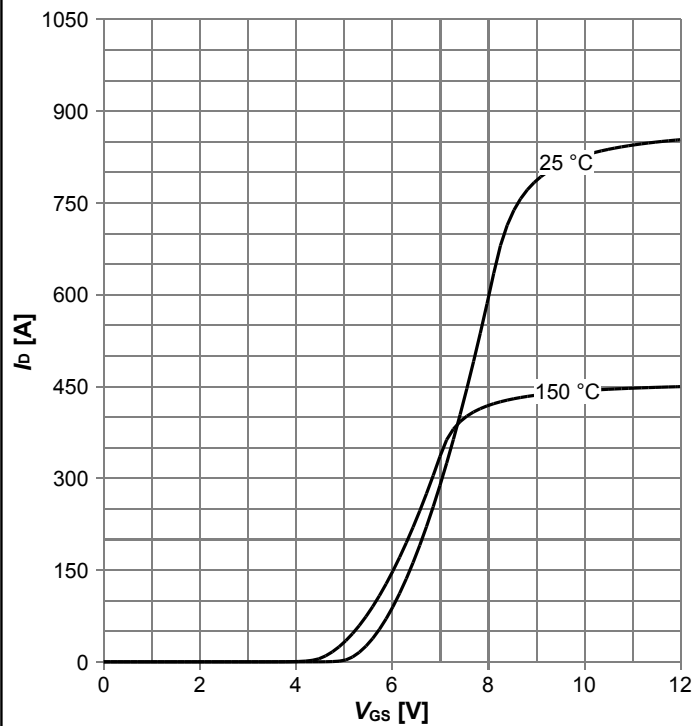
$R_{DS(on)}=f(I_D); T_j=125\text{ °C}; \text{parameter: } V_{GS}$

Diagram 8: Drain-source on-state resistance



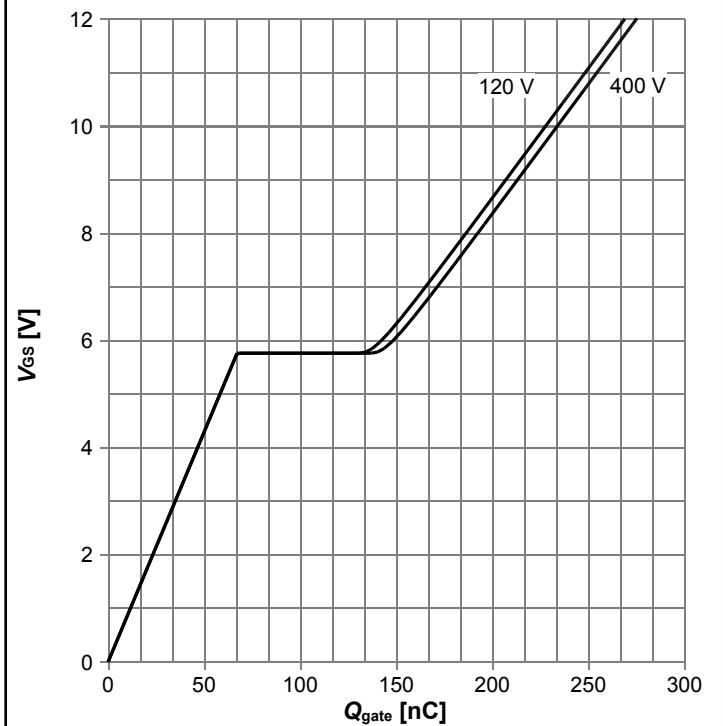
$R_{DS(on)}=f(T_j); I_D=58.2\text{ A}; V_{GS}=10\text{ V}$

Diagram 9: Typ. transfer characteristics



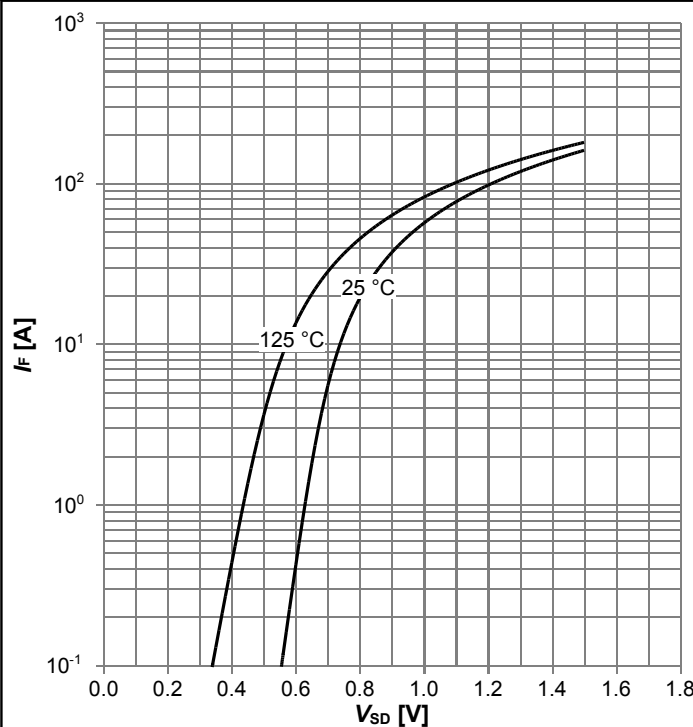
$I_D=f(V_{GS}); V_{DS}=20V; \text{parameter: } T_j$

Diagram 10: Typ. gate charge



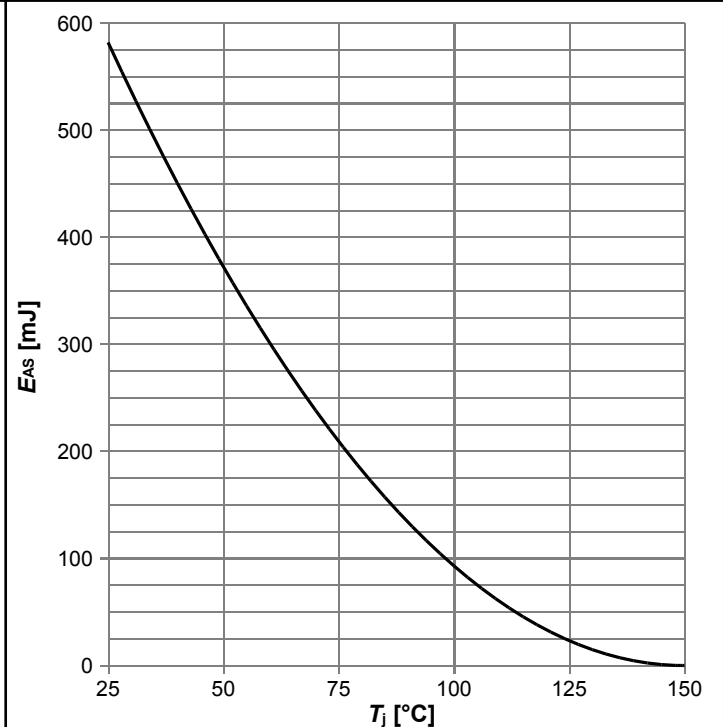
$V_{GS}=f(Q_{gate}); I_D=58.2 \text{ A pulsed}; \text{parameter: } V_{DD}$

Diagram 11: Forward characteristics of reverse diode



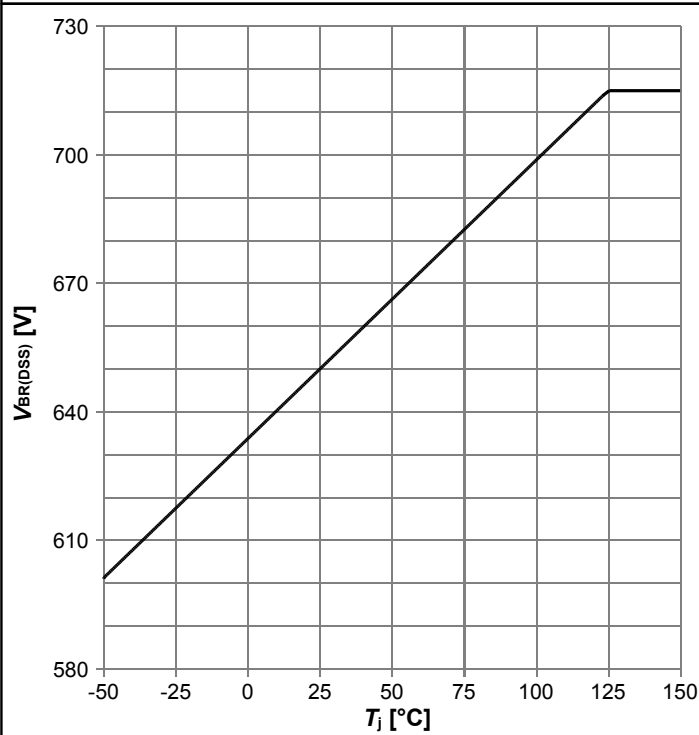
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 12: Avalanche energy



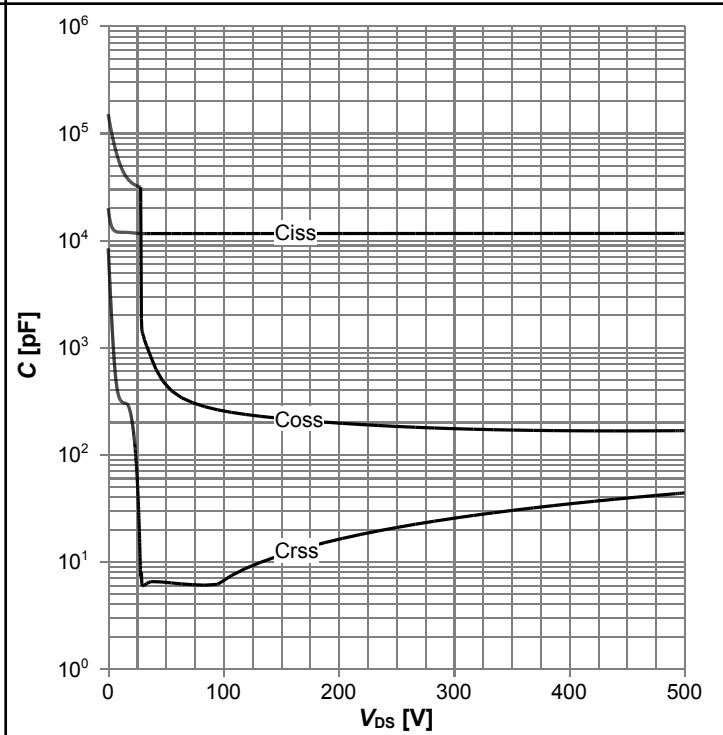
$E_{AS}=f(T_j); I_D=8.3 \text{ A}; V_{DD}=50 \text{ V}$

Diagram 13: Drain-source breakdown voltage



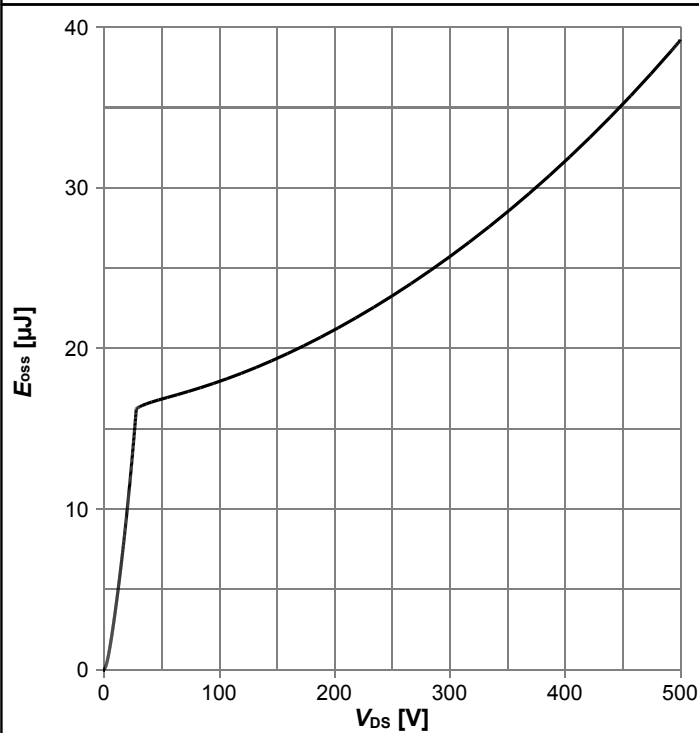
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$

Diagram 14: Typ. capacitances



$C=f(V_{DS}); V_{GS}=0\text{ V}; f=250\text{ kHz}$

Diagram 15: Typ. Coss stored energy



$E_{oss}=f(V_{DS})$

5 Test Circuits

Table 8 Diode characteristics

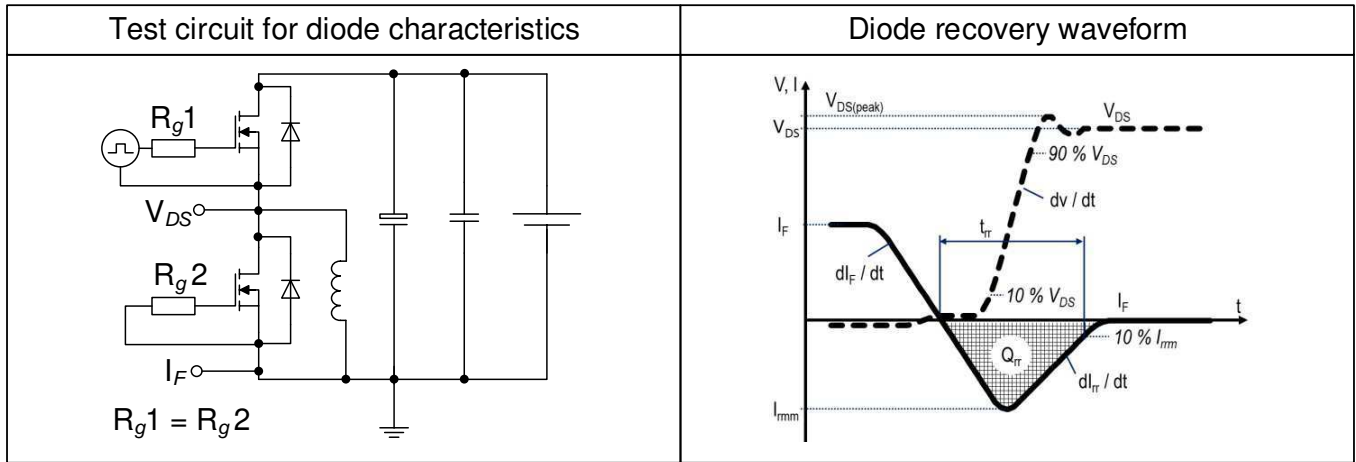


Table 9 Switching times

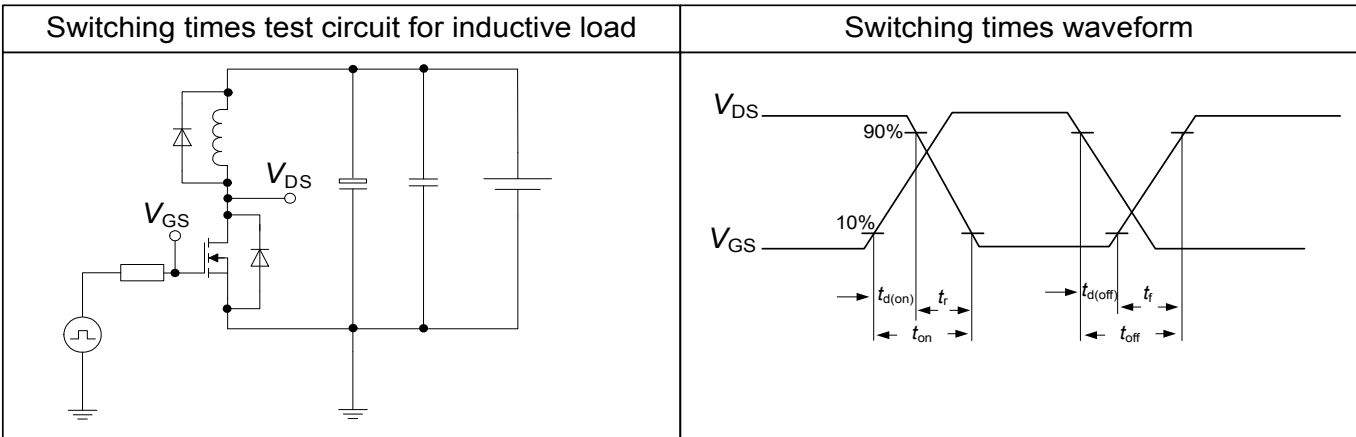
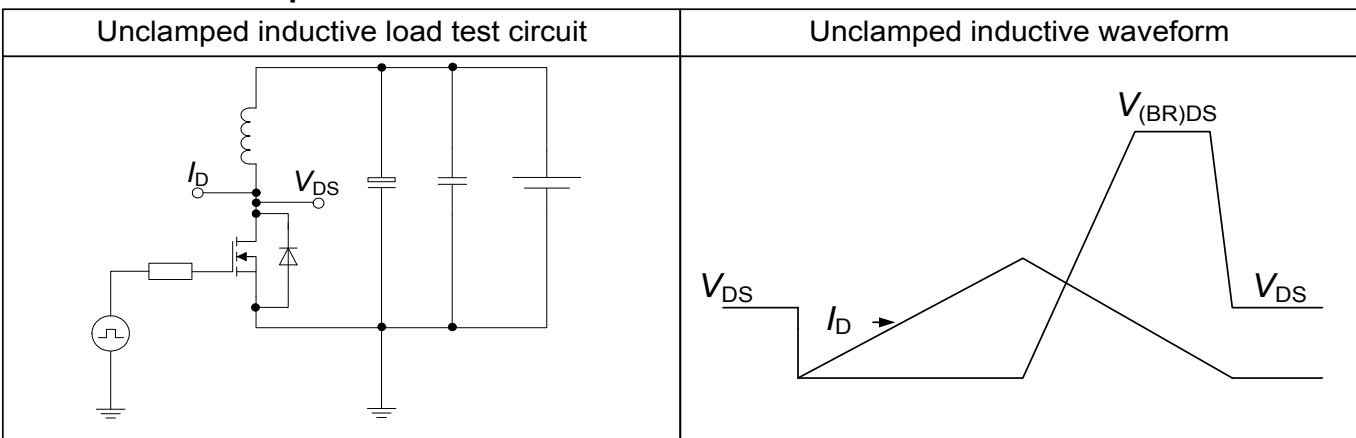
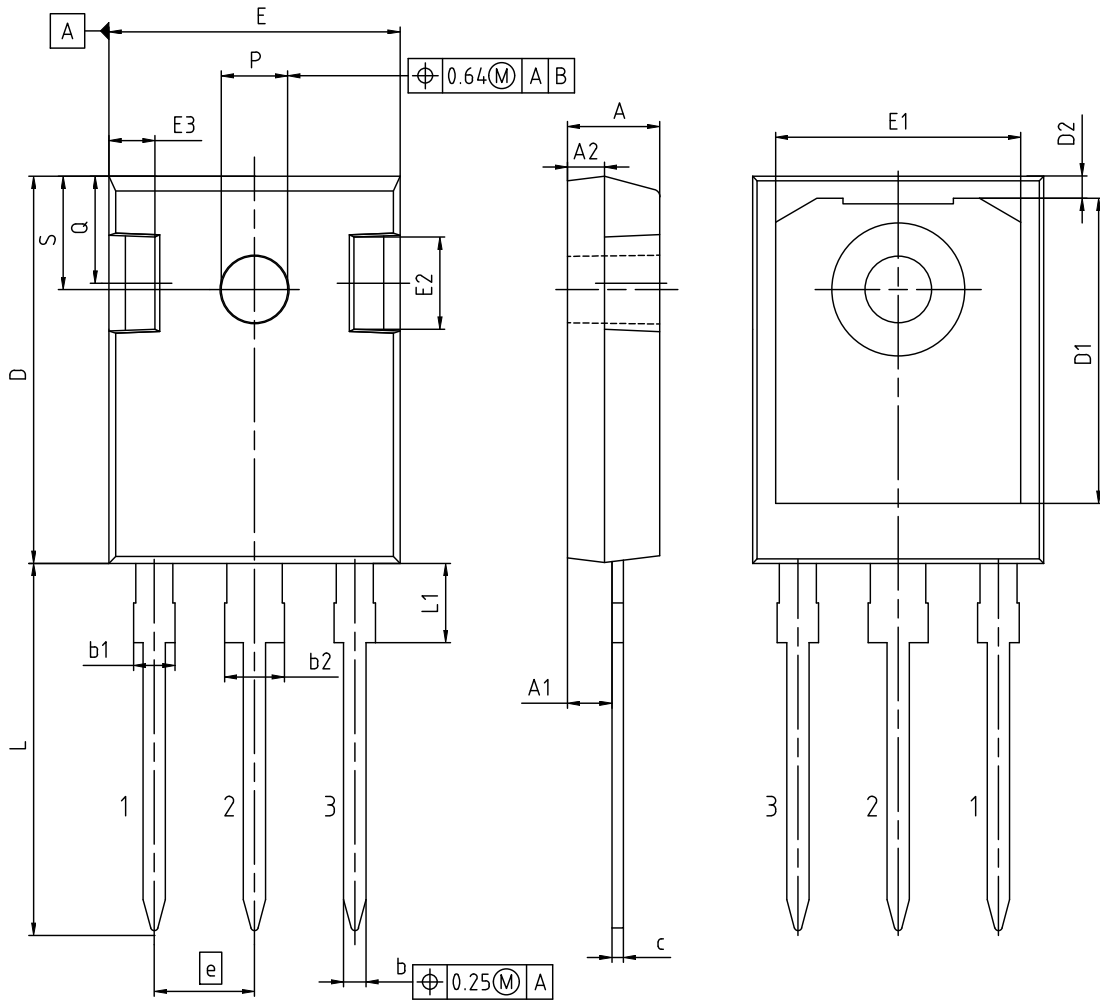


Table 10 Unclamped inductive load



6 Package Outlines



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

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Figure 1 Outline PG-TO247-3, dimensions in mm

7 Appendix A

Table 11 Related Links

- IFX CoolMOS CFD7 650V Webpage: www.infineon.com
- IFX CoolMOS CFD7 650V application note: www.infineon.com
- IFX CoolMOS CFD7 650V simulation model: www.infineon.com
- IFX Design tools: www.infineon.com

Revision History

IPW65R018CFD7

Revision: 2021-04-19, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2021-04-19	Release of final version

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