Maximum Ratings / Höchstzulässige Werte P722-F64 600V/30A

Parameter	Condition		Symbol	Datasheet values max.	Unit
DC link Capacitor					
Max.DC voltage		Tc=25°C	UMAX	500	V
Transistor H-bridge(MOSFET)					
Drain to source breakdown voltage			Vbr	**600**	V
DC drain current	Tj=Tjmax	Th=80°C, Tc=80°C	Id	**25**	A
Pulsed drain current	Tj=Tjmax tp=1ms	Th=80°C, Tc=80°C	Idpuls	**115**	A
Avalanche energy, single pulse	ID=10A	VDD=50V	E_{AS}	1800	mJ
Avalanche energy, repetitive	ID=20A	VDD=50V	E_{AR}	1	mJ
Avalanche current, repetitive	Tj=Tjmax		I_{AR}	20	A
Drain source voltage slope	Is=46A Tj=125°C	VDS=480V	dv/dt	80	V/ns
Power dissipation	Tj=Tjmax	Th=80°C, Tc=80°C	Ptot	**103**	W
Gate-source peak voltage			Vgs	**±20**	V
max. Chip temperature			**Tjmax**	**150**	°C
Diode H-bridge(BODY DIODE)					
DC forward current	Tj=Tjmax	Th=80°C, Tc=80°C	I_F	52	A
Repetitive peak forward current	tp limited by Tj max		I_{FRM}	115	A
Reverse diode dv/dt	Is=46A Tj=125°C	VDS=480V	dv/dt	40	V/ns
Max. diode commutation speed	Is=46A Tj=125°C	VDS=480V	di/dt	600	A/us
Power dissipation per Diode	Tj=Tjmax	Th=80°C Tc=80°C	P_{tot}	103	W

Maximum Ratings / Höchstzulässige Werte P722-F64 600V/30A

Parameter	Condition	Symbol	Datasheet values max.	Unit
Thermal properties				
Storage temperature		T_{stg}	-40…+125	°C
Operation temperature		T_{op}	-40…+125	°C
Insulation properties				
Insulation voltage	t=1min	V_{is}	4000	Vdc
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Additional notes and remarks:

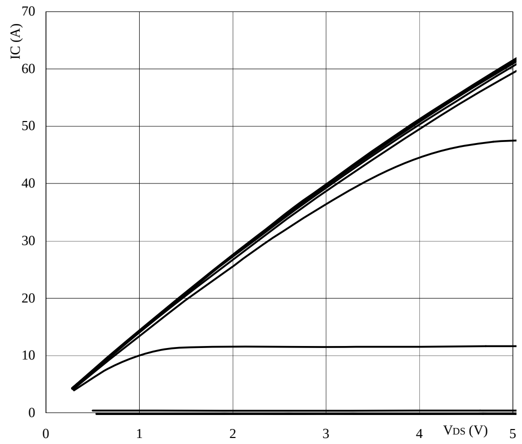
** Allowed number of short circuits must be less than 1000 times, and time duration between short circuits should be more than 1 second!*

Characteristic values/ Charateristische Werte P722-F64 600V P722

Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Transistor H-bridge(MOSFET)										
Avalanche breakdown voltage	$V_{(BR)DS}$			0		46		700		V
Static drain to source ON resistance	$R_{ds(on)}$	Tj=25°C Tj=125°C		10	400	30		0,074 0,16	0,09	Ohm
Gate threshold voltage	$V_{(GS)th}$	Tj=25°C Tj=125°C		VGS=VDS		2.9m	3	4	5	V
Drain to Source breakdown voltage	$V_{(BR)DSS}$	Tj=25°C Tj=125°C		0		0.25m	600			V
Drain to Source Leakage Current	I_{dss}	Tj=25°C Tj=125°C		0	600			6		uA
Gate-emitter leakage current	I_{GES}	Tj=25°C Tj=125°C		20	0				100	nA
Turn On Delay Time	$t_{d(ON)}$	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		40,5		ns
Rise Time	t_r	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		16,3		ns
Turn off delay time	$t_{d(OFF)}$	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		168,5		ns
Fall time	t_f	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		39,3		ns
Total gate charge	Q_g	Tj=25°C Tj=125°C		10	480	46		250		nC
Gate to source charge	Q_{gs}	Tj=25°C Tj=125°C		10	480	46		55		nC
Gate to drain charge	Q_{gd}	Tj=25°C Tj=125°C		10	480	46		130		nC
Turn-on energy loss per pulse	E_{on}	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		4,4		mWs
Turn-off energy loss per pulse	E_{off}	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	10	400	30		0,07		mWs
Input capacitance	C_{iss}	Tj=25°C Tj=125°C	f=1 MHz	0	25			7,7		nF
Output capacitance	C_{oss}	Tj=25°C Tj=125°C	f=1 MHz	0	25			2,2		nF
Reverse transfer capacitance	C_{ies}	Tj=25°C Tj=125°C	f=1 MHz	0	25			0,077		nF
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal grease thickness≤50um					0,68		K/W
Diode H-bridge(BODY DIODE)										
Diode forward voltage	V_F	Tj=25°C Tj=125°C				30	0,6	1 0,9	1,8	V
Peak reverse recovery current	I_{RM}	Tj=25°C Tj=125°C	Rgon=4 Ω	10	400	30		132,6		A
Reverse recovery time	t_{rr}	Tj=25°C Tj=125°C	Rgon=4 Ω	10	400	30		117		ns
Reverse recovered charge	Q_{rr}	Tj=25°C Tj=125°C	Rgon=4 Ω	10	400	30		9,7		uC
Reverse recovered energy	R_{thJH}	Tj=25°C Tj=125°C	Rgon=4 Ω	10	400	30		0,65		mWs
Thermal resistance chip to heatsink per chip Thermal resistance chip to case per chip			Thermal grease thickness≤50um					0,68		K/W K/W
NTC-Thermistor **NTC-Widerstand**										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				20,9	22	23,1	kΩ
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=1503Ω					2,9		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	Tj=25°C						210		mW
B-value B-Wert	$B_{(25/100)}$	Tj=25°C	Tol. ±3%					3980		K

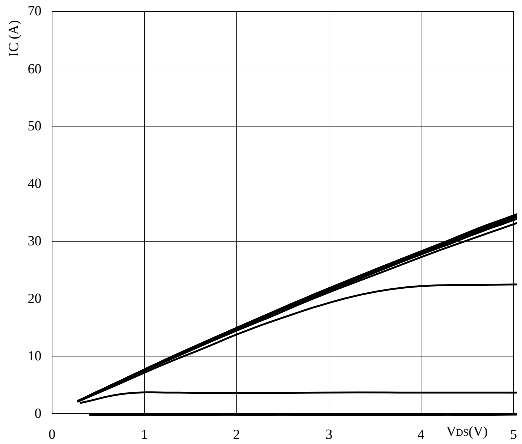
Output inverter

Figure 1. Typical output characteristics
Output inverter MOSFET
Ic= f(VDS)



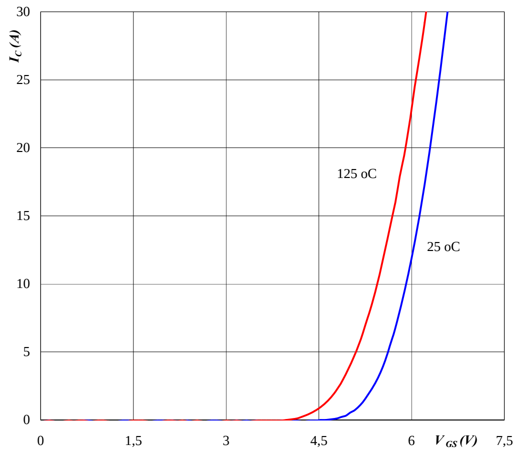
parameter: tp = 250 us Tj = 25 °C
VGS parameter: from: 2 V to 12 V
in 1 V steps

Figure 2. Typical output characteristics
Output inverter MOSFET
Ic= f(VDS)



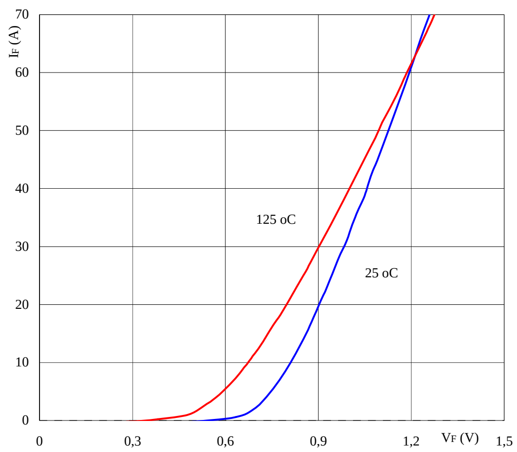
parameter: tp = 250 us Tj = 125 °C
VGS parameter: from: 2 V to 12 V
in 1 V steps

Figure 3. Typical transfer characteristics
Output inverter MOSFET
Ic= f(VGS)



parameter: tp = 250 us VDS = 10 V

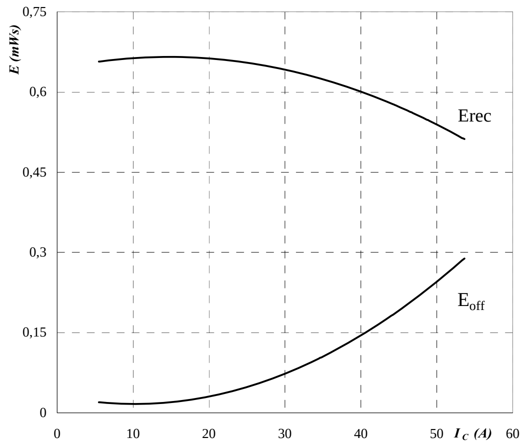
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter MOSFET IF=f(VF)



parameter: tp = 250 us

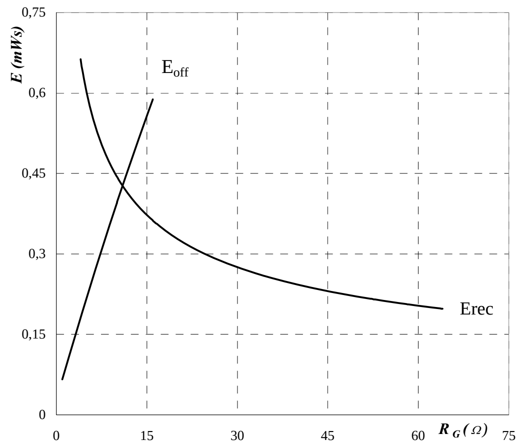
Output inverter

Figure 5. Typical switching energy losses as a function of collector current
Output inverter MOSFET
E = f (Ic)



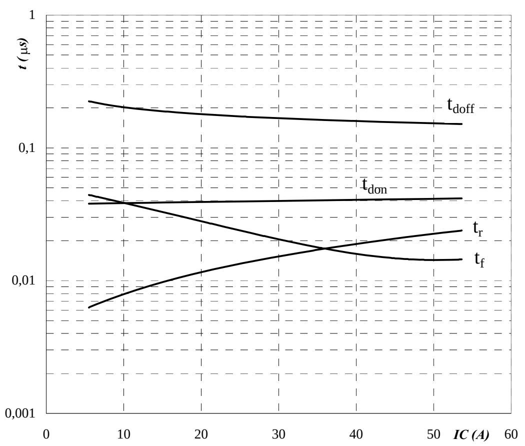
inductive load, Tj = 125 °C
VDS = 400 V
VGS= 10 V
Rgon= 4 Ω
Rgoff= 1 Ω

Figure 6. Typical switching energy losses as a function of gate resistor
Output inverter MOSFET
E = f (RG)



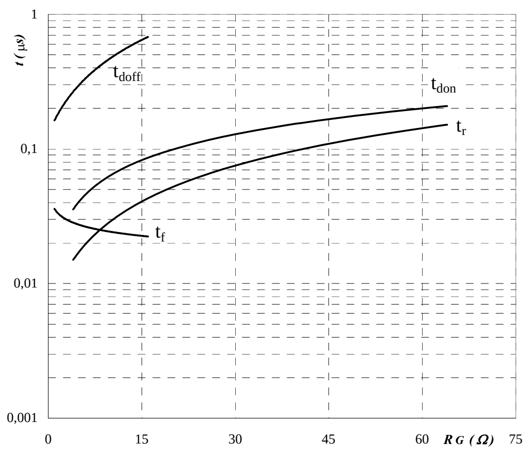
inductive load, Tj = 125 °C
VDS = 400 V
VGS= 10 V
Ic = 30 A

Figure 7. Typical switching times as a function of collector current
Output inverter MOSFET
t = f (Ic)



inductive load, Tj = 125 °C
VDS = 400 V
VGS= 10 V
Rgon= 4 Ω
Rgoff= 1 Ω

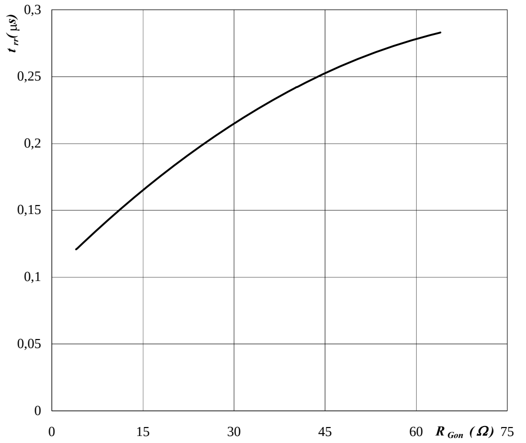
Figure 8. Typical switching times as a function of gate resistor
Output inverter MOSFET
t = f (RG)



inductive load, Tj = 125 °C
VDS = 400 V
VGS= 10 V
Ic = 30 A

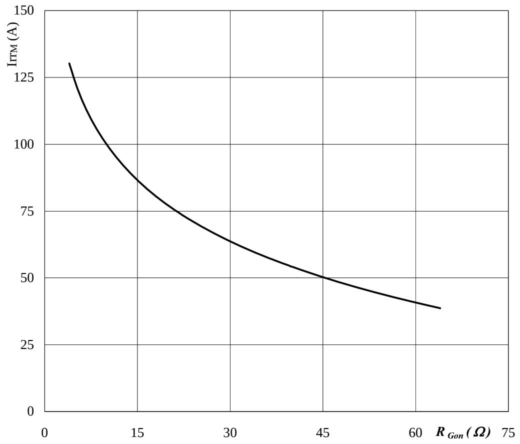
Output inverter

Figure 9. Typical reverse recovery time as a function of IGBT turn on gate resistor
Output inverter MOSFET FRED diode
t_{rr} = f (Rgon)



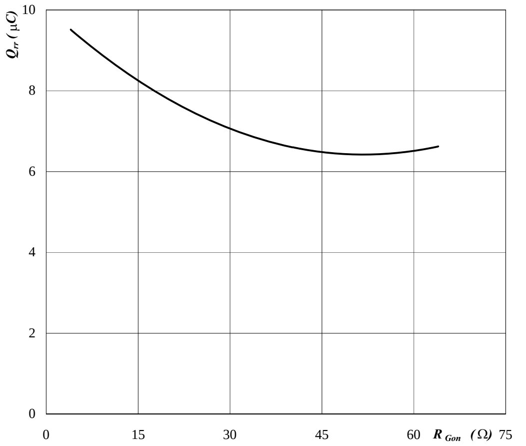
Tj = 125 °C
V_R = 400 V
I_F = 30 A
V_{GS} = 10 V

Figure 10. Typical reverse recovery current as a function of IGBT turn on gate resistor
Output inverter MOSFET FRED diode
I_{RRM} = f (Rgon)



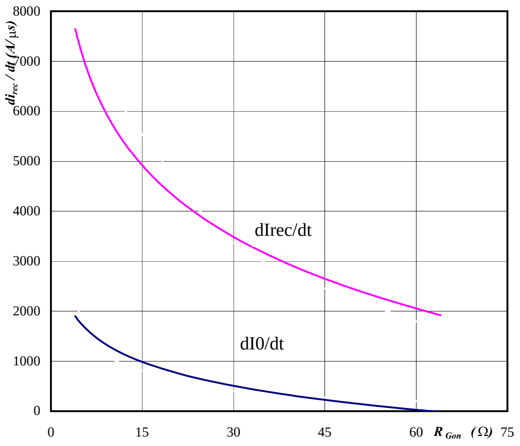
Tj = 125 °C
V_R = 400 V
I_F = 30 A
V_{GS} = 10 V

Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor
Output inverter MOSFET FRED diode
Q_{rr} = f (Rgon)



Tj = 125 °C
V_R = 400 V
I_F = 30 A
V_{GS} = 10 V

Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter MOSFET FRED diode
dI0/dt,dIrec/dt= f (Rgon)

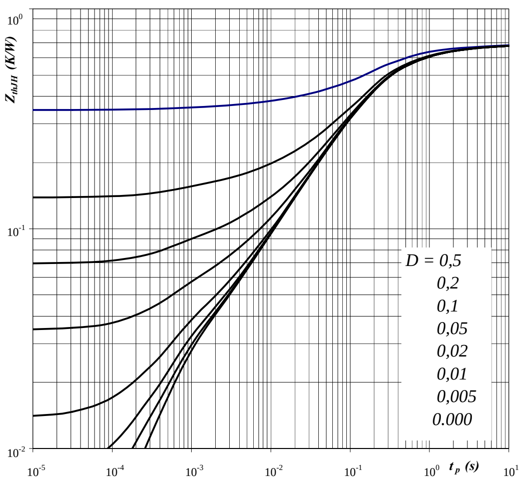


Tj = 125 °C
V_R = 400 V
I_F = 30 A
V_{GS} = 10 V

Output inverter

Figure 13. MOSFET transient thermal impedance as a function of pulse width

ZthJH = f(tp)



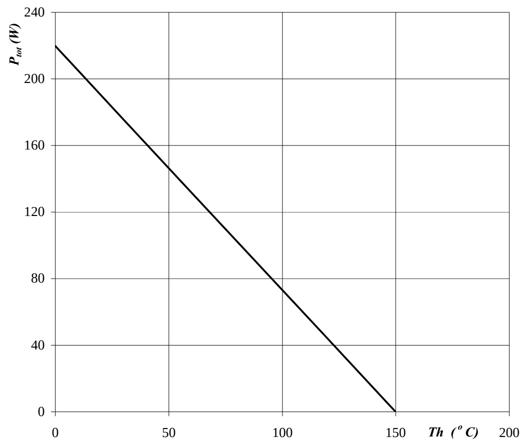
Parameter: D = tp / T RthJH= 0,68 K/W

MOSFET thermal model values

R (C/W)	Tau (s)
0,03	1,4E+01
0,12	1,4E+00
0,34	2,1E-01
0,13	6,0E-02
0,05	8,8E-03
0,02	7,2E-04

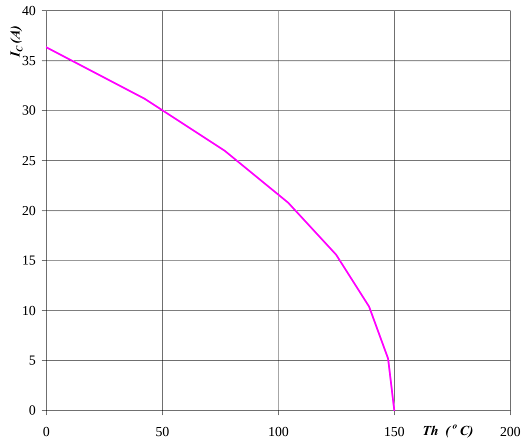
Output inverter

Figure 14. Power dissipation as a function of heatsink temperature
Output inverter MOSFET
Ptot = f (Th)



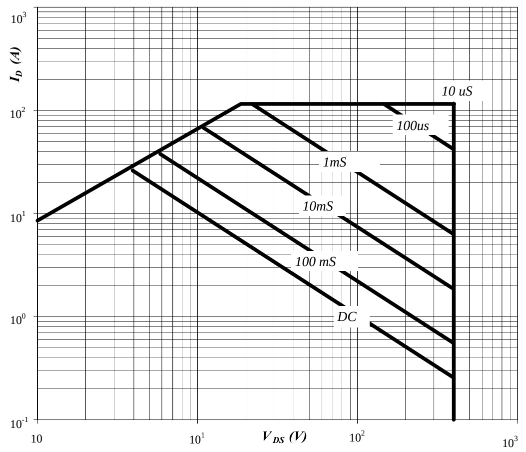
parameter: Tj= 150 ºC

Figure 15. Collector current as a function of heatsink temperature
Output inverter MOSFET
Ic = f (Th)



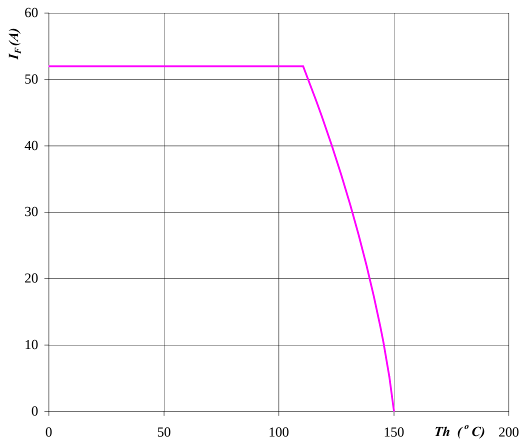
parameter: Tj= 150 ºC
VGS= 10 V

Figure 16. Safe operating area function of drain-surce voltage
Output inverter MOSFET
I_D = f (V_{DS})



Parameter: D = 0
Th = 80 °C

Figure 17. Forward current as a function of heatsink temperature
Output inverter BODY DIODE
IF = f (Th)



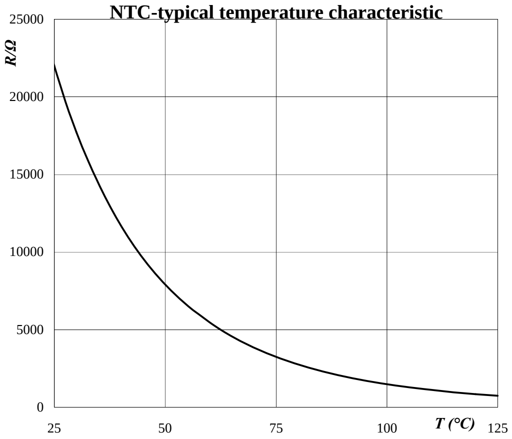
parameter: Tj= 150 ºC

fastPACK0 H 2nd gen

Thermistor

Figure 18. **Typical NTC characteristic as afunction of temperature**

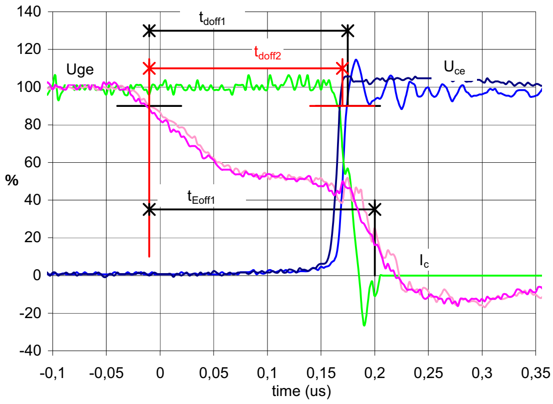
$R_T = f(T)$



Switching definitions

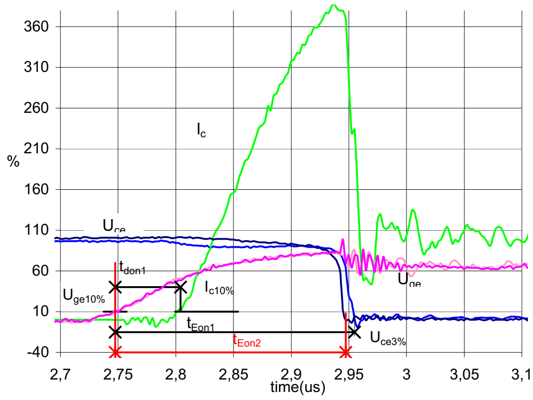
General conditions: Tj= 125 °C Rgon= 8 Ω Rgoff= 2 Ω

Figure 1. Turn-off Switching Waveforms & definition of tdoff, t_{Eoff} (t_{Eoff} = integrating time for E_{off})
Output inverter MOSFET



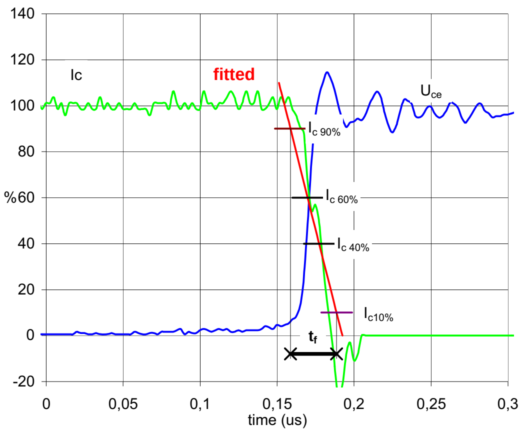
Uge(0%)=	0 V	without capacitor
Uge(100%)=	10 V	with capacitor
Uc(100%)=	400 V	
Ic(100%)=	31 A	
tdoff=	0,18 us	
t_{Eoff}=	0,22 us	

Figure 2. Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})
Output inverter MOSFET



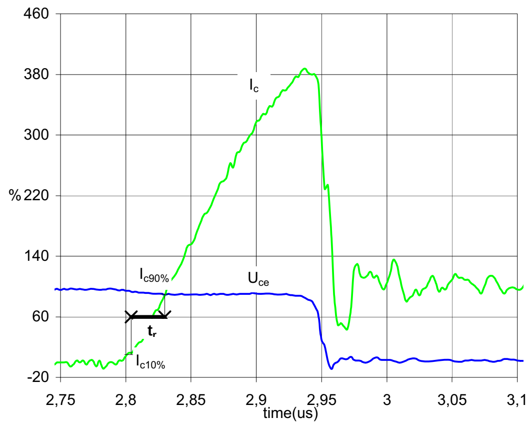
Uge(0%)=	0 V	without capacitor
Uge(100%)=	10 V	with capacitor
Uc(100%)=	400 V	
Ic(100%)=	31 A	
tdon=	0,06 us	
t_{Eon}=	0,21 us	

Figure 3. Turn-off Switching Waveforms & definition of t_f
Output inverter MOSFET



Uc(100%)=	400 V
Ic(100%)=	31 A
t_f=	0,018 us

Figure 4. Turn-on Switching Waveforms & definition of t_r
Output inverter MOSFET

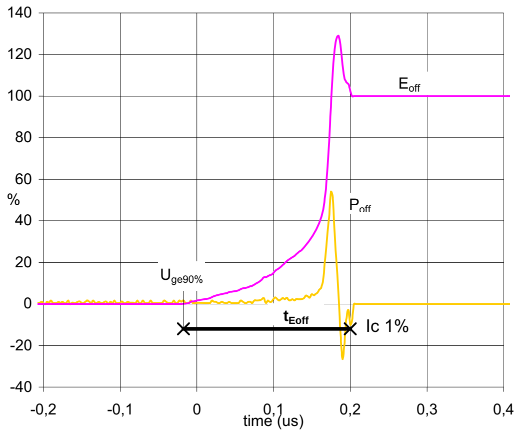


Uc(100%)=	400 V
Ic(100%)=	31 A
t_r=	0,028 us

Switching definitions

Figure 5. Turn-off Switching Waveforms & definition of t_{Eoff}

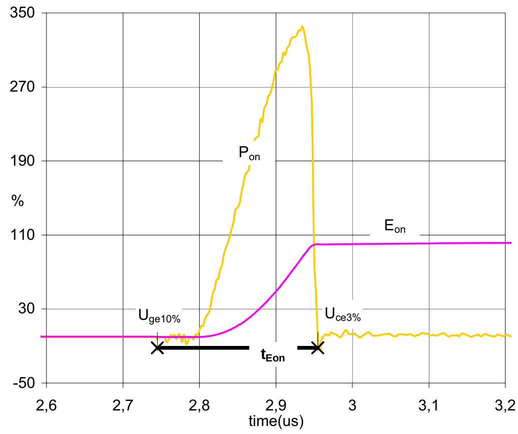
Output inverter MOSFET



Poff(100%)= 12,24 kW
Eoff(100%)= 0,09 mJ
t_{Eoff}= 0,22 us

Figure 6. Turn-on Switching Waveforms & definition of t_{Eon}

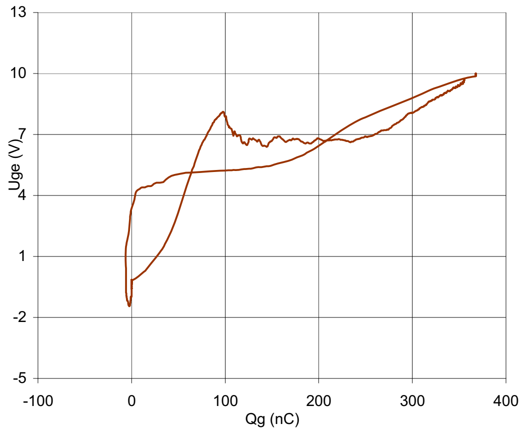
Output inverter MOSFET



Pon(100%)= 12,2 kW
Eon(100%)= 3,63 mJ
t_{Eon}= 0,21 us

Figure 7. Gate voltage vs Gate charge

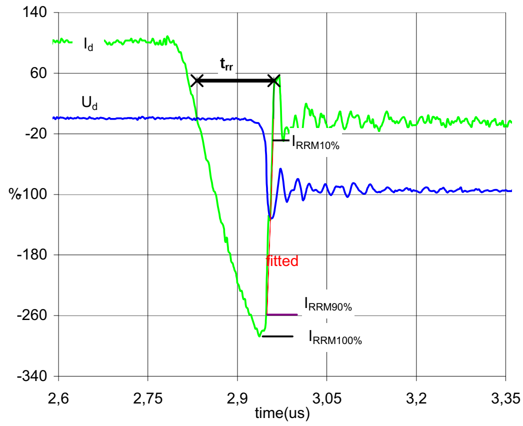
Output inverter MOSFET



Ugeoff= 0 V
Ugeon= 10 V
Uc(100%)= 400 V
Ic(100%)= 31 A
Qg= 367,7 nC

Figure 8. Turn-off Switching Waveforms & definition of t_{rr}

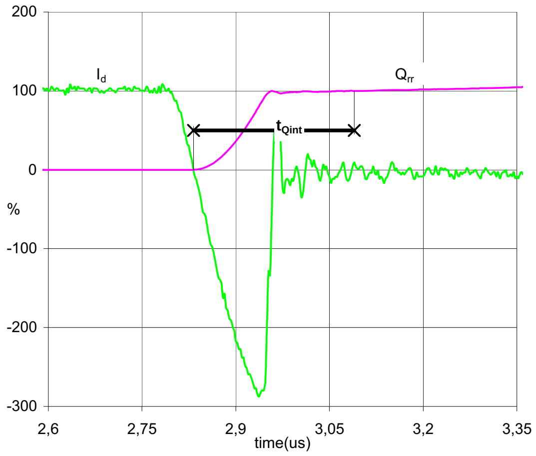
Output inverter MOSFET FRED



Ud(100%)= 400 V
Id(100%)= 31 A
I_{RRM}(100%)= 86 A
trr= 0,13 us

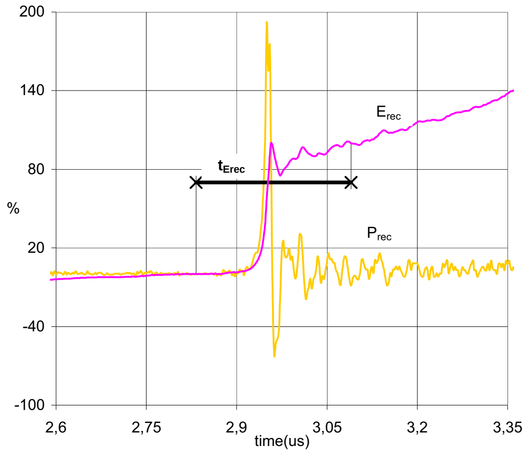
Switching definitions

Figure 9. Turn-on Switching Waveforms & definition of t_{Qrr}
(tQrr= integrating time for Qrr)
Output inverter MOSFET FRED



Id(100%)=	31 A
Qrr(100%)=	6,502 uC
tQint=	0,26 us

Figure 10. Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})
Output inverter MOSFET FRED



Prec(100%)=	12,2 kW
Erec(100%)=	0,54 mJ
tErec=	0,26 us

