flow0 V23990-P629-F56-01-14

Maximum Ratings / Höchstzulässige Werte			**P629-F56 1200V/25A**	
Parameter	**Condition**	**Symbol**	**Datasheet values max.**	**Unit**
Transistor H-bridge(IGBT) **Transistor H-Brücke(IGBT)**				
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung		V_{CE}	1200	V
DC collector current Kollektor-Dauergleichstrom	Tj=Tjmax Th=80°C, Tc=80°C	I_C	38	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	tp limited by Tj max	I_{cpuls}	75	A
Power dissipation per IGBT Verlustleistung pro IGBT	Tj=Tjmax Th=80°C Tc=80°C	P_{tot}	129	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	±20	V
SC withstand time* Kurzschlußverhalten*	Tj=Tjmax VGE=15V VCC=360V	t_{SC}	10	us
max. Chip temperature max. Chiptemperatur		T_{jmax}	150	°C
Diode H-bridge **Diode H-Brücke**				
DC forward current Dauergleichstrom	Tj=Tjmax Th=80°C, Tc=80°C	I_F	25	A
Repetitive peak forward current Periodischer Spitzenstrom	tp limited by	I_{FRM}	50	A
Power dissipation per Diode Verlustleistung pro Diode	Tj=Tjmax Th=80°C Tc=80°C	P_{tot}	56	W
max. Chip temperature max. Chiptemperatur		T_{jmax}	150	°C
Thermal properties **Thermische Eigenschaften**				
Storage temperature Lagertemperatur		T_{stg}	-40…+125	
Operation temperature Betriebstemperatur		T_{op}	-40…+125	
Insulation properties **Modulisolation**				
Insulation voltage Isolationsspannung	t=1min	V_{is}	4000	
Creepage distance Kriechstrecke			min 12,7	
Clearance Luftstrecke			min 12,7	

Additional notes and remarks:

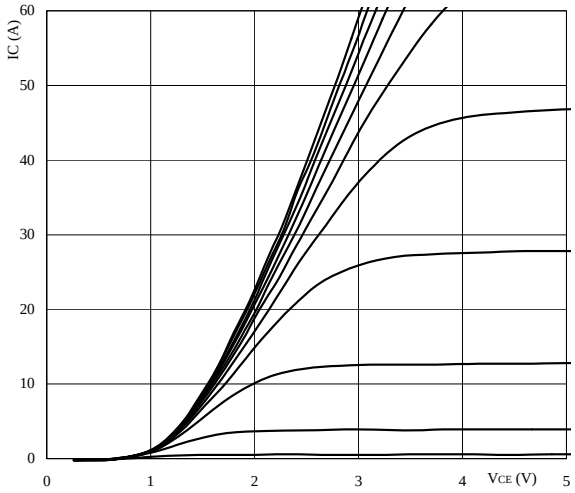
** Allowed number of short circuits must be less than 1000 times, and time duration between short circuits should be more than 1 second!*

Characteristic values/ Charateristische Werte **P629-F56 1**

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Transistor H-bridge(IGBT)										
Transistor H-Brücke(IGBT)										
Gate emitter threshold voltage	$V_{GE(th)}$	Tj=25°C	VCE=VGE			1m	3	5,5	7	V
Gate-Schwellenspannung		Tj=125°C								
Collector-emitter saturation voltage	$V_{CE(sat)}$	Tj=25°C		15		25		2,12	2,9	V
Kollektor-Emitter Sättigungsspannung		Tj=125°C						2,24		
Collector-emitter cut-off	I_{CES}	Tj=25°C		0	600				0,1	mA
Kollektor-Emitter Reststrom		Tj=125°C								
Gate-emitter leakage current	I_{GES}	Tj=25°C		20	0				200	nA
Gate-Emitter Reststrom		Tj=125°C								
Integrated Gate resistor	R_{gint}							none		Ω
Integrirter Gate Widerstand										
Turn-on delay time	$t_{d(on)}$	Tj=25°C	Rgoff=16 Ω							ns
Einschaltverzögerungszeit		Tj=125°C	Rgon=16 Ω	±15	600	25		131		
Rise time	t_r	Tj=25°C	Rgoff=16 Ω							ns
Anstiegszeit		Tj=125°C	Rgon=16 Ω	±15	600	25		15		
Turn-off delay time	$t_{d(off)}$	Tj=25°C	Rgoff=16 Ω							ns
Abschaltverzögerungszeit		Tj=125°C	Rgon=16 Ω	±15	600	25		233		
Fall time	t_f	Tj=25°C	Rgoff=16 Ω							ns
Fallzeit		Tj=125°C	Rgon=16 Ω	±15	600	25		92		
Turn-on energy loss per pulse	E_{on}	Tj=25°C	Rgoff=16 Ω							mWs
Einschaltverlustenergie pro Puls		Tj=125°C	Rgon=16 Ω	±15	600	25		1,35		
Turn-off energy loss per pulse	E_{off}	Tj=25°C	Rgoff=16 Ω							mWs
Abschaltverlustenergie pro Puls		Tj=125°C	Rgon=16 Ω	±15	600	25		1,76		
Input capacitance	C_{ies}	Tj=25°C	f=1MHz	0	25			2,02		nF
Eingangskapazität		Tj=125°C								
Output capacitance	C_{oss}	Tj=25°C	f=1MHz	0	25			0,19		nF
Ausgangskapazität		Tj=125°C								
Reverse transfer capacitance	Cies	Tj=25°C	f=1MHz	0	25			0,06		nF
Rückwirkungskapazität		Tj=125°C								
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal foil thickness=76um					0,54		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip			Kunze foil KU ALF5							
Diode H-bridge										
Diode H-Brücke										
Diode forward voltage	V_F	Tj=25°C				25	1	2,65	4	V
Durchlaßspannung		Tj=125°C						2,31		
Peak reverse recovery current	I_{RM}	Tj=25°C								A
Rückstromspitze		Tj=125°C	Rgon=16 Ω	±15	600	25		54,5		
Reverse recovery time	t_{rr}	Tj=25°C								ns
Sperreverzögerungszeit		Tj=125°C	Rgon=16 Ω	±15	600	25		147		
Reverse recovered charge	Q_{rr}	Tj=25°C								uC
Sperrverzögerungsladung		Tj=125°C	Rgon=16 Ω	±15	600	25		3,42		
Reverse recovered energy	Erec	Tj=25°C								mWs
Sperrverzögerungsenergie		Tj=125°C	Rgon=16 Ω	±15	600	25		1,55		
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal foil thickness=76um					1,25		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip			Kunze foil KU ALF5							
NTC-Thermistor										
NTC-Widerstand										
Rated resistance	R_{25}	Tj=25°C					20,9	22	23,1	kOhm
Nennwiderstand		Tj=125°C								
Deviation of R100	$D_{R/R}$	Tj=25°C						2,9		%/K
Abweichung von R100		Tj=125°C								
Power dissipation given Epcos-Typ	P	Tj=25°C						210		mW
Verlustleistung Epcos-Typ angeben		Tj=125°C								
B-value	$B_{(25/100)}$	Tj=25°C						3980		K
B-Wert		Tj=125°C								

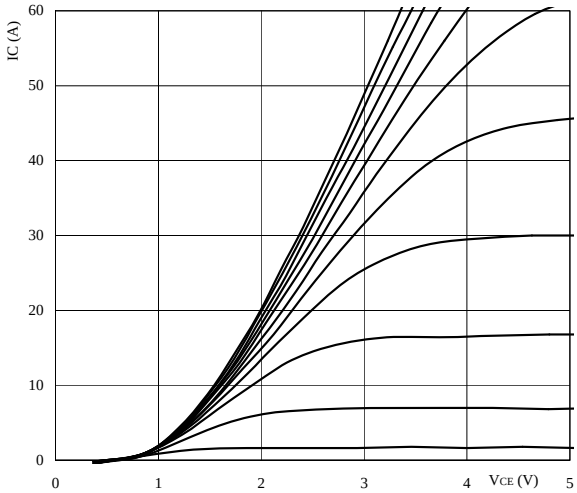
Output inverter

Figure 1. **Typical output characteristics**
Output inverter IGBT
Ic= f(VCE)



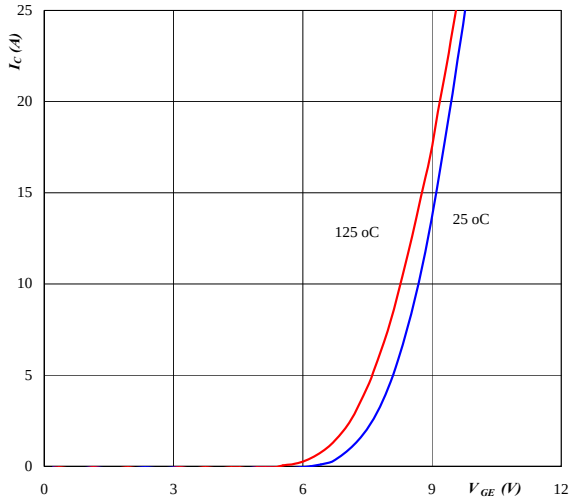
parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

Figure 2. **Typical output characteristics**
Output inverter IGBT
Ic= f(VCE)



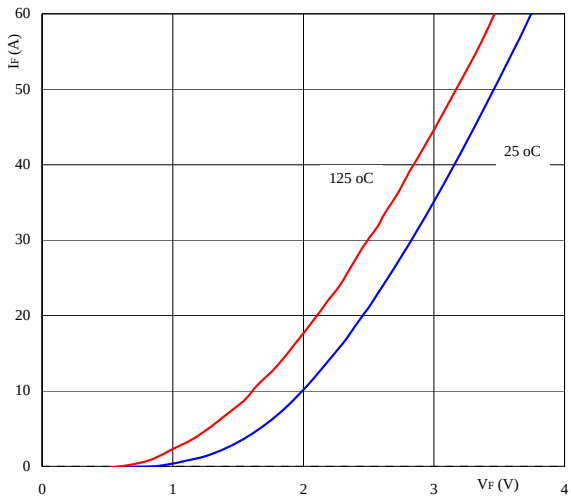
parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

Figure 3. **Typical transfer characteristics**
Output inverter IGBT
Ic= f(VGE)



parameter: tp = 250 us VCE = 10 V

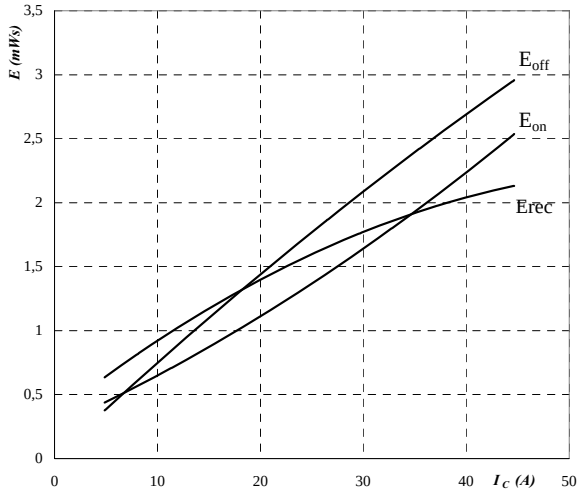
Figure 4. **Typical diode forward current as a function of forward voltage**
Output inverter FRED IF=f(VF)



parameter: tp = 250 us

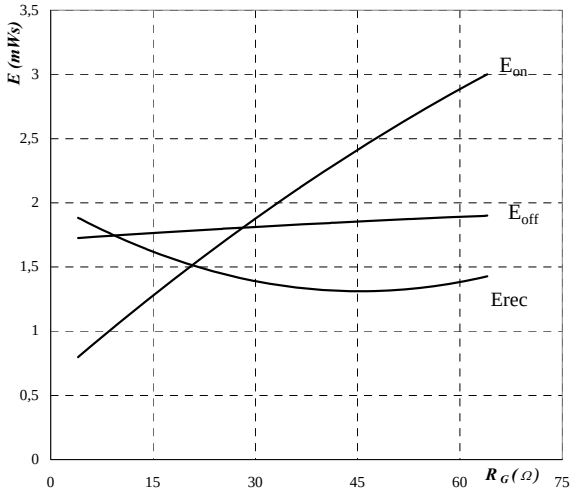
Output inverter

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



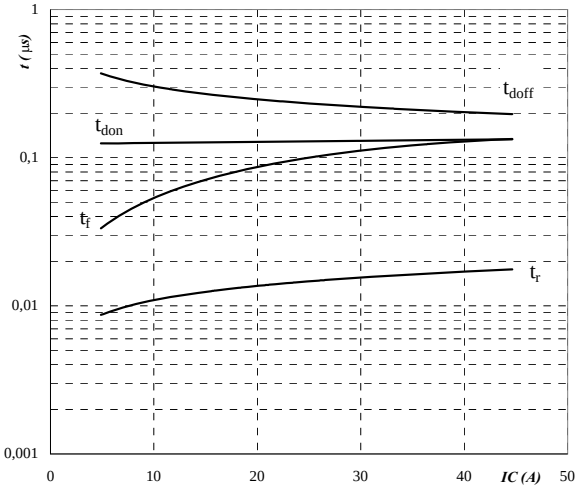
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Rgon= 16 Ω
Rgoff= 16 Ω

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



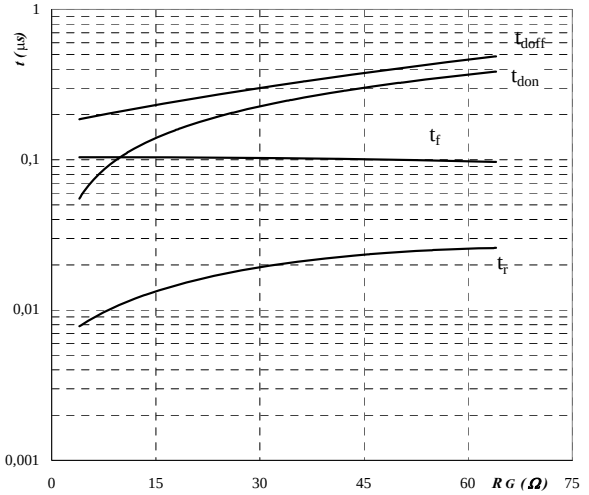
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Ic = 25 A

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



inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Rgon= 16 Ω
Rgoff= 16 Ω

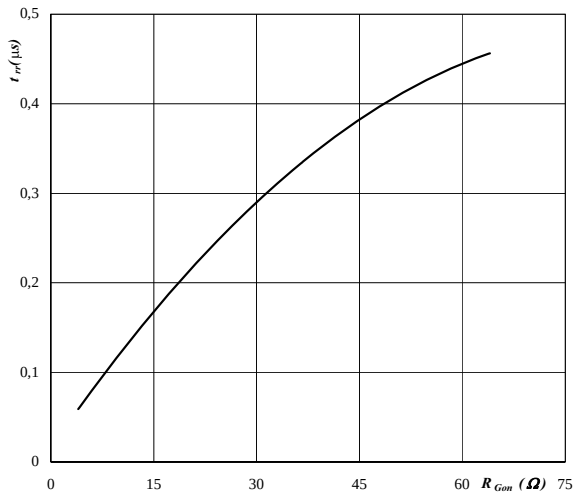
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Ic = 25 A

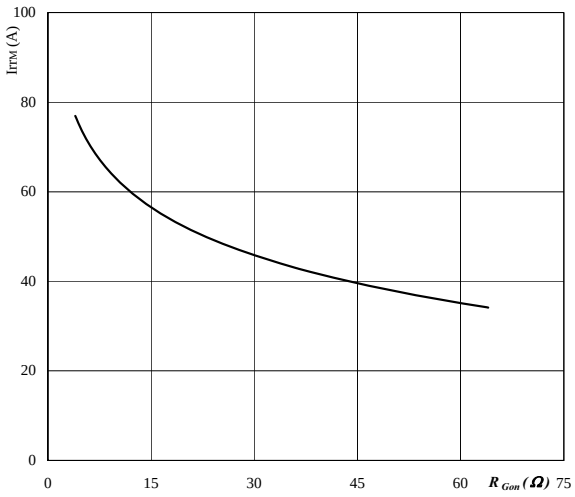
Output inverter

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



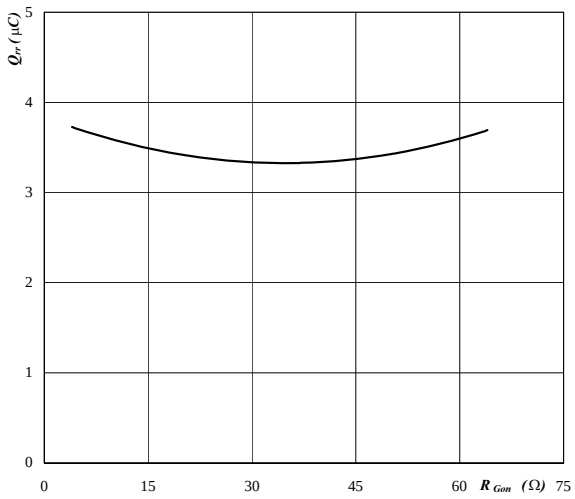
Tj = 125 °C
V_R = 600 V
I_F = 25 A
V_{GE} = ±15 V

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



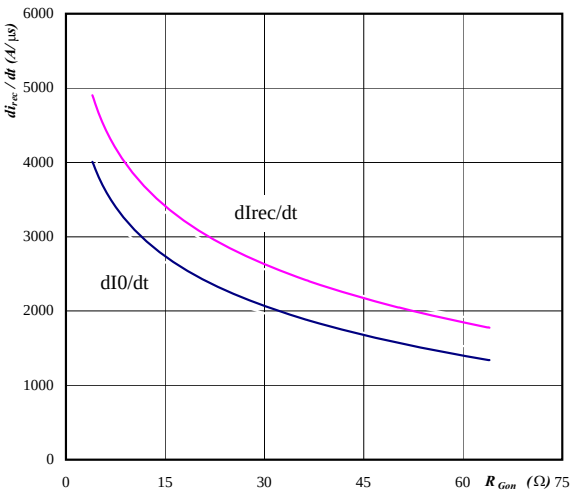
Tj = 125 °C
V_R = 600 V
I_F = 25 A
V_{GE} = ±15 V

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



Tj = 125 °C
V_R = 600 V
I_F = 25 A
V_{GE} = ±15 V

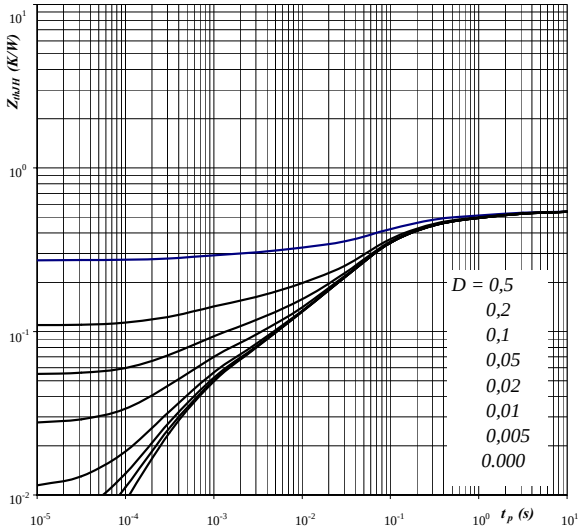
Figure 12. **Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor**
Output inverter FRED diode
dI0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 600 V
I_F = 25 A
V_{GE} = ±15 V

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width
$Z_{thJH} = f(tp)$

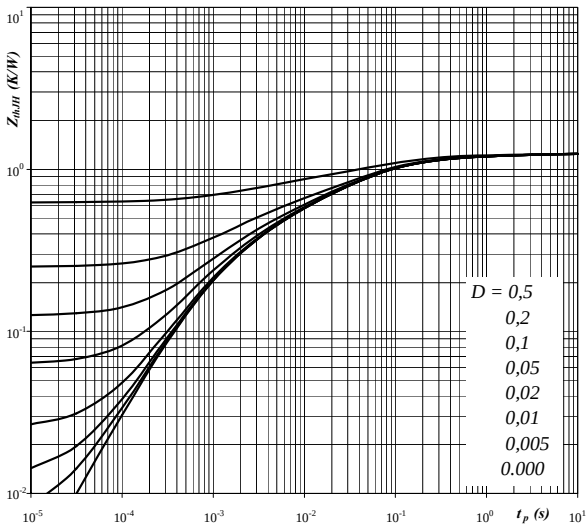


Parameter: D = tp / T RthJH= 0,54 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	7,6E+00
0,07	1,3E+00
0,15	1,7E-01
0,22	4,8E-02
0,05	3,6E-03
0,04	4,5E-04

Figure 14. FRED transient thermal impedance as a function of pulse width
$Z_{thJH} = f(tp)$



Parameter: D = tp / T RthJH= 1,25 K/W

FRED thermal model values

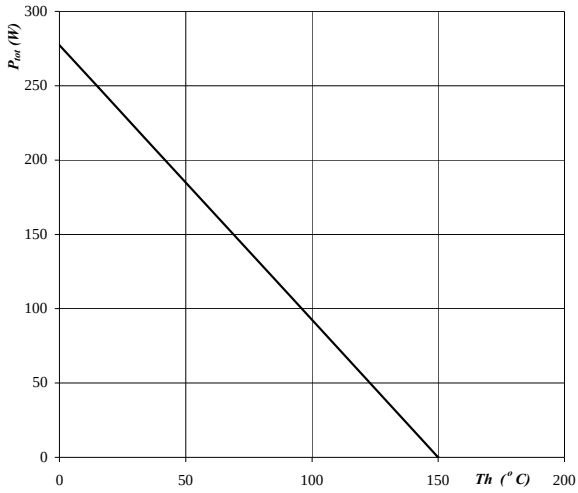
R (C/W)	Tau (s)
0,04	3,4E+00
0,10	5,6E-01
0,37	8,0E-02
0,32	2,0E-02
0,27	3,3E-03
0,15	6,9E-04
#REF!	#REF!

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

$P_{tot} = f(Th)$

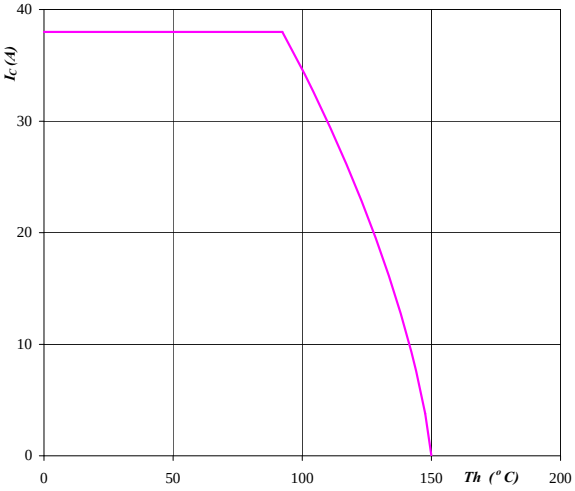


parameter: Tj= 150 ºC

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

$I_C = f(Th)$



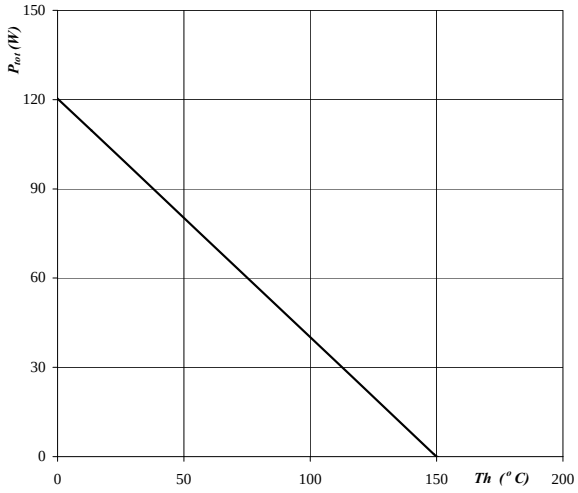
parameter: Tj= 150 ºC

V_{GE}= 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

$P_{tot} = f(Th)$

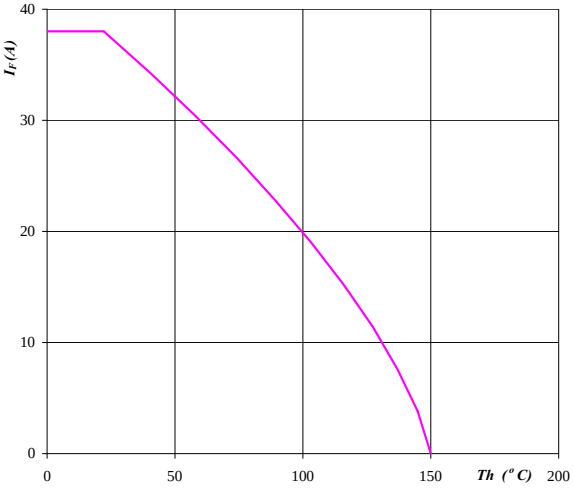


parameter: Tj= 150 ºC

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

$I_F = f(Th)$

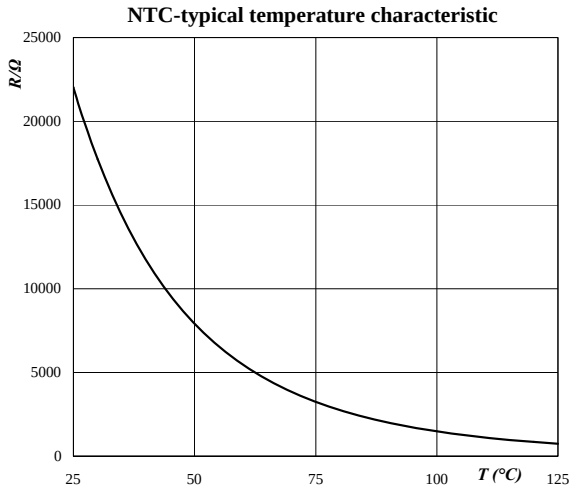


parameter: Tj= 150 ºC

Thermistor

Figure 19. Typical NTC characteristic as afunction of temperature

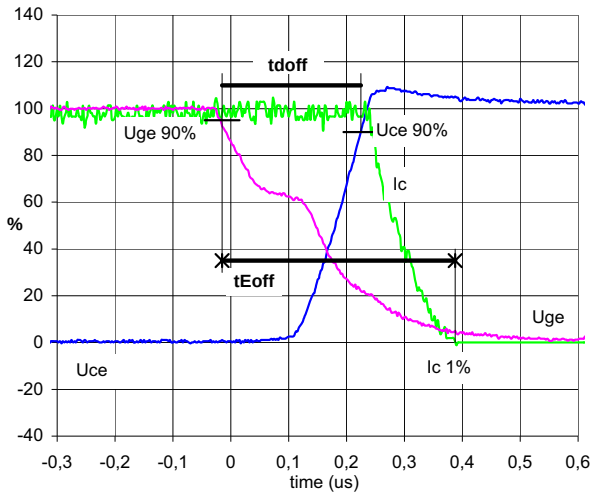
$R_T = f(T)$



Switching definitions

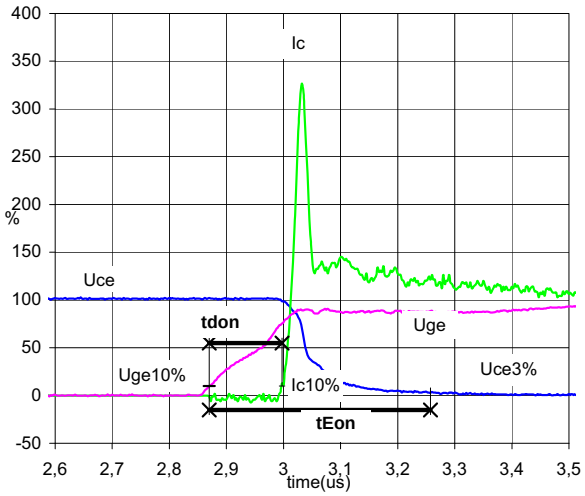
General conditions: Tj= 125 °C Rgon= 16 Ω Rgoff= 16 Ω

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



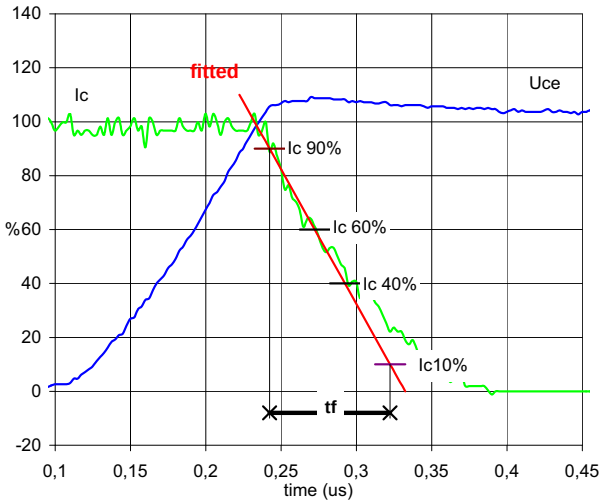
Uge(0%)= -15 V
Uge(100%)= 15 V
Uc(100%)= 600 V
Ic(100%)= 25 A
tdoff= 0,23 us
t_{Eoff}= 0,40 us

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



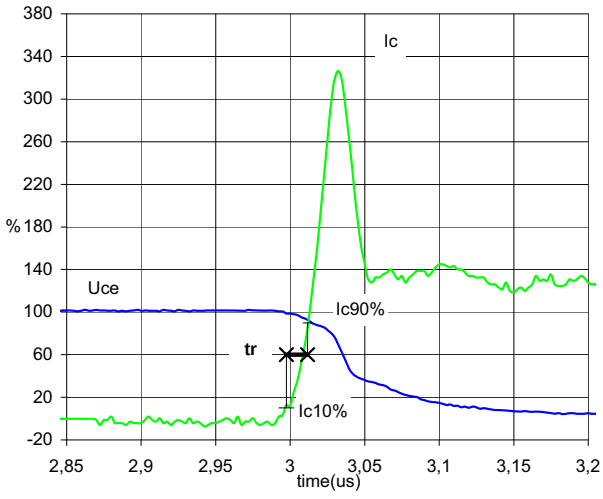
Uge(0%)= -15 V
Uge(100%)= 15 V
Uc(100%)= 600 V
Ic(100%)= 25 A
tdon= 0,13 us
t_{Eon}= 0,39 us

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



Uc(100%)= 600 V
Ic(100%)= 25 A
t_f= 0,092 us

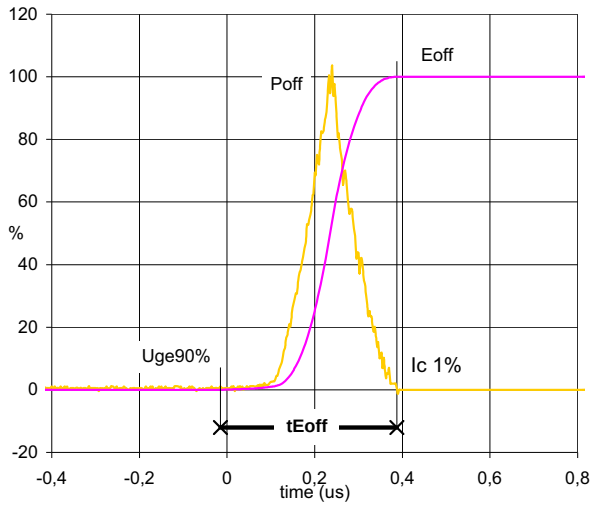
Figure 4. **Turn-on Switching Waveforms & definition of t_r**
Output inverter IGBT



Uc(100%)= 600 V
Ic(100%)= 25 A
t_r= 0,015 us

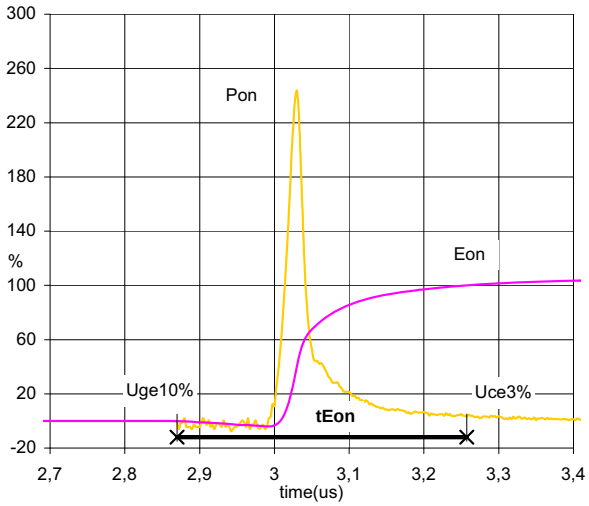
Switching definitions

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



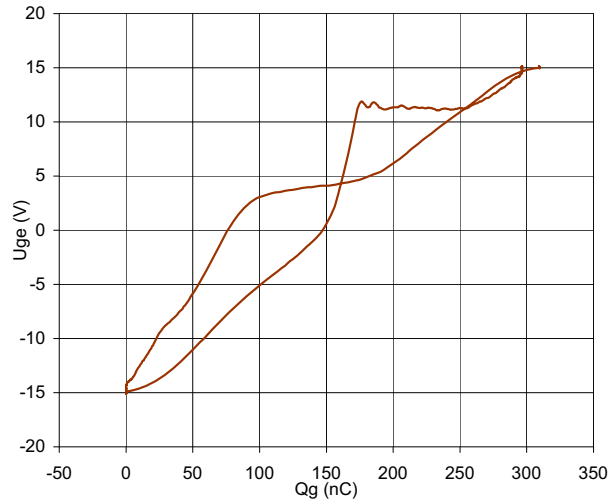
Poff(100%)= 14,96 kW
Eoff(100%)= 1,76 mJ
t_{Eoff}= 0,40 us

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



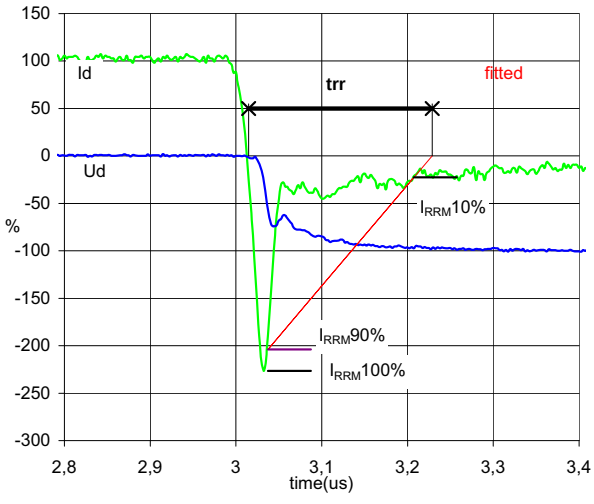
Pon(100%)= 15 kW
Eon(100%)= 1,35 mJ
t_{Eon}= 0,39 us

Figure 7. Gate voltage vs Gate charge
Output inverter IGBT



Ugeoff= -15 V
Ugeon= 15 V
Uc(100%)= 600 V
Ic(100%)= 25 A
Qg= 309,3 nC

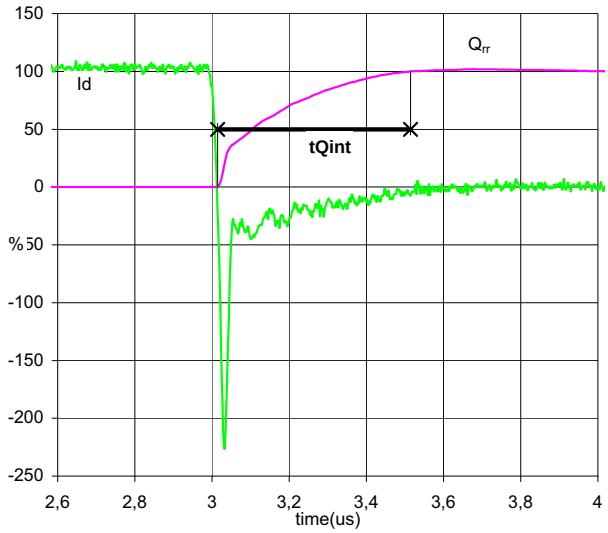
Figure 8. Turn-off Switching Waveforms & definition of t_{rr}
Output inverter FRED



Ud(100%)= 600 V
Id(100%)= 25 A
I_{RRM}(100%)= 55 A
trr= 0,15 us

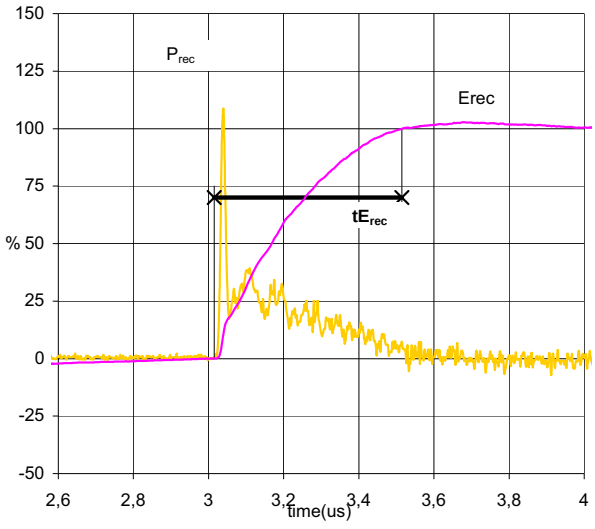
Switching definitions

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



Id(100%)= 25 A
Qrr(100%)= 3,419 uC
tQint= 0,50 us

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



Prec(100%)= 15 kW
Erec(100%)= 1,55 mJ
tErec= 0,50 us