fastPACK 0 H 2nd gen V23990-P729-F46-01-14

Maximum Ratings / Höchstzulässige Werte P729-F46 1200V/25A

Parameter	Condition	Symbol	Datasheet values max.	Unit
DC link Capacitor **DC link Kondensator**				
Max.DC voltage Max. Gleichspannung	T_C=25°C	U_{MAX}	1000	V
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	30	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}	73	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	18	A
Repetitive peak forward current Periodischer Spitzenstrom	tp limited by Tj max	I_{FRM}	50	A
Power dissipation per Diode Verlustleistung pro Diode	Tj=Tjmax Th=80°C Tc=80°C	P_{tot}	35	W
max. Chip temperature max. Chiptemperatur		T_{jmax}	150	°C
Thermal properties **Thermische Eigenschaften**				
Storage temperature Lagertemperatur		T_{stg}	-40…+125	°C
Operation temperature Betriebstemperatur		T_{op}	-40…+125	°C

fastPACK 0 H 2nd gen V23990-P729-F46-01-14

Maximum Ratings / Höchstzulässige Werte — P729-F46 1200V/25A

Parameter	Condition	Symbol	Datasheet values max.	Unit
Insulation properties **Modulisolation**				
Insulation voltage Isolationsspannung	t=1min	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			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!*

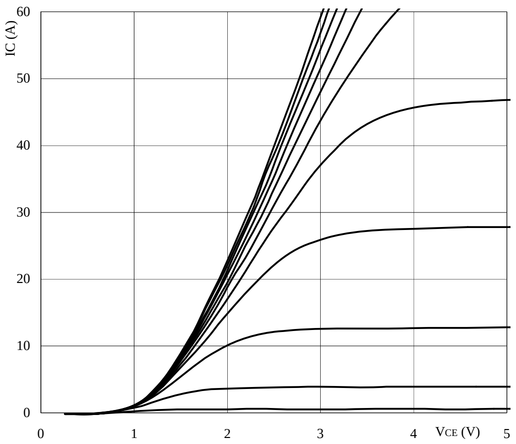
fastPACK 0 H 2nd gen V23990-P729-F46-01-14

Characteristic values/ Charateristische Werte **P729-F46**

Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Capacitor **Kondensator**										
C value C Wert	C						45	56	67	nF
Transistor H-bridge(IGBT) **Transistor H-Brücke(IGBT)**										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			1m	4	5,5	7	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		25		2,12 2,24	2,9	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	600				0,1	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		20	0				200	nA
Integrated Gate resistor Integrirter Gate Widerstand	R_{gint}							none		Ω
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		131		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		15		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		233		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		92		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		1,35		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgoff=16 Ω Rgon=16 Ω	±15	600	25		1,76		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			2,02		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,19		nF
Reverse transfer capacitance Rückwirkungskapazität	Cies	Tj=25°C Tj=125°C	f=1MHz	0	25			0,06		nF
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,95		K/W K/W
Diode H-bridge **Diode H-Brücke**										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				25	1	2,65 2,31	4	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=16 Ω	±15	600	25		54,5		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=16 Ω	±15	600	25		147		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=16 Ω	±15	600	25		3,42		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=16 Ω	±15	600	25		1,55		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJH} R_{thJC}		Thermal grease thickness≤ WarmeleitpasteDicke≤50u					1,99		K/W K/W
NTC-Thermistor **NTC-Widerstand**										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				20,9	22	23,1	kOhm
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

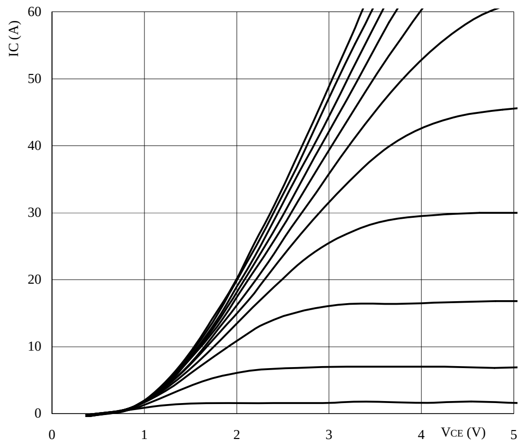
Output inverter

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



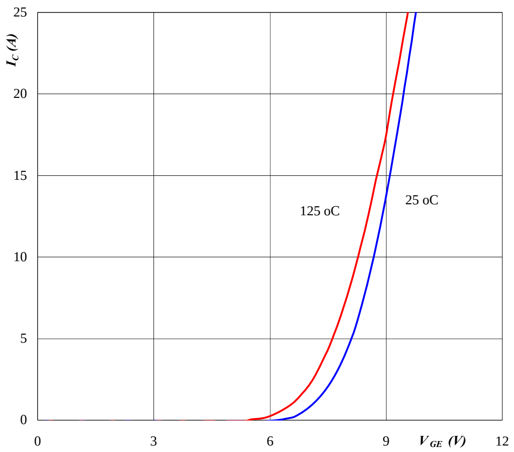
parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



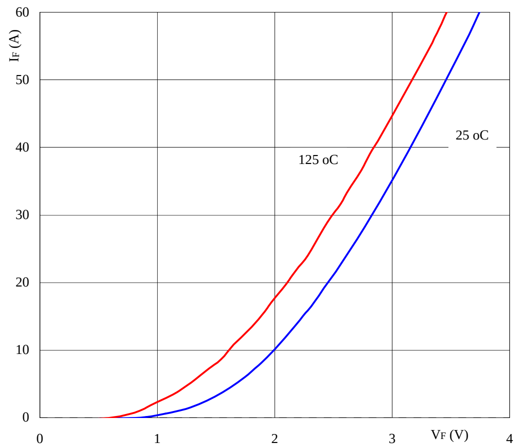
parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: tp = 250 us VCE = 10 V

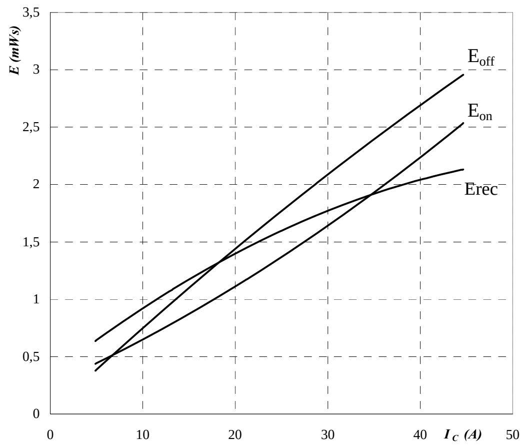
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 us

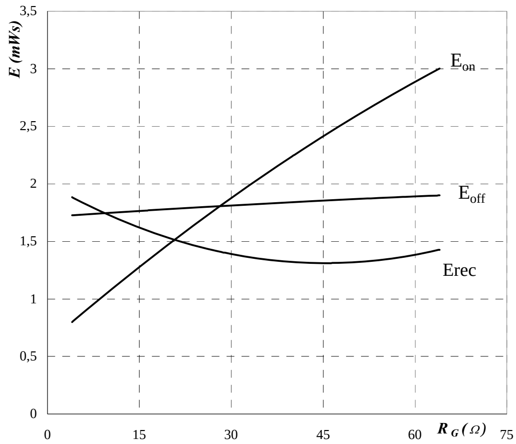
Output inverter

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



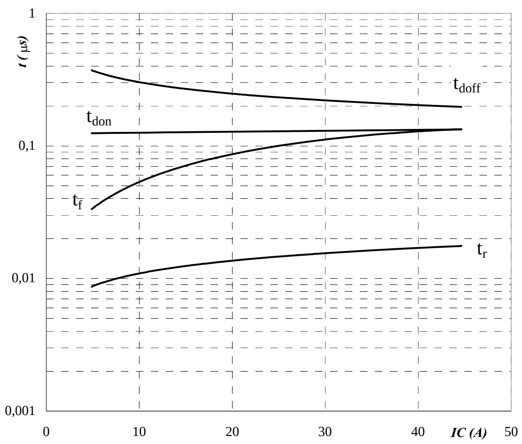
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Rgon= 16 Ω
Rgoff= 16 Ω

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



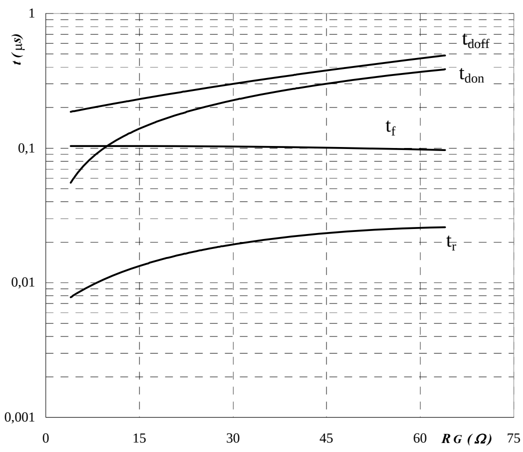
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Ic = 25 A

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

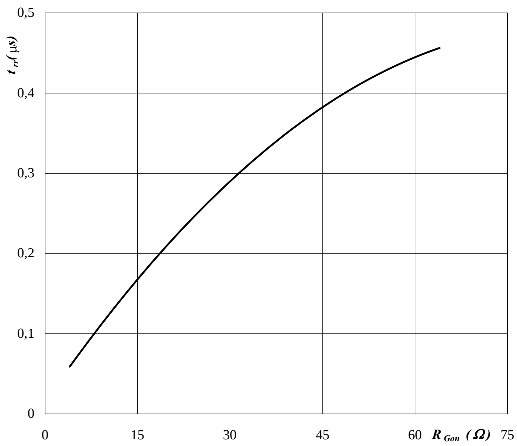
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



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

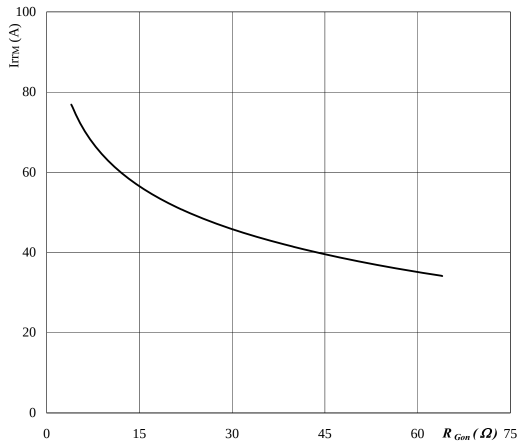
Output inverter

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



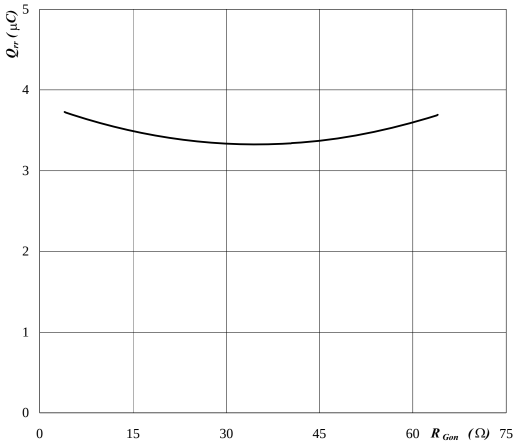
Tj = 125 °C
V_R = 600 V
I_F= 25 A
V_{GE}= ±15 V

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



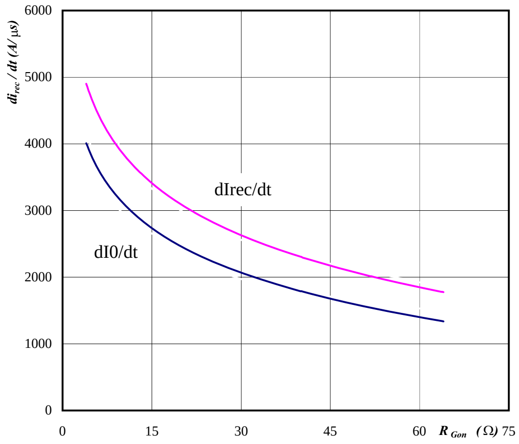
Tj = 125 °C
V_R = 600 V
I_F= 25 A
V_{GE}= ±15 V

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

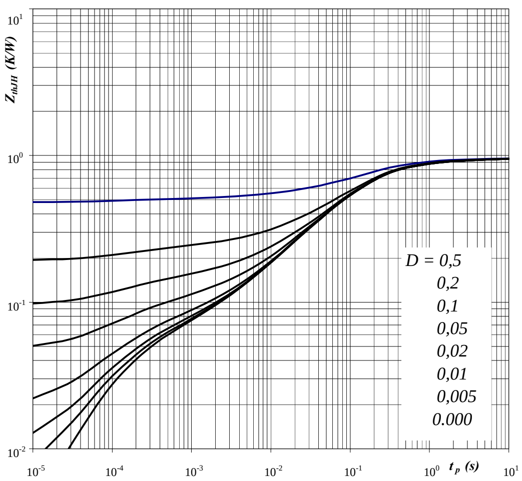
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
dI0/dt,dIrec/dt= f (Rgon)



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
ZthJH = f(tp)

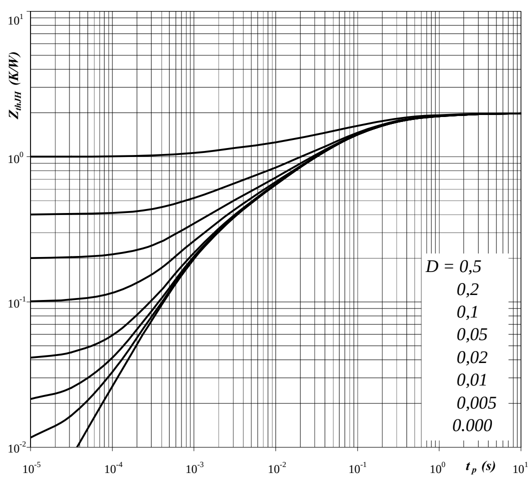


Parameter: D = tp / T RthJH= 0,95 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	1,6E+01
0,10	1,7E+00
0,30	2,6E-01
0,36	8,0E-02
0,11	1,1E-02
0,03	8,0E-04

Figure 14. FRED transient thermal impedance as a function of pulse width
ZthJH = f(tp)



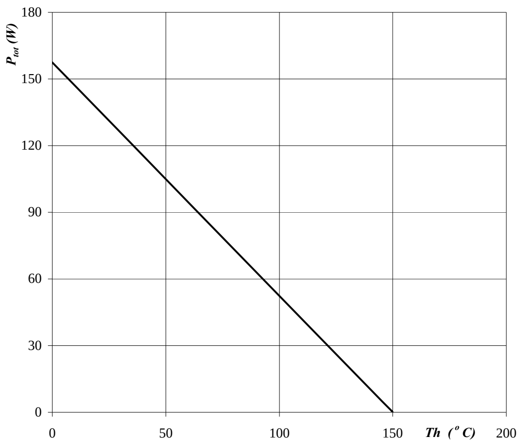
Parameter: D = tp / T RthJH= 1,99 K/W

FRED thermal model values

R (C/W)	Tau (s)
0,03	1,1E+01
0,17	1,1E+00
0,65	1,6E-01
0,60	3,9E-02
0,32	7,4E-03
0,23	1,1E-03

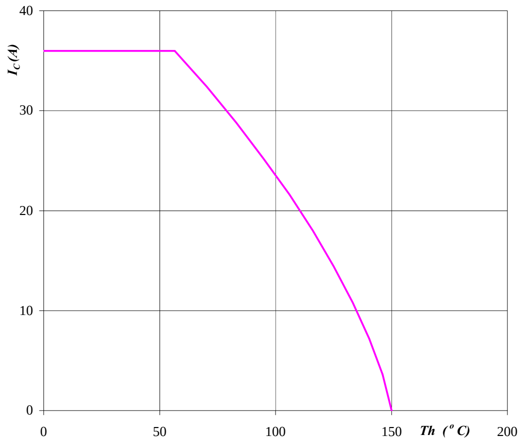
Output inverter

Figure 15. Power dissipation as a function of heatsink temperature
Output inverter IGBT
P_{tot} = f (Th)



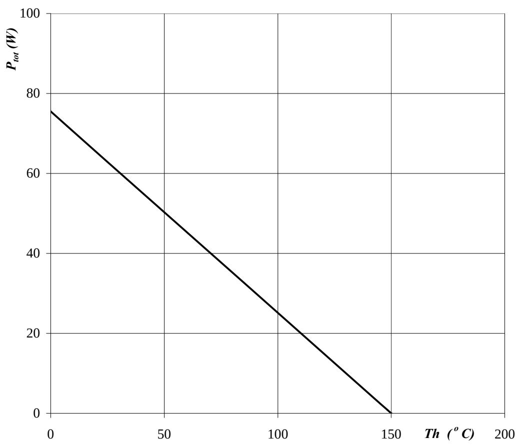
parameter: Tj= 150 ºC

Figure 16. Collector current as a function of heatsink temperature
Output inverter IGBT
I_C = f (Th)



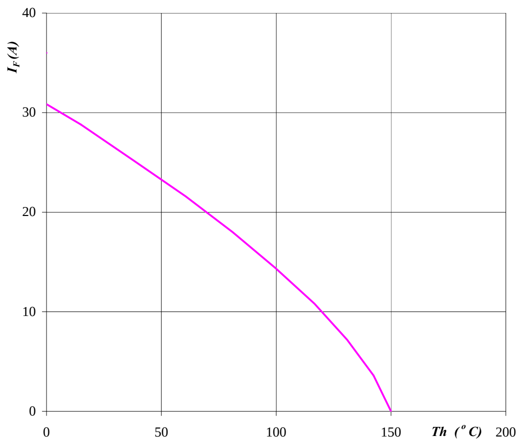
parameter: Tj= 150 ºC
V_{GE}= 15 V

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)

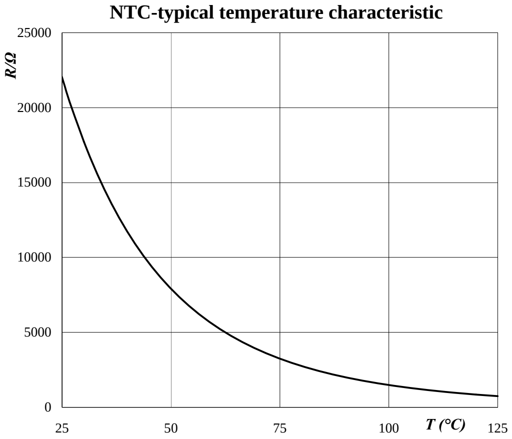


parameter: Tj= 150 ºC

Thermistor

Figure 19. Typical NTC characteristic as afunction of temperature

R_T = f (T)

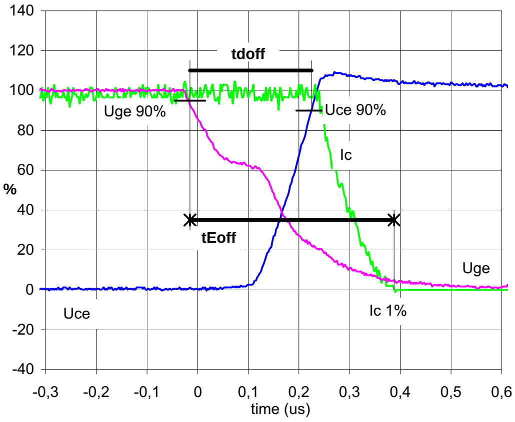


fastPACK0 H 2nd gen V23990-P729-F46

Switching definitions

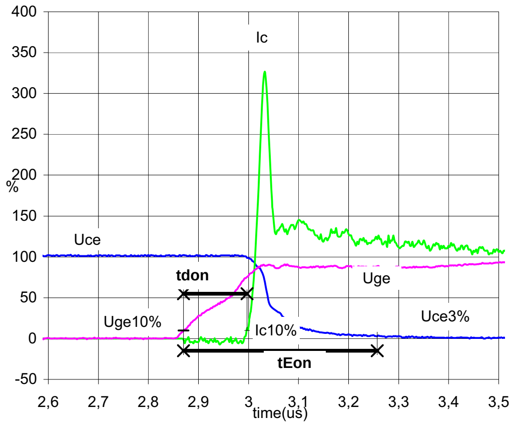
General conditions: Tj= 125 °C Rgon= 16 Ω Rgoff= 16 Ω

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



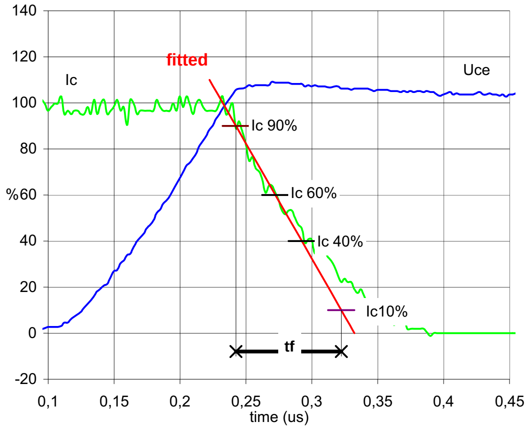
Uge(0%)= -15 V
Uge(100%)= 15 V
Uc(100%)= 600 V
Ic(100%)= 25 A
tdoff= 0,23 us
t_{Eoff}= 0,40 us

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



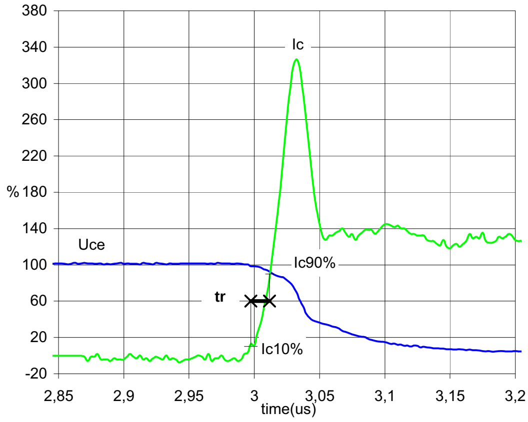
Uge(0%)= -15 V
Uge(100%)= 15 V
Uc(100%)= 600 V
Ic(100%)= 25 A
tdon= 0,13 us
t_{Eon}= 0,39 us

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

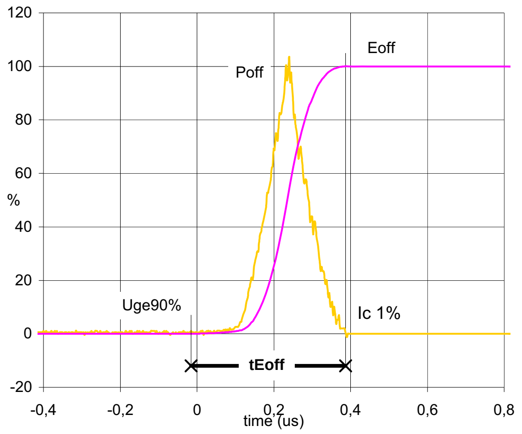
Figure 4. Turn-on Switching Waveforms & definition of t_r
Output inverter IGBT



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

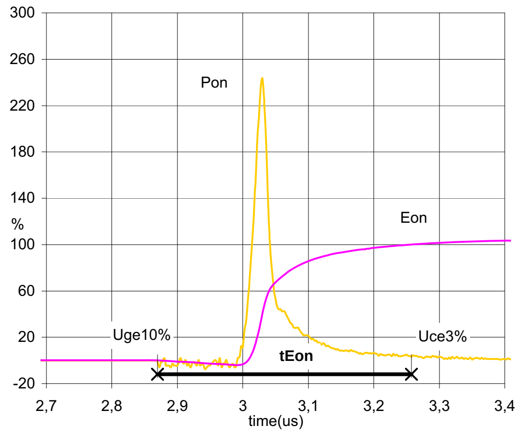
Switching definitions

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



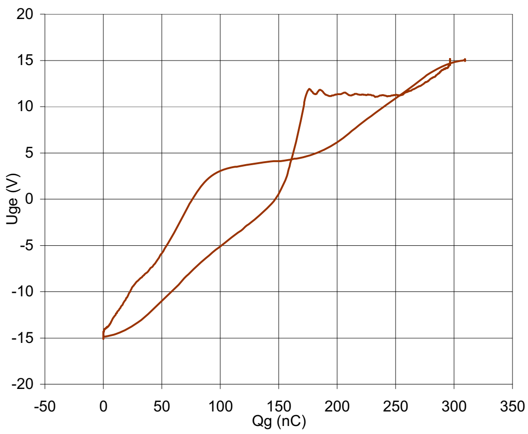
Poff(100%)= 14,96 kW
Eoff(100%)= 1,76 mJ
t_{Eoff}= 0,40 us

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



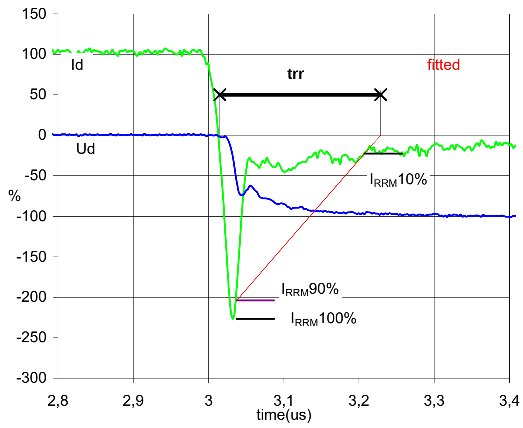
Pon(100%)= 15 kW
Eon(100%)= 1,35 mJ
t_{Eon}= 0,39 us

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

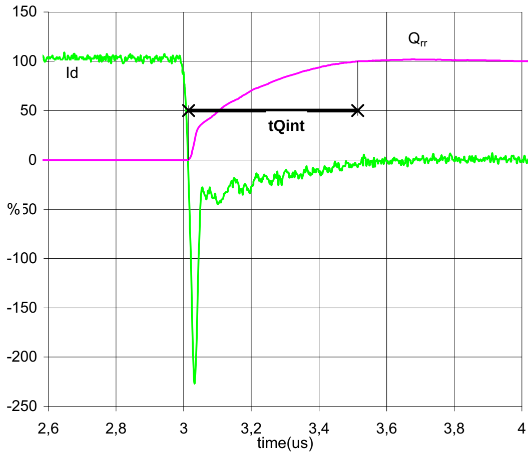
Figure 8. Turn-off Switching Waveforms & definition of t_{rr}
Output inverter FRED



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

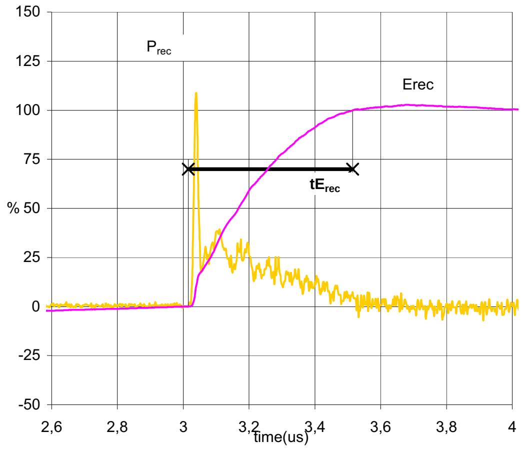
Switching definitions

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