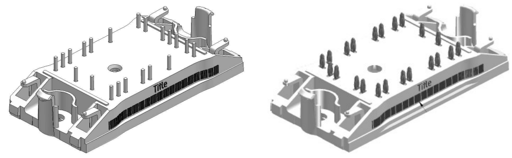
V23990-P621-F68-PM
V23990-P621-F68Y-PM
preliminary datasheet

flowNPC 0 **900V/36A**

Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 900V CoolMos C3 and 1200V SiC diode

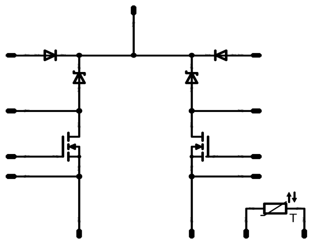
flow0 12mm housing



12mm solder pin 12mm PressFiT pin

Target Applications
- solar inverter

Schematic



Types
- V23990-P621-F68-PM
- V23990-P621-F68Y-PM

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	DC current	T_h=80°C T_c=80°C	47 50	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	370	A
I2t-value	I^2t			360	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	52 79	W
Maximum Junction Temperature	$T_j$max			150	°C
Boost MOSFET					
Drain to source breakdown voltage	V_{DS}			900	V
DC drain current	I_D	T_j=$T_j$max	T_h=80°C T_c=80°C	19 24	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max		96	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	105 159	W
Gate-source peak voltage	V_{GS}			±20	V
Maximum Junction Temperature	$T_j$max			150	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost FWD					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	23 23	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		90	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	89 134	W
Maximum Junction Temperature	$T_j$max			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

Characteristic Values

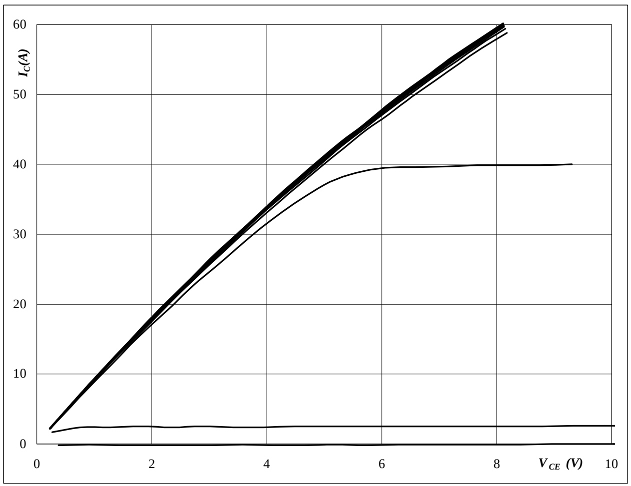
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Bypass Diode										
Forward voltage	V_F				15	Tj=25°C Tj=125°C	0,8	1,1 1,05	1,6	V
Threshold voltage (for power loss calc. only)	V_{to}				15	Tj=25°C Tj=125°C		0,9 0,8		V
Slope resistance (for power loss calc. only)	r_t				15	Tj=25°C Tj=125°C		0,01 0,01		Ω
Reverse current	I_r			1600		Tj=25°C Tj=125°C			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,34		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,89		
Boost MOSFET										
Static drain to source ON resistance	$R_{DS(on)}$		10		36	Tj=25°C Tj=125°C		0,11 0,24		Ω
Gate threshold voltage	$V_{(GS)th}$		VGS=VDS		0,0029	Tj=25°C Tj=125°C	2,5	3	3,9	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			200	nA
Zero Gate Voltage Drain Current	I_{dss}		0	900		Tj=25°C Tj=125°C			10000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=2 Ω Rgon=2 Ω	10	700	15	Tj=25°C Tj=125°C		37 35		ns
Rise Time	t_r					Tj=25°C Tj=125°C		7 8		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		418 453		
Fall time	t_f					Tj=25°C Tj=125°C		347 92		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,243 0,259		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,148 0,174		
Total gate charge	Q_g	Rgon=2 Ω	10	400	26	Tj=25°C Tj=125°C		270		nC
Gate to source charge	Q_{gs}					Tj=25°C Tj=125°C		32		
Gate to drain charge	Q_{gd}					Tj=25°C Tj=125°C		115		
Input capacitance	C_{iss}	f=1 MHz	0	100		Tj=25°C		6800		pF
Output capacitance	C_{oss}							330		
Reverse transfer capacitance	C_{rss}							38		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,67		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,44		
Boost FWD										
Forward voltage	V_F				26	Tj=25°C Tj=150°C		2,48 3,98		V
Reverse leakage current	I_{rm}		10	700	26	Tj=25°C Tj=150°C			600	µA
Peak recovery current	I_{RRM}	Rgon=2 Ω	10	700	26	Tj=25°C Tj=125°C		11,47 10,32		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		11,2 25,2		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		0,12 0,13		µC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,032 0,036		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		3115 2191		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,07		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,71		
Thermistor										
Rated resistance	R					T=25°C		22		kΩ
Deviation of R25	ΔR/R	R25=22KΩ				T=25°C	-0,03		+3%	%
Power dissipation	P					T=25°C			200	mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	B(25/50)	Tol. ±3%				Tj=25°C		3950		K
B-value	B(25/100)	Tol. ±3%				Tj=25°C		3998		K

INPUT BOOST

Figure 3 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



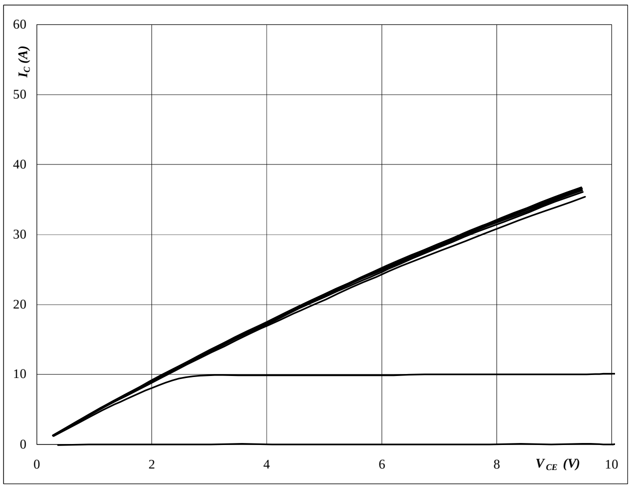
At

t_p =	250	μs
T_j =	25	°C
V_{GS} from	3 V to 13 V in steps of 1 V	

Figure 4 BOOST FRED

Typical output characteristics

$I_D = f(V_{DS})$



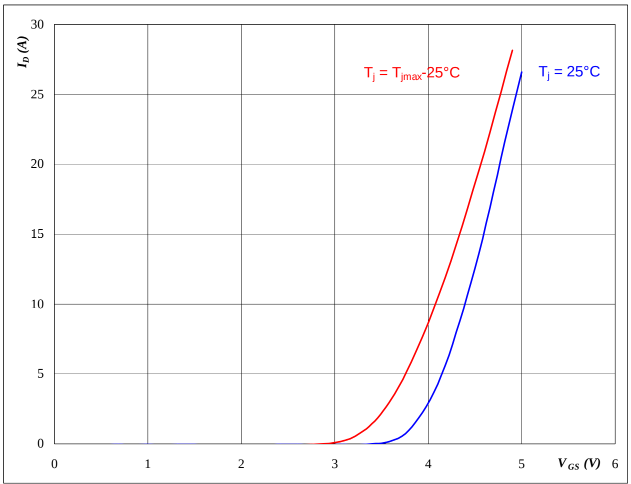
At

t_p =	250	μs
T_j =	125	°C
V_{GS} from	3 V to 13 V in steps of 1 V	

Figure 3 BOOST MOSFET

Typical transfer characteristics

$I_D = f(V_{DS})$



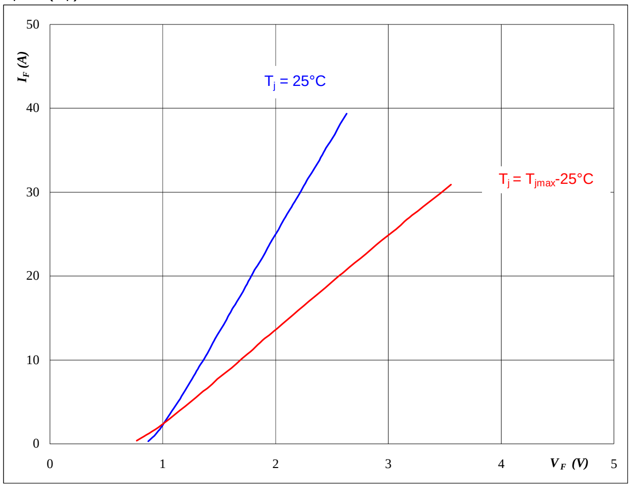
At

t_p =	250	μs
V_{DS} =	10	V

Figure 4 BOOST FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

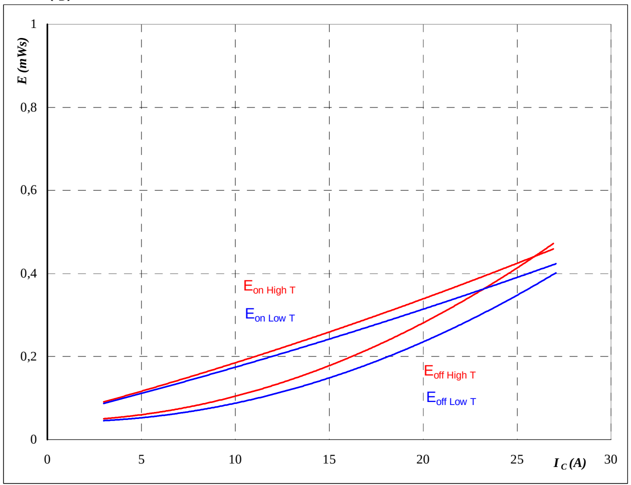
t_p =	250	μs

INPUT BOOST

Figure 5 BOOST MOSFET

Typical switching energy losses
as a function of collector current

$E = f(I_D)$



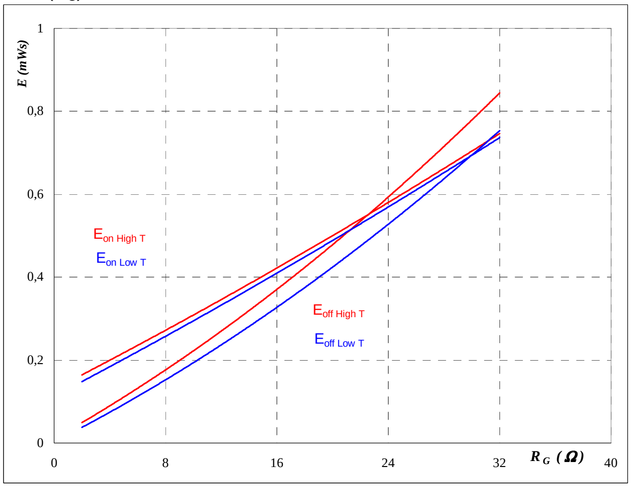
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 BOOST MOSFET

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



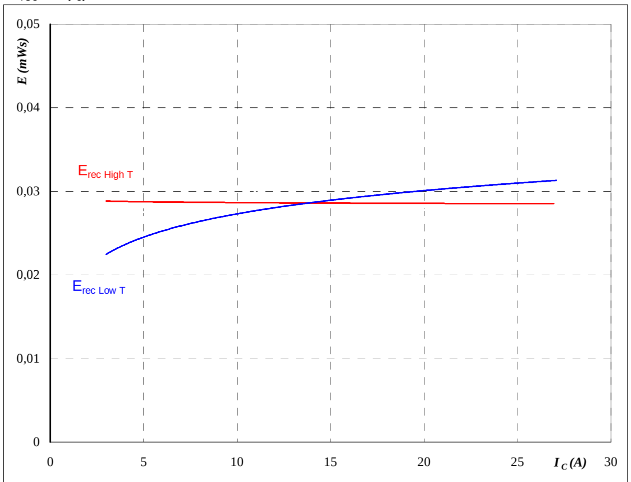
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	10	V
I_D =	15	A

Figure 7 BOOST MOSFET

Typical reverse recovery energy loss
as a function of collector (drain) current

$E_{rec} = f(I_c)$



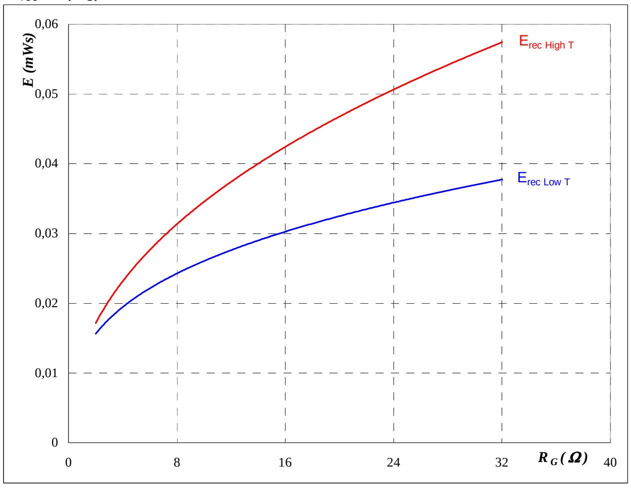
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 8 BOOST MOSFET

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

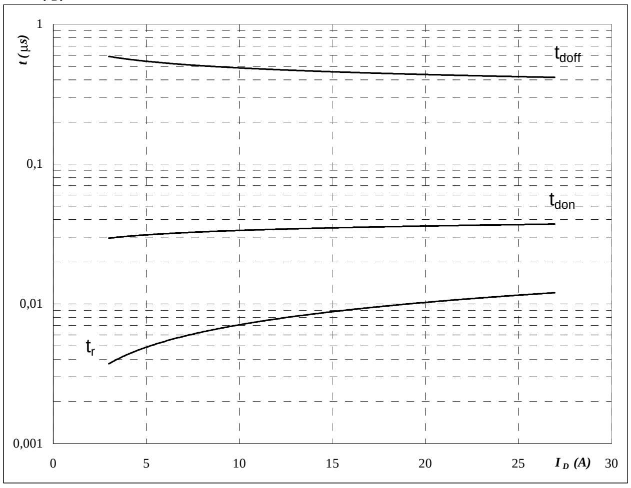
T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	10	V
I_D =	15	A

INPUT BOOST

Figure 9 BOOST MOSFET

Typical switching times as a function of collector current

t = f(I_D)



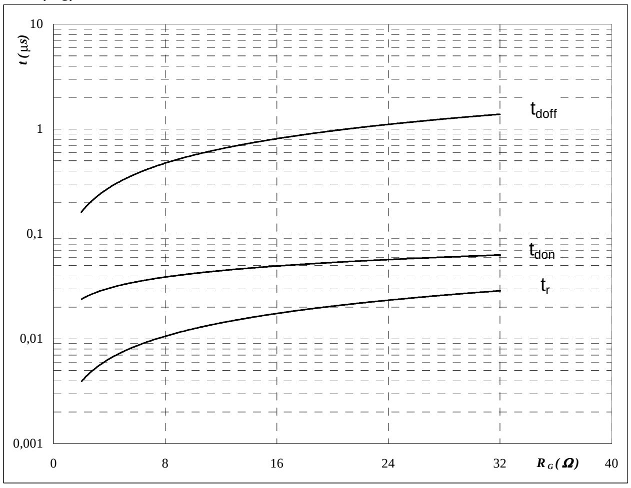
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 BOOST MOSFET

Typical switching times as a function of gate resistor

t = f(R_G)



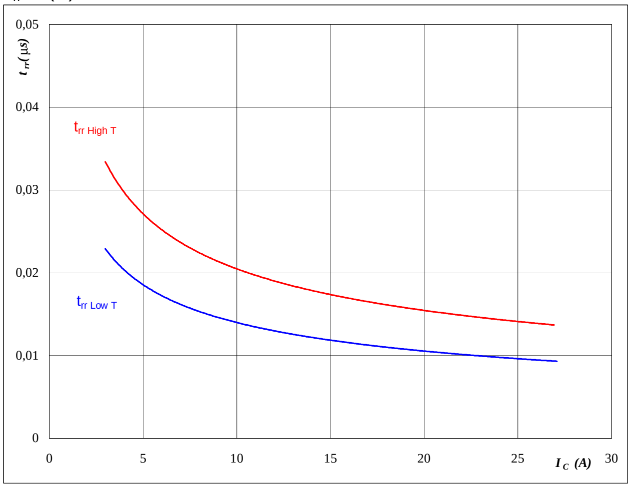
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	10	V
I_C =	15	A

Figure 11 BOOST FRED

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



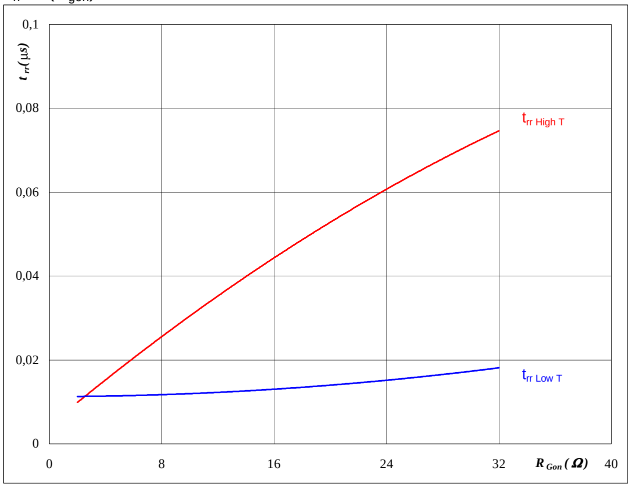
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 12 BOOST FRED

Typical reverse recovery time as a function of IGBT turn on gate resistor

t_{rr} = f(R_{gon})



At

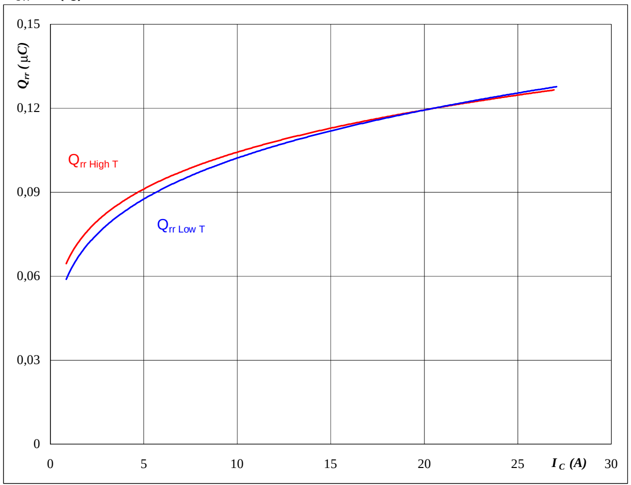
T_j =	25/125	°C
V_R =	700	V
I_F =	15	A
V_{GS} =	10	V

INPUT BOOST

Figure 13 BOOST FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



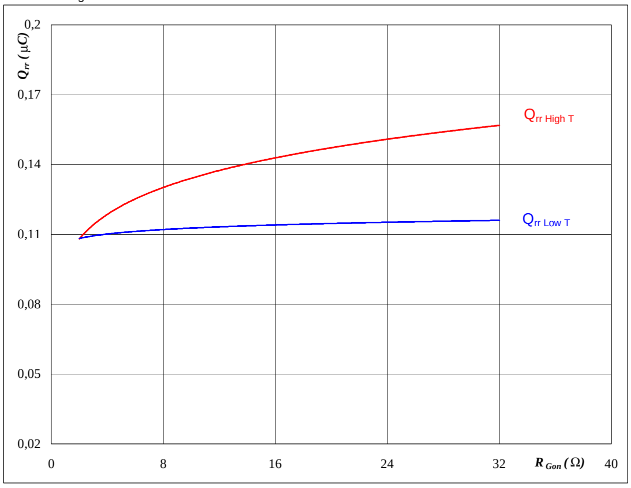
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 14 BOOST FRED

Typical reverse recovery charge as a function of IGBT turn on gate resistor

$Q_{rr} = f(R_{gon})$



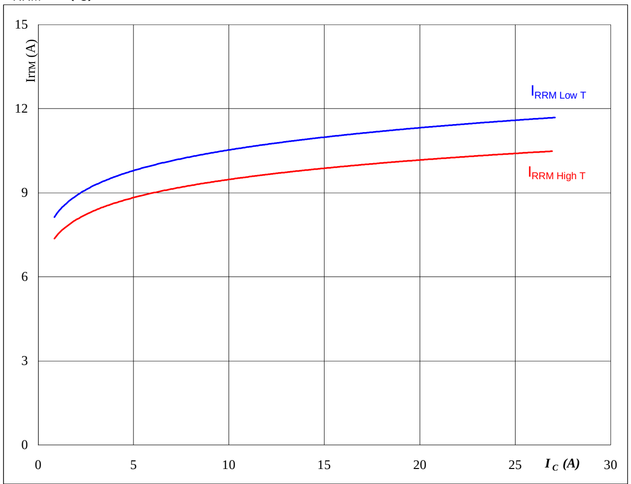
At

Tj =	25/125	°C
VR =	700	V
IF =	15	A
VGS =	10	V

Figure 15 BOOST FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



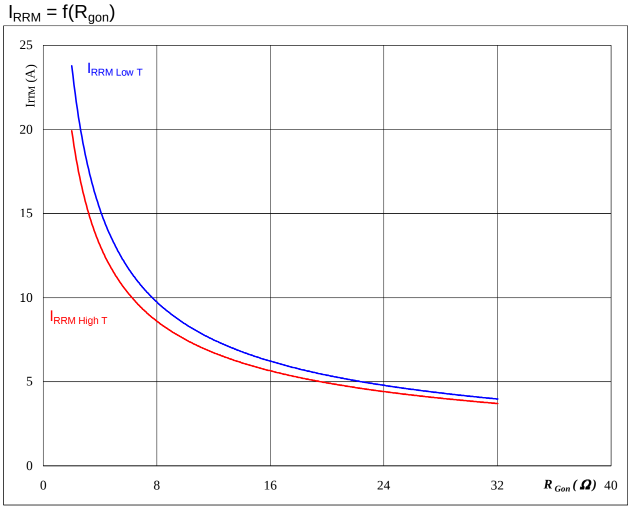
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 16 BOOST FRED

Typical reverse recovery current as a function of IGBT turn on gate resistor

$I_{RRM} = f(R_{gon})$



At

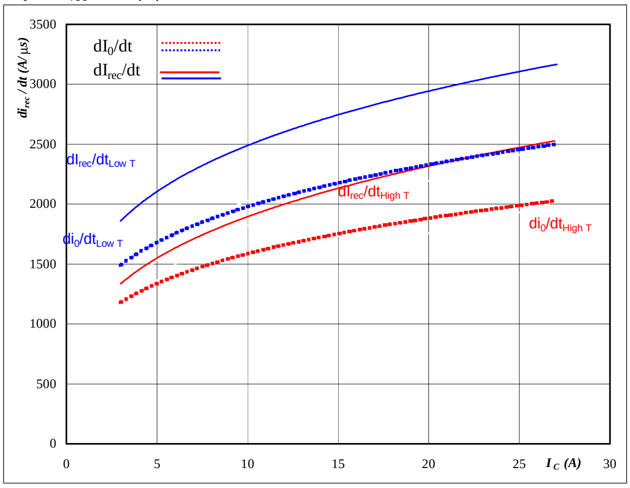
T_j =	25/125	°C
V_R =	700	V
I_F =	15	A
V_{GS} =	10	V

INPUT BOOST

Figure 17 BOOST FRED

Typical rate of fall of forward and reverse recovery current as a function of collector current

$dI_0/dt, dI_{rec}/dt = f(Ic)$



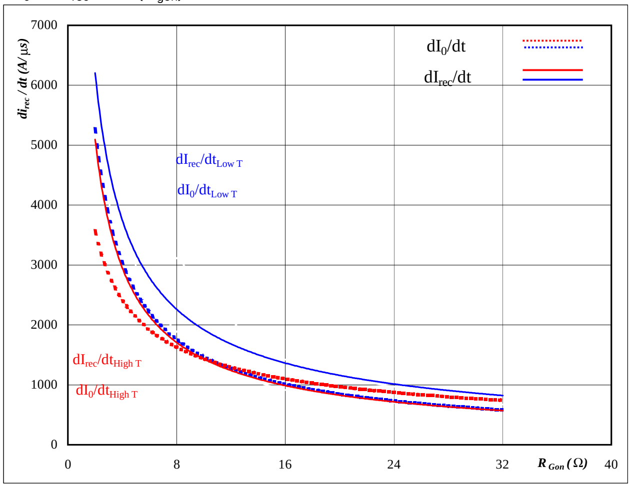
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	10	V
R_{gon} =	8	Ω

Figure 18 BOOST FRED

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



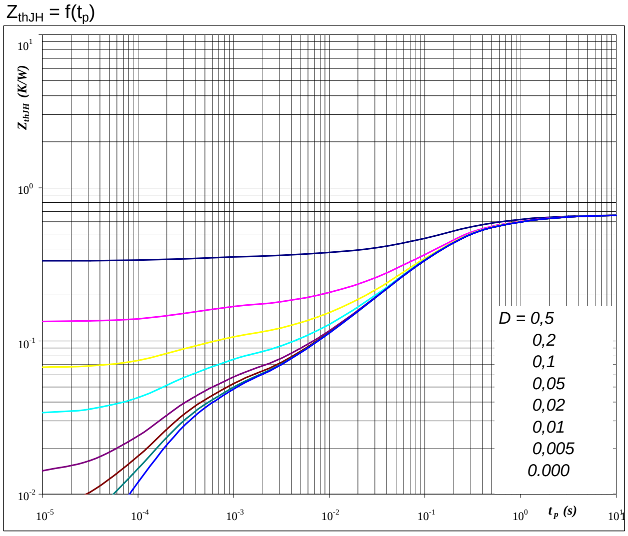
At

Tj =	25/125	°C
VR =	700	V
IF =	15	A
VGS =	10	V

Figure 19 BOOST MOSFET

IGBT/MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,67	K/W

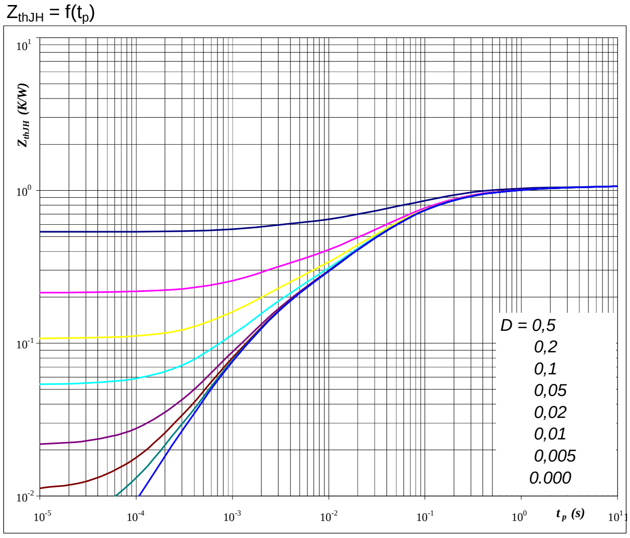
IGBT thermal model values

R (C/W)	Tau (s)
0,02816	6,312
0,1209	0,9855
0,3549	0,1598
0,09717	0,03096
0,02697	0,004091
0,03879	0,0003081

Figure 20 BOOST FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,07	K/W

FRED thermal model values

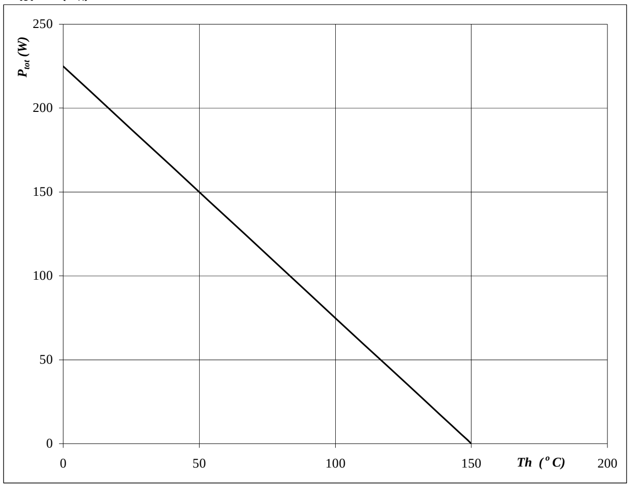
R (C/W)	Tau (s)
0,06553	3,724
0,1846	0,3982
0,5013	0,07136
0,2111	0,01224
0,1082	0,001527
0	0

INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



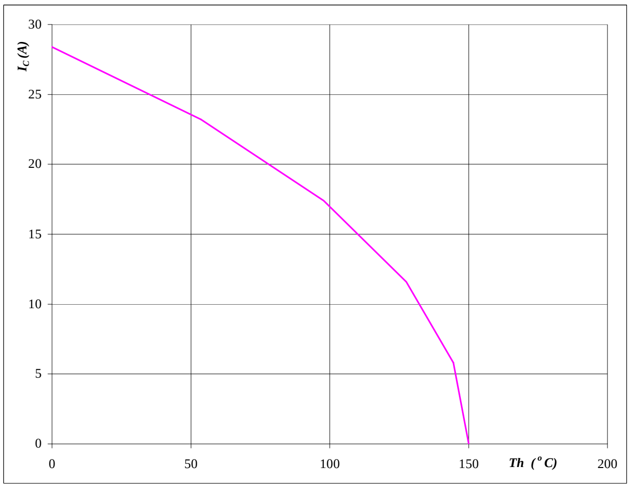
At

T_j = 150 ºC

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

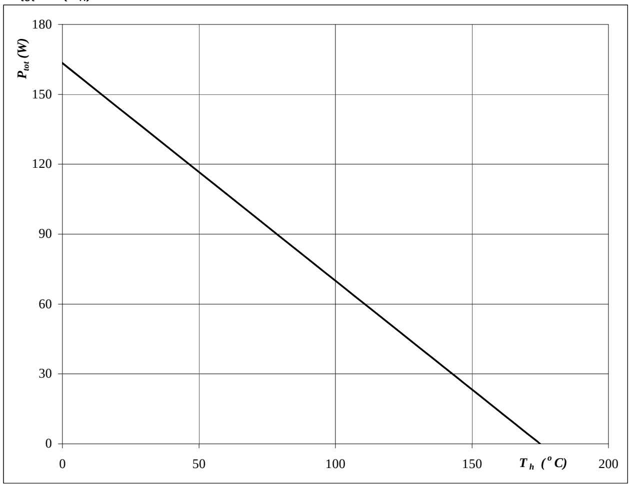
T_j = 150 ºC

V_{GS} = 10 V

Figure 23 BOOST FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



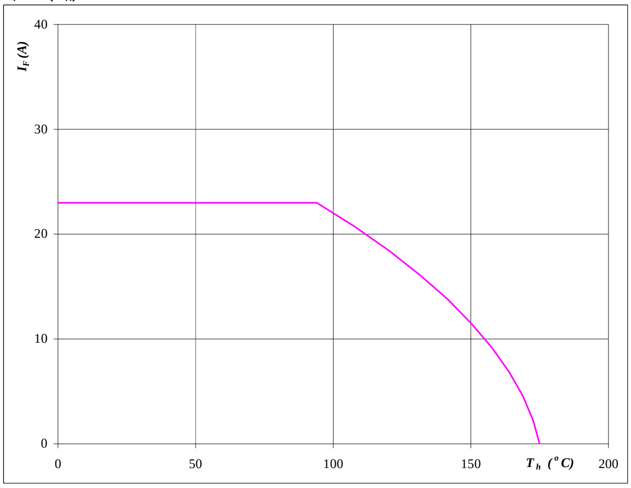
At

T_j = 175 ºC

Figure 24 BOOST FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

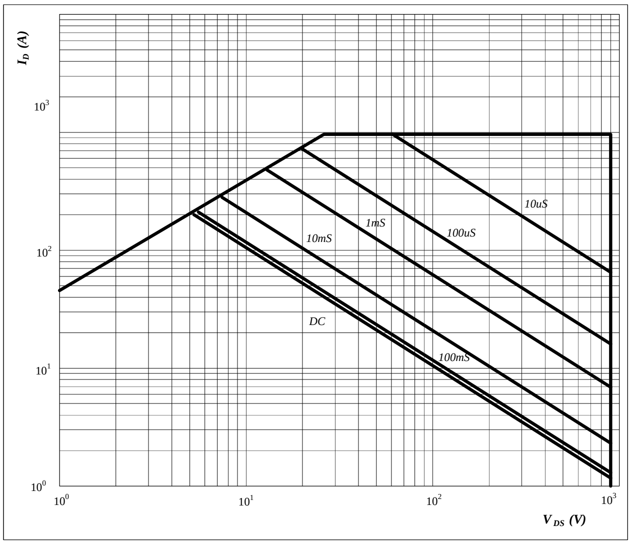
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



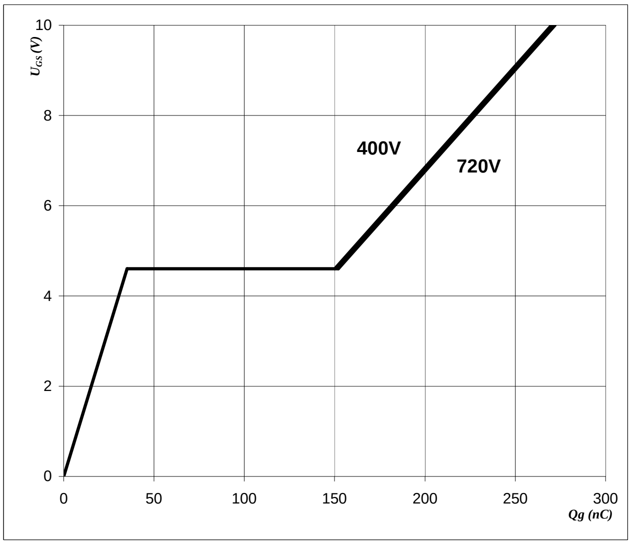
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	10	V
T_j =	T_{jmax}	ºC

Figure 26 BOOST MOSFET

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



At

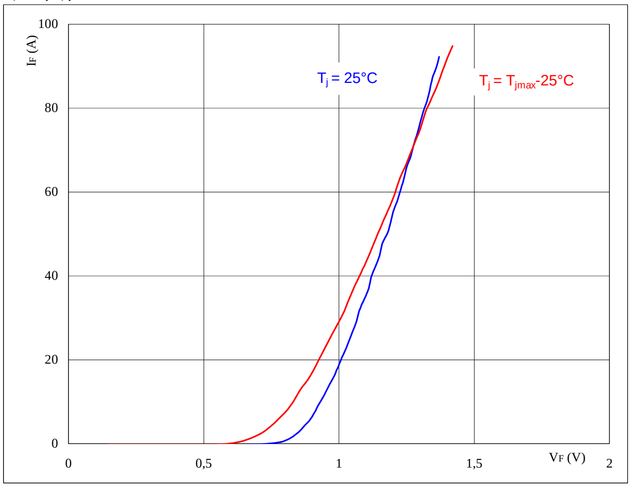
I_D =	26	A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



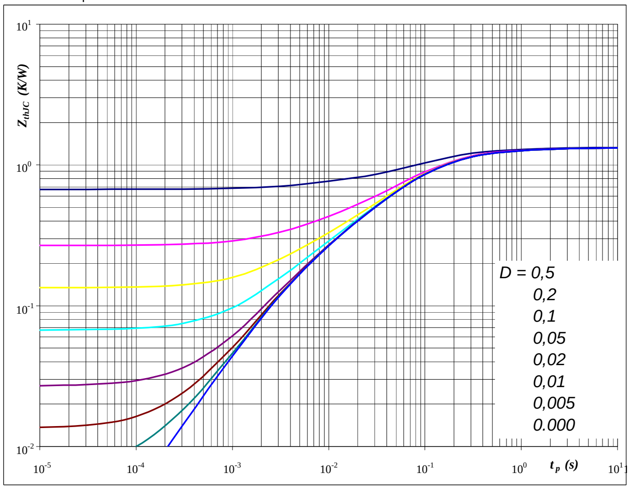
At

t_p = 250 µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

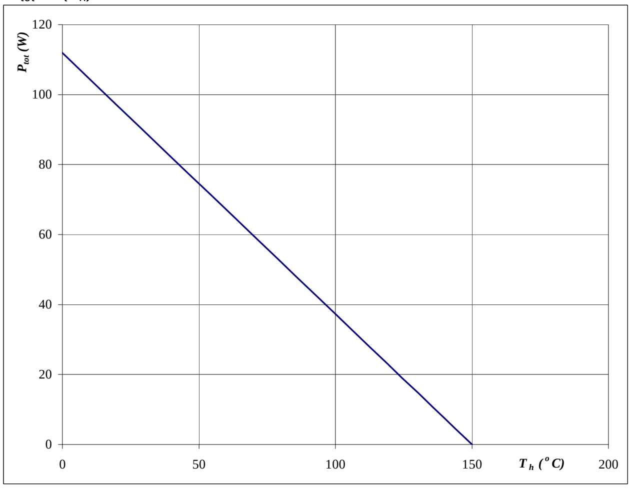
D = t_p / T

R_{thJH} = 1,341 K/W

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



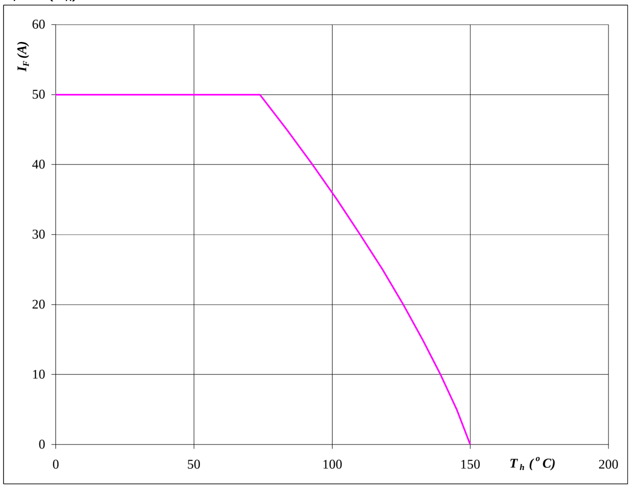
At

T_j = 150 ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



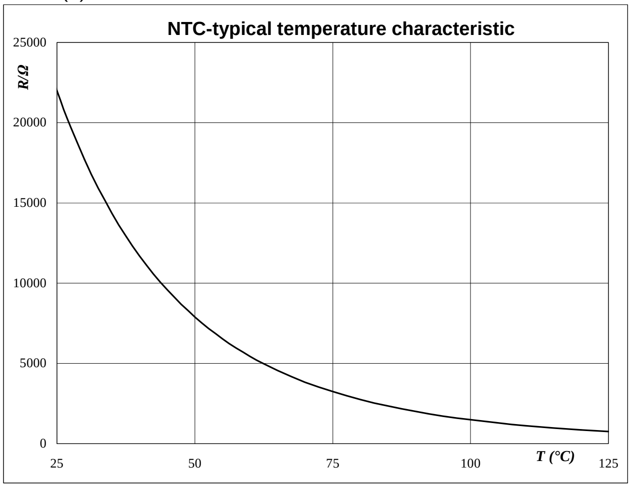
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$



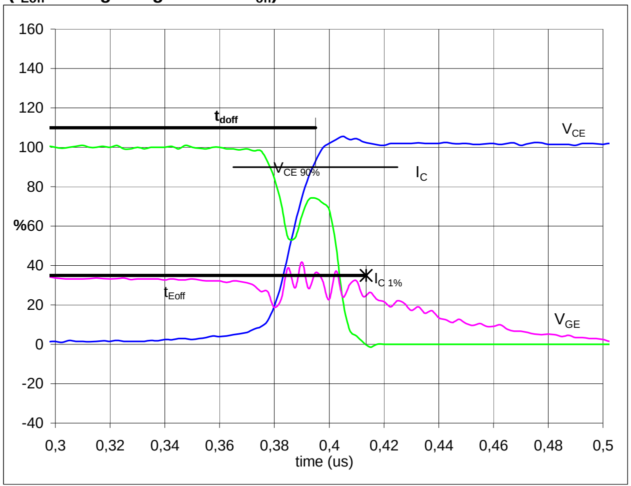
Switching Definitions BUCK MOSFET

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Output inverter IGBT

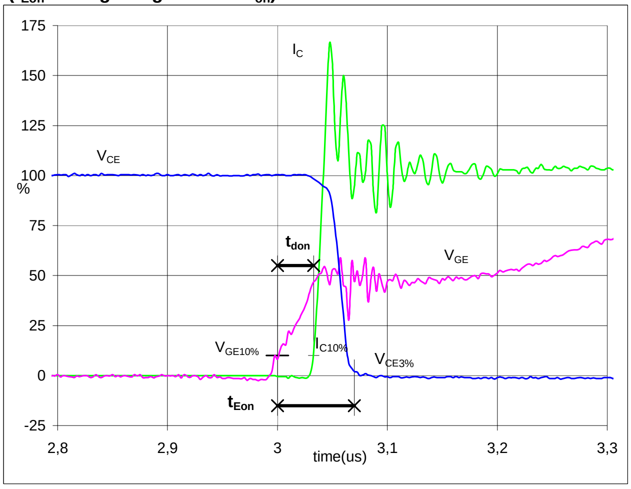
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	15	A
t_{doff} =	0,45	μs
t_{Eoff} =	0,48	μs

Figure 2 Output inverter IGBT

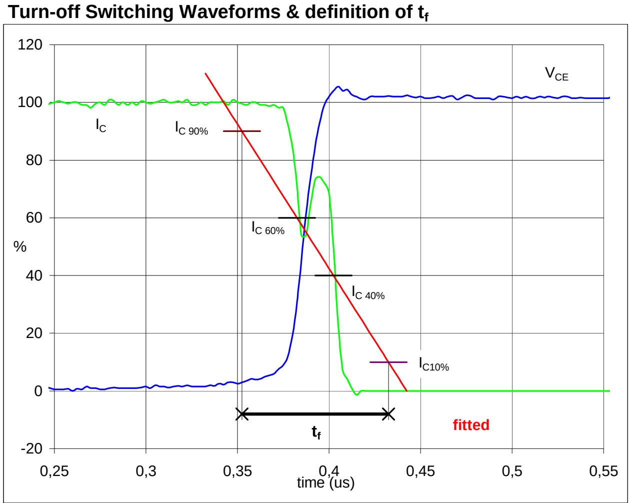
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	700	V
I_C (100%) =	15	A
t_{don} =	0,04	μs
t_{Eon} =	0,07	μs

Figure 3 Output inverter IGBT

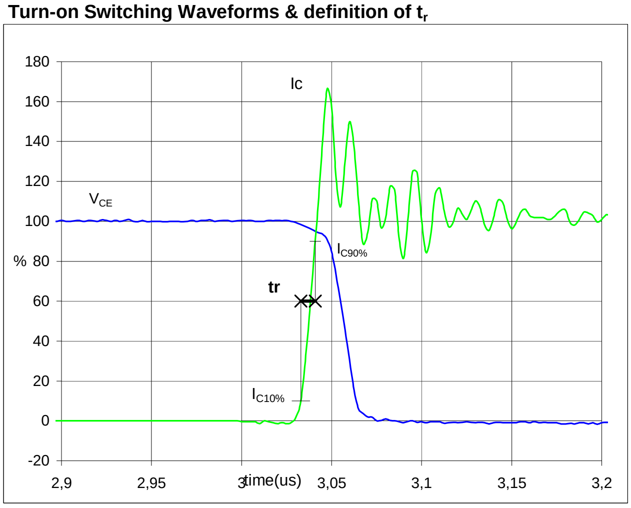
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	15	A
t_f =	0,04	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

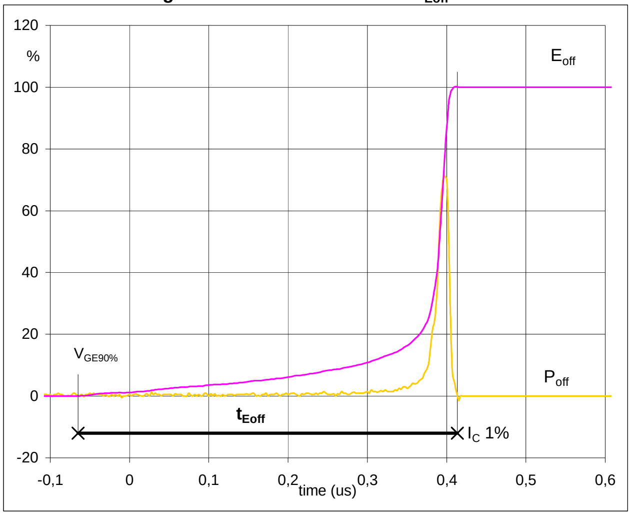


V_C (100%) =	700	V
I_C (100%) =	15	A
t_r =	0,02	μs

Switching Definitions BUCK MOSFET

Figure 5 Output inverter IGBT

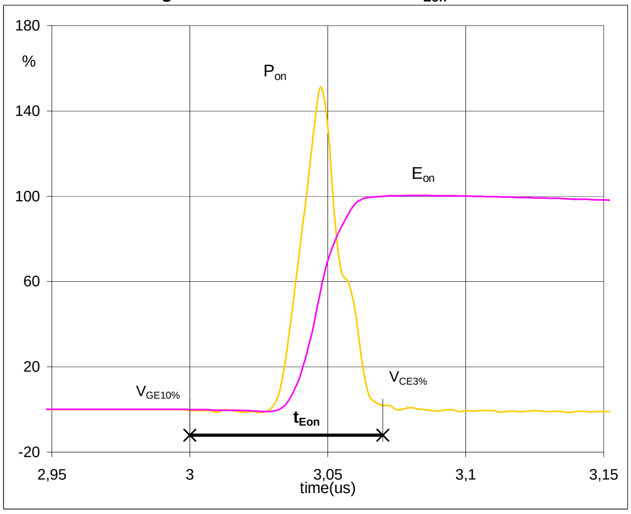
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	10,51	kW
E_{off} (100%) =	0,18	mJ
t_{Eoff} =	0,48	μs

Figure 6 Output inverter IGBT

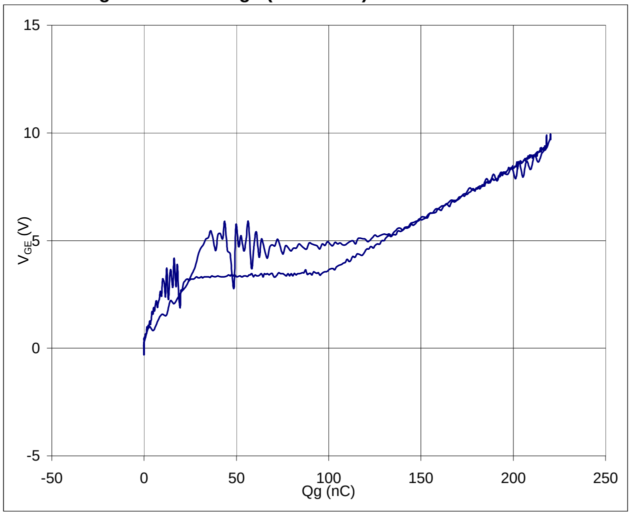
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	10,51	kW
E_{on} (100%) =	0,26	mJ
t_{Eon} =	0,07	μs

Figure 7 Output inverter FRED

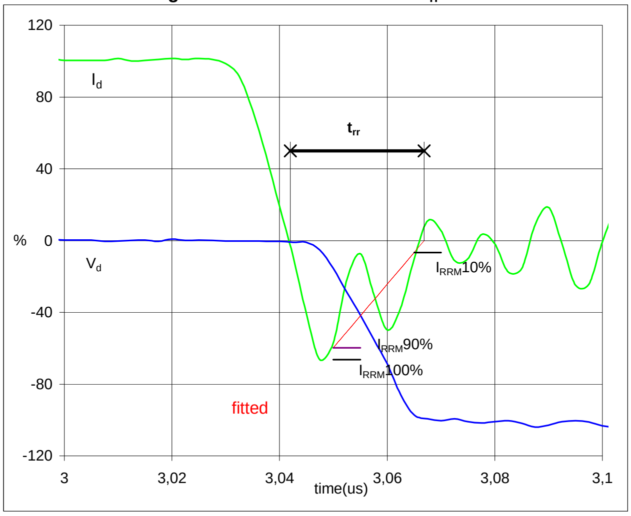
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	700	V
I_C (100%) =	15	A
Q_g =	220,25	nC

Figure 8 Output inverter IGBT

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

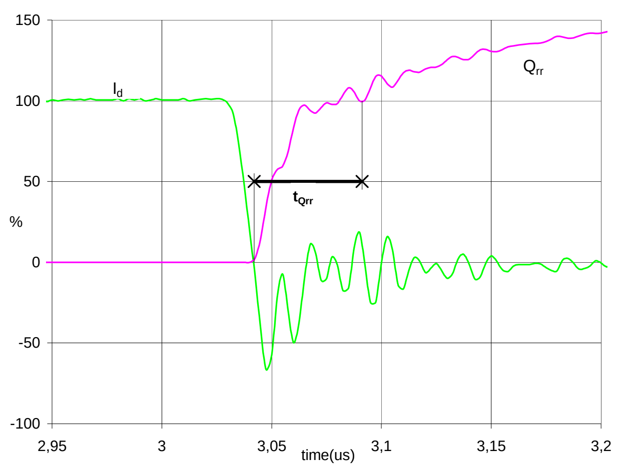


V_d (100%) =	700	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-4	A
t_{rr} =	0,03	μs

Switching Definitions BUCK MOSFET

Figure 9 Output inverter FRED

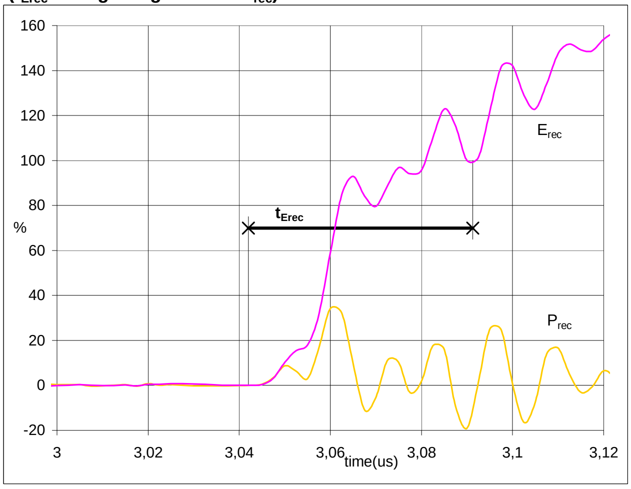
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,10	μC
t_{Qrr} =	0,05	μs

Figure 10 Output inverter FRED

Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	10,51	kW
E_{rec} (100%) =	0,07	mJ
t_{Erec} =	0,05	μs

Measurement circuits

Figure 11

BUCK stage switching measurement circuit

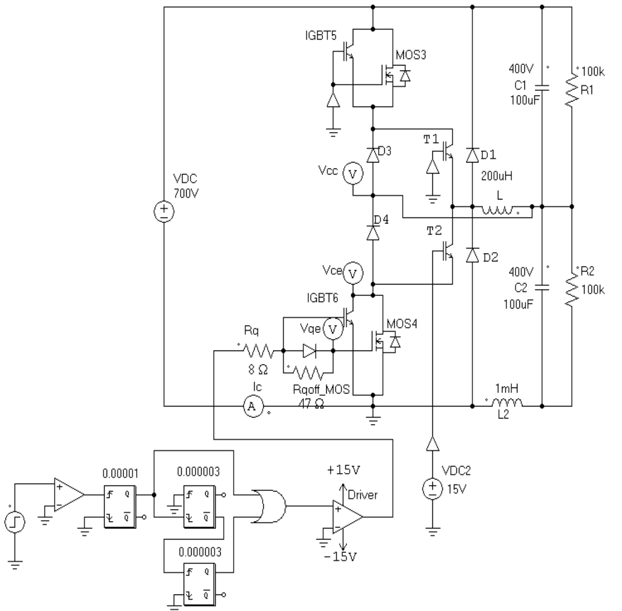
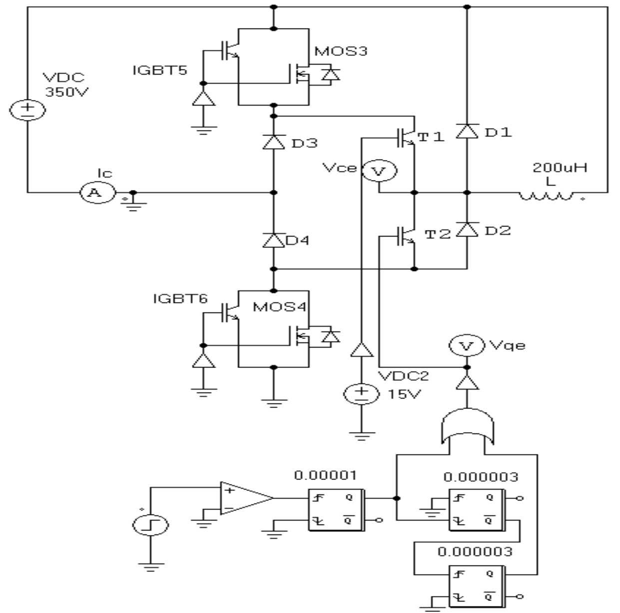


Figure 12

BOOST stage switching measurement circuit



Ordering Code and Marking - Outline - Pinout

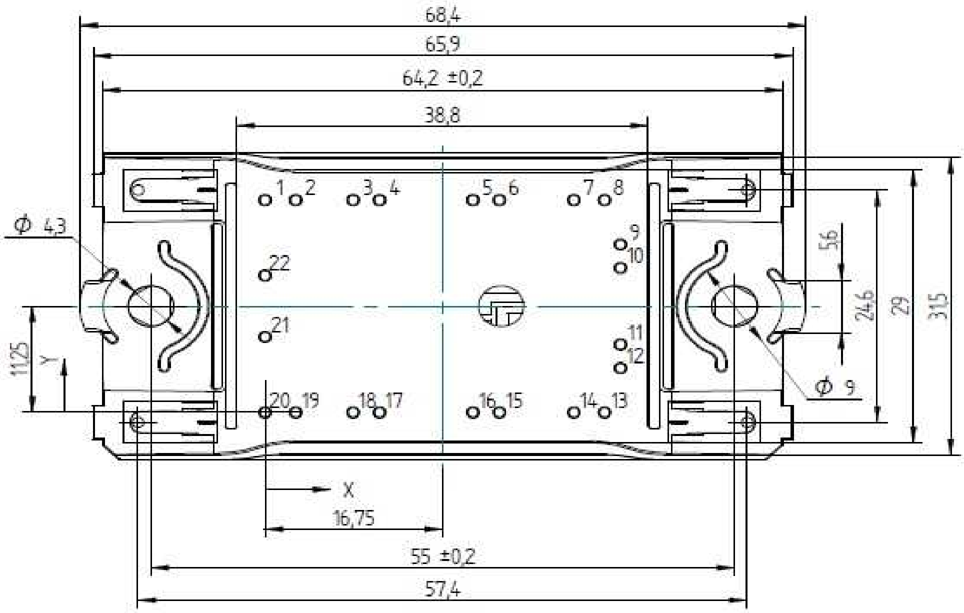
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
w/o thermal paste 12mm housing solder pin	V23990-P621-F68-PM	P621-F68	P621-F68
w/o thermal paste 12mm housing Press-fit pin	V23990-P621-F68Y-PM	P621-F68Y	P621-F68Y

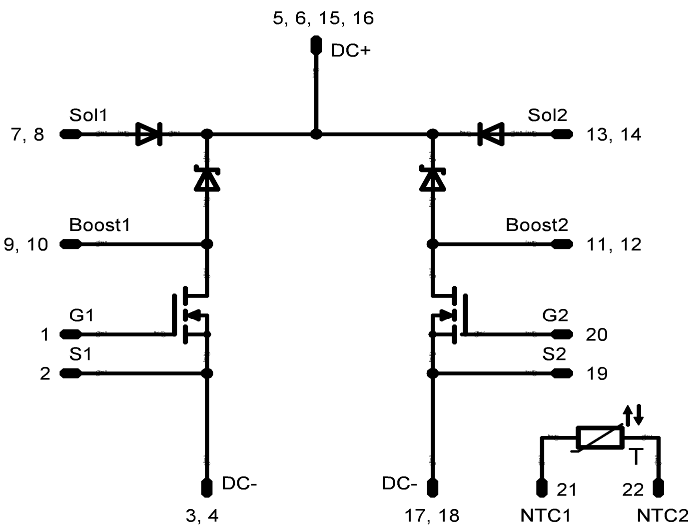
Outline

Pin table

Pin	X	Y
1	0	22,5
2	2,9	22,5
3	8,3	22,5
4	10,8	22,5
5	19,6	22,5
6	22,1	22,5
7	29,1	22,5
8	32	22,5
9	33,5	17,8
10	33,5	15,3
11	33,5	7,2
12	33,5	4,7
13	32	0
14	29,1	0
15	22,1	0
16	19,6	0
17	10,8	0
18	8,3	0
19	2,9	0
20	0	0
21	0	8
22	0	14,5



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.