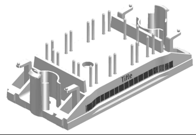
Vincotech

V23990-P629-L49
preliminary datasheet

flowBOOST **1200V/40A**

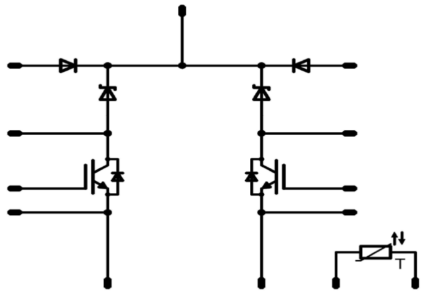
Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V SiC diode

flow0 17mm housing



Target Applications
- solar inverter

Schematic



Types
- V23990-P629-L49

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode (D7 , D8)					
Repetitive peak reverse voltage	V_{RRM}	Tj=25℃		1600	V
DC forward current	I_{FAV}	T_j=$T_j$max	T_h=80℃ T_c=80℃	34 47	A
Surge forward current	I_{FSM}	t_p=10ms sin 180°	T_j=150℃	200	A
I^2t-value	I^2t			200	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	42 63	W
Maximum Junction Temperature	$T_j$max			150	℃
Boost IGBT (T1 , T2)					
Collector-emitter break down voltage	V_{CE}	T_j=25℃		1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	40 51	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		120	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_{vj} ≤ 175℃		160	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	113 171	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 800	µs V
Maximum Junction Temperature	$T_j$max			175	℃

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost IGBT Protection Diode (D9 , D10)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃		1200	V
DC forward current	I_F	$T_j=T_j max$	T_h=80℃ T_c=80℃	10 13	A
Surge forward current	I_{FSM}	t_p=10ms, $T_j=T_j max$		21	A
Power dissipation per Diode	P_{tot}	$T_j=T_j max$	T_h=80℃ T_c=80℃	26 39	W
Maximum Junction Temperature	$T_j max$			150	℃
Boost FWD (D1 , D4)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃		1200	V
DC forward current	I_F	$T_j=T_j max$	T_h=80℃ T_c=80℃	18 23	A
Repetitive peak forward current	I_{FRM}	T_C=25˚C, t_P=8.3 ms		60	A
Power dissipation	P_{tot}	$T_j=T_j max$	T_h=80℃ T_c=80℃	64 96	W
Maximum Junction Temperature	$T_j max$			175	℃
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	℃
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 (D7 , D8)										
Forward voltage	V_F				25	Tj=25℃ Tj=125℃	0,7	1,15 1,11	1,4	V
Threshold voltage (for power loss calc. only)	V_{to}				24	Tj=25℃ Tj=125℃		0,92 0,81		V
Slope resistance (for power loss calc. only)	r_t				24	Tj=25℃ Tj=125℃		0,009 0,012		Ω
Reverse current	I_r			1600		Tj=25℃ Tj=125℃			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,67		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,10		
Boost IGBT (T1 , T2)										
Gate emitter threshold voltage	$V_{GE(th)}$		$V_{GE}=V_{CE}$		0,0015	Tj=25℃ Tj=125℃	5,2	5,8	6,4	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		40	Tj=25℃ Tj=125℃	1,7	2,10 2,48	2,6	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25℃ Tj=125℃			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	15	700	24	Tj=25℃ Tj=125℃		22 21		ns
Rise time	t_r					Tj=25℃ Tj=125℃		46 66		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		227 296		
Fall time	t_f					Tj=25℃ Tj=125℃		46 66		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,37 0,42		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,97 1,58		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		2300		pF
Output capacitance	C_{oss}							150		
Reverse transfer capacitance	C_{rss}							135		
Gate charge	Q_{Gate}		15	960	40	Tj=25℃		185		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,84		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,56		
Boost IGBT Protection Diode (D9 , D10)										
Diode forward voltage	V_F				3	Tj=25℃ Tj=125℃	0,7	1,66 1,58	2,4	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,72		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,80		
Boost FWD (D1 , D4)										
Forward voltage	V_F				10	Tj=25℃ Tj=125℃	1	1,49 1,92	2	V
Reverse leakage current	I_{rm}			1200		Tj=25℃ Tj=125℃			200	µA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	700	24	Tj=25℃ Tj=125℃		16 15		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		8 9		ns
Reverse recovery charge	Q_{rr}					Tj=25℃ Tj=125℃		0,10 0,30		µC
Reverse recovered energy	E_{rec}					Tj=25℃ Tj=125℃		0,02 0,16		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		6333 5501		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,49		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,98		

Characteristic Values

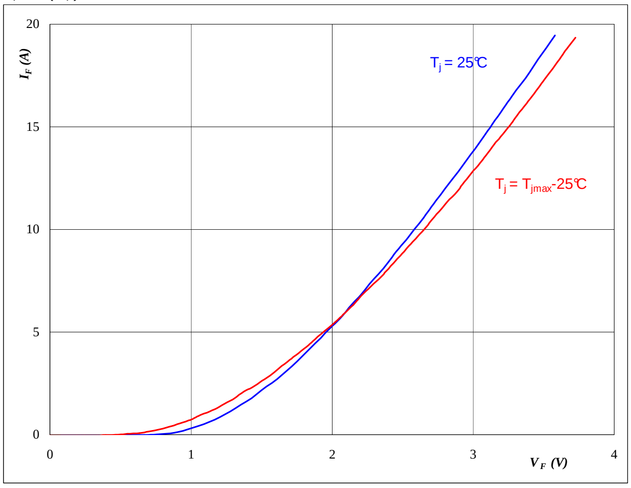
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					Tj=25℃		21511		Ω
Deviation of R25	ΔR/R	R100=1486Ω				Tc=100℃	-4,5		+4,5	%
Power dissipation	P					Tj=25℃		210		mW
Power dissipation constant						Tj=25℃		3,5		mW/K
B-value	$B_{(25/50)}$					Tj=25℃		3884		K
B-value	$B_{(25/100)}$	Tol. ±1%				Tj=25℃		3964		K
Vincotech NTC Reference									F	

Boost IGBT Protection Diode

Figure 1 Boost IGBT Protection Diode

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



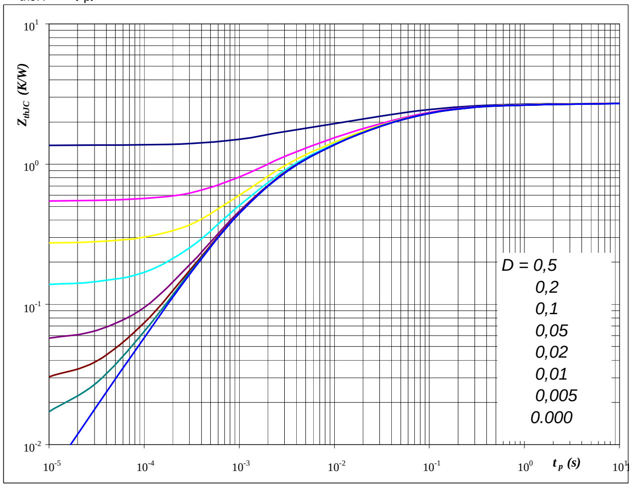
At

t_p = 250 µs

Figure 2 Boost IGBT Protection Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

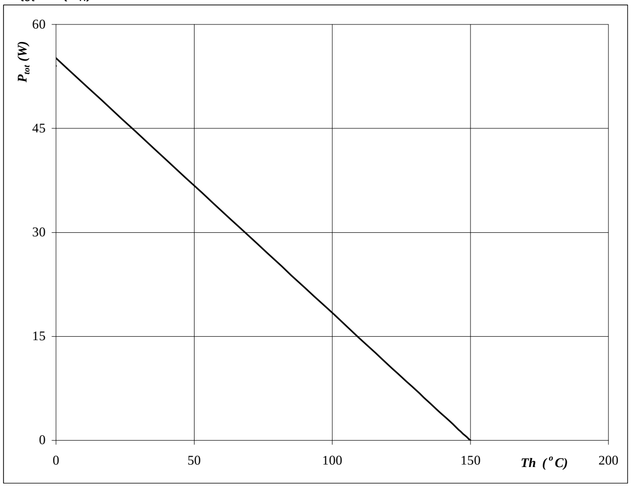
D = tp / T

R_{thJH} = 2,72 K/W

Figure 3 Boost IGBT Protection Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



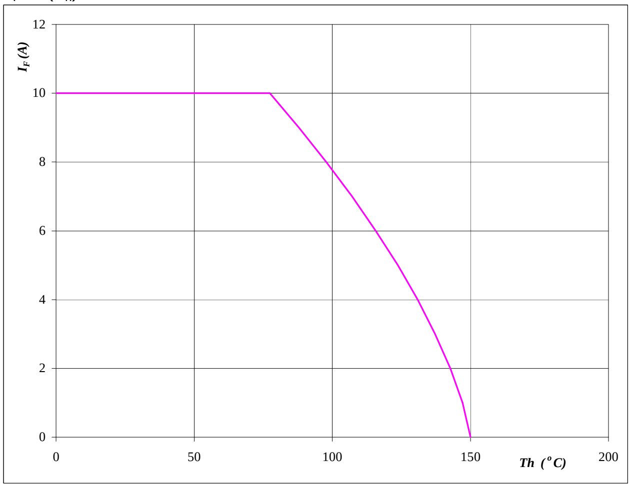
At

T_j = 150 ºC

Figure 4 Boost IGBT Protection Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

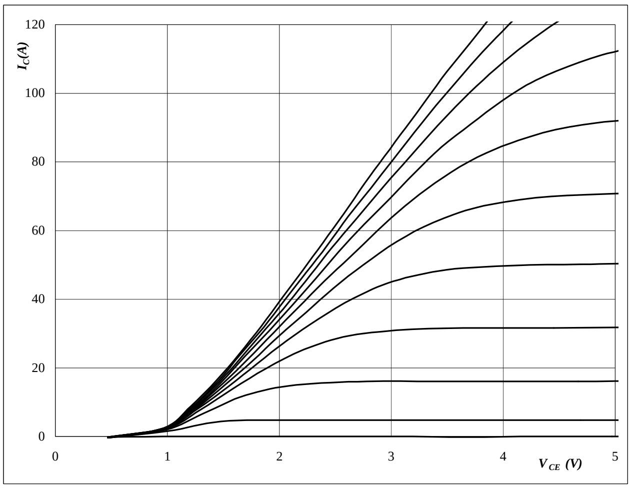
T_j = 150 ºC

INPUT BOOST

Figure 3 BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

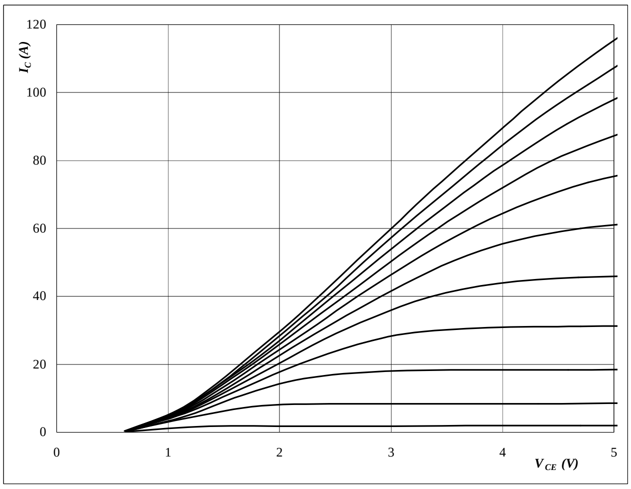
T_j = 25 ℃

V_{GS} from 7 V to 17 V in steps of 1 V

Figure 4 BOOST FWD

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

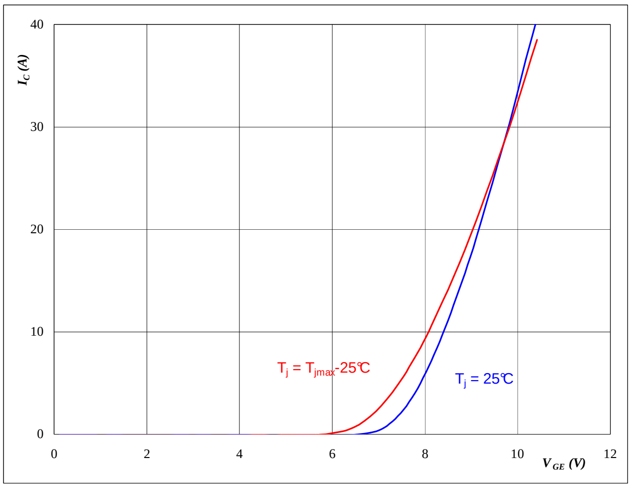
T_j = 126 ℃

V_{GS} from 7 V to 17 V in steps of 1 V

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

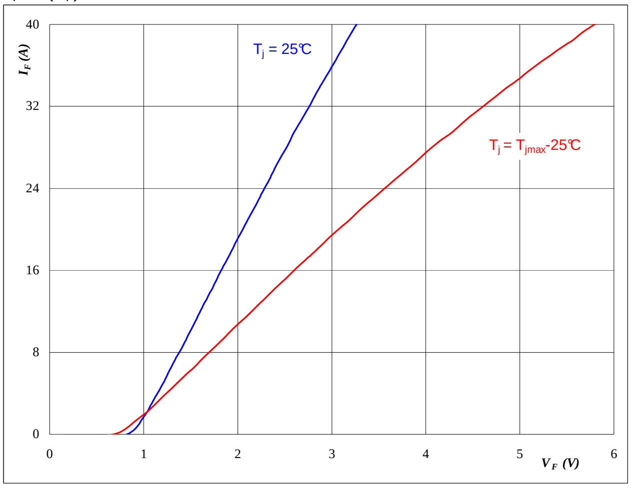
t_p = 250 µs

V_{DS} = 10 V

Figure 4 BOOST FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

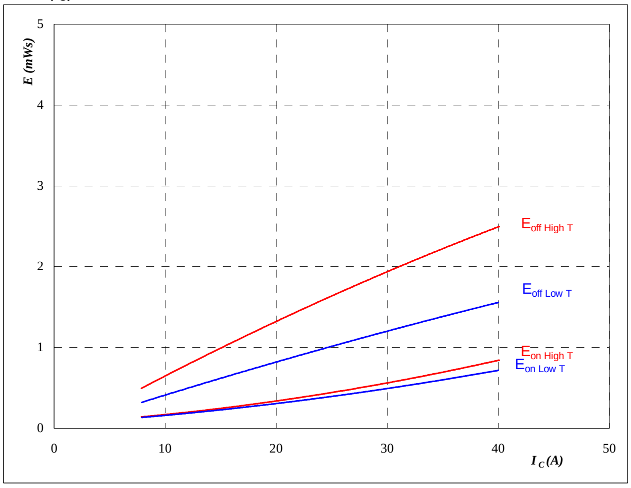
t_p = 250 µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



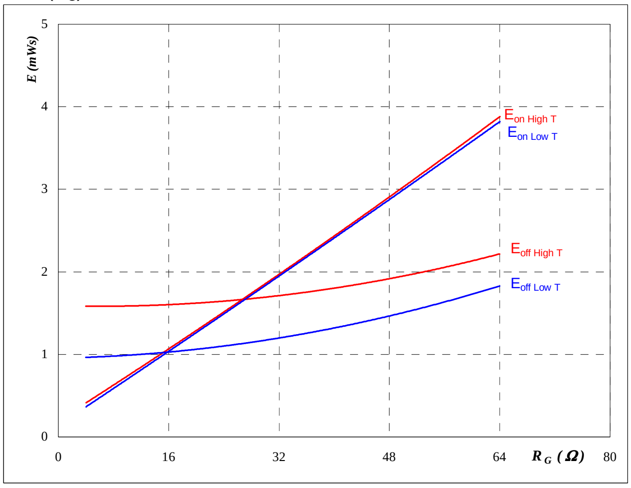
With an inductive load at

T_j =	25/125	℃
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 BOOST IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



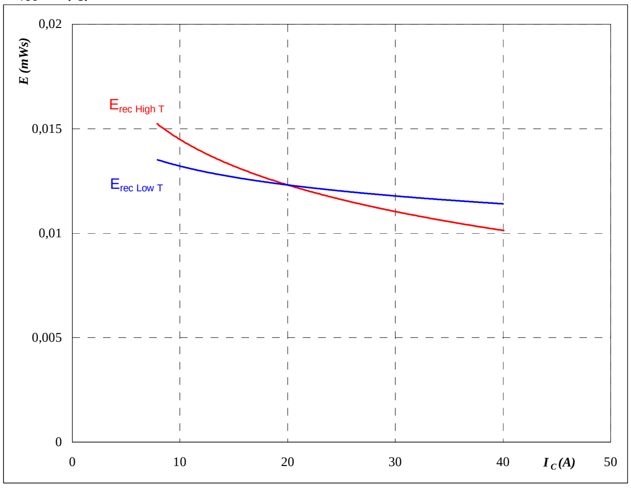
With an inductive load at

T_j =	25/125	℃
V_{DS} =	700	V
V_{GS} =	15	V
I_D =	24	A

Figure 7 BOOST IGBT

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

$E_{rec} = f(I_C)$



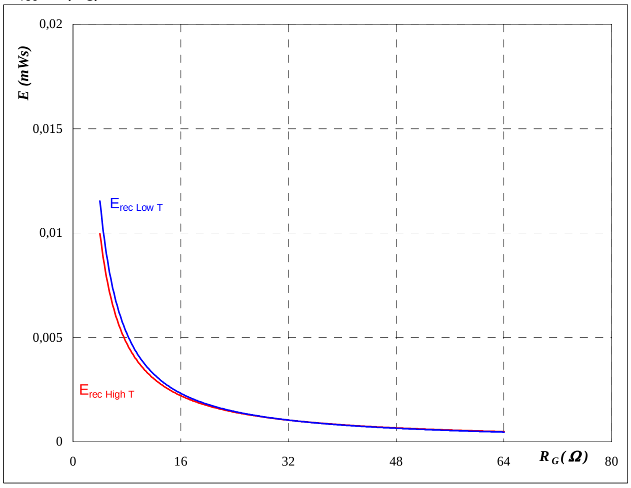
With an inductive load at

T_j =	25/125	℃
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω

Figure 8 BOOST IGBT

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

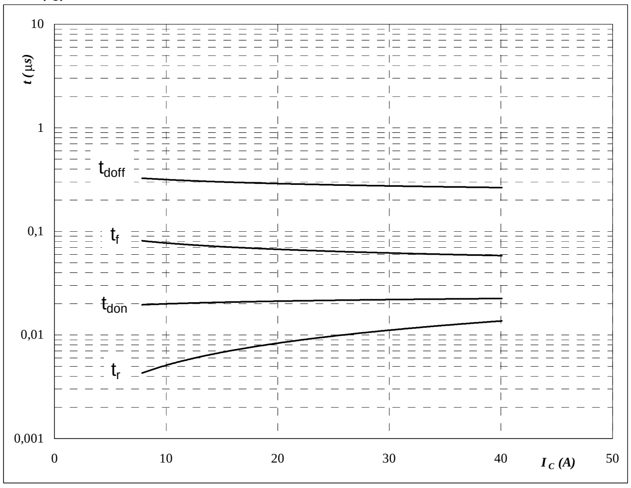
T_j =	25/125	℃
V_{DS} =	700	V
V_{GS} =	15	V
I_D =	24	A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

t = f(I_C)



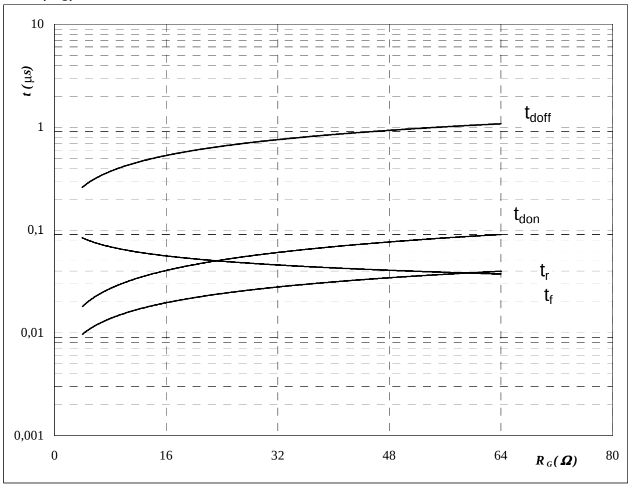
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



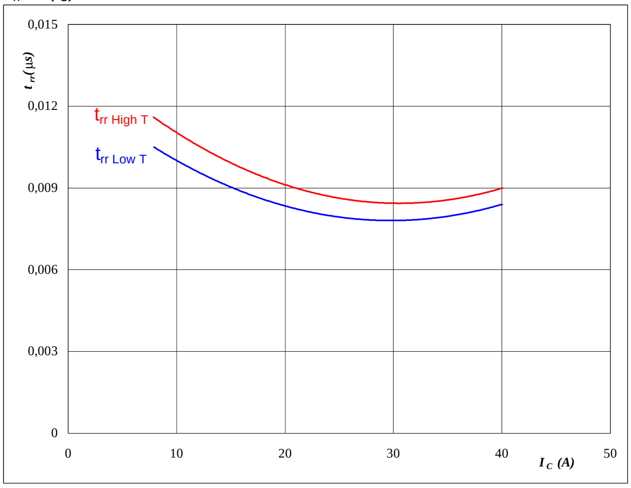
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	15	V
I_C =	24	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



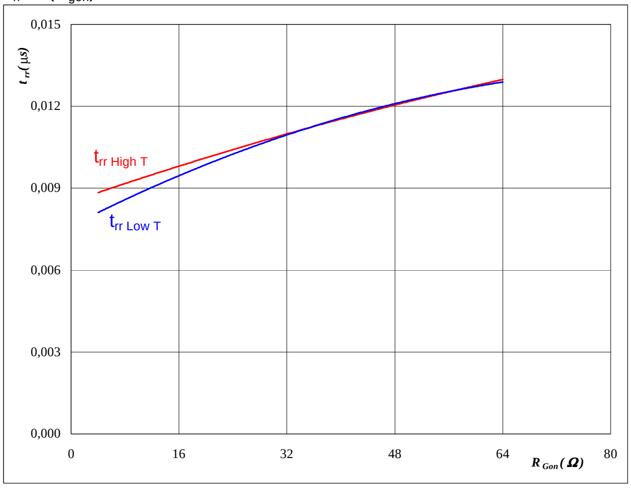
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 12 BOOST FWD

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

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



At

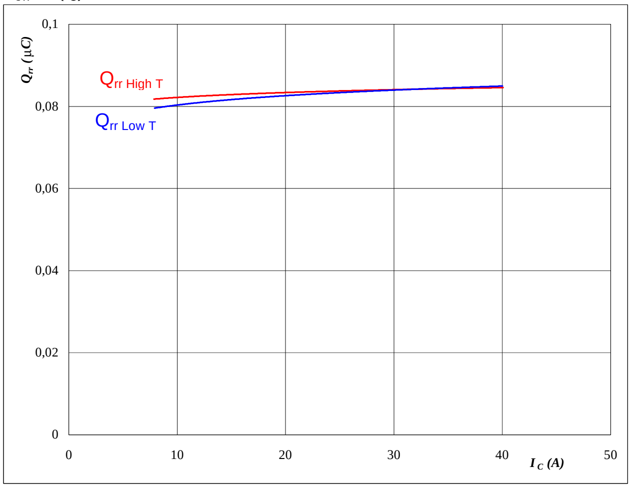
T_j =	25/125	°C
V_R =	700	V
I_F =	24	A
V_{GS} =	15	V

INPUT BOOST

Figure 13 BOOST IGBT

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



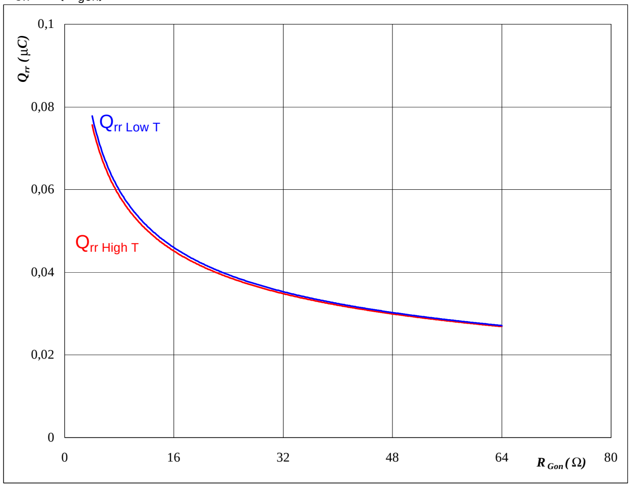
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 14 BOOST FWD

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

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



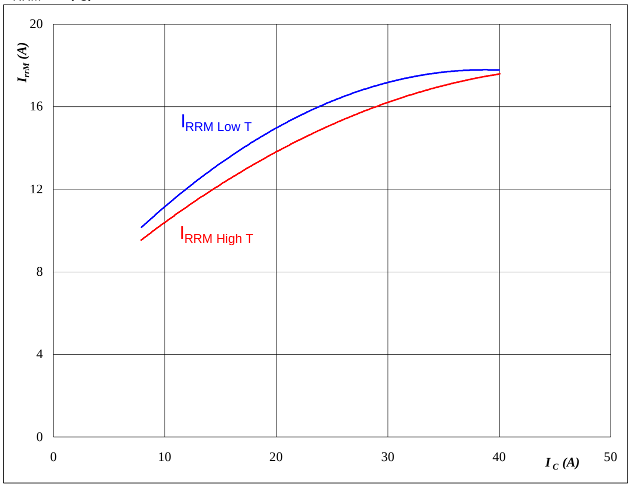
At

T_j =	25/125	°C
V_R =	700	V
I_F =	24	A
V_{GS} =	15	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



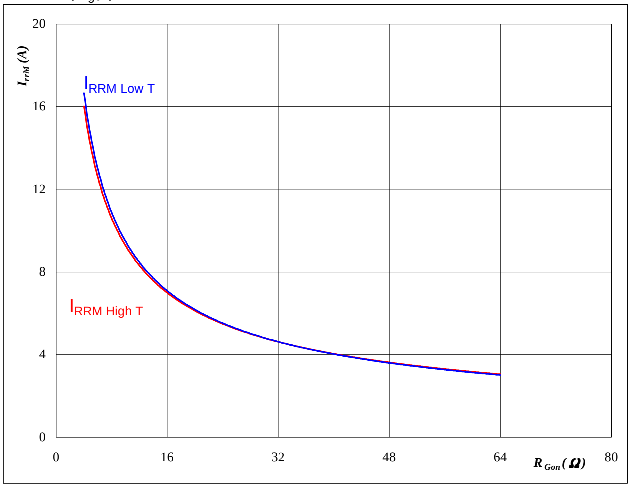
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 16 BOOST FWD

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

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



At

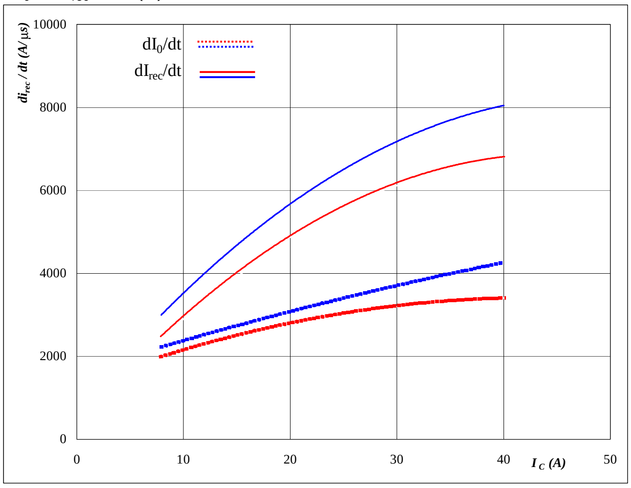
T_j =	25/125	°C
V_R =	700	V
I_F =	24	A
V_{GS} =	15	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



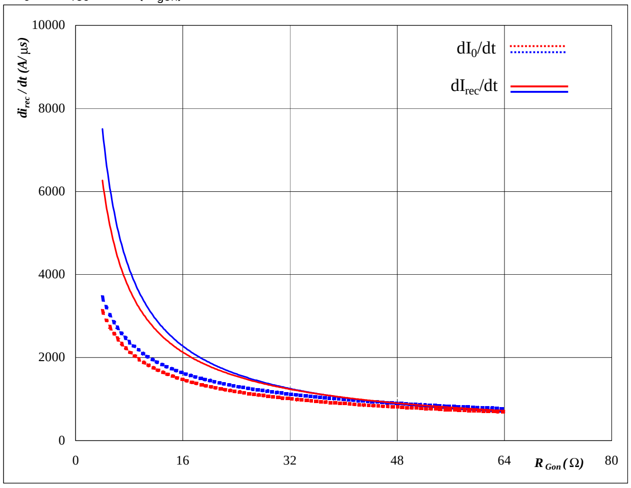
At

T_j =	25/125	℃
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 18 BOOST FWD

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

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



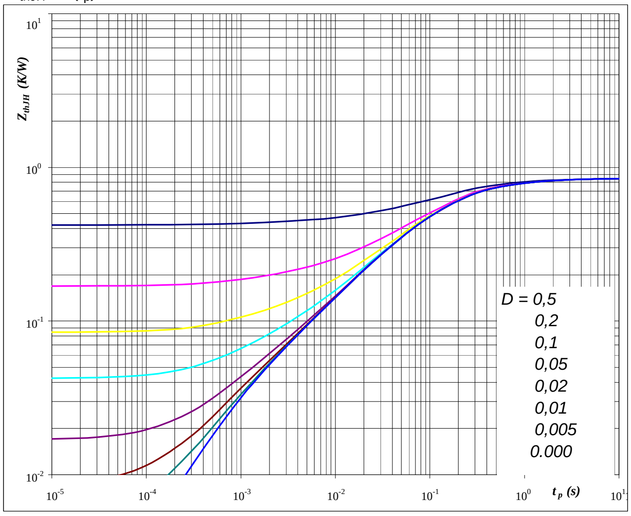
At

Tj =	25/125	℃
VR =	700	V
IF =	24	A
VGS =	15	V

Figure 19 BOOST IGBT

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

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,84	K/W

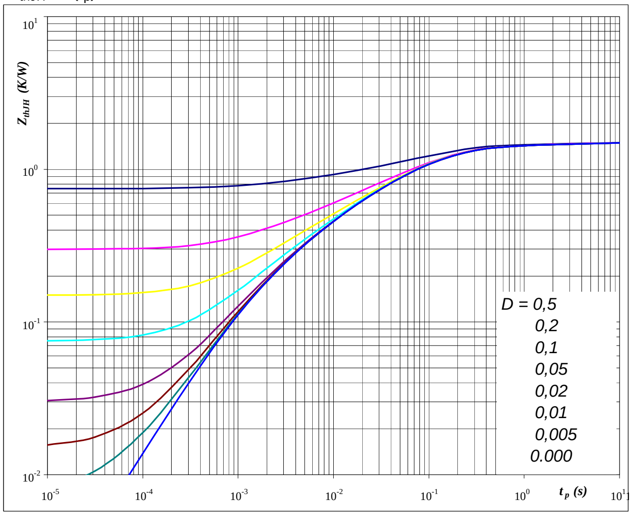
IGBT thermal model values

R (C/W)	Tau (s)
0,107	1,413
0,391	0,188
0,223	0,056
0,092	0,011
0,030	0,001

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,49	K/W

FWD thermal model values

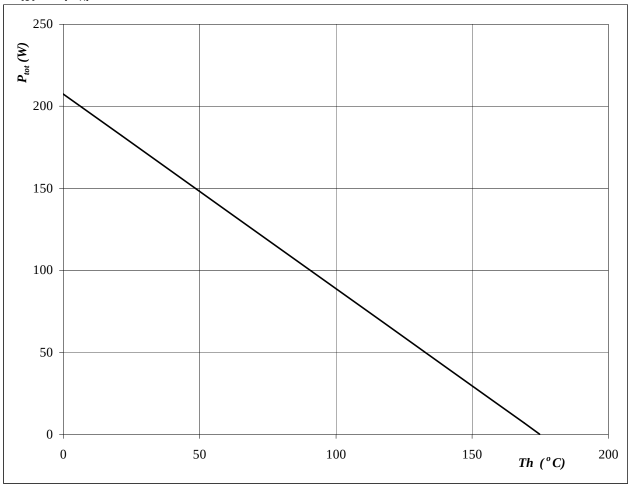
R (C/W)	Tau (s)
0,046	4,951
0,088	0,943
0,597	0,129
0,442	0,029
0,221	0,006

INPUT BOOST

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



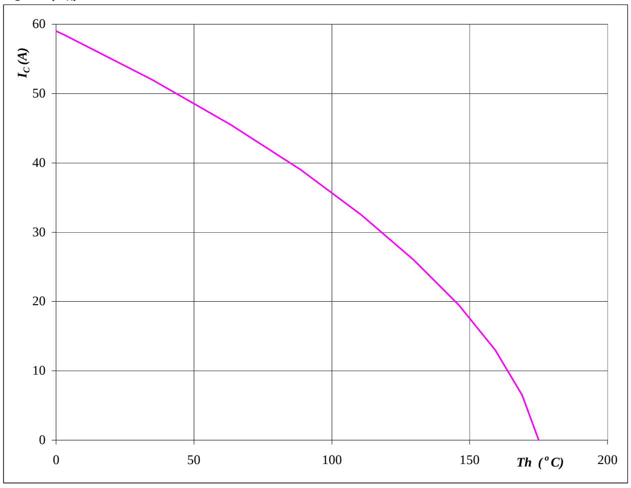
At

T_j = 175 ºC

Figure 22 BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

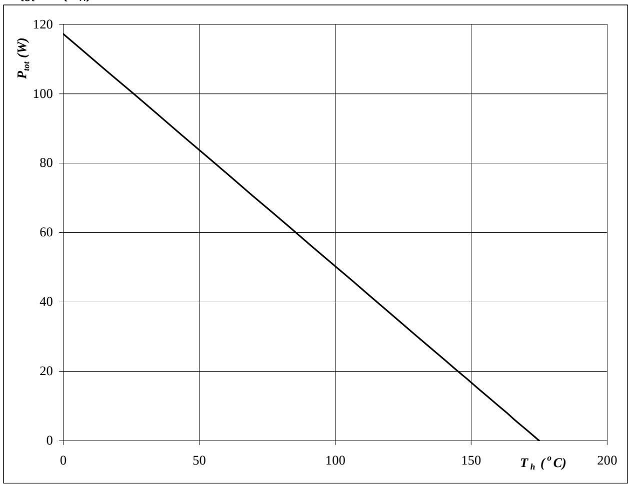
T_j = 175 ºC

V_{GS} = 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



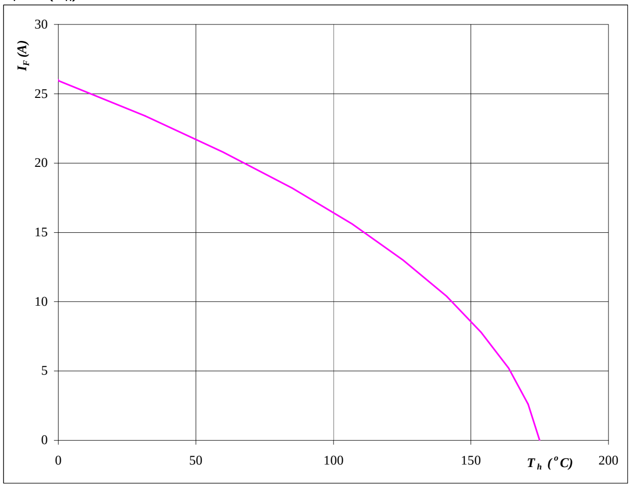
At

T_j = 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

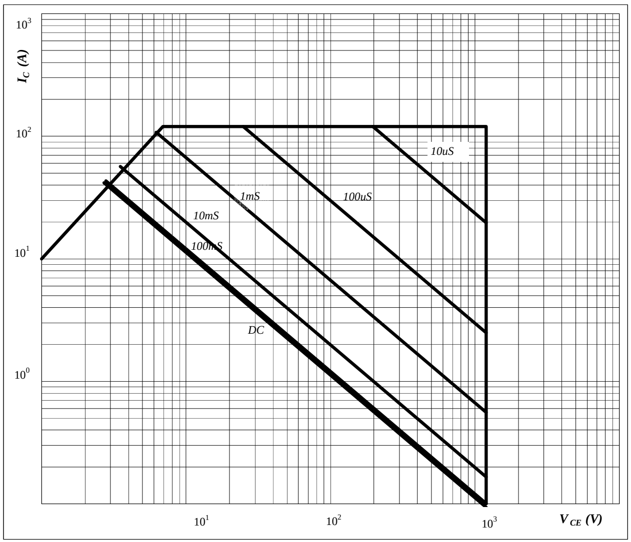
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



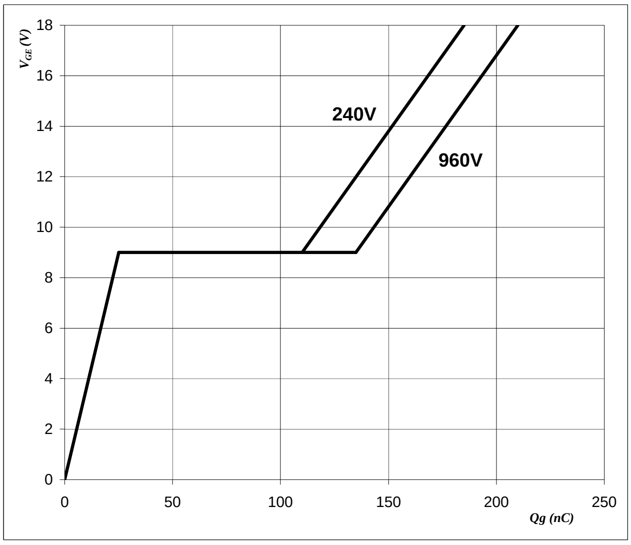
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	15	V
T_j =	T_{jmax}	ºC

Figure 26 BOOST IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$



At

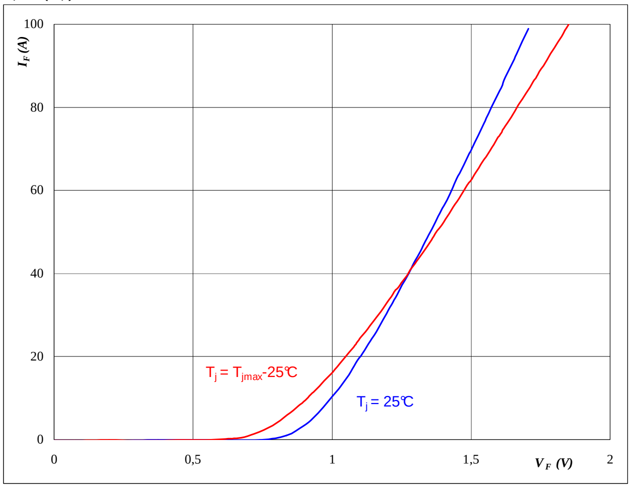
I_D =	24	A

Bypass Diode

Figure 1 Bypass Diode

Typical Diode forward current as a function of forward voltage

$I_F = f(V_F)$



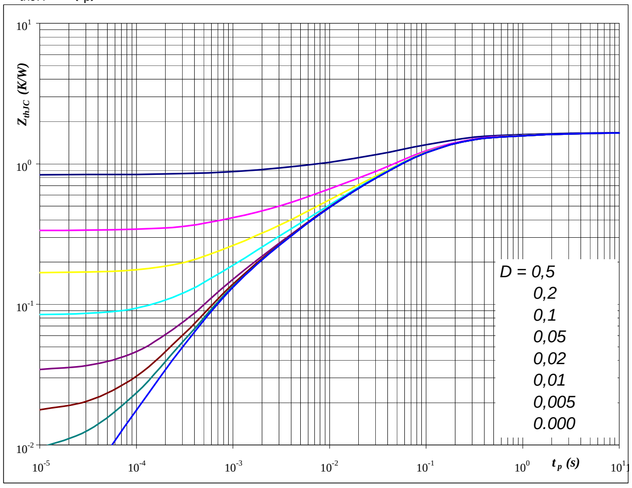
At

t_p =	250	µs

Figure 2 Bypass Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



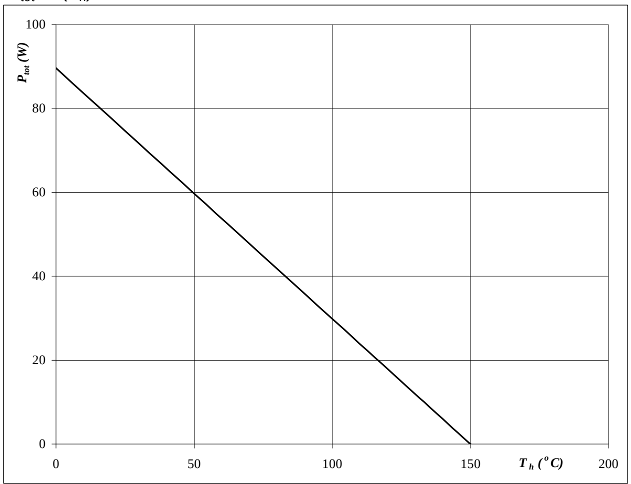
At

D =	t_p / T	
R_{thJH} =	1,67	K/W

Figure 3 Bypass Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



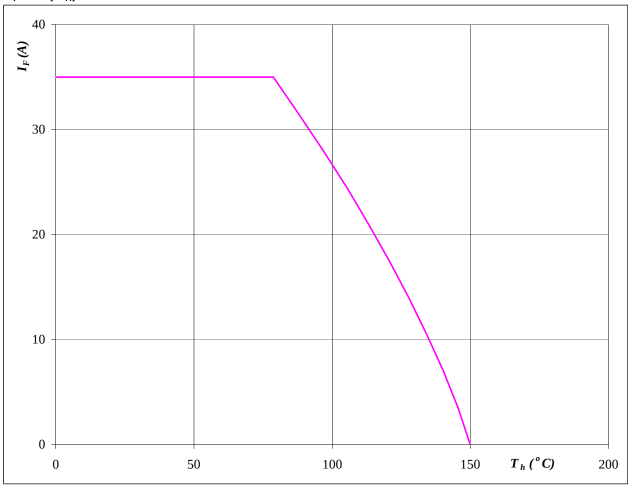
At

T_j =	150	ºC

Figure 4 Bypass Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

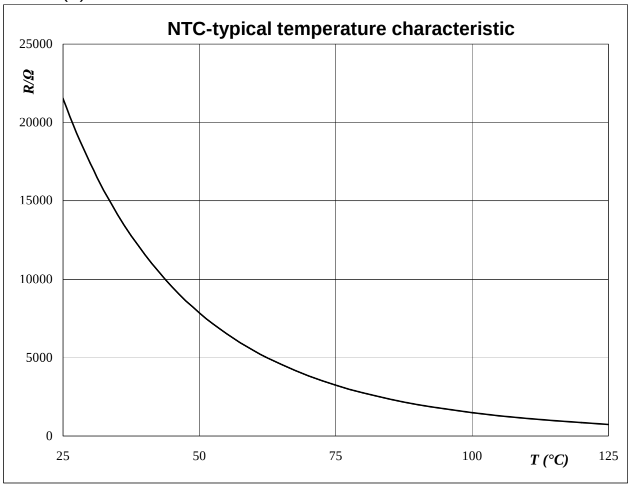
T_j =	150	ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

R_T = f(T)



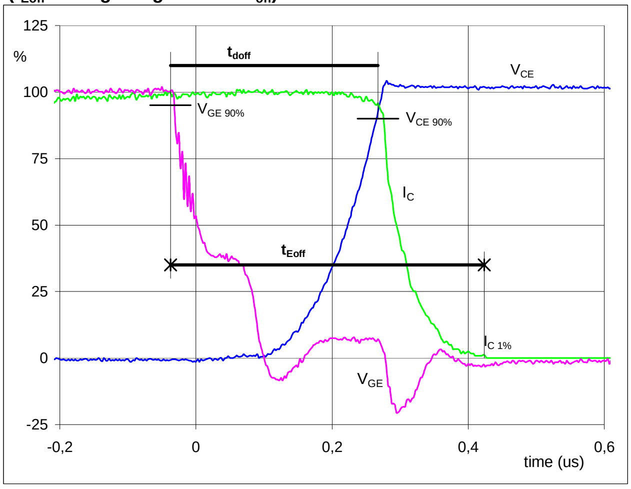
Switching Definitions BOOST IGBT

General conditions

T_j	=	124 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Boost IGBT

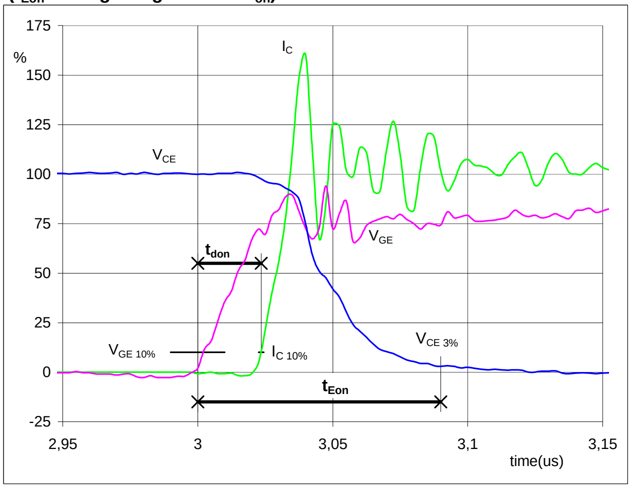
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	24	A
t_{doff} =	0,30	μs
t_{Eoff} =	0,46	μs

Figure 2 Boost IGBT

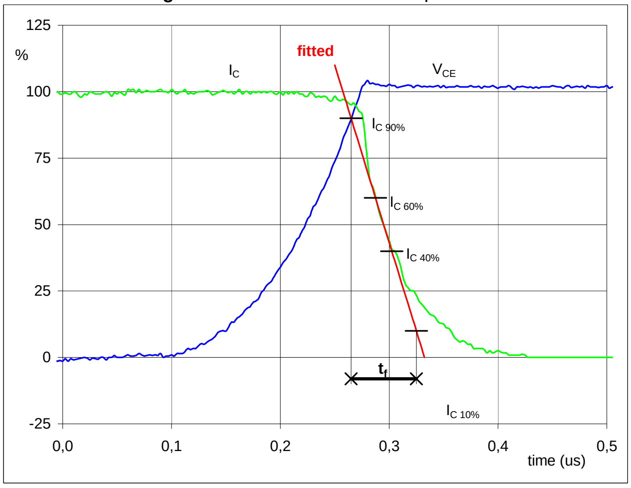
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	24	A
t_{don} =	0,02	μs
t_{Eon} =	0,09	μs

Figure 3 Boost IGBT

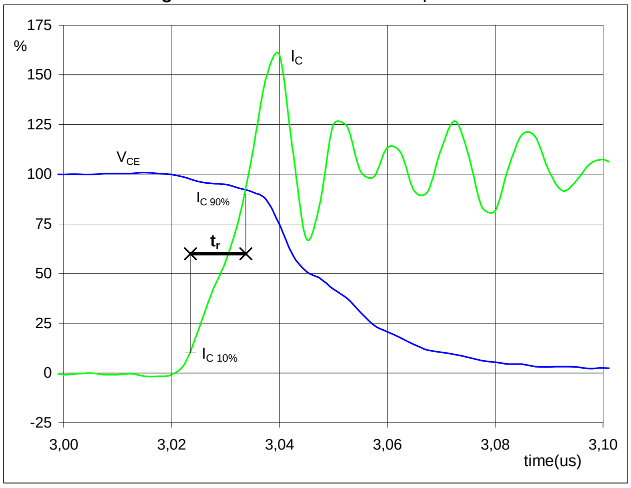
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	24	A
t_f =	0,07	μs

Figure 4 Boost IGBT

Turn-on Switching Waveforms & definition of t_r

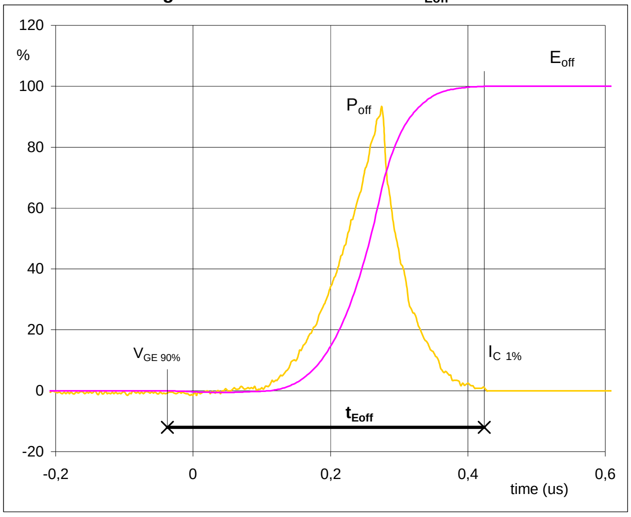


V_C (100%) =	700	V
I_C (100%) =	24	A
t_r =	0,01	μs

Switching Definitions BOOST IGBT

Figure 5 Boost IGBT

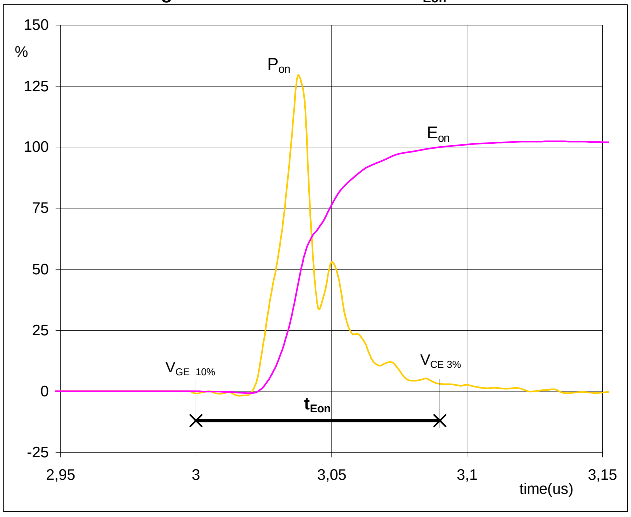
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	16,80	kW
E_{off} (100%) =	1,58	mJ
t_{Eoff} =	0,46	µs

Figure 6 Boost IGBT

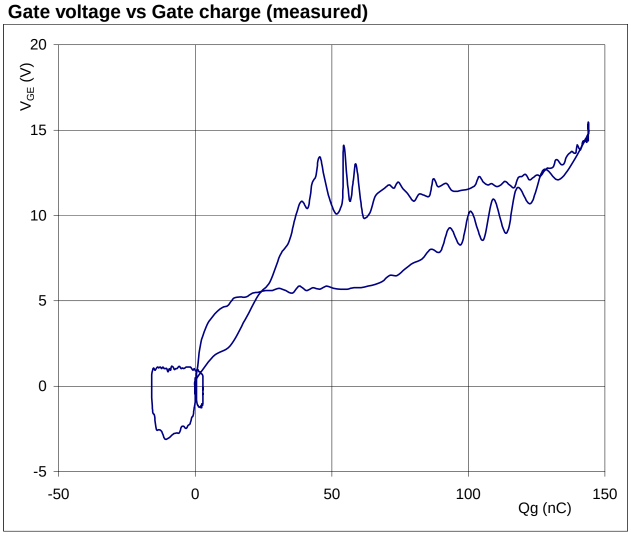
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	16,80	kW
E_{on} (100%) =	0,42	mJ
t_{Eon} =	0,09	µs

Figure 7 Boost IGBT

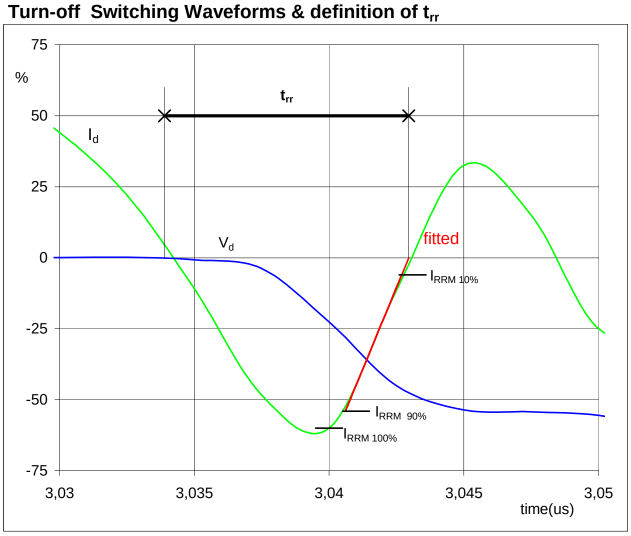
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	15	V
V_C (100%) =	700	V
I_C (100%) =	24	A
Q_g =	144	nC

Figure 8 Boost FWD

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

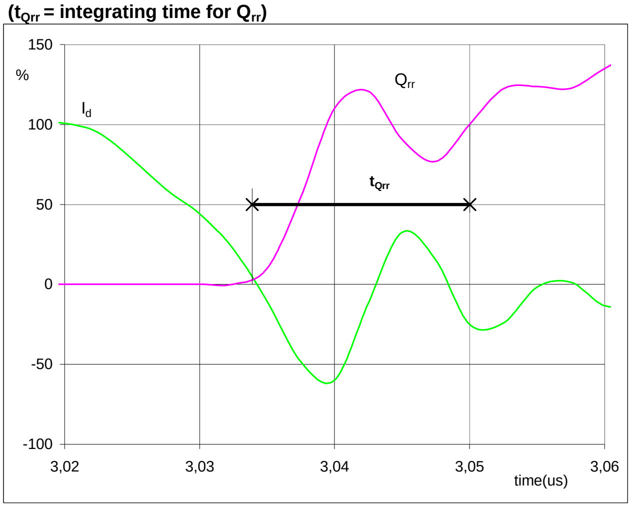


V_d (100%) =	700	V
I_d (100%) =	24	A
I_{RRM} (100%) =	-15	A
t_{rr} =	0,01	µs

Switching Definitions BOOST FWD

Figure 9	Boost FWD

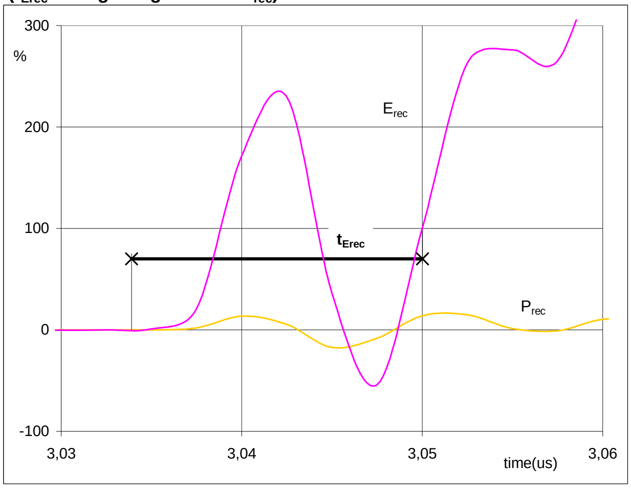
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	24	A
Q_{rr} (100%) =	0,08	μC
t_{Qrr} =	0,02	μs

Figure 10	Boost FWD

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



P_{rec} (100%) =	16,80	kW
E_{rec} (100%) =	0,01	mJ
t_{Erec} =	0,02	μs

Ordering Code and Marking - Outline - Pinout

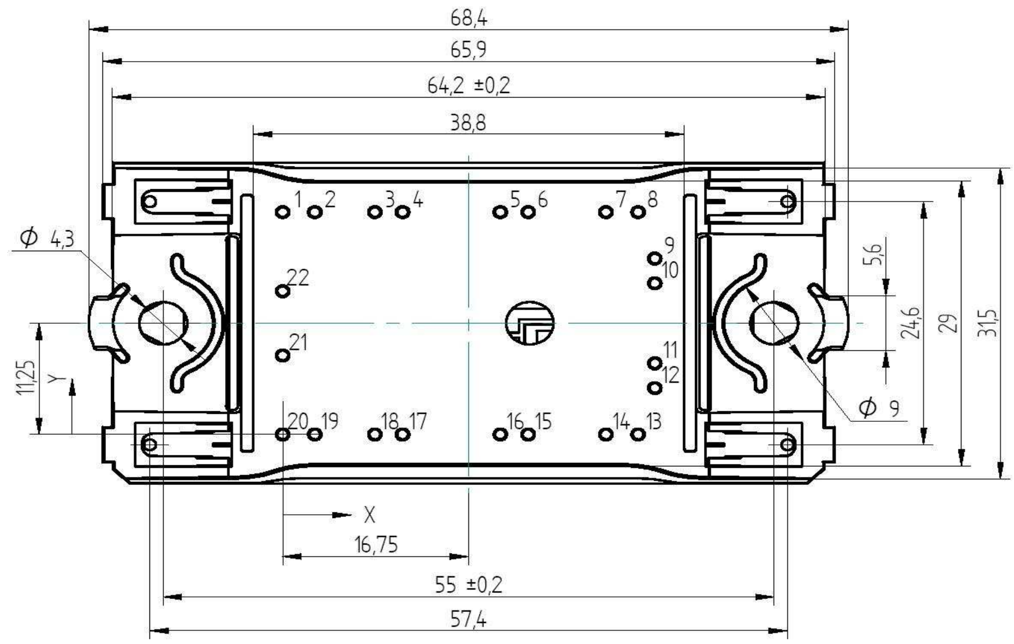
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P629-L49-PM	P629-L49	P629-L49

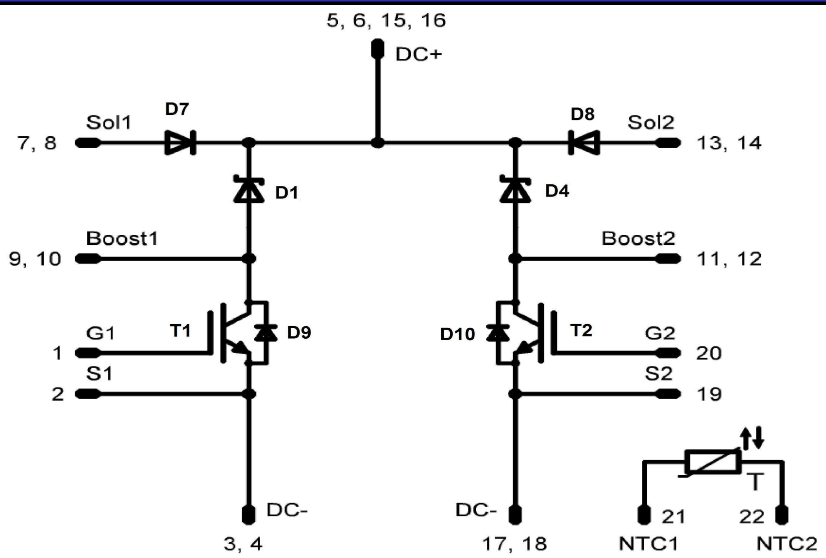
Outline

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



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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.
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.