V23990-P629-F62-PM / V23990-P629-F629-PM
V23990-P629-F628Y-PM / V23990-P629-F629Y-PM

flow BOOST 0 — 1200 V / 40 A

Features

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

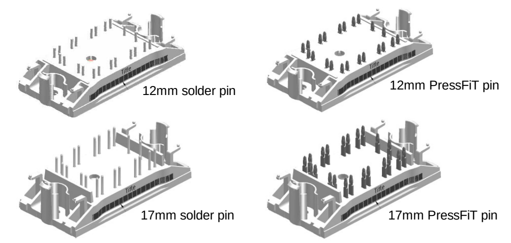
Target Applications

- solar inverter

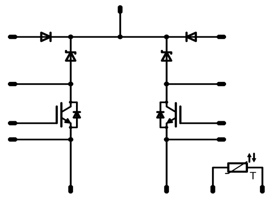
Types

- V23990-P629-F62-PM
- V23990-P629-F629-PM
- V23990-P629-F628Y-PM
- V23990-P629-F629Y-PM

flow0 12mm and 17mm housing



Schematic



Maximum Ratings

T_j=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	35 45	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	220	A
I2t-value	I^2t			240	A^2s
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	41 62	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost IGBT					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	35 48	A
Pulsed collector current	I_{CRM}	t_p limited by $T_j$max		160	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	108 164	W
Gate-emitter peak voltage	V_{GE}			±25	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 600	μs V
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Inverse Diode					
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	6 9	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		6	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	24 37	W
Maximum Junction Temperature	T_{jmax}			150	°C
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	24 28	A
Repetitive peak forward current	I_{FRM}	tp limited by Tjmax tp=8.3 ms, Half Sine Wave		90	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	90 136	W
Maximum Junction Temperature	T_{jmax}			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 9,57	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or VGS [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				25	Tj=25°C Tj=125°C	0,8	1,13 1,09	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				25	Tj=25°C Tj=125°C		0,93 0,80		V
Slope resistance (for power loss calc. only)	r_t				25	Tj=25°C Tj=125°C		0,008 0,011		Ω
Reverse current	I_r			1600		Tj=25°C Tj=125°C			0,05	mA
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,71		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							1,13		
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00025	Tj=25°C Tj=125°C	3,5	5,5	7,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	Tj=25°C Tj=125°C		2,74 3	3,5	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25°C Tj=125°C			1	mA
Gate-emitter leakage current	I_{GES}		25	0		Tj=25°C Tj=125°C			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	15	600	40	Tj=25°C Tj=125°C		25 25		ns
Rise time	t_r					Tj=25°C Tj=125°C		9 10		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		172 202		
Fall time	t_f					Tj=25°C Tj=125°C		13 35		
Turn-on energy loss	E_{on}					Tj=25°C Tj=125°C		0,41 0,51		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=125°C		0,85 1,66		
Input capacitance	C_{ies}	f=1MHz	0	30		Tj=25°C		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Total gate charge	Q_G		15	600	40	Tj=25°C		220		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						0,65		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,43		
Boost Inverse Diode										
Diode forward voltage	V_F				3	Tj=25°C Tj=125°C	0,7	1,8 1,63	2,4	V
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						2,87		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							1,89		
Boost FWD										
Forward voltage	V_F				15	Tj=25°C Tj=150°C	1	1,58 2,17	1,9	V
Reverse leakage current	I_{rm}			1200		Tj=25°C Tj=150°C			600	μA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	600	40	Tj=25°C Tj=150°C		24 23		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		9 9		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=150°C		100 112		nC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		0,004 0,011		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		10933 7266		A/μs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,06		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,70		

Characteristic Values

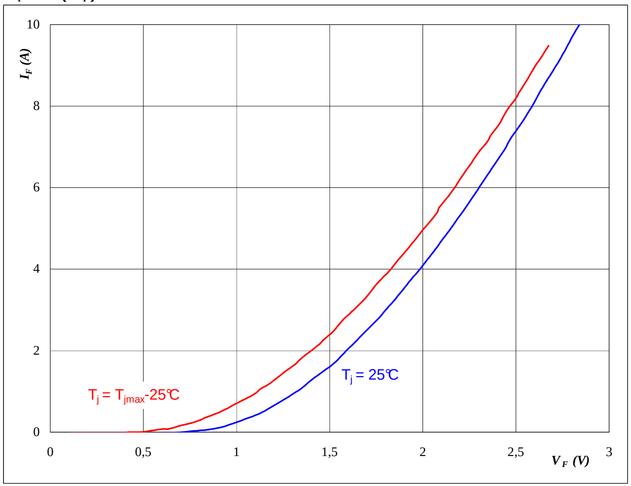
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or VGS [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				Tc=100°C	-12		+12	%
Power dissipation	*P*					Tj=25°C		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
Vincotech NTC Reference						Tj=25°C			B	

Boost IGBT Protection Diode

Figure 1 Boost IGBT Protection Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



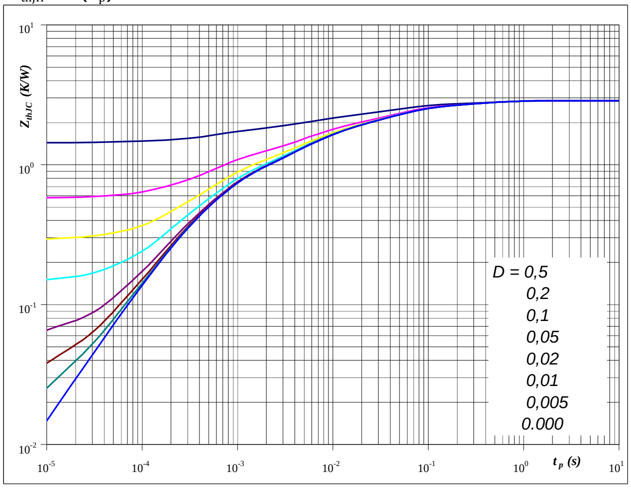
At

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

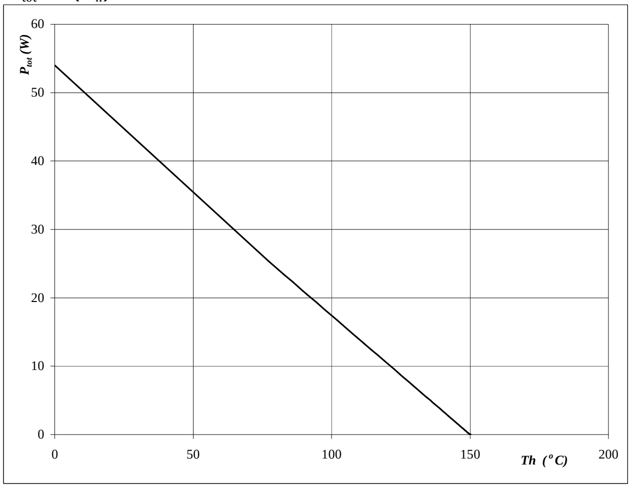
$D = t_p / T$

R_{thJH} = 2,87 K/W

Figure 3 Boost IGBT Protection Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



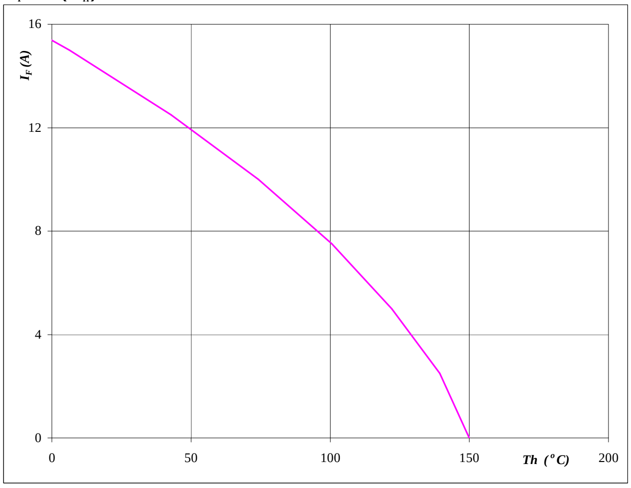
At

T_j = 150 ºC

Figure 4 Boost IGBT Protection Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

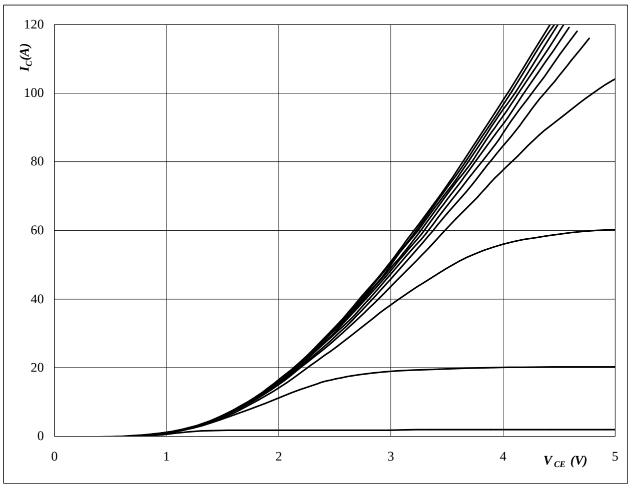
T_j = 150 ºC

INPUT BOOST

Figure 3 BOOST IGBT

Typical output characteristics

$I_D = f(V_{DS})$



At

t_p = 250 µs

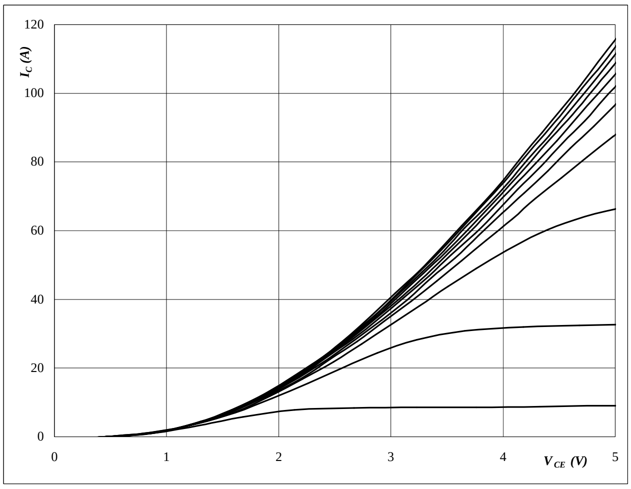
T_j = 25 °C

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

Figure 4 BOOST FWD

Typical output characteristics

$I_D = f(V_{DS})$



At

t_p = 250 µs

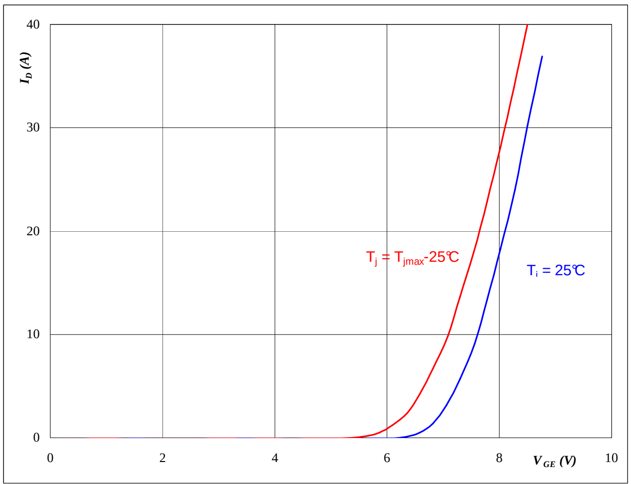
T_j = 125 °C

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

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_D = f(V_{GE})$



At

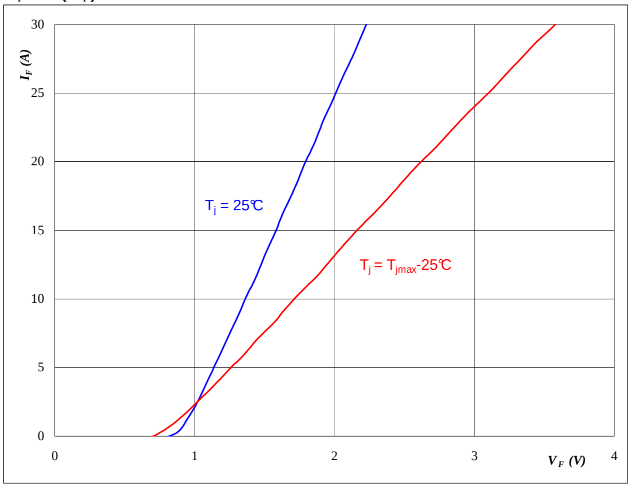
t_p = 250 µs

V_{DS} = 10 V

Figure 4 BOOST FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

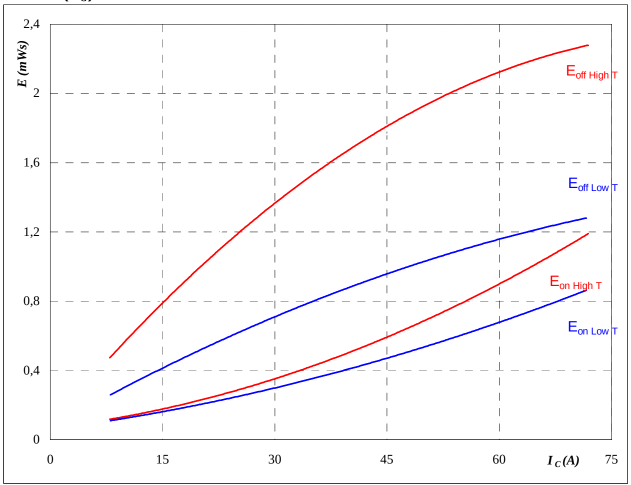
t_p = 250 µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



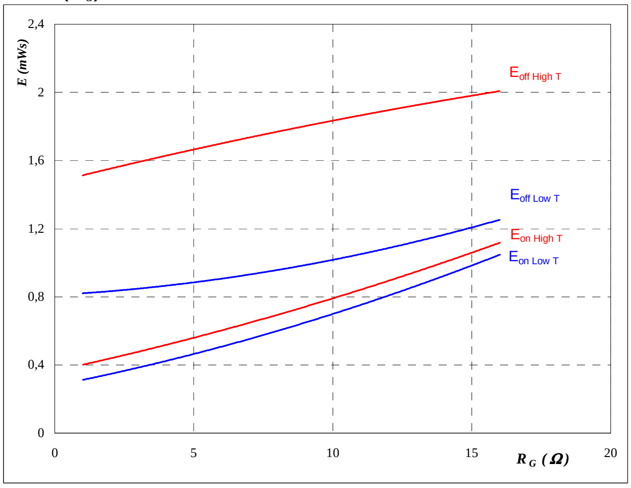
With an inductive load at

T_j =	25/125	°C
V_{DS} =	600	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

$E = f(R_G)$



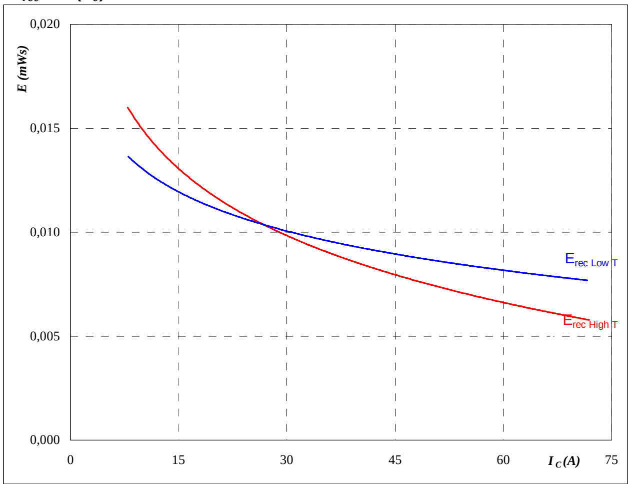
With an inductive load at

T_j =	25/125	°C
V_{DS} =	600	V
V_{GS} =	15	V
I_D =	40	A

Figure 7 BOOST IGBT

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

$E_{rec} = f(I_c)$



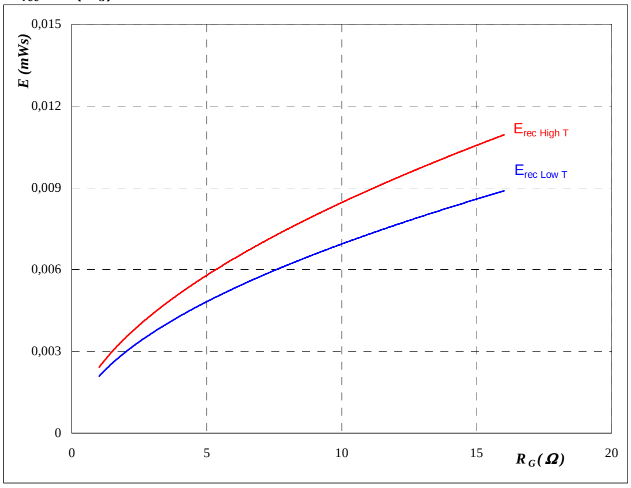
With an inductive load at

T_j =	25/125	°C
V_{DS} =	600	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

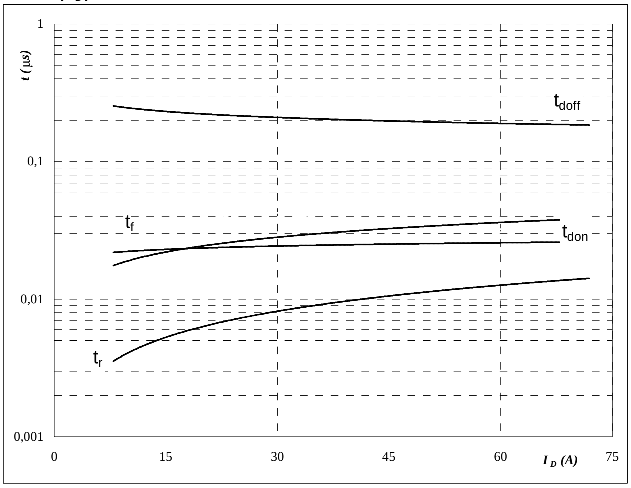
T_j =	25/125	°C
V_{DS} =	600	V
V_{GS} =	15	V
I_D =	40	A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_D)$



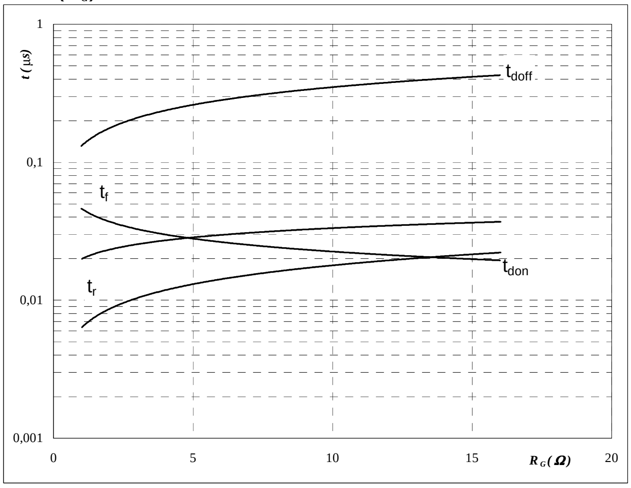
With an inductive load at

T_j =	125	°C
V_{DS} =	600	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

$t = f(R_G)$



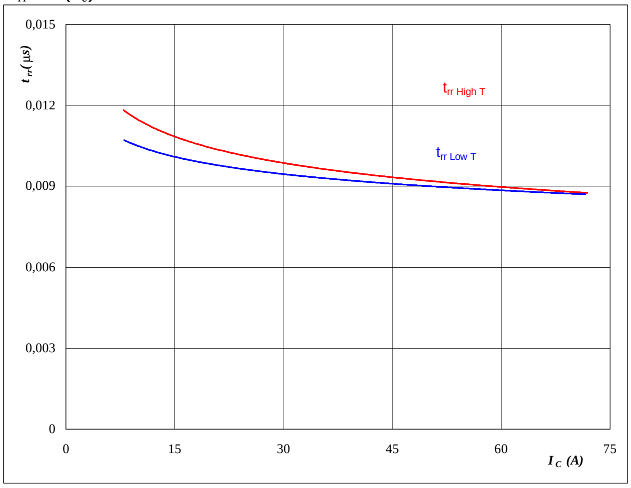
With an inductive load at

T_j =	125	°C
V_{DS} =	600	V
V_{GS} =	15	V
I_C =	40	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



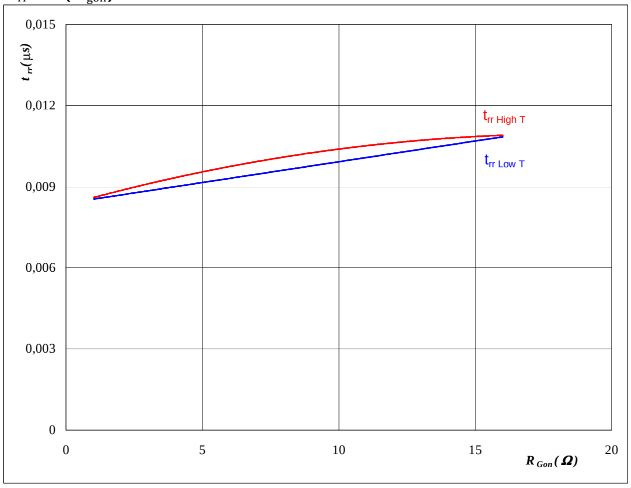
At

T_j =	25/125	°C
V_{CE} =	600	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

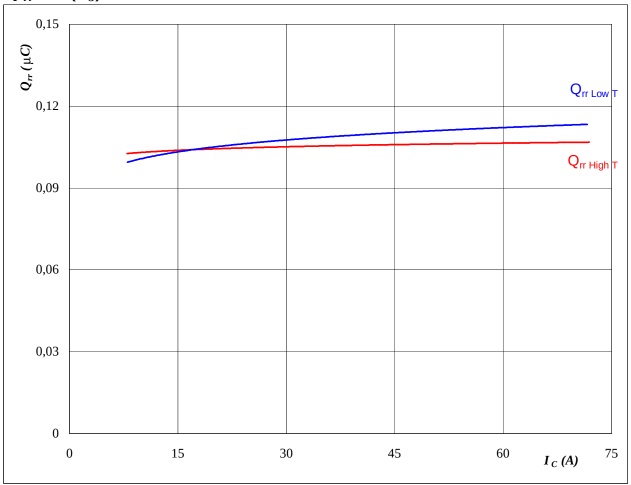
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GS} =	15	V

INPUT BOOST

Figure 13	BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



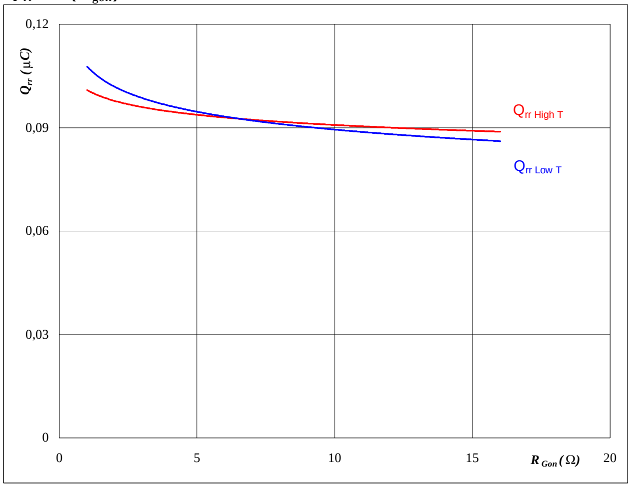
At

T_j =	25/125	°C
V_{CE} =	600	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

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



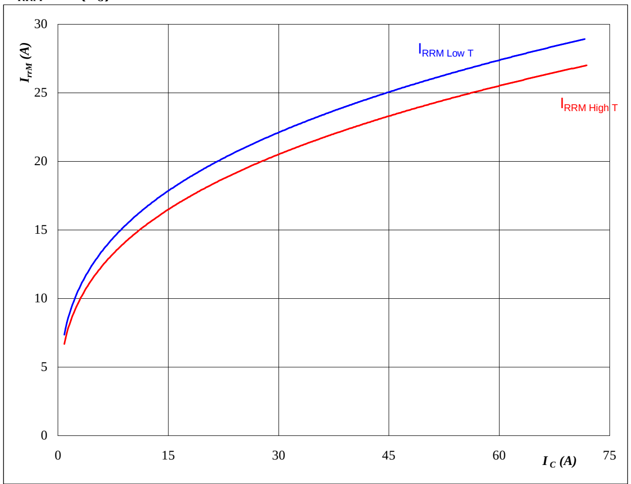
At

T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GS} =	15	V

Figure 15	BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



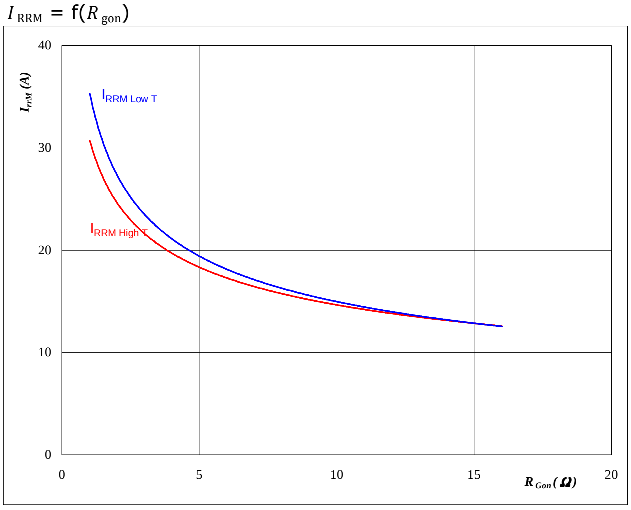
At

T_j =	25/125	°C
V_{CE} =	600	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

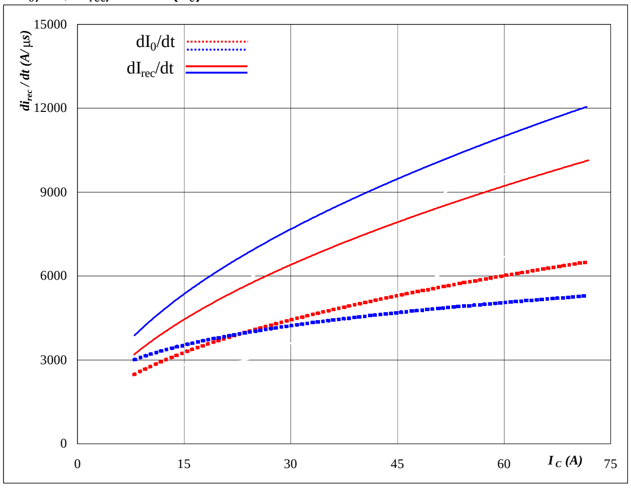
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GS} =	15	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



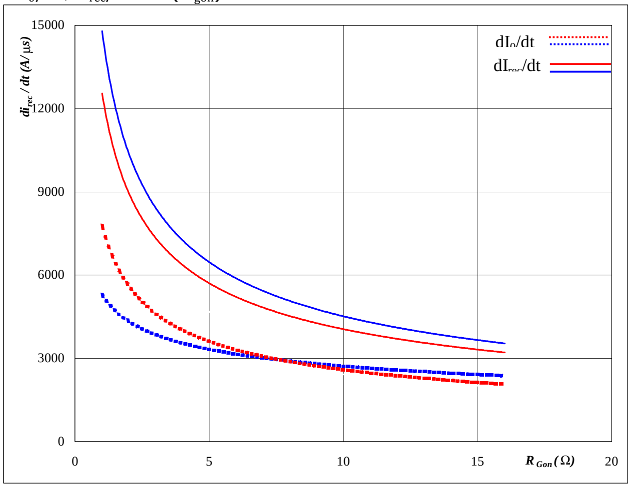
At

T_j =	25/125	°C
V_{CE} =	600	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

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



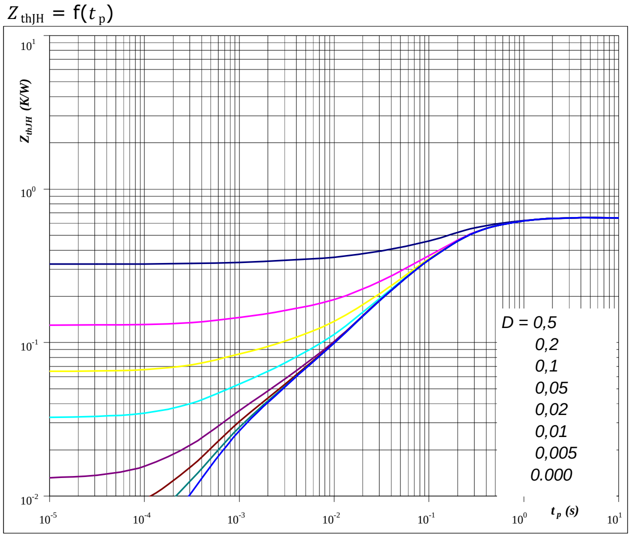
At

T_j =	25/125	°C
V_R =	600	V
I_F =	40	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} =	0,65	K/W	R_{thJH} =	0,56	K/W

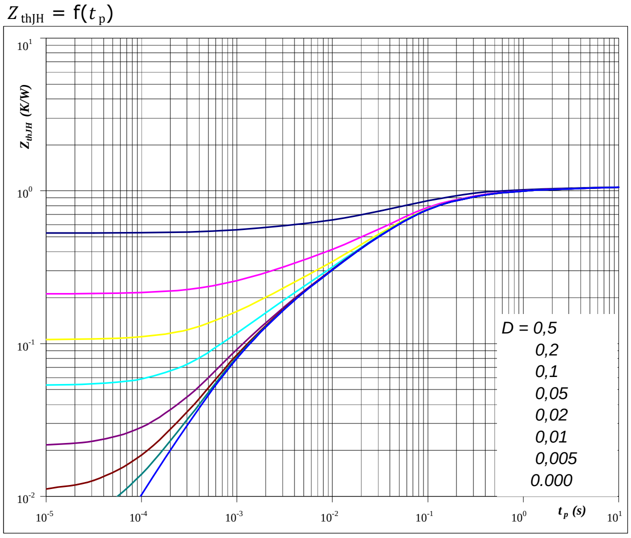
IGBT thermal model values

Thermal grease		Phase change	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,198	0,495	0,164	0,409
0,347	0,111	0,287	0,092
0,075	0,015	0,062	0,012
0,028	0,001	0,023	0,001
0,027	0,004	0,022	0,003

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} =	1,06	K/W	R_{thJH} =	0,92	K/W

FWD thermal model values

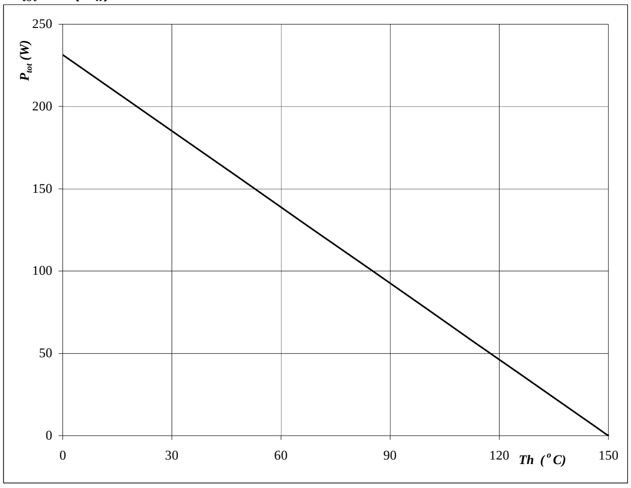
Thermal grease		Phase change	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,063	3,888	0,055	3,394
0,180	0,398	0,157	0,347
0,525	0,062	0,458	0,054
0,203	0,009	0,177	0,008
0,089	0,001	0,077	0,001

INPUT BOOST

Figure 21	BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



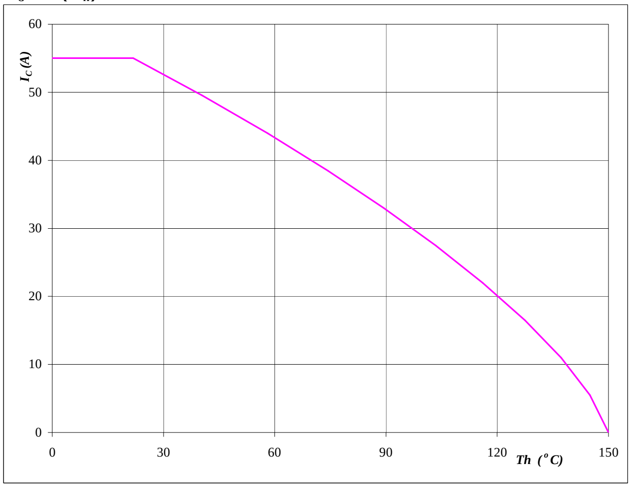
At

T_j = 150 ºC

Figure 22	BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

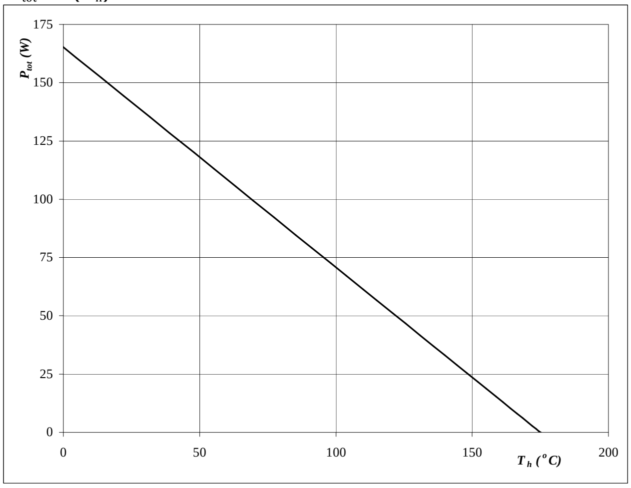
T_j = 150 ºC

V_{GS} = 15 V

Figure 23	BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



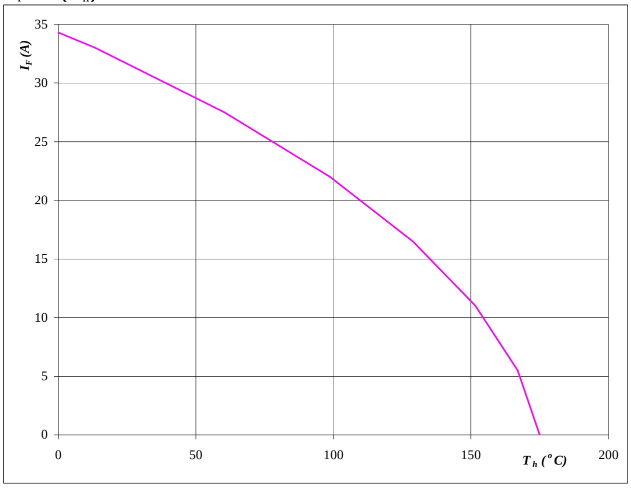
At

T_j = 175 ºC

Figure 24	BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

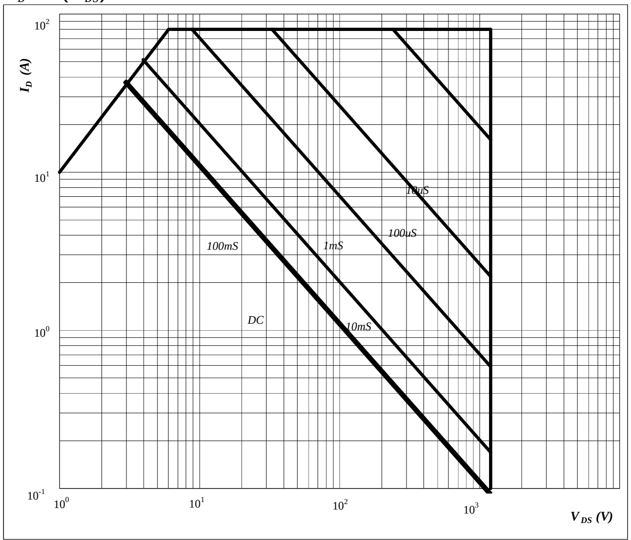
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



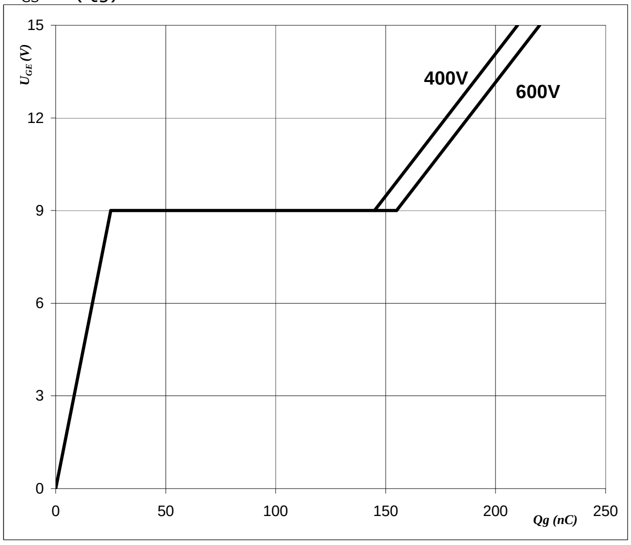
At

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

$V_{GS} = f(Qg)$



At

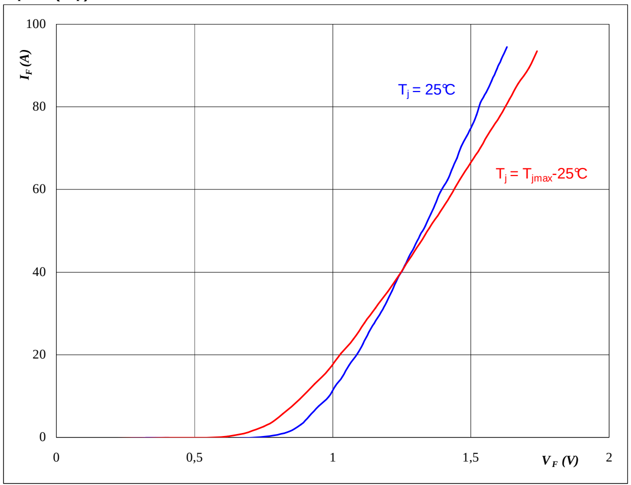
I_D =	40	A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



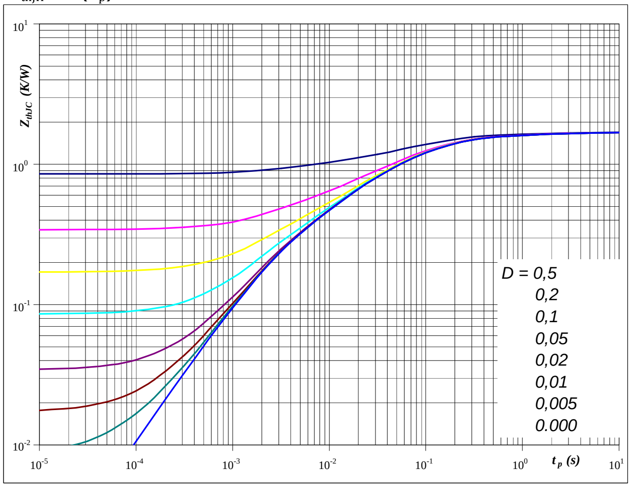
At

t_p = 250 µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

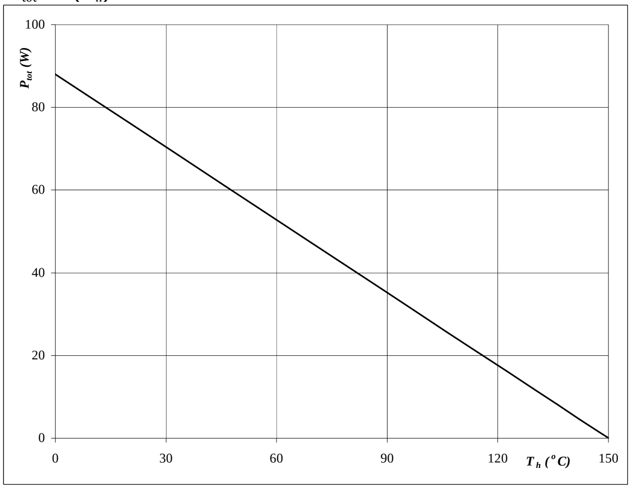
D = t_p / T

R_{thJH} = 1,705 K/W

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



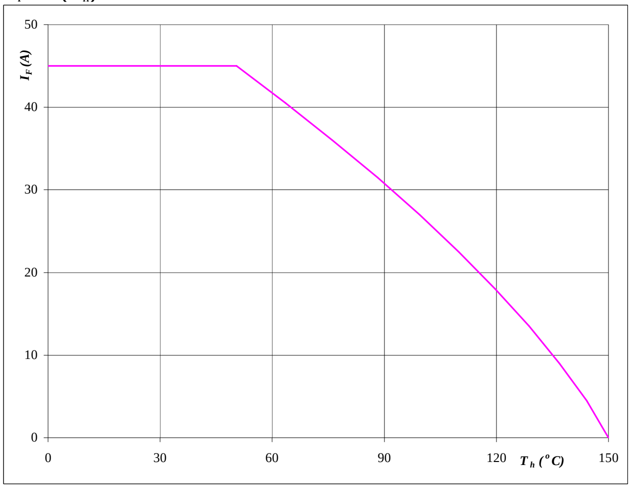
At

T_j = 150 ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



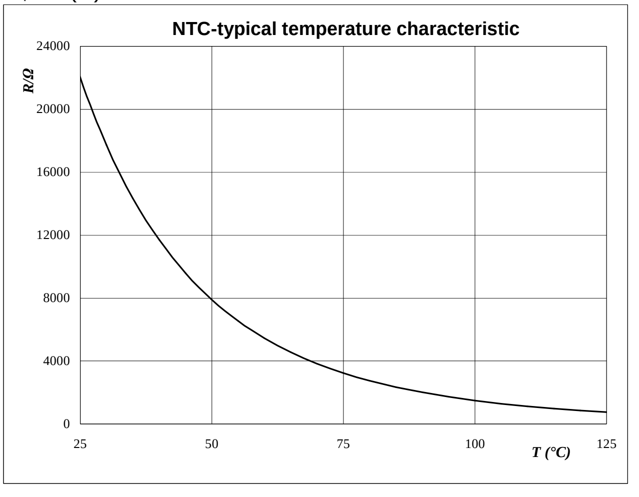
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

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



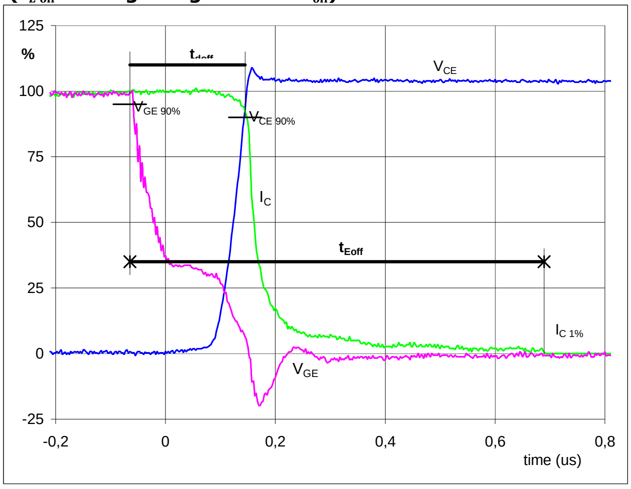
Switching Definitions BOOST IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Output inverter IGBT

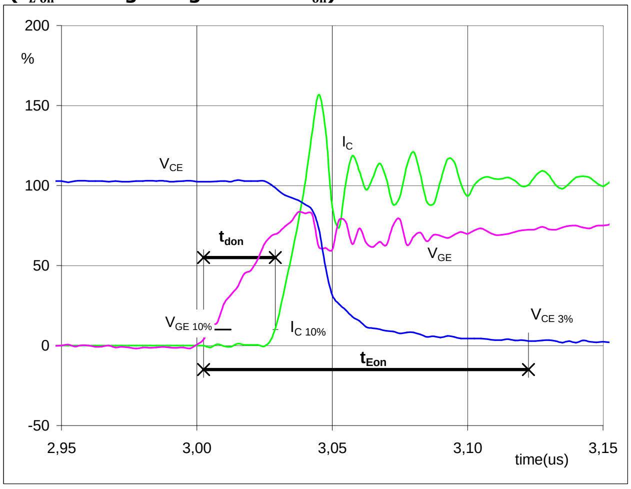
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} ($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) = 0 V
V_{GE} (100%) = 15 V
V_C (100%) = 600 V
I_C (100%) = 40 A
t_{doff} = 0,202 μs
$t_{E\,off}$ = 0,754 μs

Figure 2 Output inverter IGBT

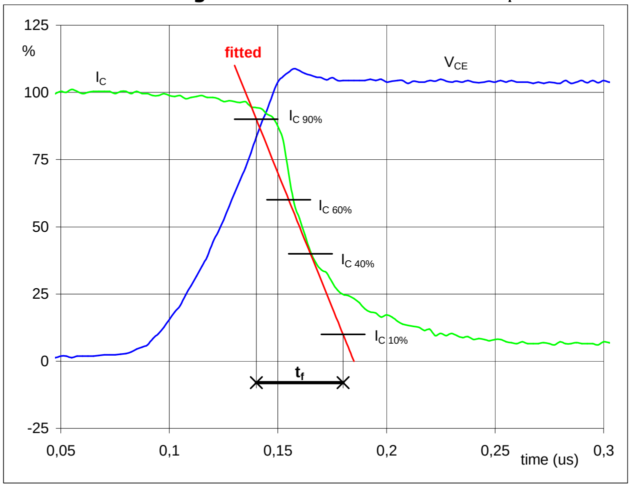
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} ($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) = 0 V
V_{GE} (100%) = 15 V
V_C (100%) = 600 V
I_C (100%) = 40 A
t_{don} = 0,025 μs
$t_{E\,on}$ = 0,120 μs

Figure 3 Output inverter IGBT

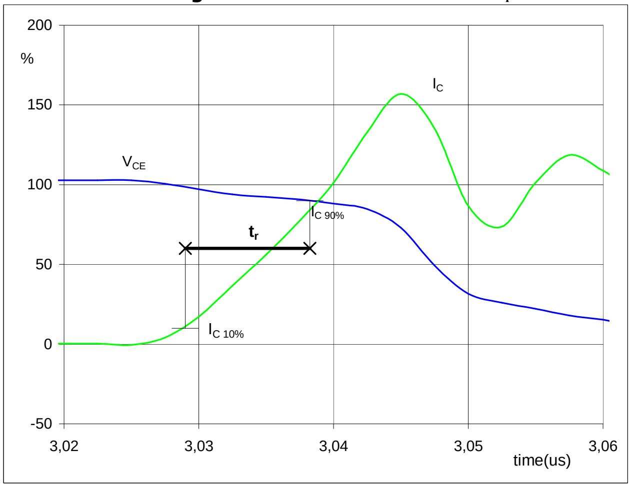
Turn-off Switching Waveforms & definition of t_f



V_C (100%) = 600 V
I_C (100%) = 40 A
t_f = 0,035 μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

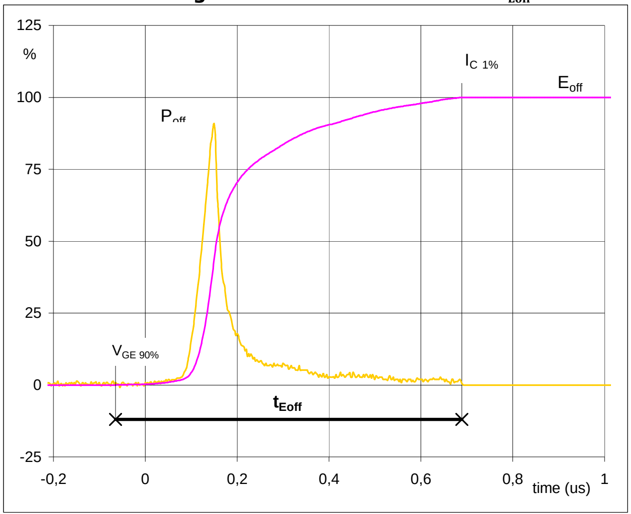


V_C (100%) = 600 V
I_C (100%) = 40 A
t_r = 0,010 μs

Switching Definitions BOOST IGBT

Figure 5 Output inverter IGBT

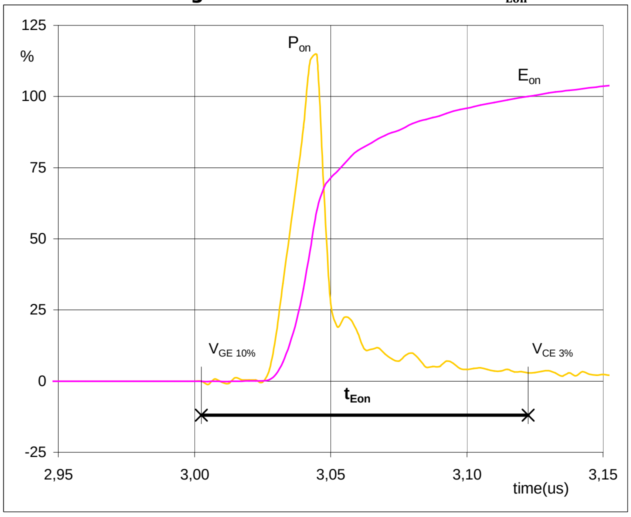
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	24,06	kW
E_{off} (100%) =	1,66	mJ
$t_{E\ off}$ =	0,75	μs

Figure 6 Output inverter IGBT

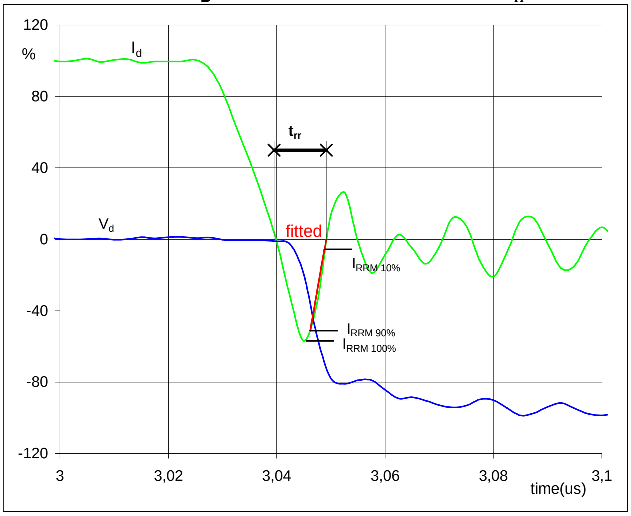
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	24,06	kW
E_{on} (100%) =	0,51	mJ
$t_{E\ on}$ =	0,12	μs

Figure 7 Output inverter FWD

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

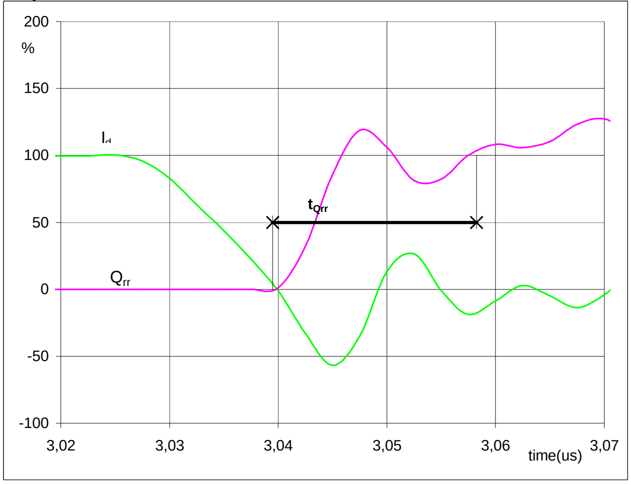


V_d (100%) =	600	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-23	A
t_{rr} =	0,009	μs

Switching Definitions BOOST IGBT

Figure 8 Output inverter FWD

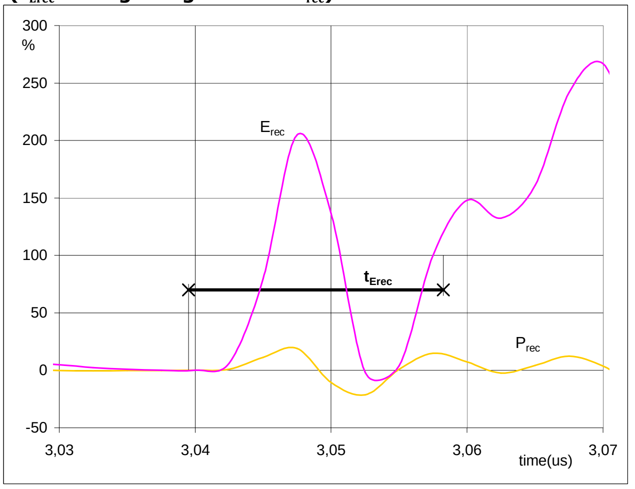
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	0,110	μC
$t_{Q\,rr}$ =	0,019	μs

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	24,06	kW
E_{rec} (100%) =	0,011	mJ
$t_{E\,rec}$ =	0,019	μs

Ordering Code and Marking - Outline - Pinout

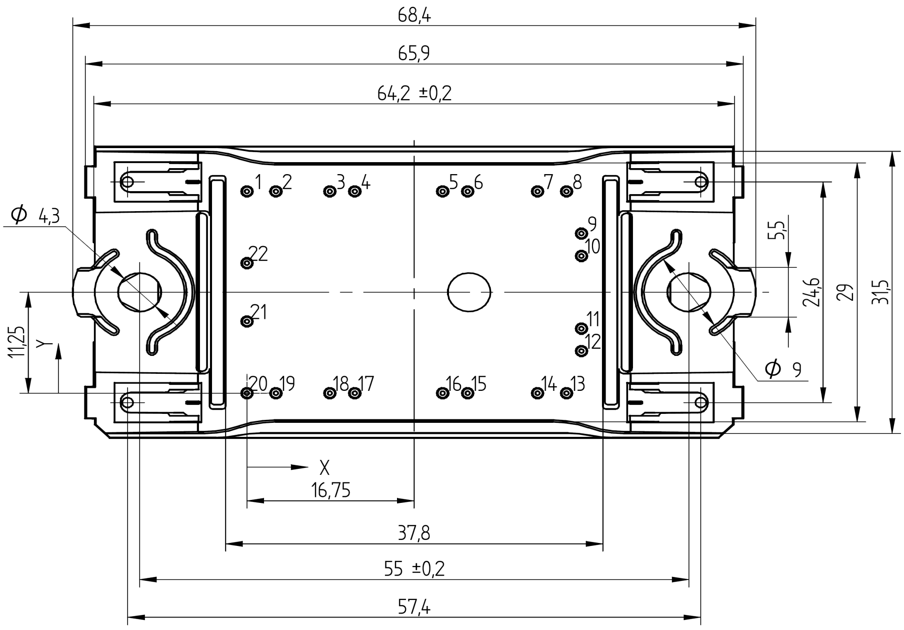
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P629-F62-PM	P629-F62	P629-F62
without thermal paste 17mm housing	V23990-P629-F629-PM	P629-F629	P629-F629
without thermal paste 12mm housing with PressFiT	V23990-P629-F628Y-PM	P629-F628Y	P629-F628Y
without thermal paste 17mm housing with PressFiT	V23990-P629-F629Y-PM	P629-F629Y	P629-F629Y

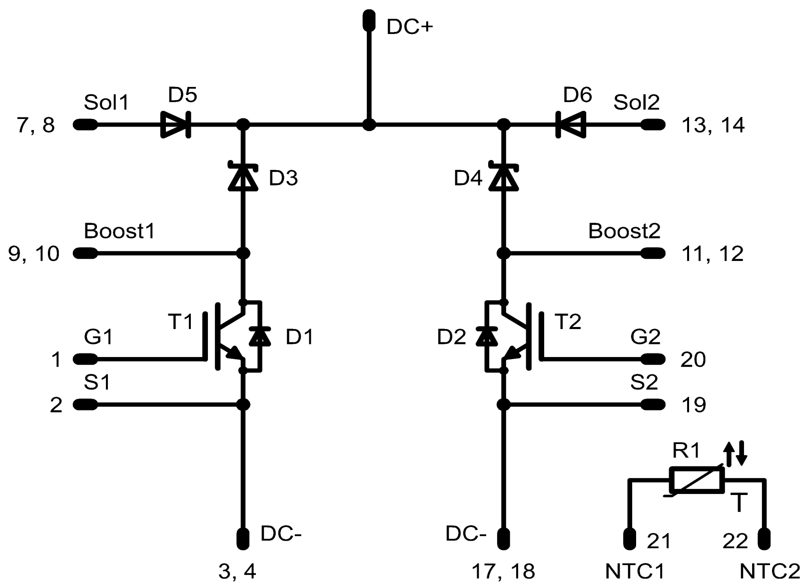
Outline

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



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2	IGBT	1200V	40A	Boost Switch	
D1,D2	FWD	1200V	3A	Boost Inverse Diode	
D3,D4	FWD	1200V	15A	Bypass Diode	
D5,D6	Rectifier	1600V	25A	Rectifier Diode	
T	NTC	-	-	Thermistor	

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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.