flowBOOST 1200V/40A

Features

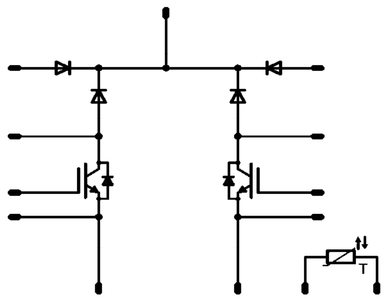
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V Si diode

flow0 12mm housing

Target Applications

- solar inverter

Schematic



Types

- V23990-P629-F73-PM

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode					
Repetitive peak reverse voltage	V_{RRM}	Tj=25℃		1600	V
DC forward current	I_{FAV}	Tj=Tjmax	T_h=80℃ T_c=80℃	34 46	A
Surge forward current	I_{FSM}	t_p=10ms sin 180°	T_j=25℃	220	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℃	41 62	W
Maximum Junction Temperature	$T_j$max			150	℃
Boost IGBT					
Collector-emitter break down voltage	V_{CE}	Tj=25℃		1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	34 47	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		160	A
Turn off safe operating area		VCE ≤ 800V, Tj ≤ Top max		160	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	108 164	W
Gate-emitter peak voltage	V_{GE}			±25	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 600	µs V
Maximum Junction Temperature	$T_j$max			150	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost IGBT Protection Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃		1600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃ T_c=80℃	34 47	A
Surge forward current	I_{FSM}	tp=10ms, sin 180°		220	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	41 62	W
Maximum Junction Temperature	$T_j$max			150	℃
Boost FWD					
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℃	37 50	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		150	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	82 125	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										
Forward voltage	V_F				25	Tj=25℃ Tj=125℃		1,13 1,09	1,21	V
Threshold voltage (for power loss calc. only)	V_{to}				40	Tj=25℃ Tj=125℃		0,93 0,80		V
Slope resistance (for power loss calc. only)	r_t				40	Tj=25℃ Tj=125℃		0,008 0,011		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						1,71		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,13		
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,00025	Tj=25℃ Tj=125℃	3,5	5,5	7,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		40	Tj=25℃ Tj=125℃		2,74 3,01	3,2	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25℃ Tj=125℃			1	mA
Gate-emitter leakage current	I_{GES}		±25	0		Tj=25℃ Tj=125℃			±250	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	15	700	40	Tj=25℃ Tj=125℃		26 25		ns
Rise time	t_r					Tj=25℃ Tj=125℃		16 43		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		169 199		
Fall time	t_f					Tj=25℃ Tj=125℃		16 43		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		1,47 2,23		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,93 1,87		
Input capacitance	C_{ies}	f=1MHz	0	30		Tj=25℃		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_{Gate}		15	600	40	Tj=25℃		220		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,65		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,43		
Boost IGBT Protection Diode										
Diode forward voltage	V_F				25	Tj=25℃ Tj=125℃		1,13 1,08	1,21	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,71		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,13		
Boost FWD										
Forward voltage	V_F				50	Tj=25℃ Tj=125℃		2,25 2,32	2,54	V
Reverse leakage current	I_{rm}		15	700	40	Tj=25℃ Tj=125℃			60	µA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	700	40	Tj=25℃ Tj=125℃		98 117		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		78 152		ns
Reverse recovery charge	Q_{rr}					Tj=25℃ Tj=125℃		3,71 7,08		µC
Reverse recovered energy	E_{rec}					Tj=25℃ Tj=125℃		1,83 3,69		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		5120 4285		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,16		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,76		

Characteristic Values

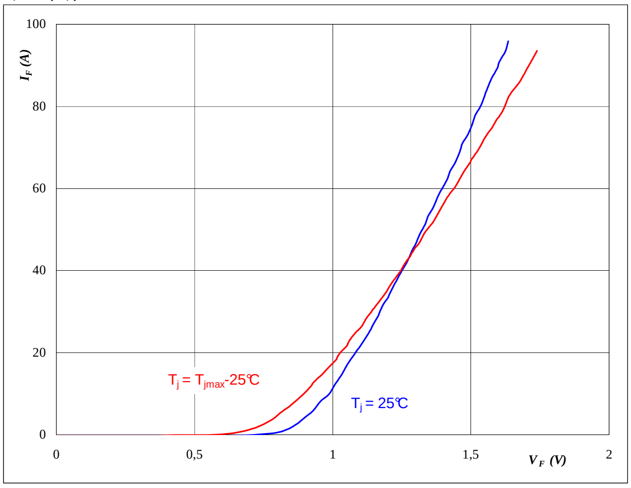
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R	Tol. ±5%				Tj=25℃		22000		Ω
Deviation of R25	ΔR/R	R100=1503Ω				Tc=100℃	-5		+5	%
Power dissipation	P					Tj=25℃		200		mW
Power dissipation constant						Tj=25℃		2		mW/K
B-value	B(25/50)	Tol. ±3%				Tj=25℃		3950		K
B-value	B(25/100)	Tol. ±3%				Tj=25℃		3996		K
Vincotech NTC Reference									B	

Boost IGBT Protection Diode

Figure 1	Boost IGBT Protection Diode

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



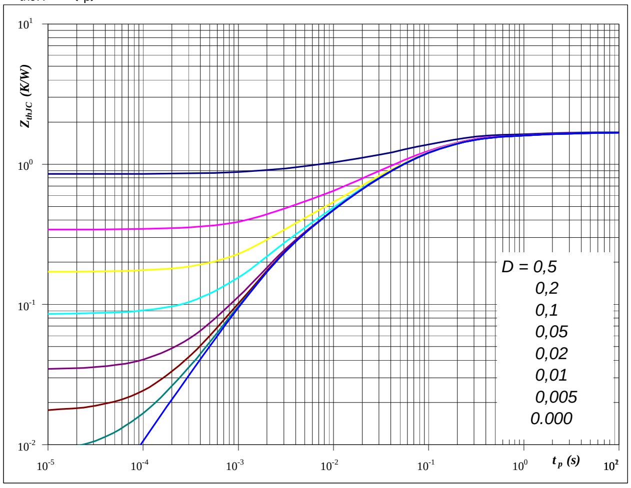
At

t_p =	250	µs

Figure 2	Boost IGBT Protection Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



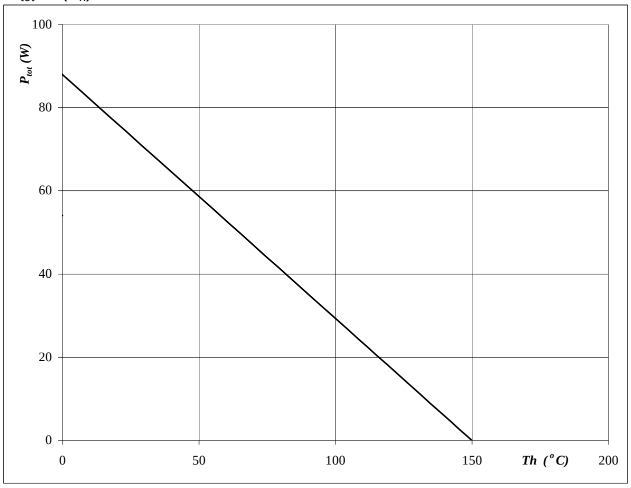
At

D =	tp / T	
R_{thJH} =	1,71	K/W

Figure 3	Boost IGBT Protection Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



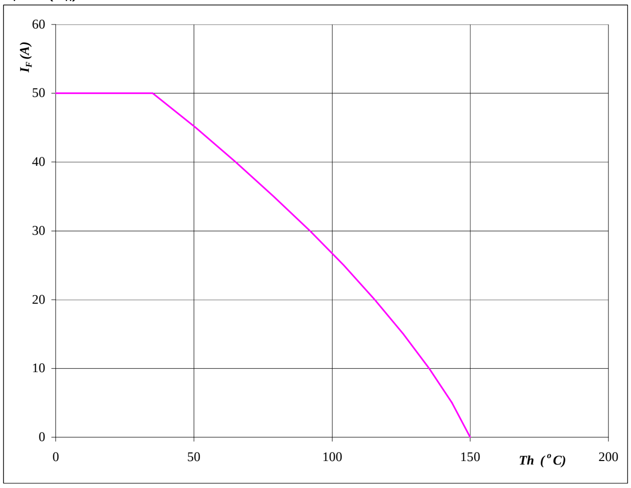
At

T_j =	150	ºC

Figure 4	Boost IGBT Protection Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

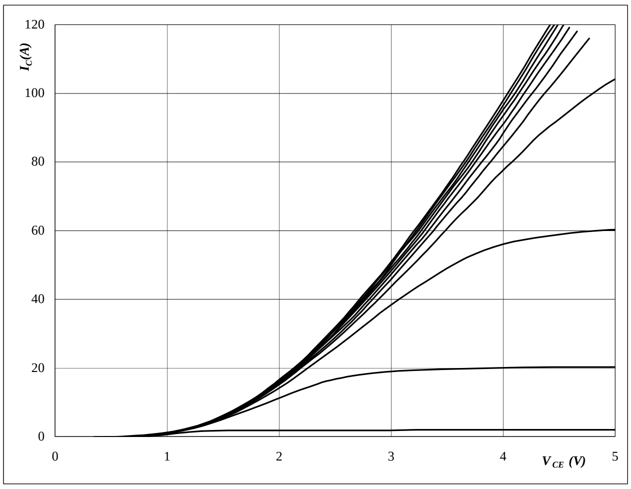
T_j =	150	ºC

INPUT BOOST

Figure 3 BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



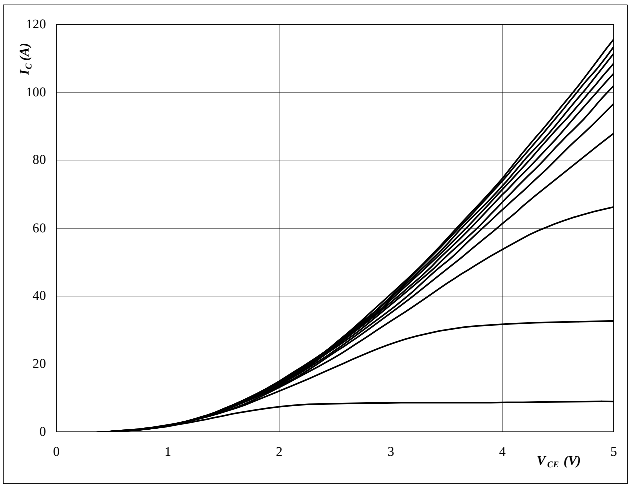
At

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

$I_C = f(V_{CE})$



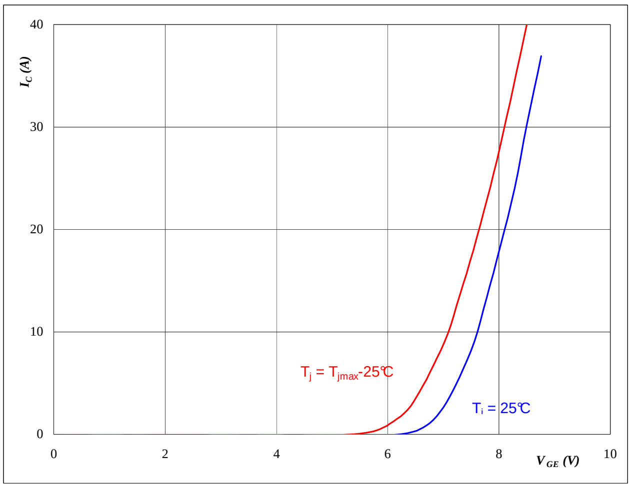
At

t_p =	250	μs
T_j =	125	℃
V_{GS} from	7 V to 17 V in steps of 1 V	

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



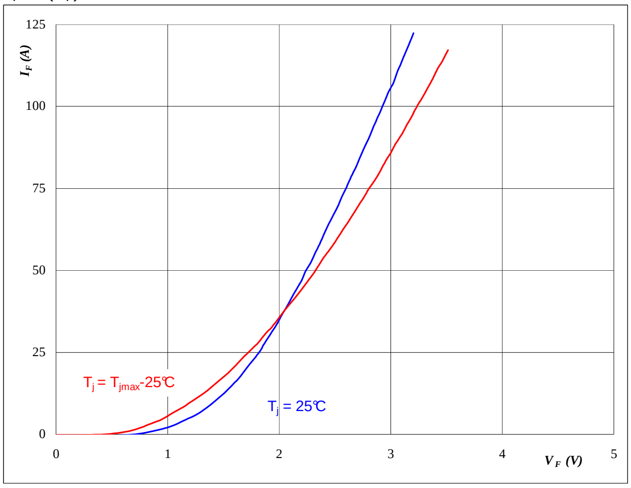
At

t_p =	250	μs
V_{DS} =	10	V

Figure 4 BOOST FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



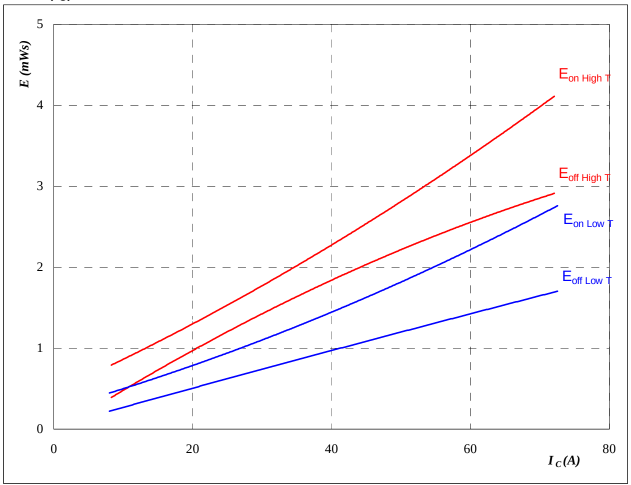
At

t_p =	250	μs

INPUT BOOST

Figure 5	BOOST IGBT

Typical switching energy losses
as a function of collector current
E = f(I_C)

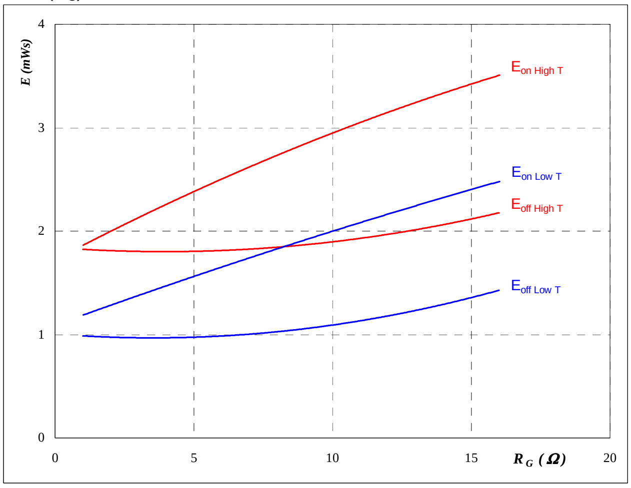


With an inductive load at

T_j =	25/126	°C
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)

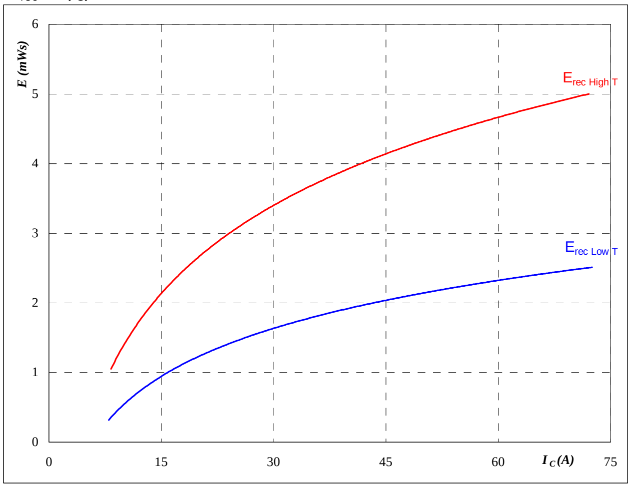


With an inductive load at

T_j =	25/126	°C
V_{DS} =	700	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)

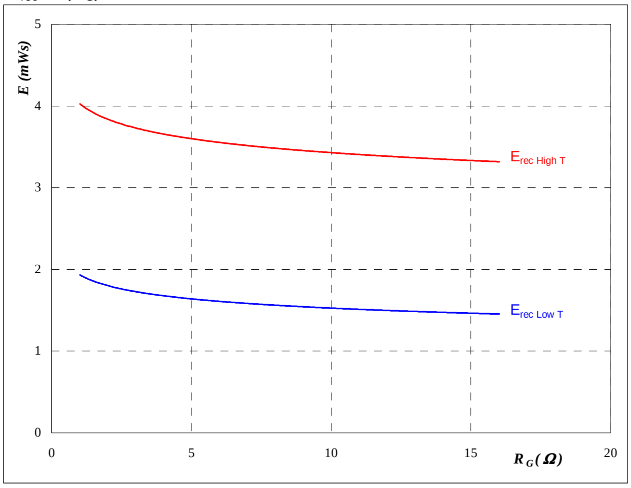


With an inductive load at

T_j =	25/126	°C
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

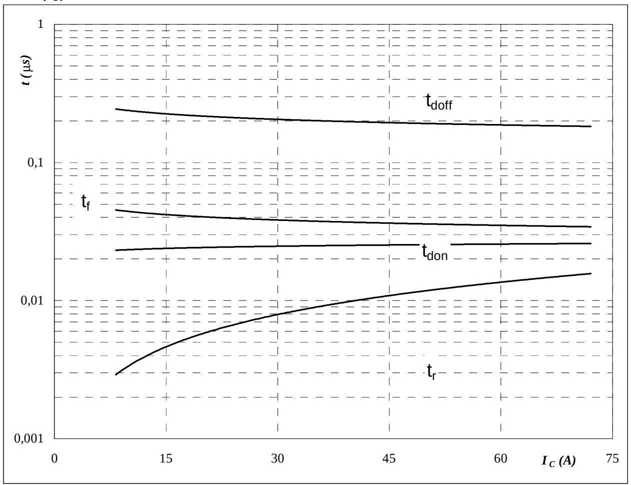
T_j =	25/126	°C
V_{DS} =	700	V
V_{GS} =	15	V
I_D =	40	A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



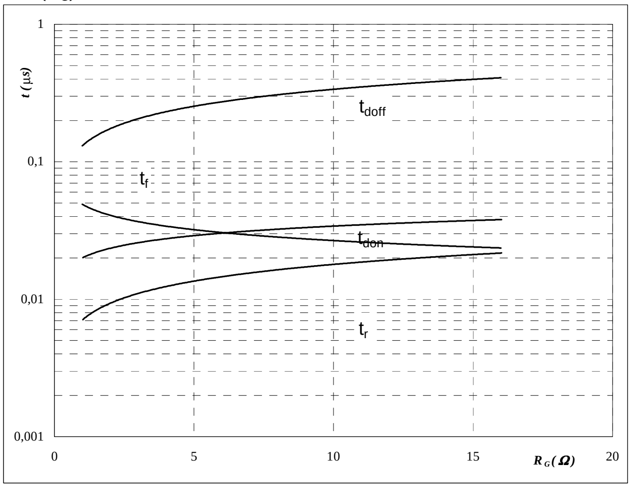
With an inductive load at

T_j =	126	℃
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

$t = f(R_G)$



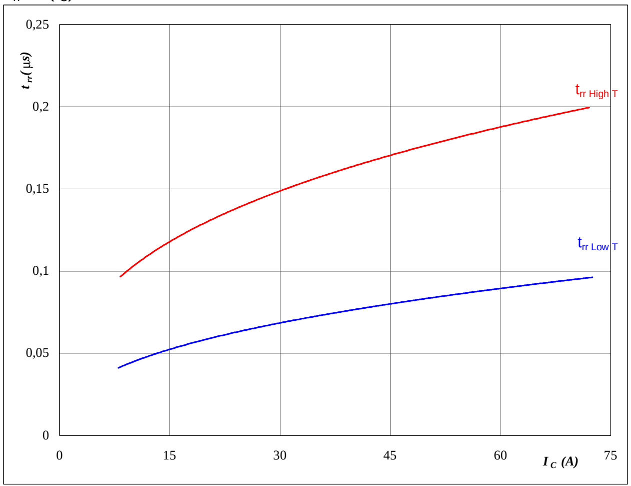
With an inductive load at

T_j =	126	℃
V_{DS} =	700	V
V_{GS} =	15	V
I_C =	40	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



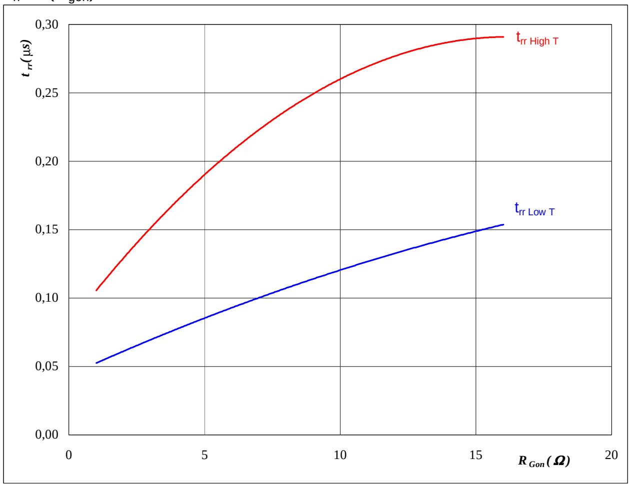
At

T_j =	25/126	℃
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

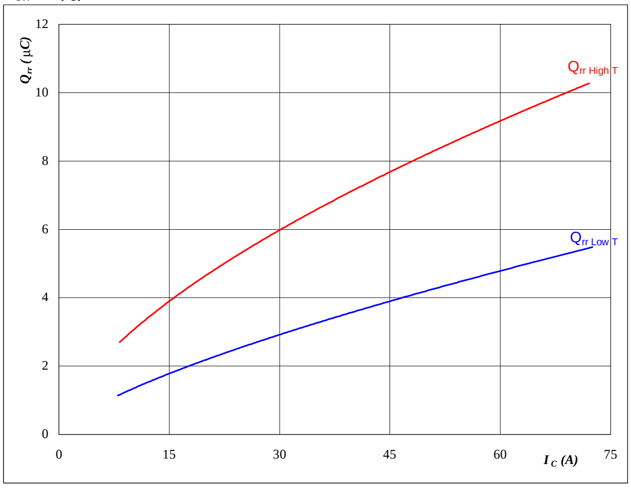
T_j =	25/126	℃
V_R =	700	V
I_F =	40	A
V_{GS} =	15	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



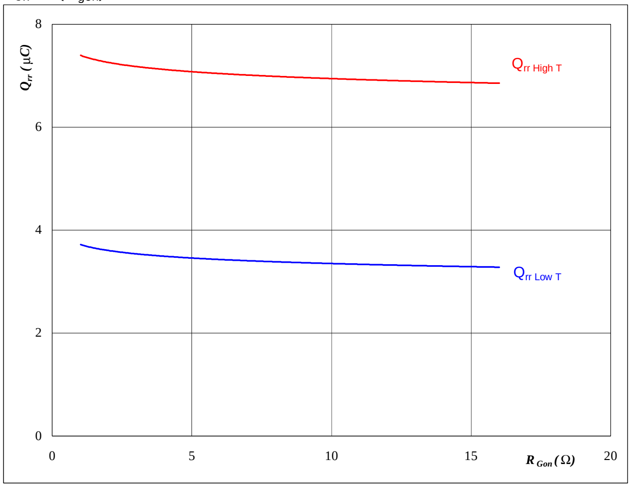
At

T_j =	25/126	°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

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



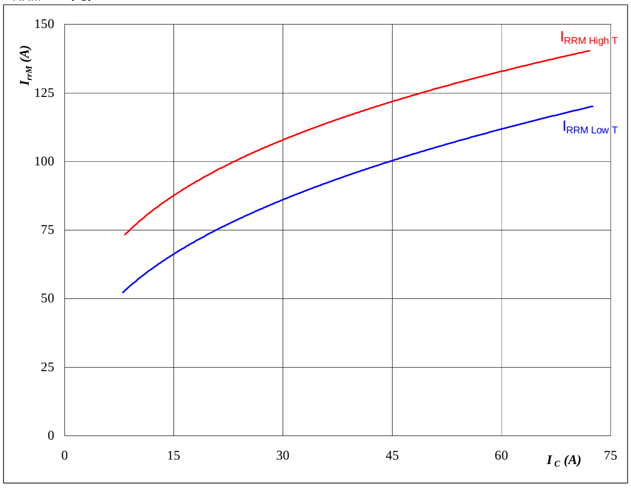
At

T_j =	25/126	°C
V_R =	700	V
I_F =	40	A
V_{GS} =	15	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



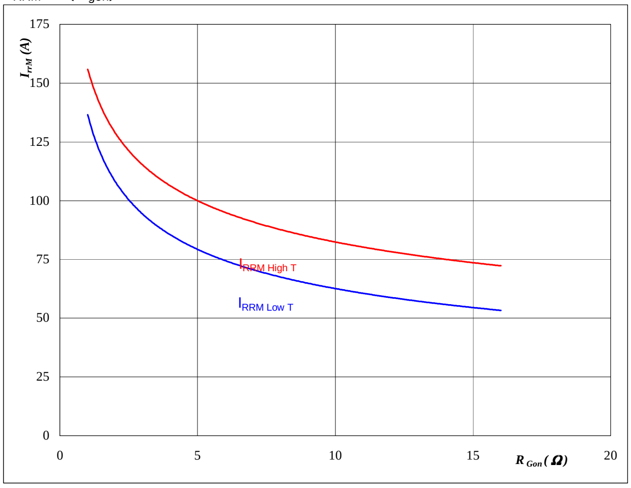
At

T_j =	25/126	°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

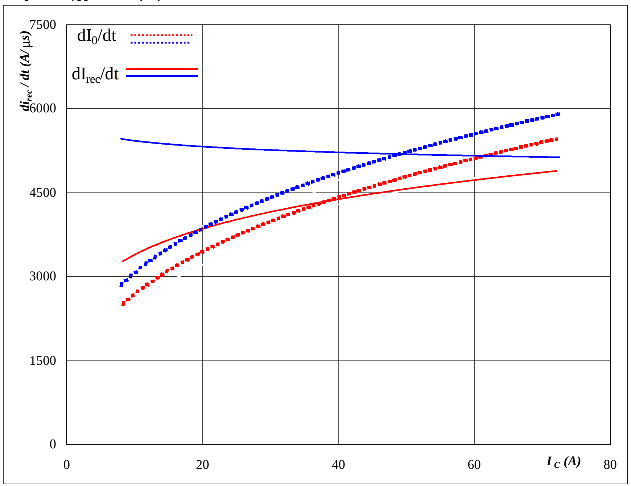
T_j =	25/126	°C
V_R =	700	V
I_F =	40	A
V_{GS} =	15	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



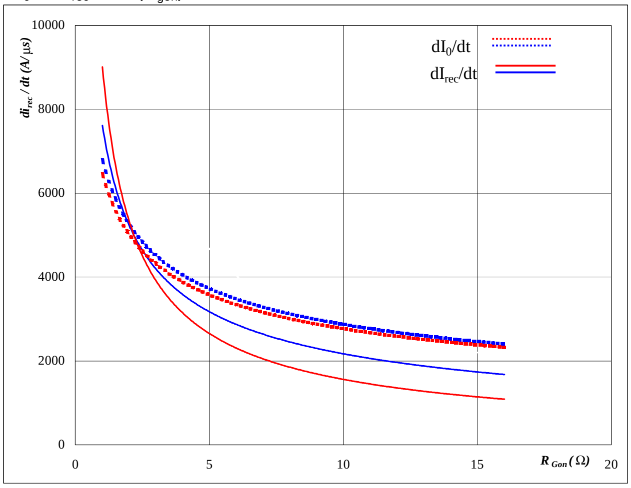
At

T_j =	25/126	℃
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

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



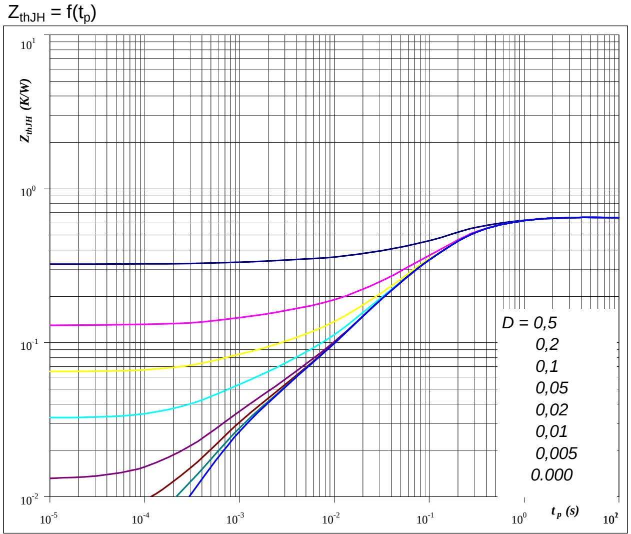
At

Tj =	25/126	℃
VR =	700	V
IF =	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

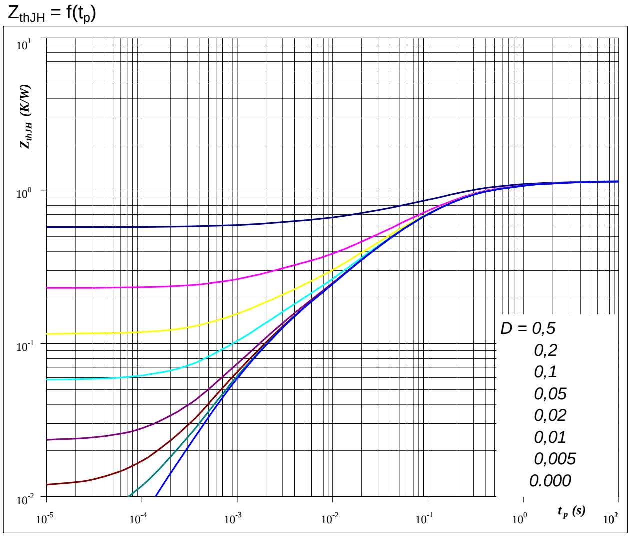
IGBT thermal model values

R (C/W)	Tau (s)
0,198	0,495
0,347	0,111
0,075	0,015
0,028	0,001
0,027	0,004

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} =	1,16	K/W

FWD thermal model values

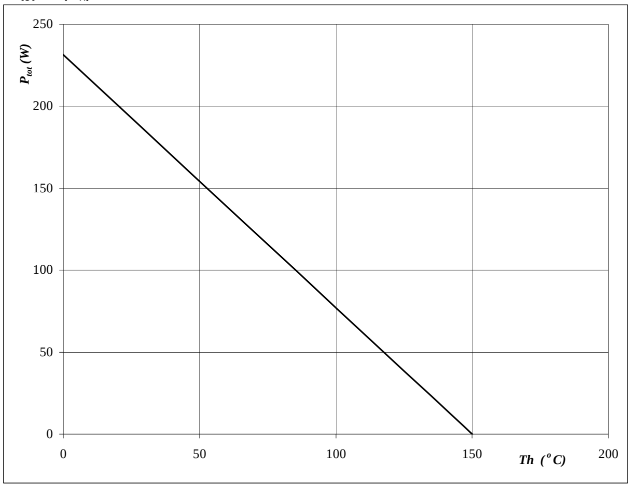
R (C/W)	Tau (s)
0,041	5,298
0,115	1,001
0,447	0,186
0,324	0,053
0,154	0,012

INPUT BOOST

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



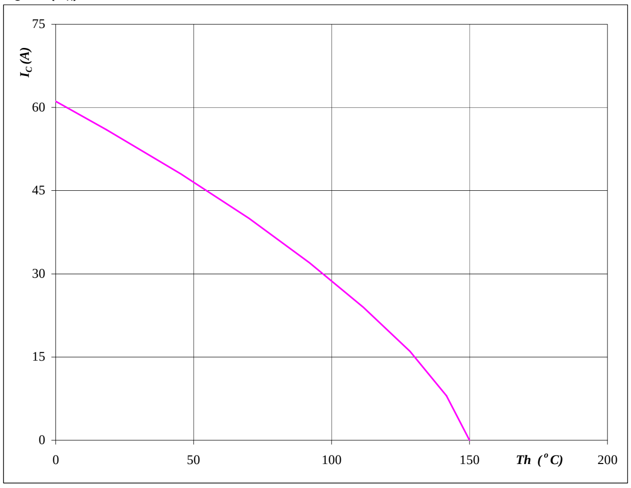
At

T_j = 150 ºC

Figure 22 BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

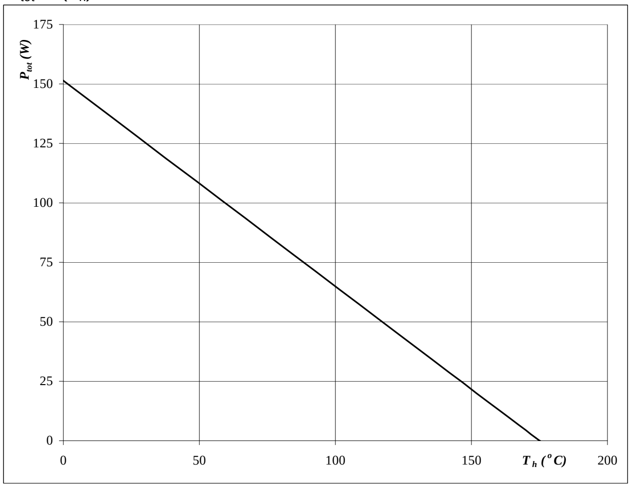
T_j = 150 ºC

V_{GS} = 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



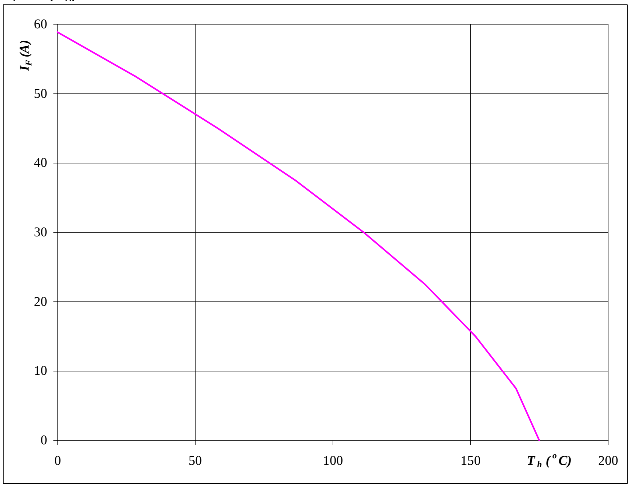
At

T_j = 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

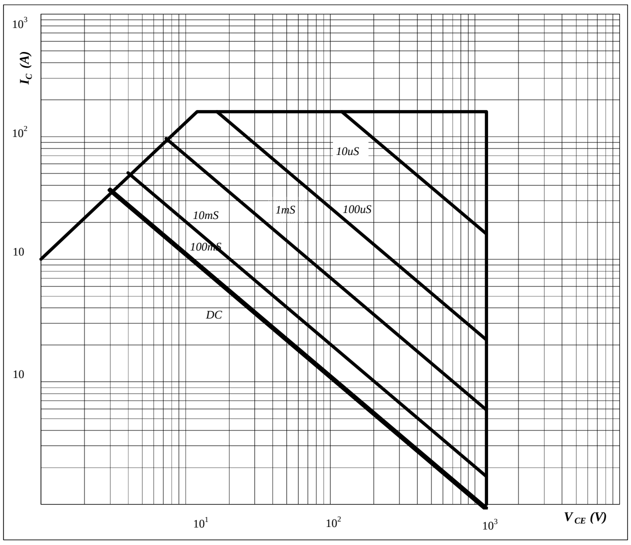
T_j = 175 ºC

INPUT BOOST

Figure 25	BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



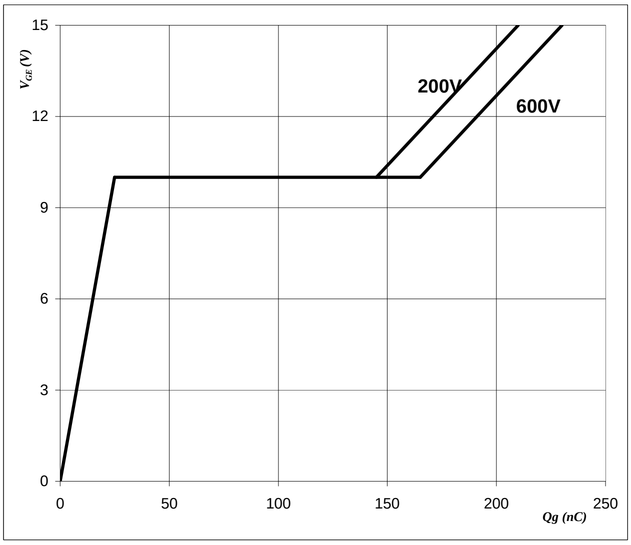
At

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

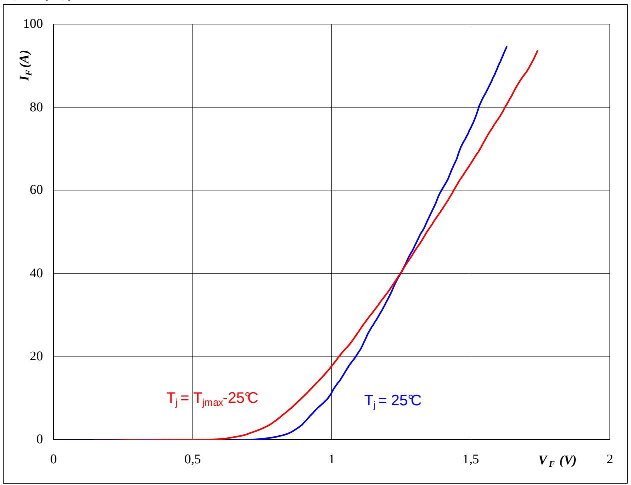
I_D =	40	A

Bypass Diode

Figure 1 Bypass Diode

Typical Diode forward current as a function of forward voltage

$I_F = f(V_F)$



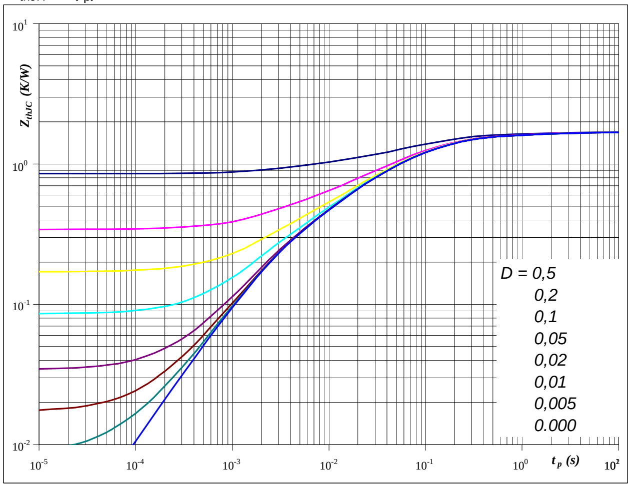
At

t_p = 250 µs

Figure 2 Bypass Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

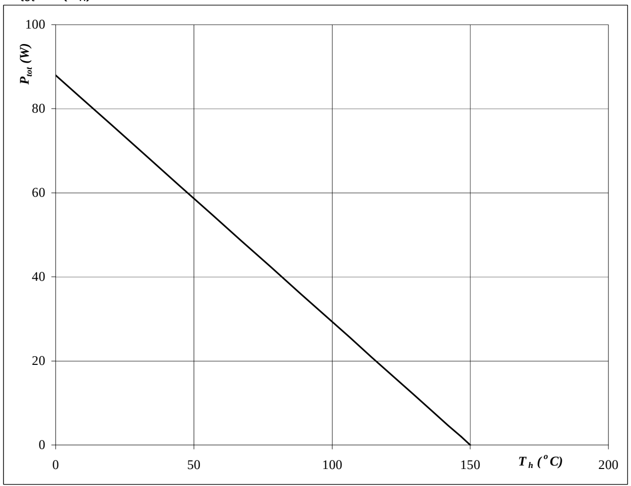
D = t_p / T

R_{thJH} = 1,705 K/W

Figure 3 Bypass Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



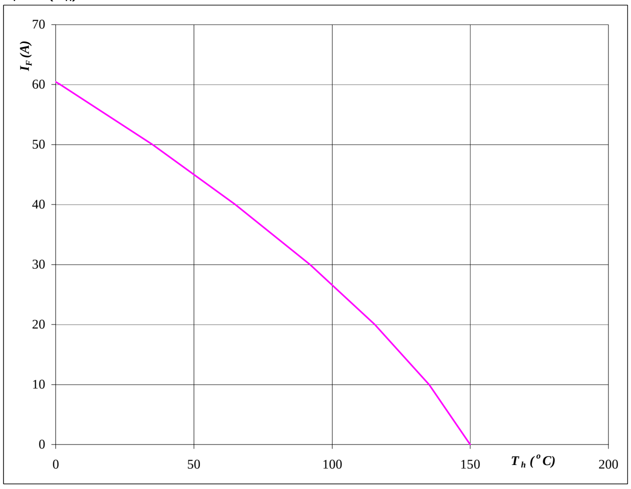
At

T_j = 150 ºC

Figure 4 Bypass Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



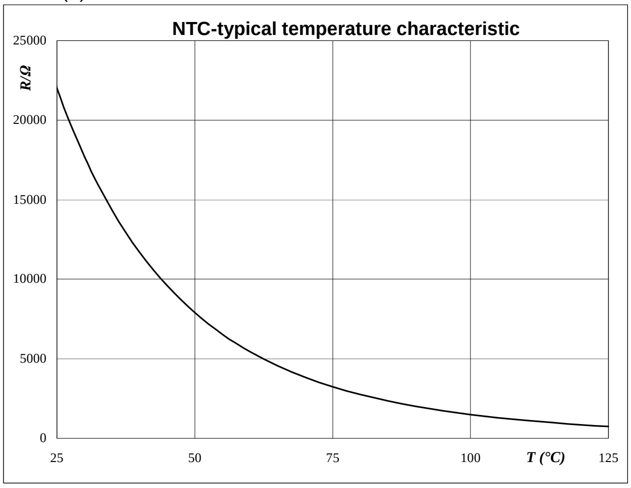
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

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



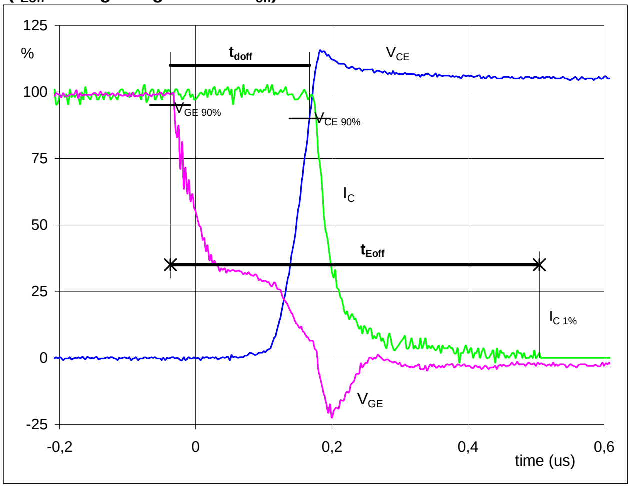
Switching Definitions BOOST IGBT

General conditions

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

Figure 1 Boost IGBT

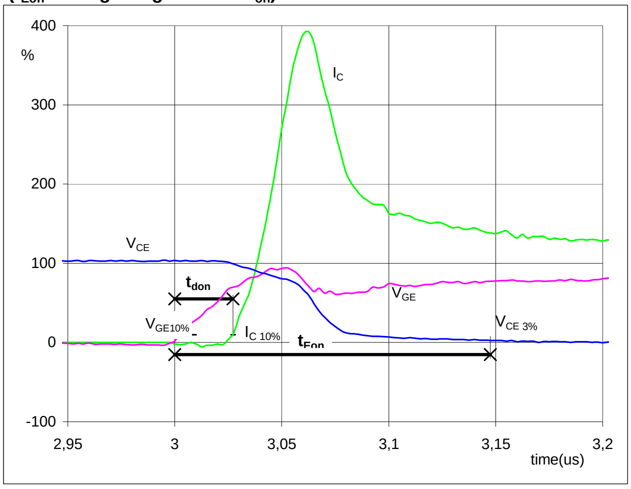
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{doff} =	0,20	μs
t_{Eoff} =	0,54	μs

Figure 2 Boost IGBT

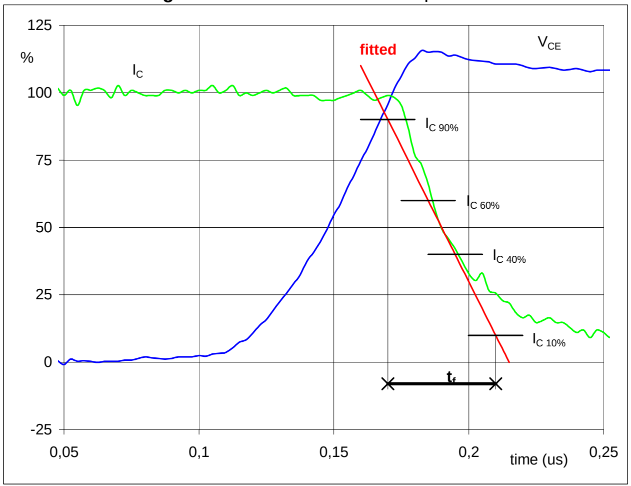
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{don} =	0,03	μs
t_{Eon} =	0,15	μs

Figure 3 Boost IGBT

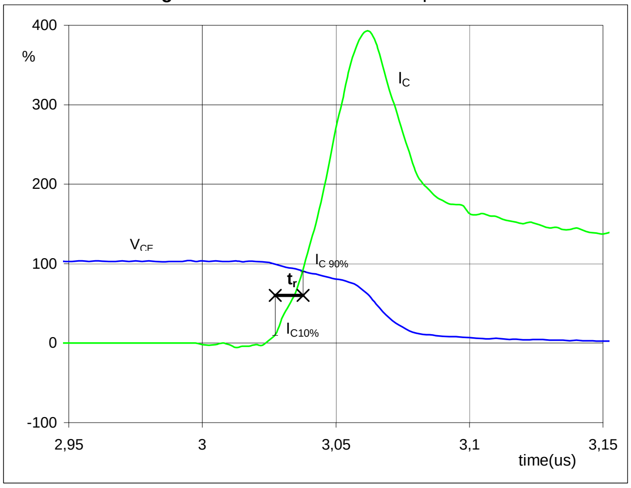
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	40	A
t_f =	0,04	μs

Figure 4 Boost IGBT

Turn-on Switching Waveforms & definition of t_r

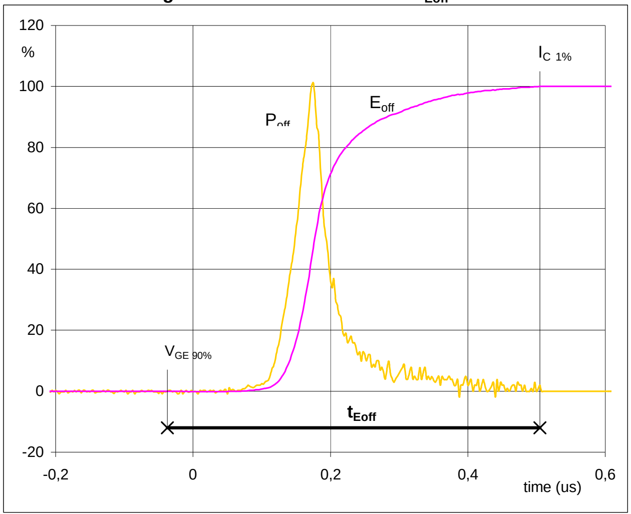


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,01	μs

Switching Definitions BOOST IGBT

Figure 5 Boost IGBT

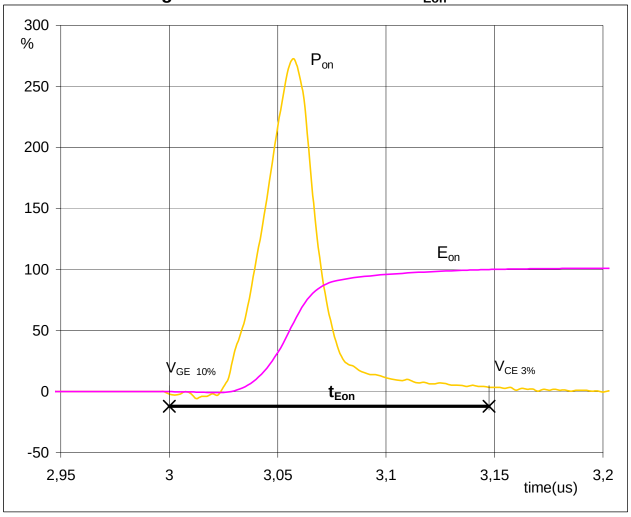
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	27,95	kW
E_{off} (100%) =	1,87	mJ
t_{Eoff} =	0,54	μs

Figure 6 Boost IGBT

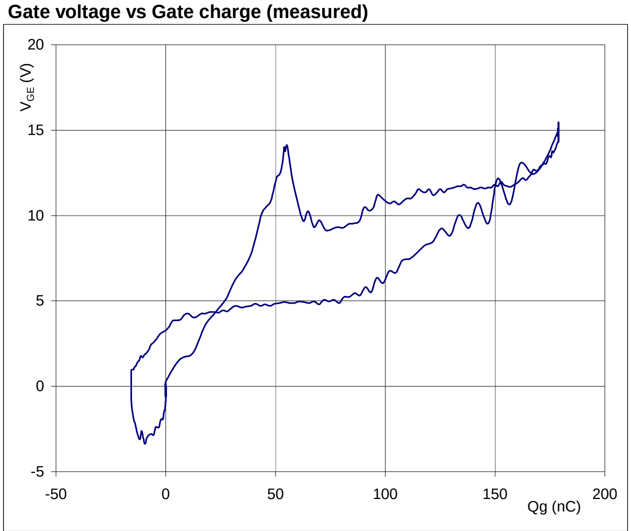
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	27,95	kW
E_{on} (100%) =	2,23	mJ
t_{Eon} =	0,15	μs

Figure 7 Boost IGBT

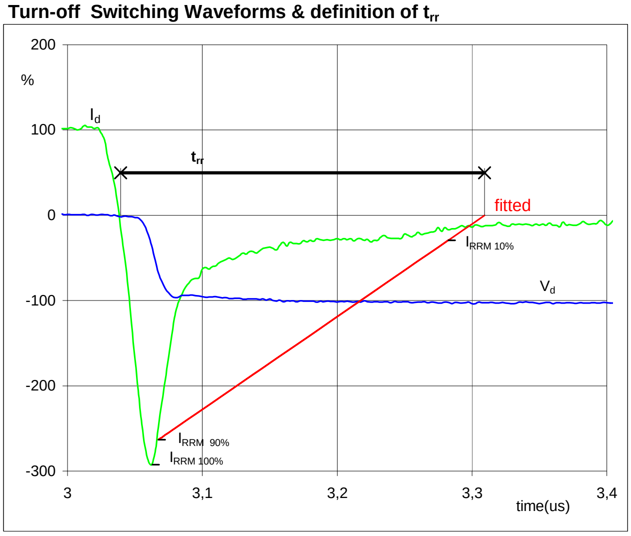
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
Q_g =	178,86	nC

Figure 8 Boost FWD

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

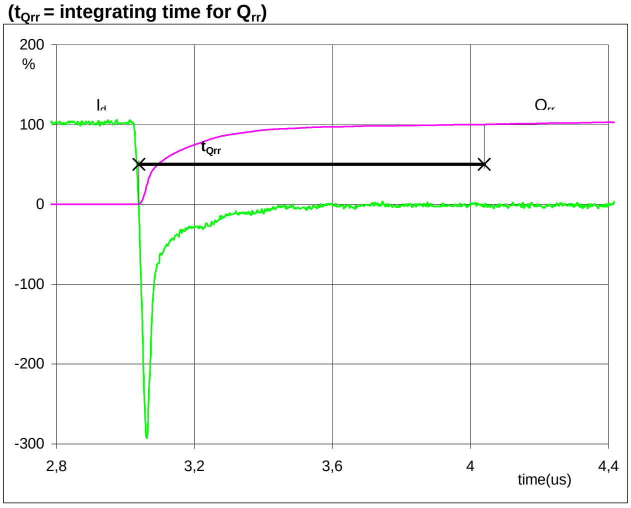


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-117	A
t_{rr} =	0,15	μs

Switching Definitions BOOST FWD

Figure 9 Boost FWD

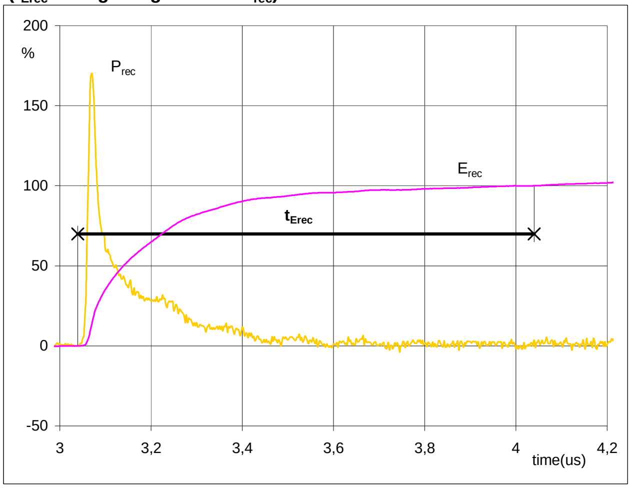
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	7,08	μC
t_{Qrr} =	1,00	μs

Figure 10 Boost FWD

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



P_{rec} (100%) =	27,95	kW
E_{rec} (100%) =	3,69	mJ
t_{Erec} =	1,00	μs

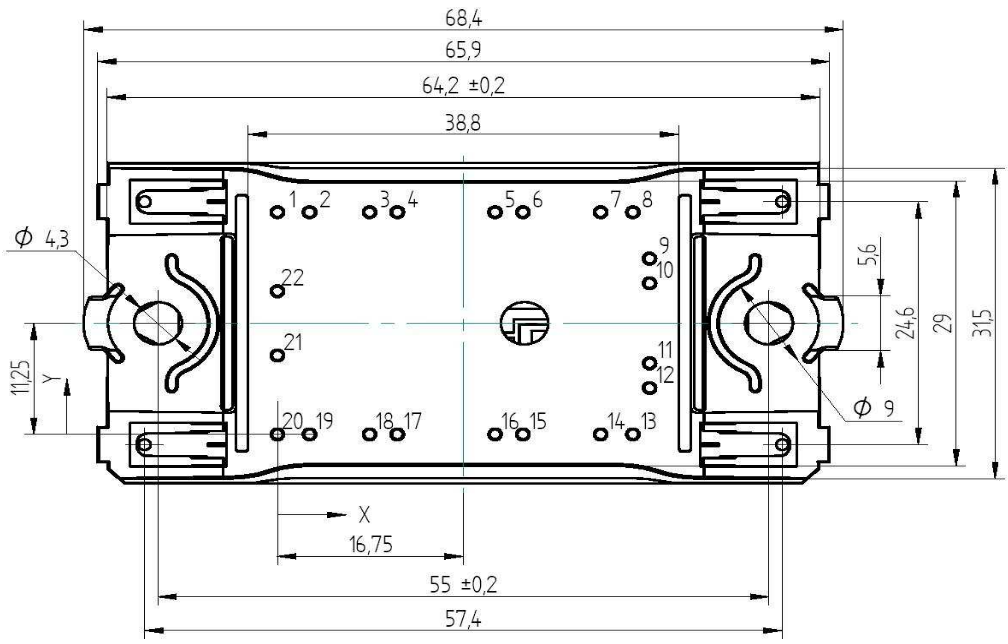
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

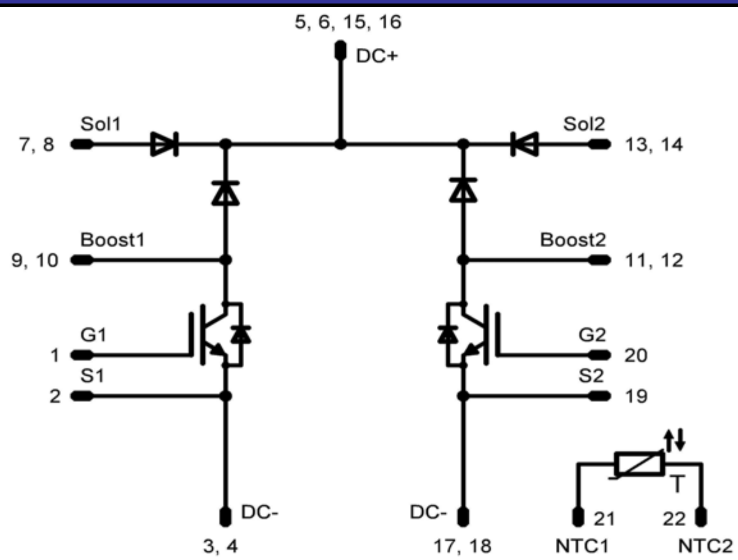
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P629-F73-PM	P629-F73-PM	P629-F73-PM

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.

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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.