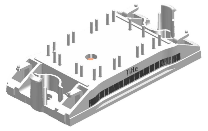
flowBOOST 1200V/40A

Features

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

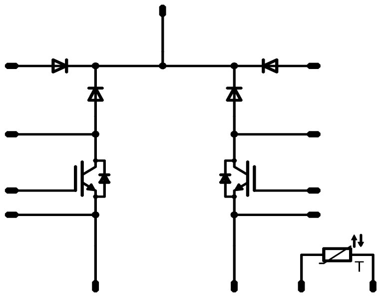
flow0 17mm housing



Target Applications

- solar inverter

Schematic



Types

- V23990-P629-L59-PM

Maximum Ratings

$T_j=25$℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Bypass Diode (D7 , D8)				
Repetitive peak reverse voltage	V_{RRM}	$T_j=25$℃	1600	V
DC forward current	I_{FAV}	$T_j=T_jmax$ $T_h=80$℃ $T_c=80$℃	34 40	A
Surge forward current	I_{FSM}	$t_p=10ms$ sin 180° $T_j=25$℃	220	A
I^2t-value	I^2t		240	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$ $T_h=80$℃ $T_c=80$℃	42 63	W
Maximum Junction Temperature	T_jmax		150	℃
Boost IGBT (T1 , T2)				
Collector-emitter break down voltage	V_{CE}	$T_j=25$℃	1200	V
DC collector current	I_C	$T_j=T_jmax$ $T_h=80$℃ $T_c=80$℃	40 45	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax	120	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$ $T_h=80$℃ $T_c=80$℃	113 171	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j\leq150$℃ $V_{GE}=15V$	10 800	µs V
Maximum Junction Temperature	T_jmax		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}	tp=10ms, sin 180°, Tj=Tjmax	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℃	39 53	A
Surge forward current	I_{FSM}	tp=10ms, sin 180°, Tj=25℃	270	A
Power dissipation	P_{tot}	T_j=$T_j$max T_h=80℃ T_c=80℃	89 134	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 0,82		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℃		35 68		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		225 293		
Fall time	t_f					Tj=25℃ Tj=125℃		35 68		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		1,09 1,82		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		1,01 1,61		
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	600	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				50	Tj=25℃ Tj=125℃	1,5	2,28 2,36	2,8	V
Reverse leakage current	I_{rm}			1200		Tj=25℃ Tj=125℃			60	µA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	700	24	Tj=25℃ Tj=125℃		63 78		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		83 208		ns
Reverse recovery charge	Q_{rr}					Tj=25℃ Tj=125℃		2,25 5,02		µC
Reverse recovered energy	E_{rec}					Tj=25℃ Tj=125℃		0,98 2,42		mWs
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25℃ Tj=125℃		5304 3201		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		

Characteristic Values

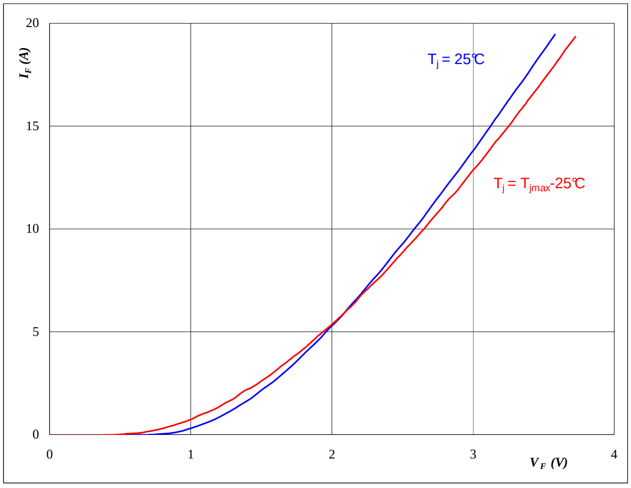
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					Tj=25℃		21511		Ω
Deviation of R25	ΔR/R	R100=1486Ω				Tc=100℃	-4,5		+4,5	%
Power dissipation	P					Tj=25℃		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

$I_F = f(V_F)$



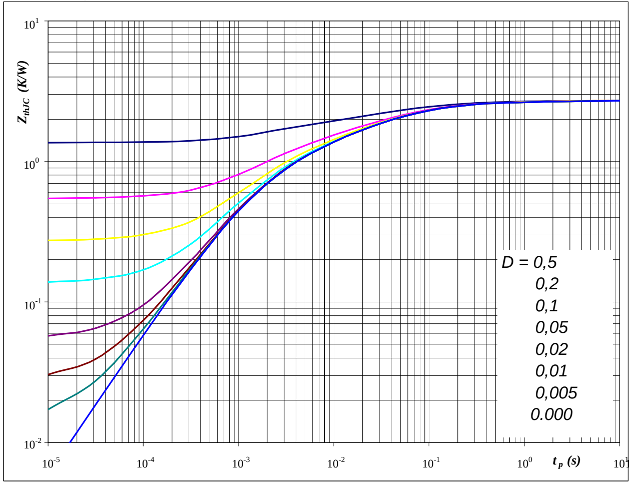
At

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

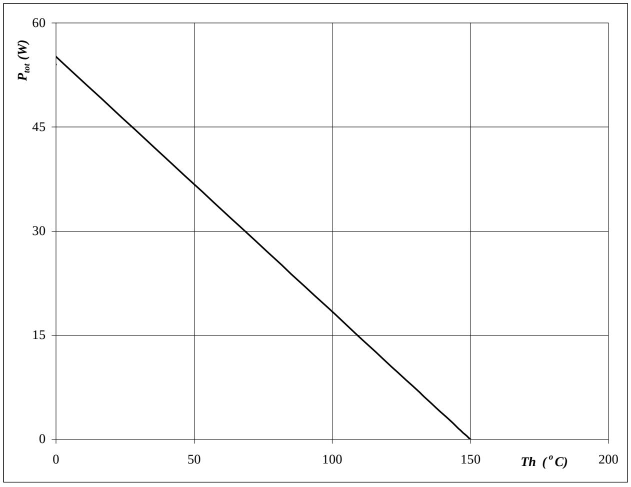
D = tp / T

R_{thJH} = 2,72 K/W

Figure 3 Boost IGBT Protection Diode

Power dissipation as a
function of heatsink temperature

$P_{tot} = f(T_h)$



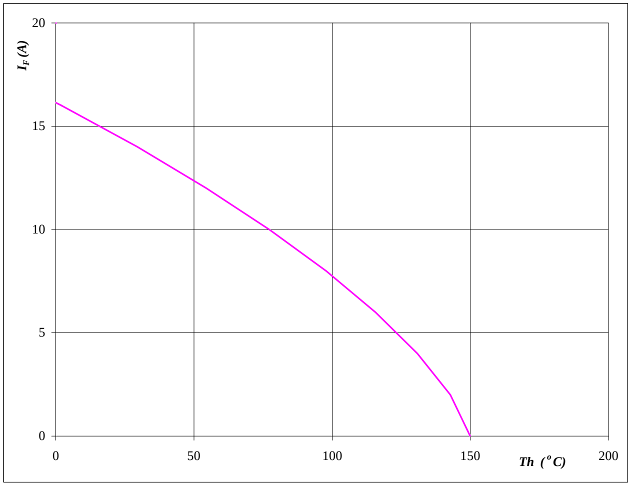
At

T_j = 150 ºC

Figure 4 Boost IGBT Protection Diode

Forward current as a
function of heatsink temperature

$I_F = f(T_h)$



At

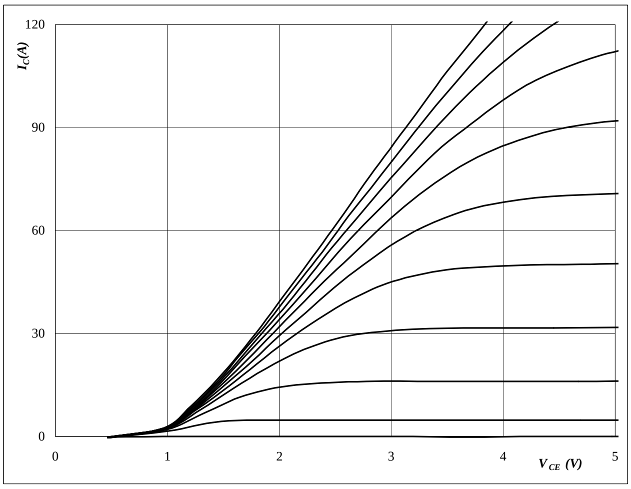
T_j = 150 ºC

INPUT BOOST

Figure 3 BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



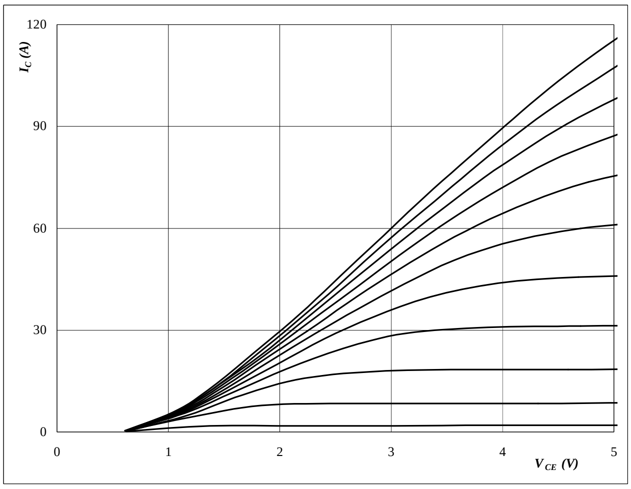
At

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

$I_C = f(V_{CE})$



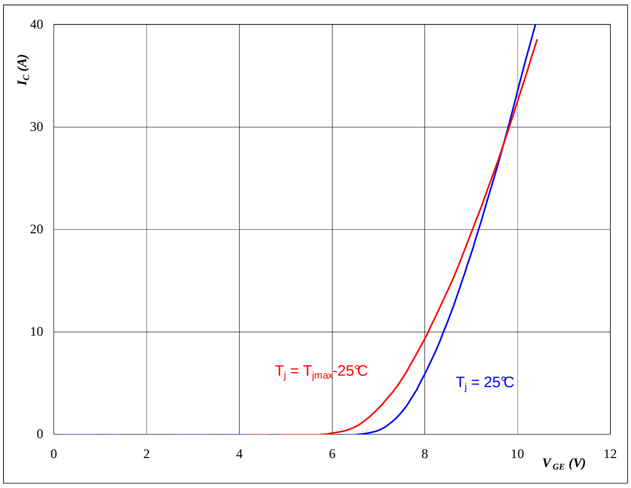
At

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

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



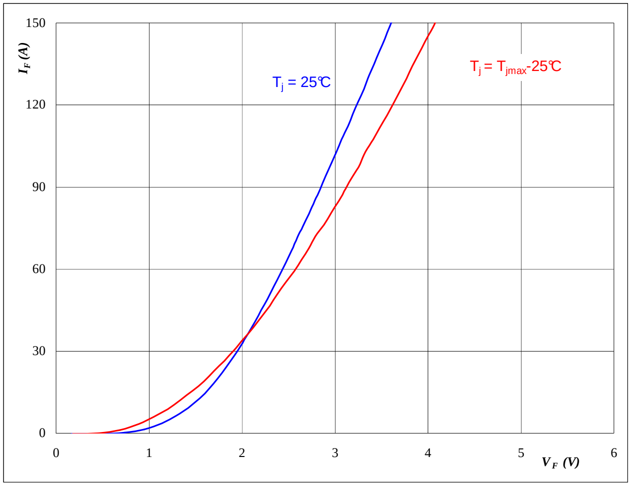
At

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

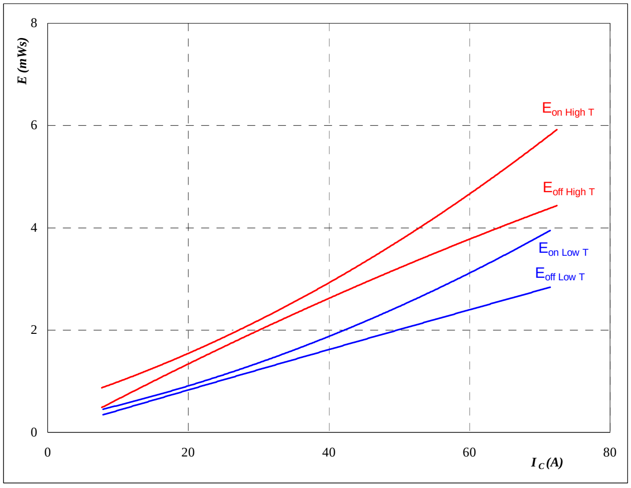
t_p = 250 µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



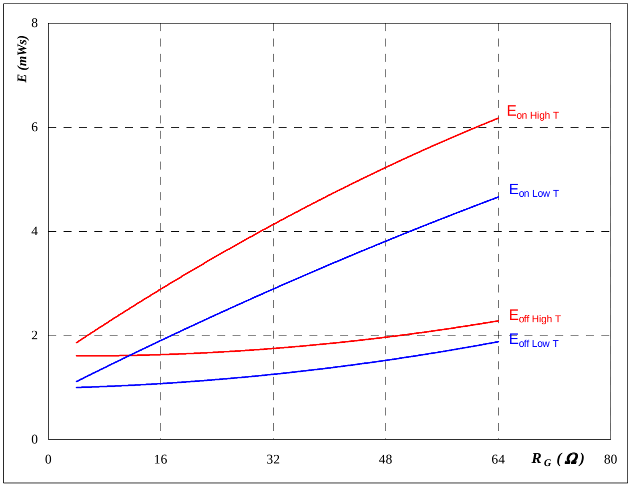
With an inductive load at

T_j = 25/125 ℃
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

$E = f(R_G)$



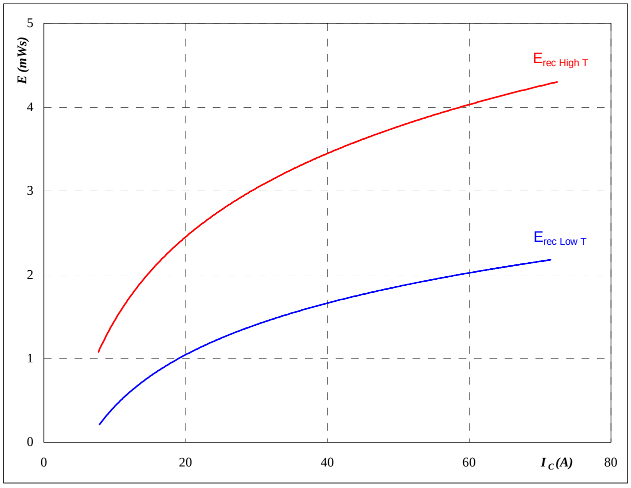
With an inductive load at

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

$E_{rec} = f(I_C)$



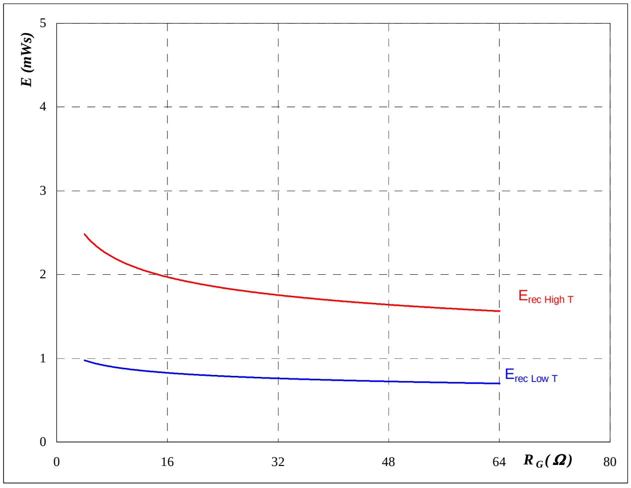
With an inductive load at

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

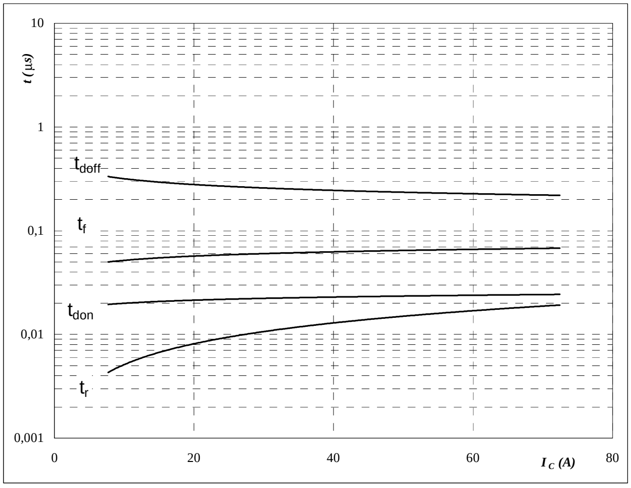
T_j = 25/125 ℃
V_{DS} = 700 V
V_{GS} = 15 V
I_D = 24 A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



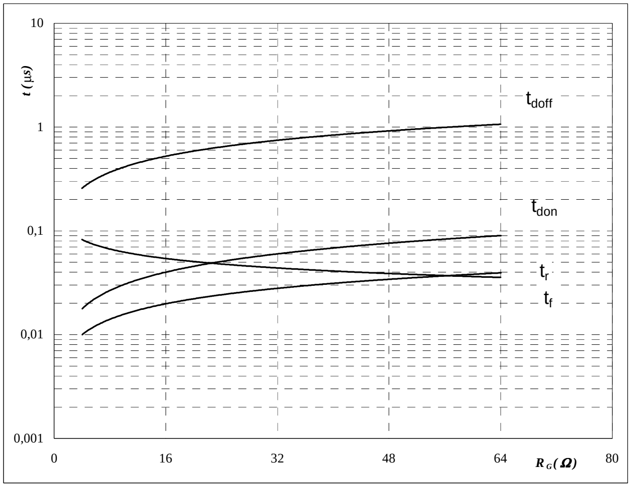
With an inductive load at

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

$t = f(R_G)$



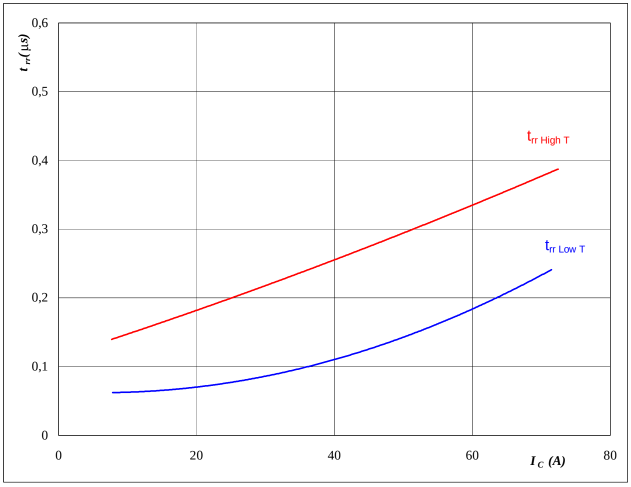
With an inductive load at

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

$t_{rr} = f(I_C)$



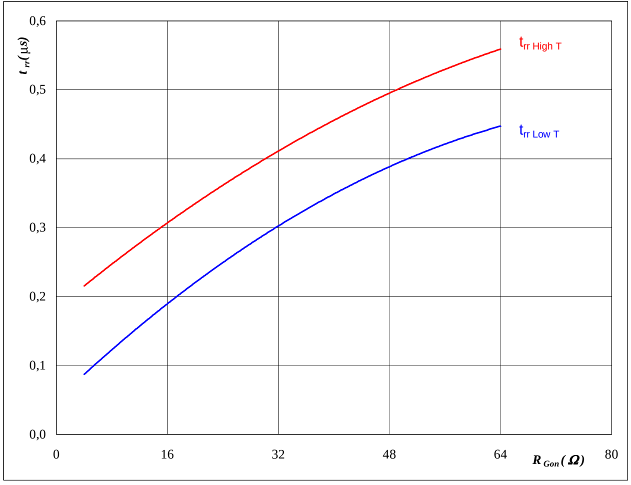
At

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

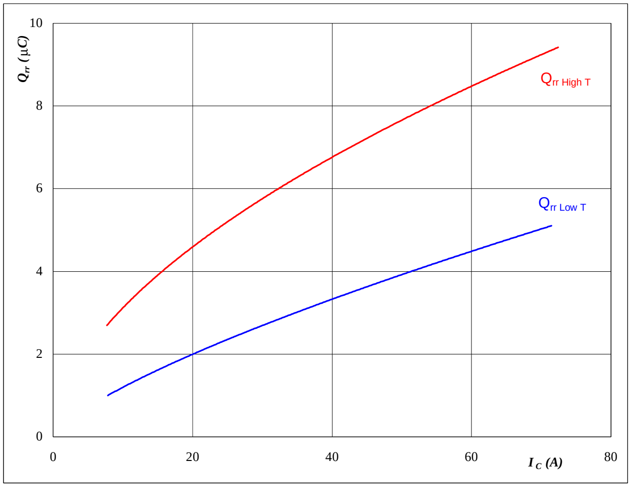
T_j = 25/125 °C
V_R = 700 V
I_F = 24 A
V_{GS} = 15 V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



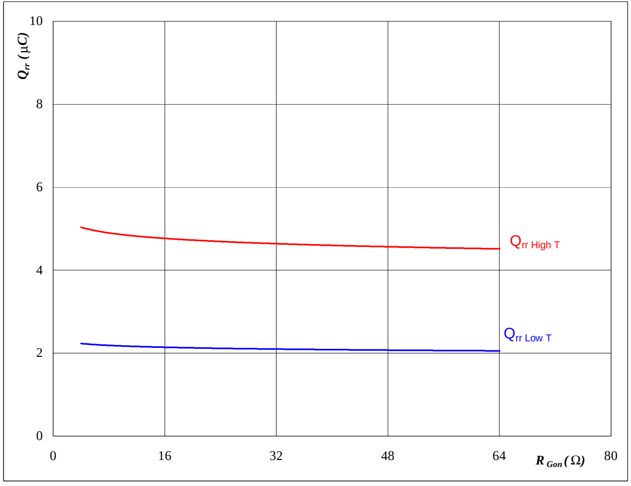
At

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

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



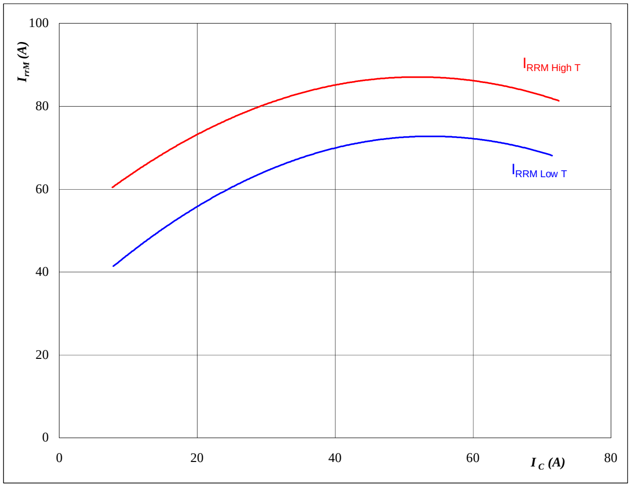
At

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

$I_{RRM} = f(I_C)$



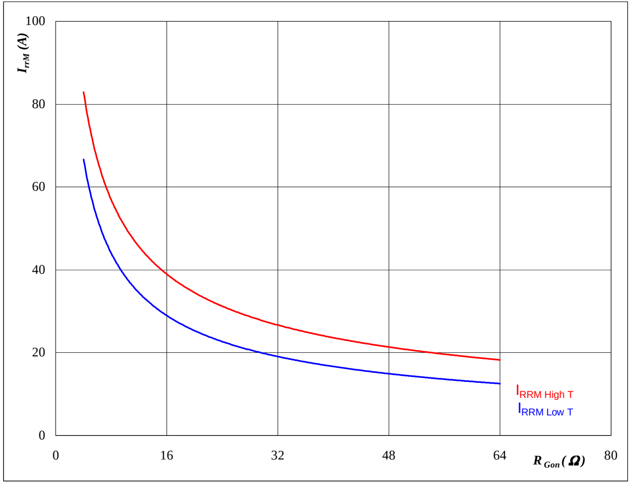
At

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

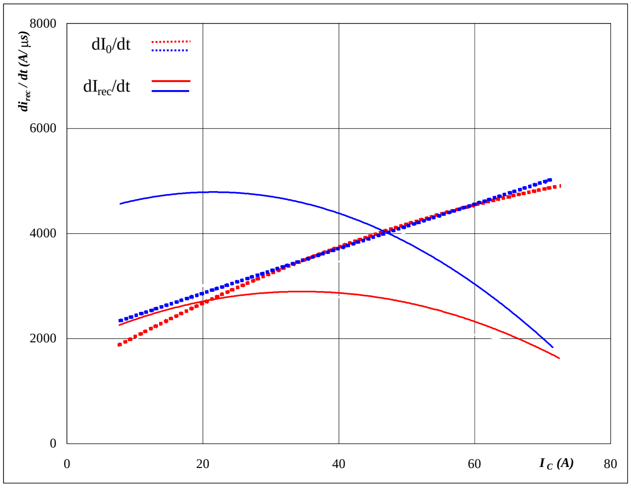
T_j = 25/125 °C
V_R = 700 V
I_F = 24 A
V_{GS} = 15 V

INPUT BOOST

Figure 17 BOOST FWD

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

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



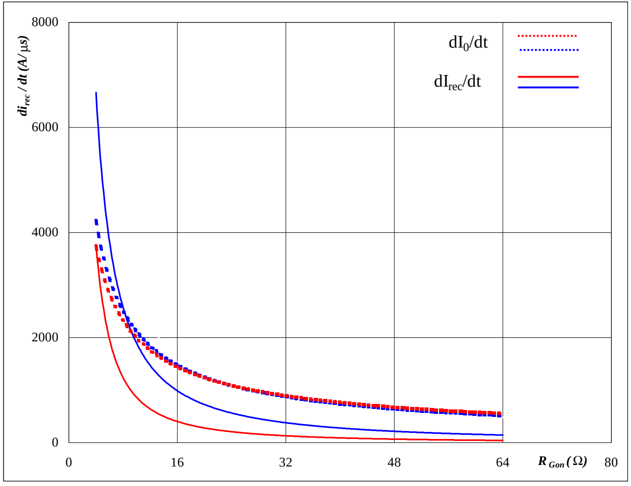
At

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

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



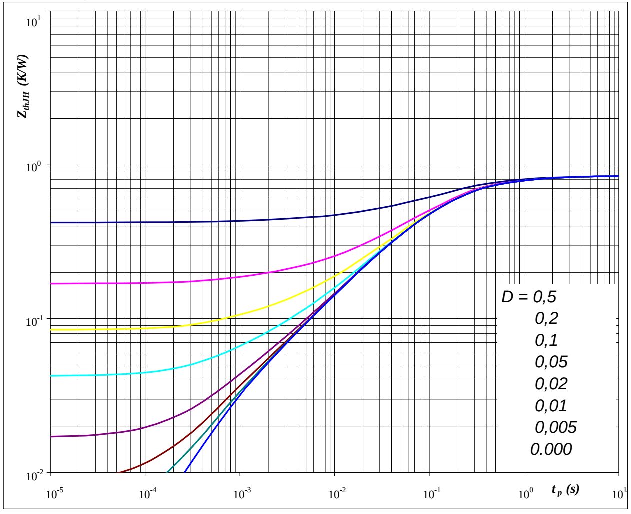
At

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

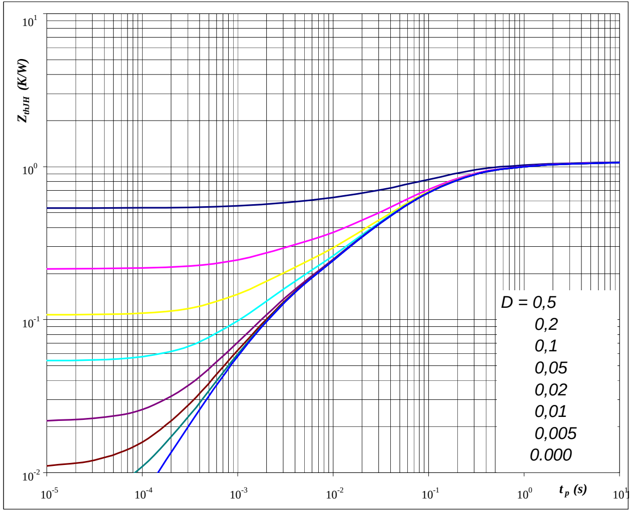
IGBT thermal model values

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} = 1,07 K/W

FWD thermal model values

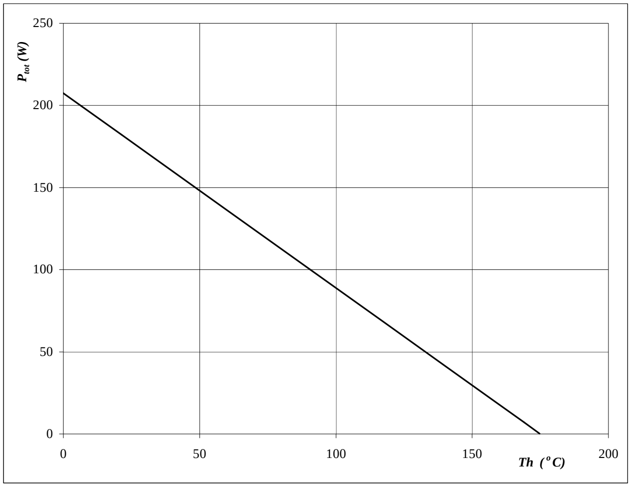
R (C/W)	Tau (s)
0,027	8,145
0,098	1,332
0,284	0,228
0,405	0,069
0,171	0,014

INPUT BOOST

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



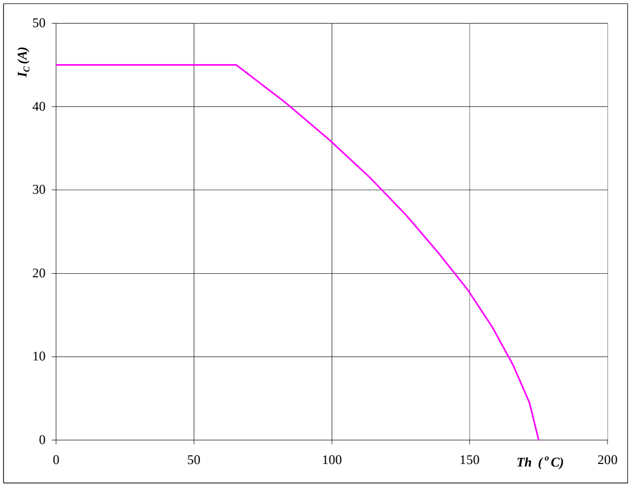
At

T_j = 175 ºC

Figure 22 BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

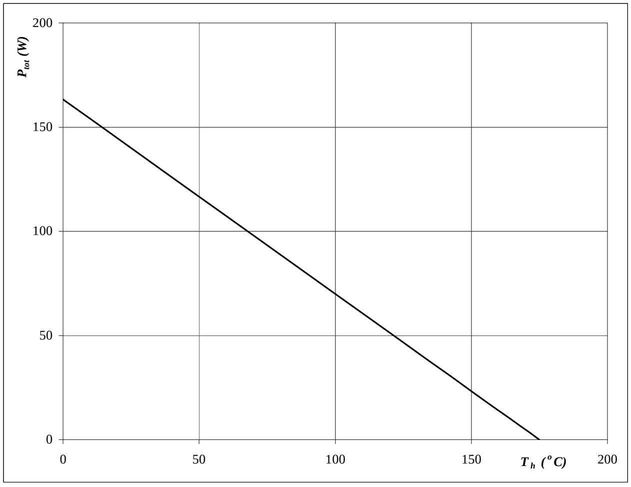
T_j = 175 ºC

V_{GS} = 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



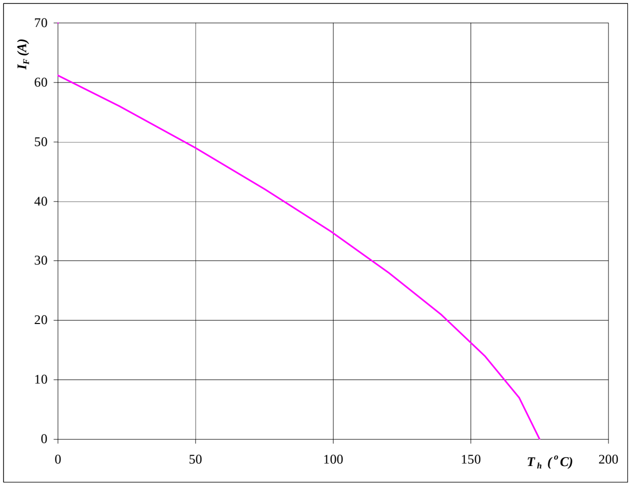
At

T_j = 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

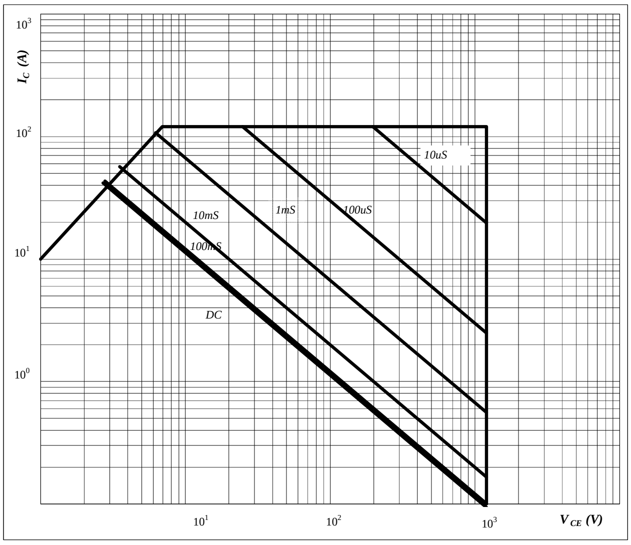
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



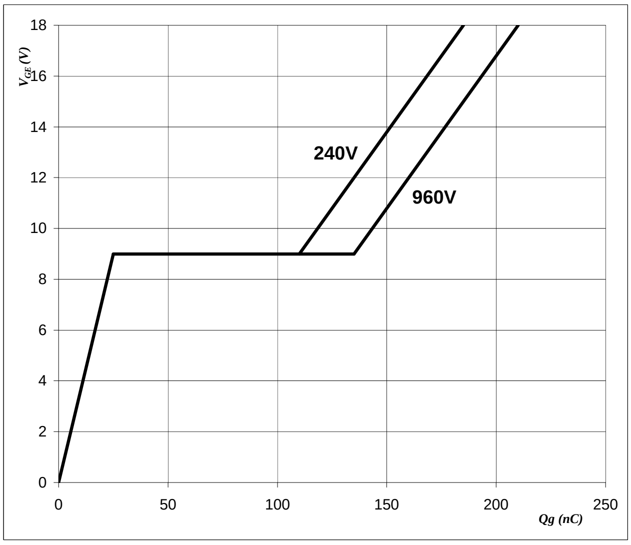
At

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

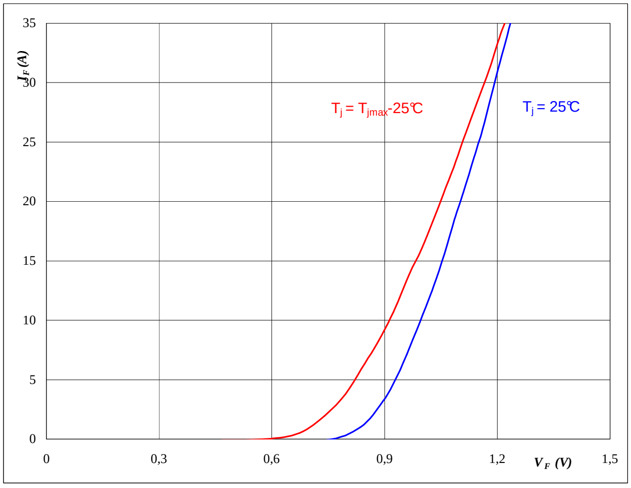
I_D =	24	A

Bypass Diode

Figure 1 Bypass Diode

Typical Diode forward current as a function of forward voltage

$I_F = f(V_F)$



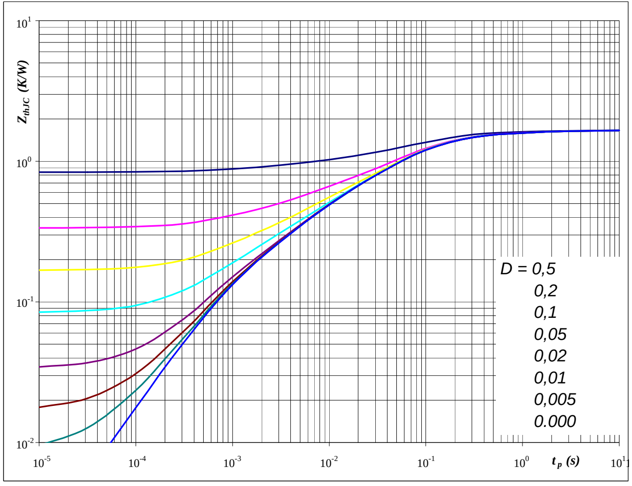
At

t_p = 250 µs

Figure 2 Bypass Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

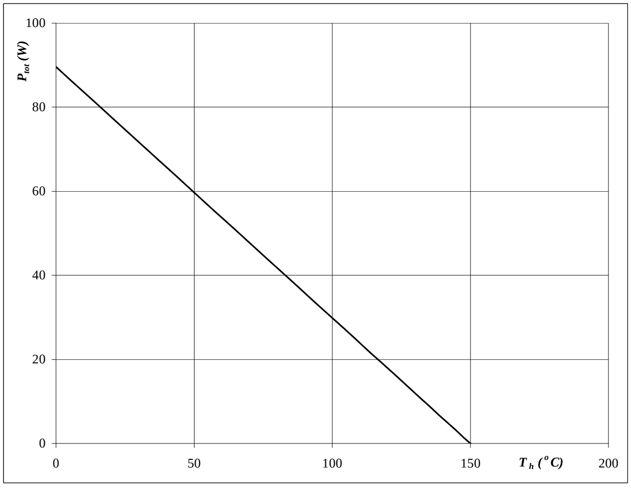
D = t_p / T

R_{thJH} = 1,674 K/W

Figure 3 Bypass Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



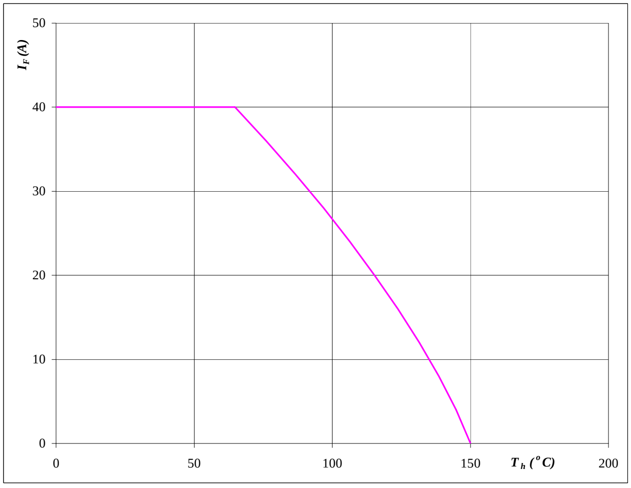
At

T_j = 150 ºC

Figure 4 Bypass Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



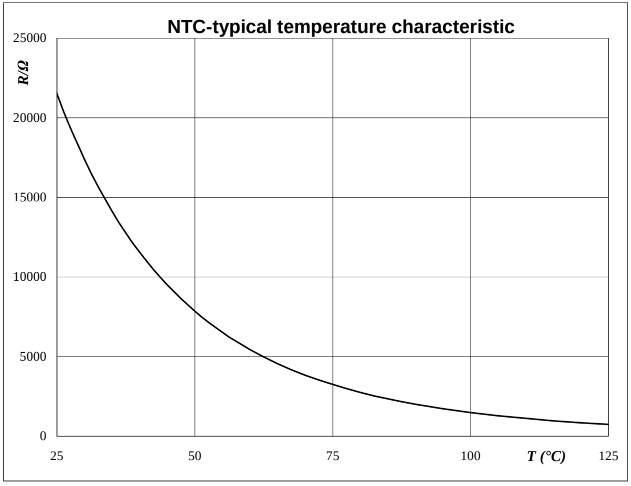
At

T_j = 150 ºC

Thermistor

Figure 1 Thermistor

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



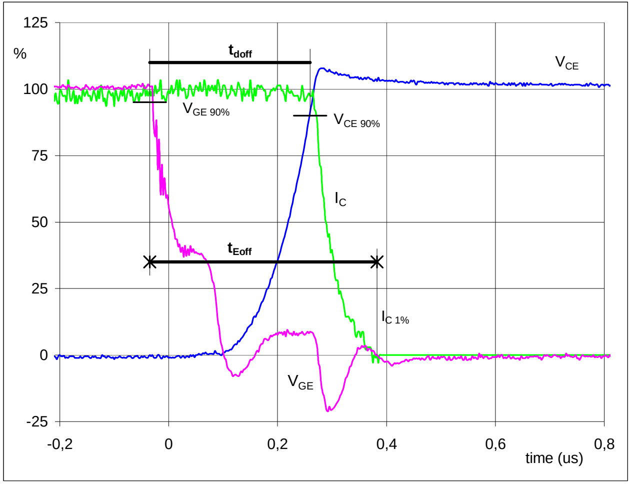
Switching Definitions BOOST IGBT

General conditions

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

Figure 1 Boost IGBT

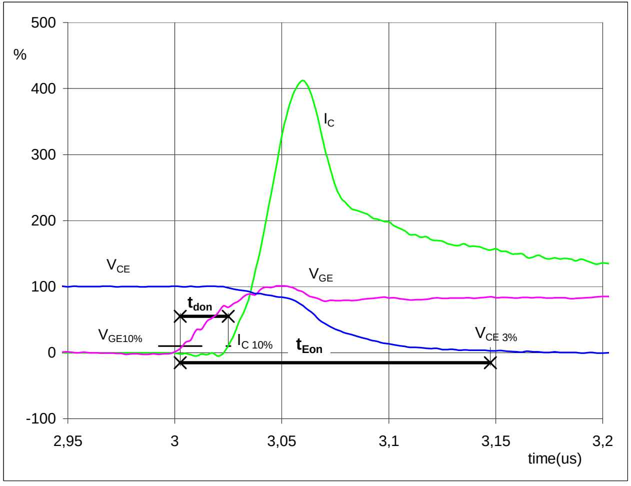
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) = 0 V
V_{GE} (100%) = 15 V
V_C (100%) = 700 V
I_C (100%) = 24 A
t_{doff} = 0,29 µs
t_{Eoff} = 0,42 µs

Figure 2 Boost IGBT

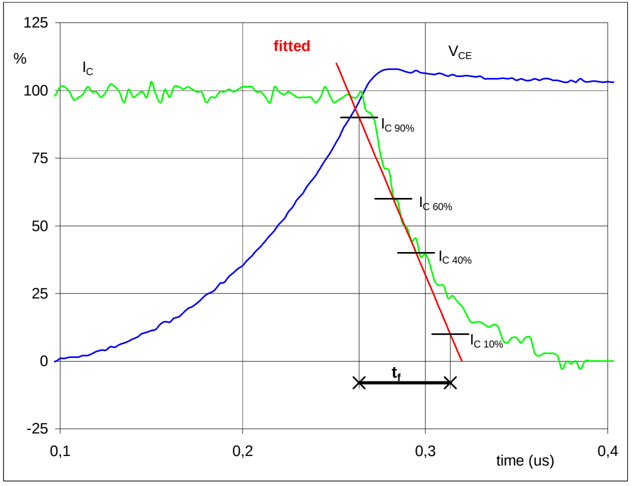
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



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} = 0,14 µs

Figure 3 Boost IGBT

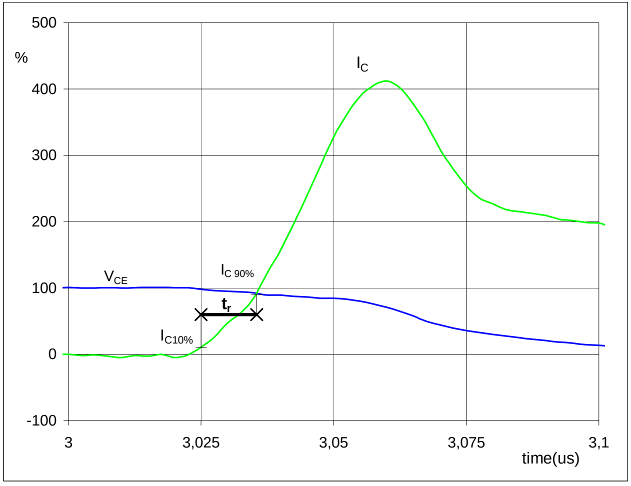
Turn-off Switching Waveforms & definition of t_f



V_C (100%) = 700 V
I_C (100%) = 24 A
t_f = 0,06 µs

Figure 4 Boost IGBT

Turn-on Switching Waveforms & definition of t_r

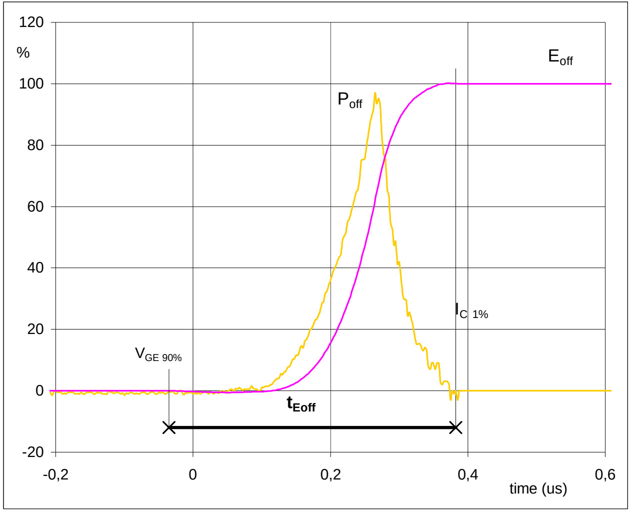


V_C (100%) = 700 V
I_C (100%) = 24 A
t_r = 0,01 µs

Switching Definitions BOOST IGBT

Figure 5 Boost IGBT

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



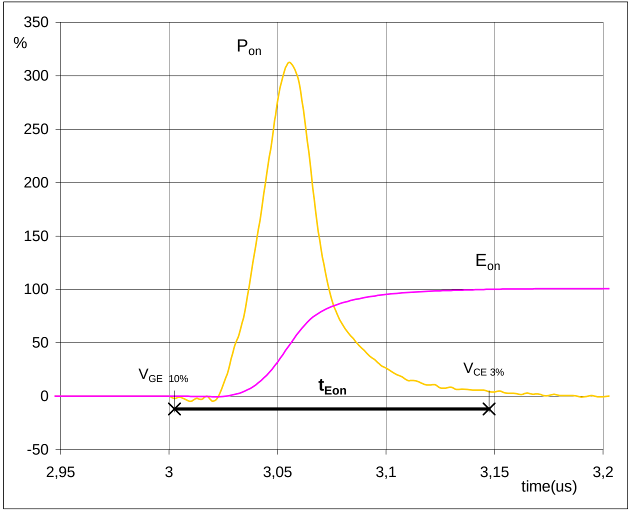
P_{off} (100%) = 16,97 kW

E_{off} (100%) = 1,55 mJ

t_{Eoff} = 0,42 µs

Figure 6 Boost IGBT

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



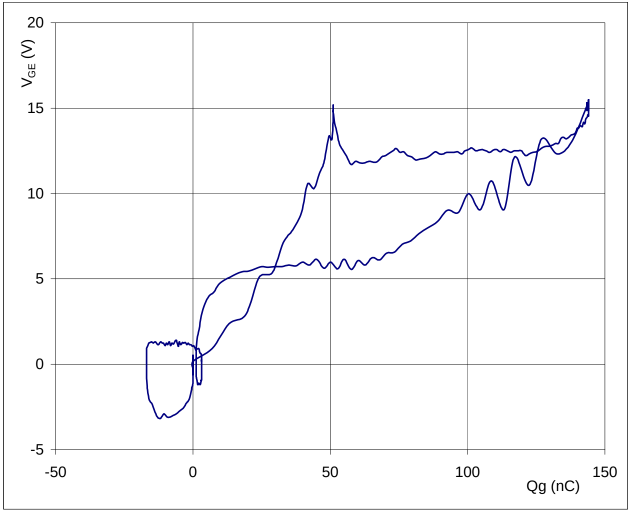
P_{on} (100%) = 16,97 kW

E_{on} (100%) = 1,85 mJ

t_{Eon} = 0,14 µs

Figure 7 Boost IGBT

Gate voltage vs Gate charge (measured)



V_{GEoff} = 0 V

V_{GEon} = 15 V

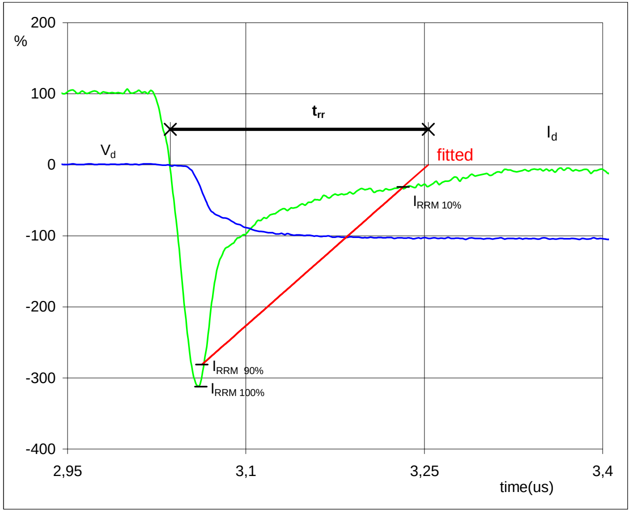
V_C (100%) = 700 V

I_C (100%) = 24 A

Q_g = 144,01 nC

Figure 8 Boost FWD

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



V_d (100%) = 700 V

I_d (100%) = 24 A

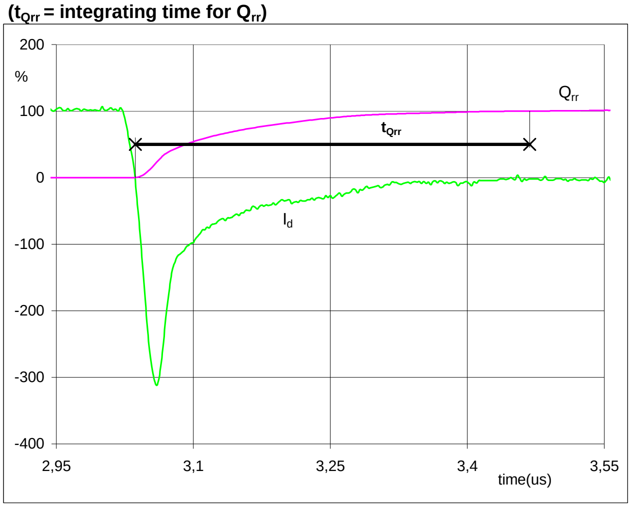
I_{RRM} (100%) = -76 A

t_{rr} = 0,21 µs

Switching Definitions BOOST FWD

Figure 9 Boost FWD

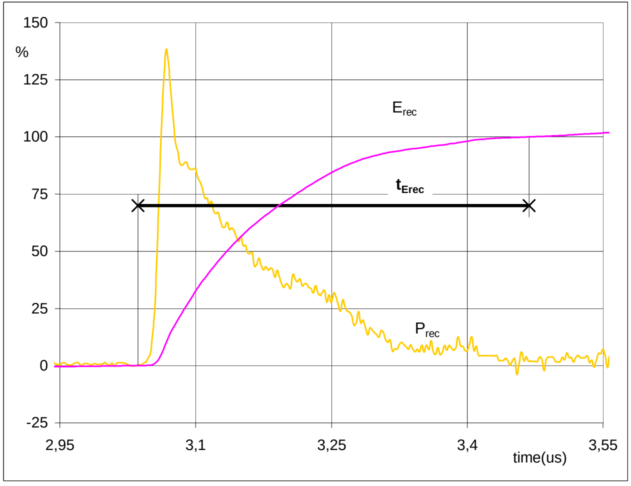
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	24	A
Q_{rr} (100%) =	4,94	μC
t_{Qrr} =	0,43	μs

Figure 10 Boost FWD

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



P_{rec} (100%) =	16,97	kW
E_{rec} (100%) =	2,36	mJ
t_{Erec} =	0,43	μs

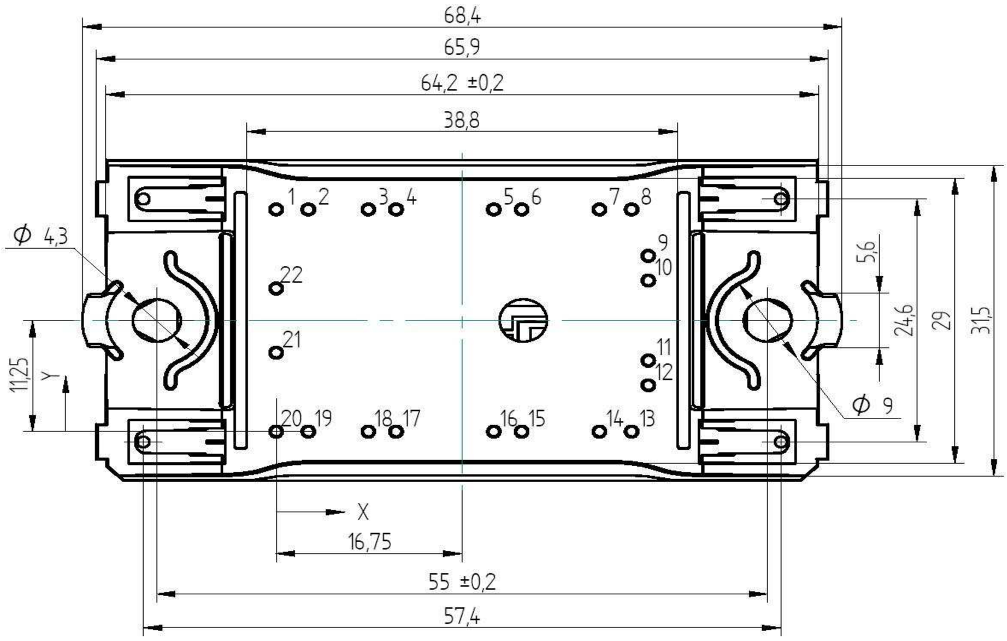
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

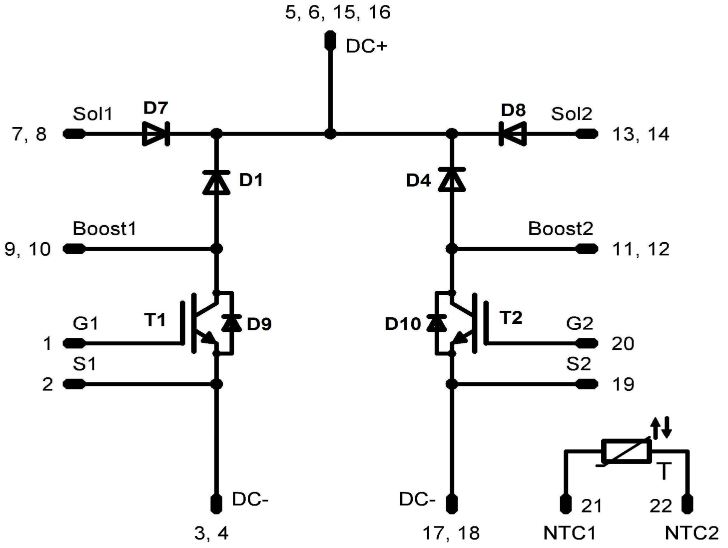
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P629-L59-PM	P629-L59-PM	P629-L59-PM

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



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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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