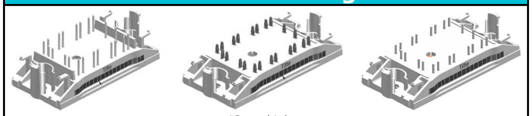
Vincotech

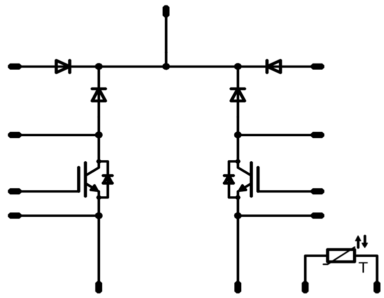
V23990-P629-L59-PM
V23990-P629-L58-PM
V23990-P629-L58Y-PM
datasheet

flow BOOST — 1200 V / 40 A

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

flow 0 housing

17mm hight solder Pin — 12mm hight Press-fit Pin — 12mm hight solder Pin

Target Applications
- solar inverter

Schematic


Types
- V23990-P629-L59-PM
- V23990-P629-L58-PM
- V23990-P629-L58Y-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode (D7 , D8)					
Repetitive peak reverse voltage	V_{RRM}	T_j=25°C		1600	V
DC forward current	I_{FAV}	T_j=Tjmax	T_h=80°C T_c=80°C	34 40	A
Surge forward current	I_{FSM}	t_p=10ms sin 180°	T_j=25°C	220	A
I^2t-value	I^2t			240	A^2s
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	42 63	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost IGBT (T1 , T2)					
Collector-emitter break down voltage	V_{CE}	T_j=25°C		1200	V
DC collector current	I_C	T_j=Tjmax	T_h=80°C T_c=80°C	40 45	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		120	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	113 171	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 800	µs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost IGBT Protection Diode (D9 , D10)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=Tjmax	T_h=80°C T_c=80°C	10 13	A
Surge forward current	I_{FSM}	t_p=10ms, sin 180°, T_j=Tjmax		21	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	26 39	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost FWD (D1 , D4)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=Tjmax	T_h=80°C T_c=80°C	39 53	A
Surge forward current	I_{FSM}	t_p=10ms, sin 180°, T_j=25°C		270	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	89 134	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 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°C Tj=125°C	0,7	1,15 1,11	1,4	V
Threshold voltage (for power loss calc. only)	V_{to}				24	Tj=25°C Tj=125°C		0,92 0,82		V
Slope resistance (for power loss calc. only)	r_t				24	Tj=25°C Tj=125°C		0,009 0,012		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						1,67		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							1,10		
Boost IGBT (T1 , T2)										
Gate emitter threshold voltage	$V_{GE(th)}$		$V_{GE}=V_{CE}$		0,0015	Tj=25°C Tj=125°C	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	Tj=25°C Tj=125°C	1,7	2,10 2,48	2,6	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25°C Tj=125°C			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			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°C Tj=125°C		22 21		ns
Rise time	t_r					Tj=25°C Tj=125°C		35 68		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		225 293		
Fall time	t_f					Tj=25°C Tj=125°C		35 68		
Turn-on energy loss	E_{on}					Tj=25°C Tj=125°C		1,09 1,82		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=125°C		1,01 1,61		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		2300		pF
Output capacitance	C_{oss}							150		
Reverse transfer capacitance	C_{rss}							135		
Gate charge	Q_G		15	600	40	Tj=25°C		185		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						0,84		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,56		
Boost IGBT Protection Diode (D9 , D1										
Diode forward voltage	V_F				3	Tj=25°C Tj=125°C	0,7	1,66 1,58	2,4	V
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						2,72		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							1,80		
Boost FWD (D1 , D4)										
Forward voltage	V_F				50	Tj=25°C Tj=125°C	1,5	2,28 2,36	2,8	V
Reverse leakage current	I_{rm}			1200		Tj=25°C Tj=125°C			60	μA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	700	24	Tj=25°C Tj=125°C		63 78		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		83 208		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		2,25 5,02		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,98 2,42		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=125°C		5304 3201		A/μs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,07		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,71		

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Characteristic Values

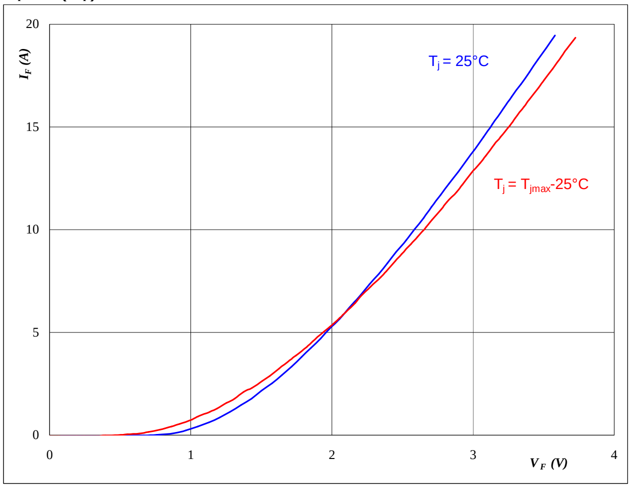
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					Tj=25°C		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486Ω				Tc=100°C	-4,5		+4,5	%
Power dissipation	P					Tj=25°C		210		mW
Power dissipation constant						Tj=25°C		3,5		mW/K
B-value	$B_{(25/50)}$					Tj=25°C		3884		K
B-value	$B_{(25/100)}$	Tol. ±1%				Tj=25°C		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

$I_F = f(V_F)$



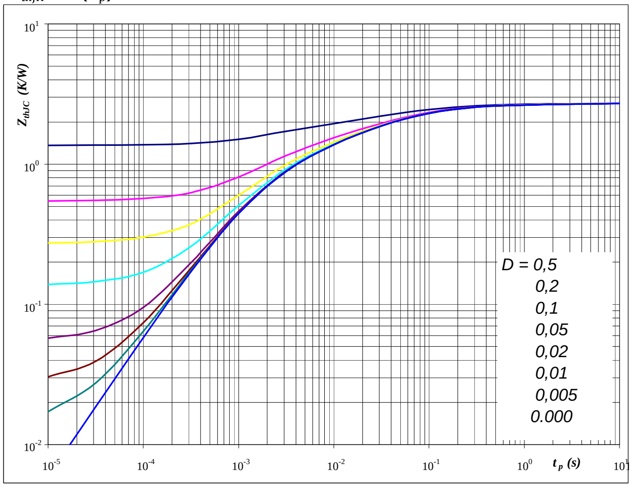
At

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

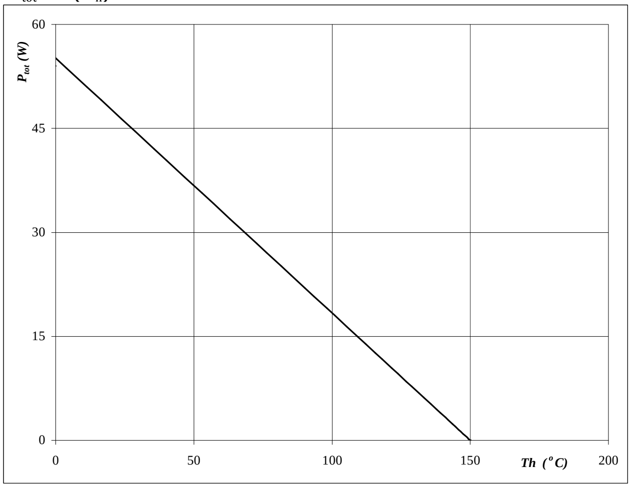
D = t_p / T

R_{thJH} = 2,72 K/W

Figure 3 Boost IGBT Protection Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



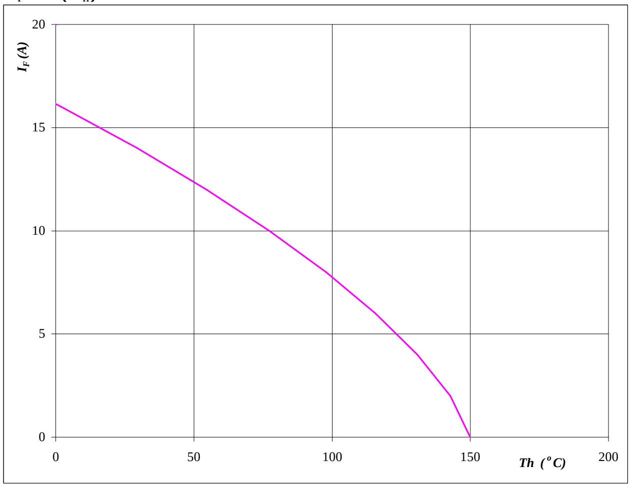
At

T_j = 150 ºC

Figure 4 Boost IGBT Protection Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

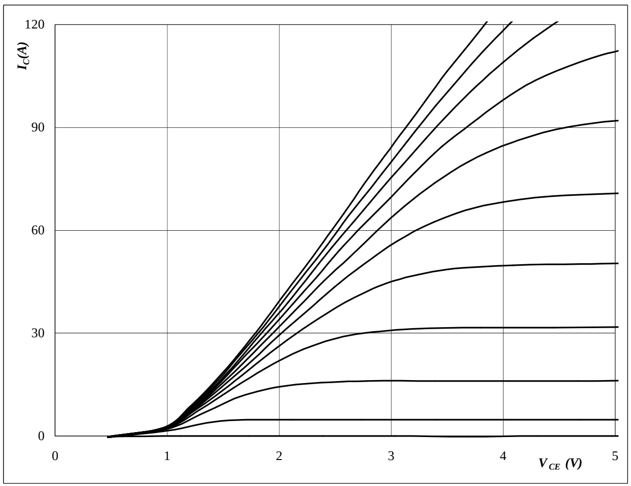
T_j = 150 ºC

INPUT BOOST

Figure 3 BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

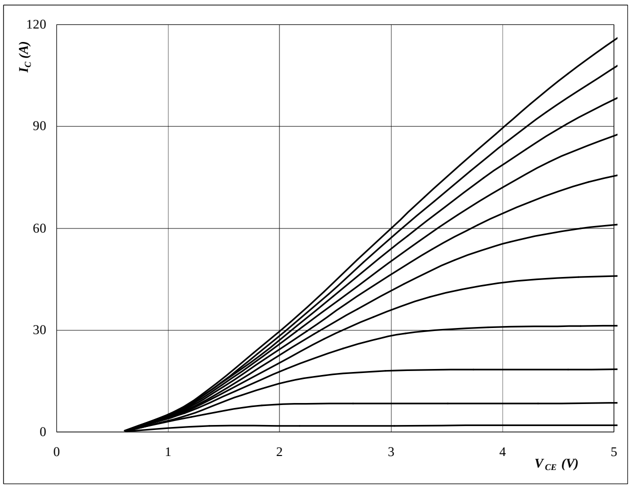
T_j = 25 °C

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

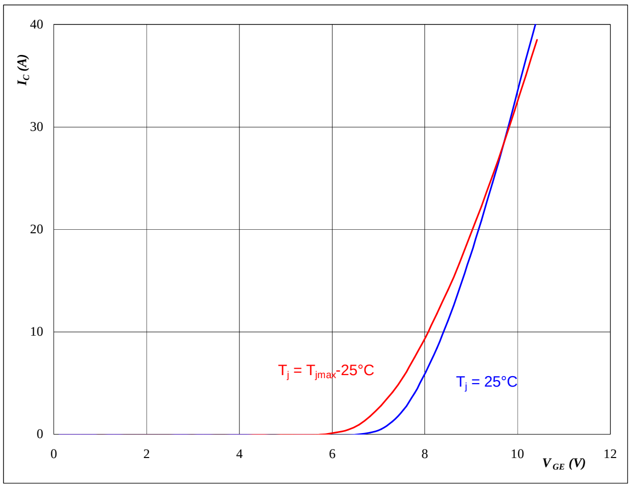
T_j = 125 °C

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

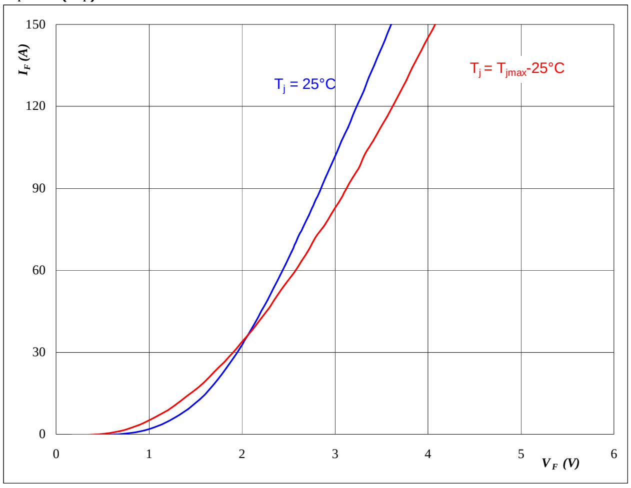
t_p = 250 µs

V_{DS} = 10 V

Figure 4 BOOST FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

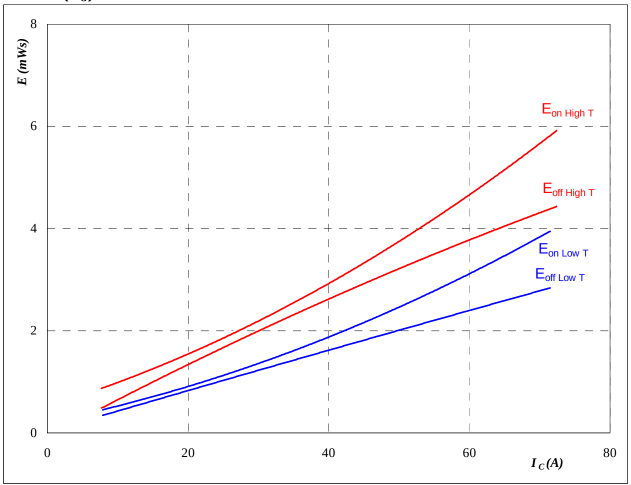
t_p = 250 µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



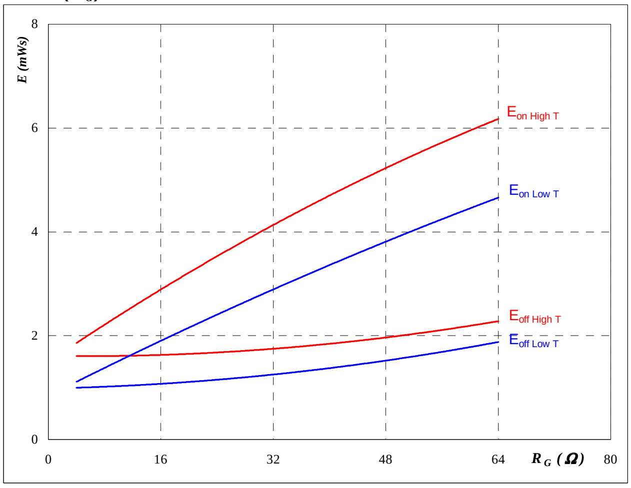
With an inductive load at

T_j =	25/125	°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

$E = f(R_G)$



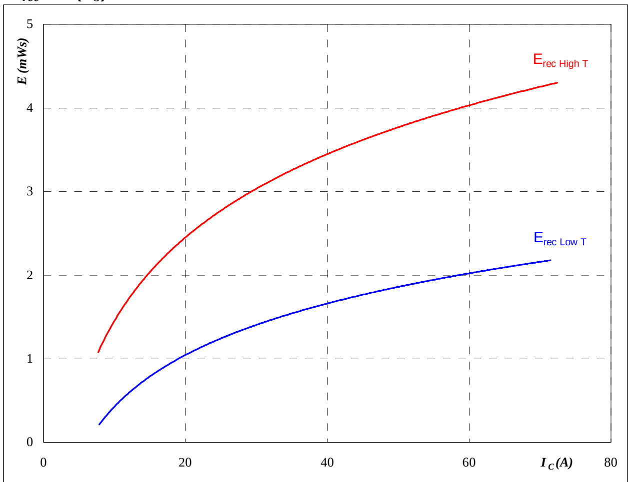
With an inductive load at

T_j =	25/125	°C
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

$E_{rec} = f(I_C)$



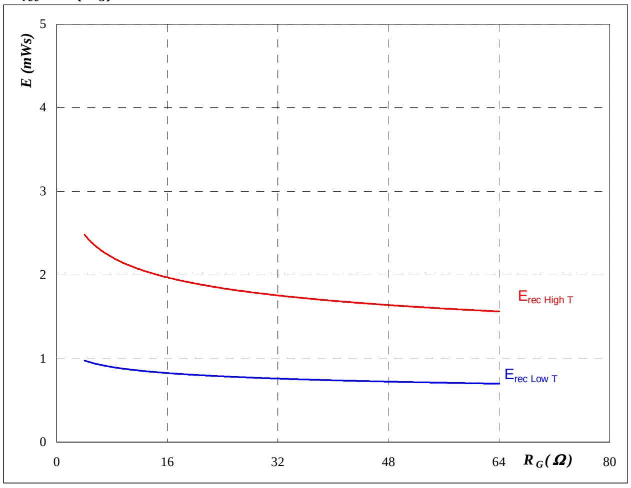
With an inductive load at

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

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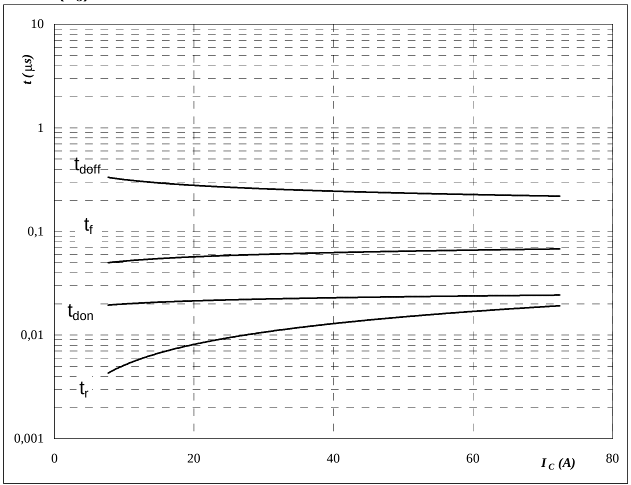
INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



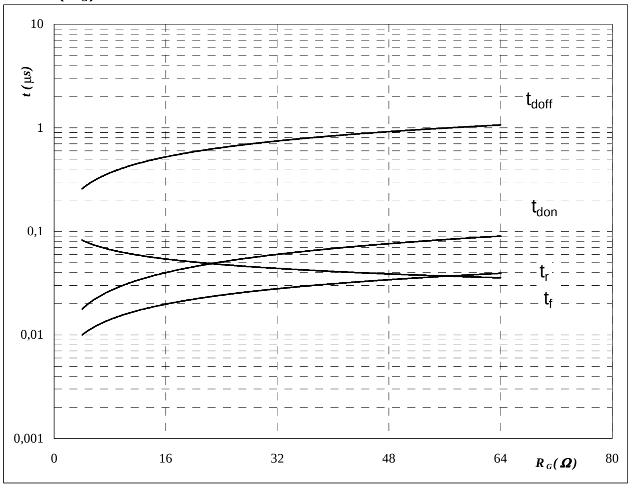
With an inductive load at

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

$t = f(R_G)$



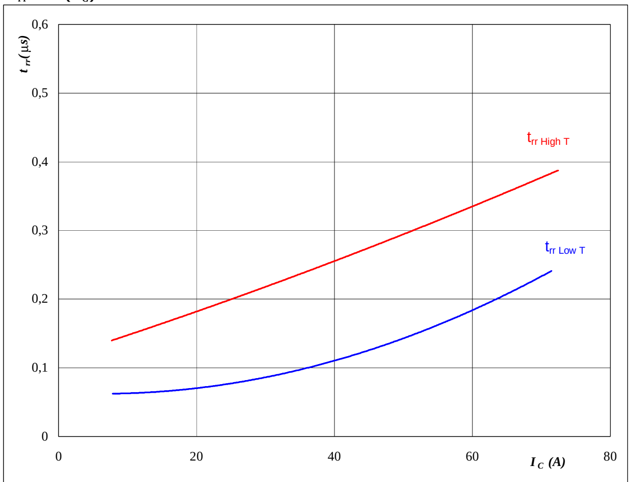
With an inductive load at

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

$t_{rr} = f(I_C)$



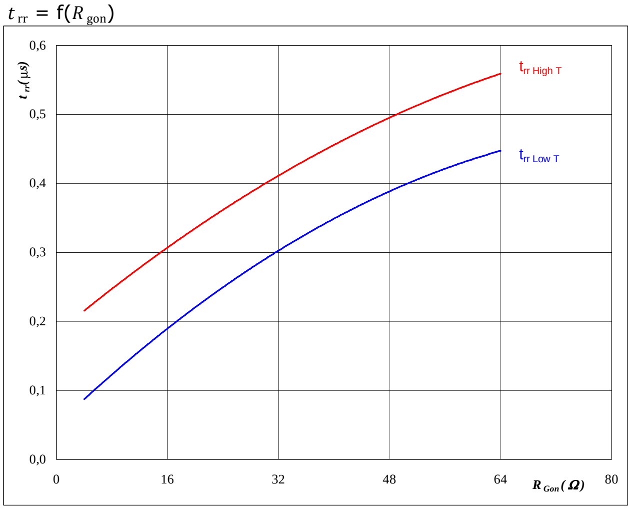
At

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

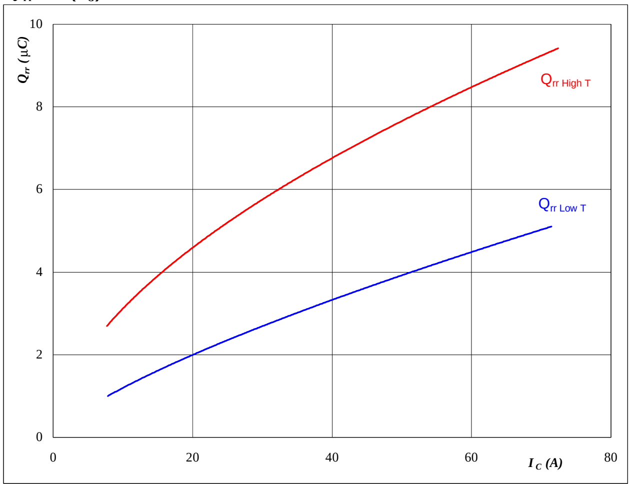
T_j =	25/125	°C
V_R =	700	V
I_F =	24	A
V_{GS} =	15	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



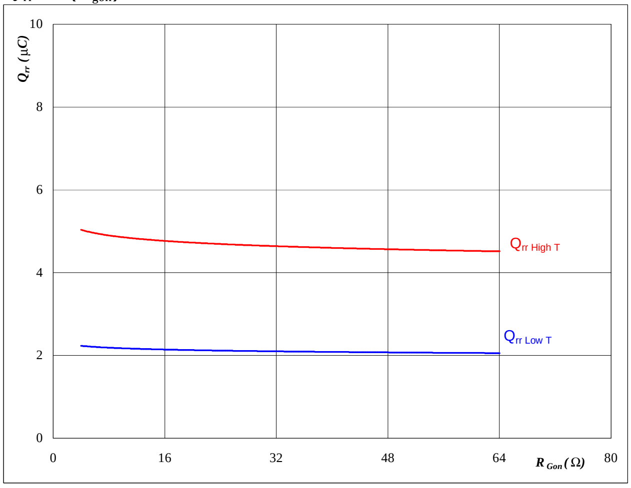
At

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

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



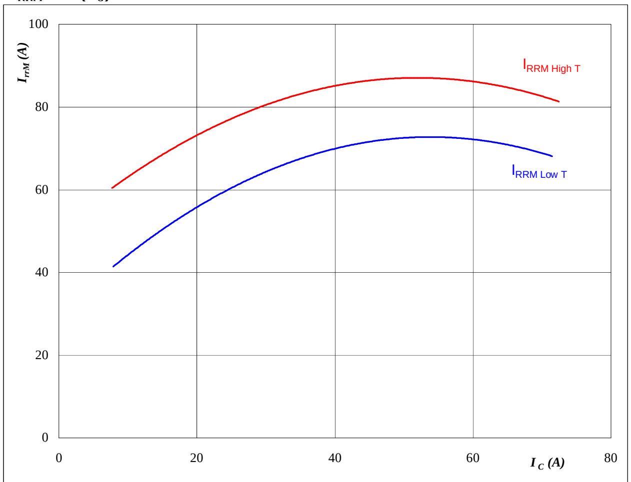
At

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

$I_{RRM} = f(I_C)$



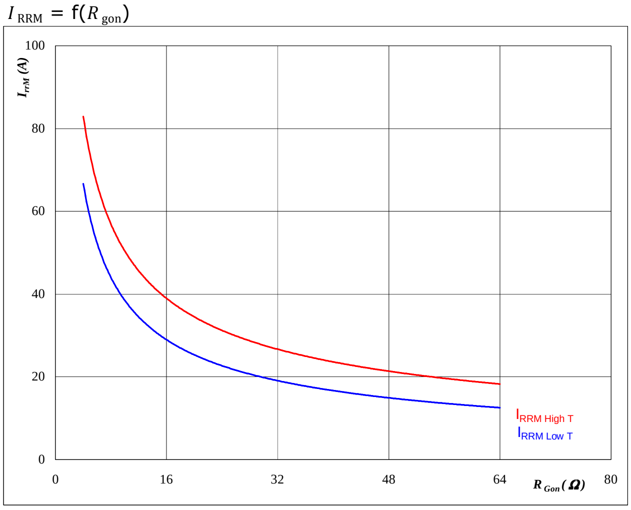
At

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

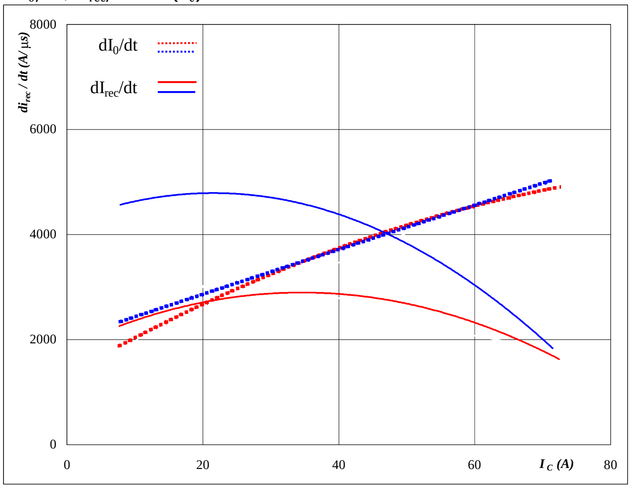
T_j =	25/125	°C
V_R =	700	V
I_F =	24	A
V_{GS} =	15	V

INPUT BOOST

Figure 17 — BOOST FWD

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

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



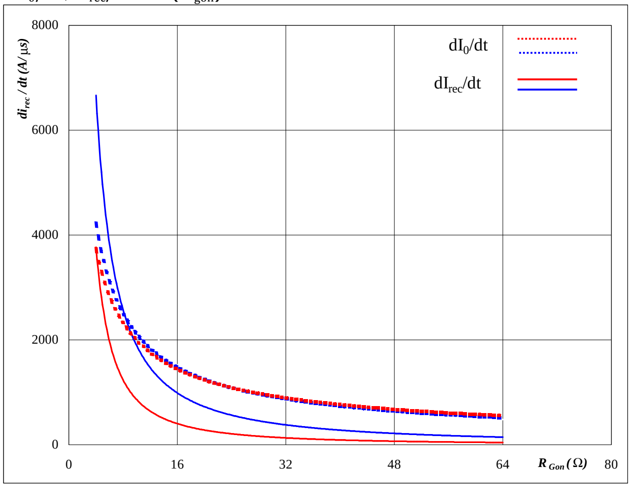
At

T_j =	25/125	°C
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

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



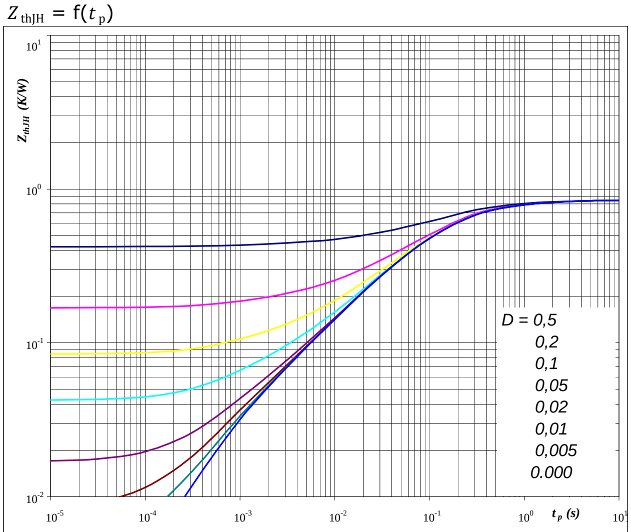
At

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

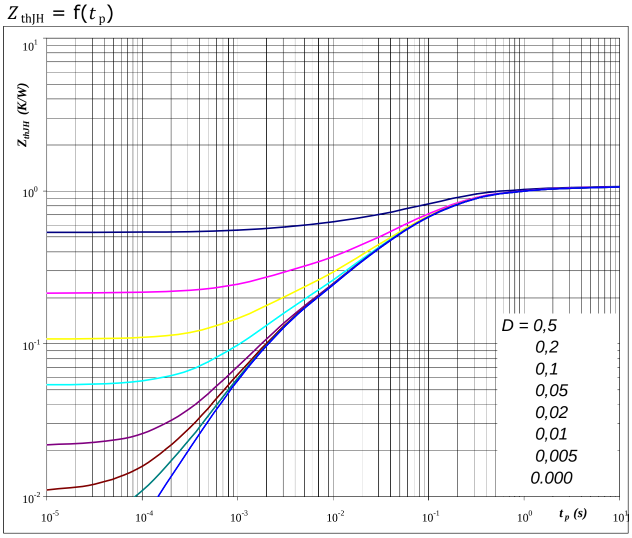
IGBT thermal model values

R (K/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

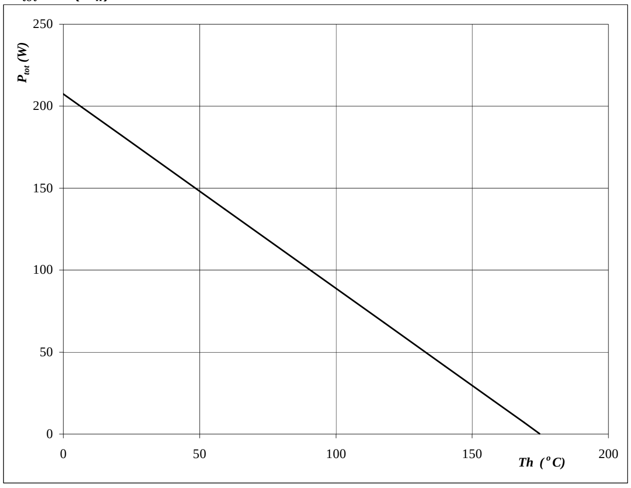
R (K/W)	Tau (s)
0,027	8,145
0,098	1,332
0,284	0,228
0,405	0,069
0,171	0,014

INPUT BOOST

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



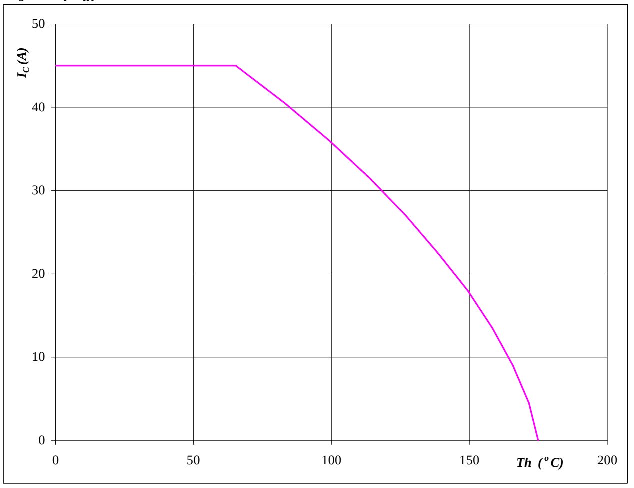
At

$T_j =$ 175 ºC

Figure 22 BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

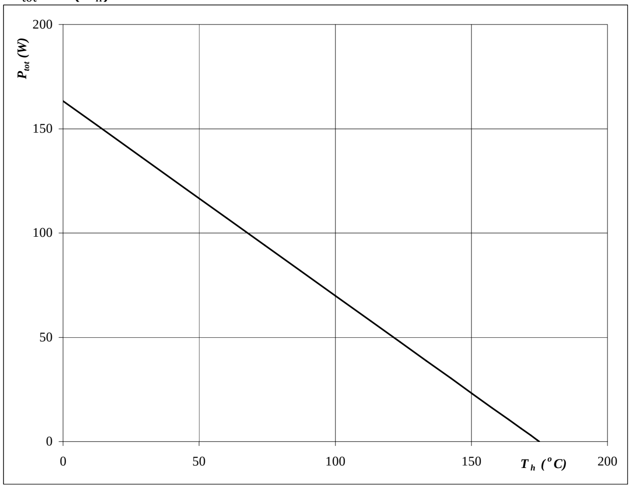
$T_j =$ 175 ºC

$V_{GS} =$ 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



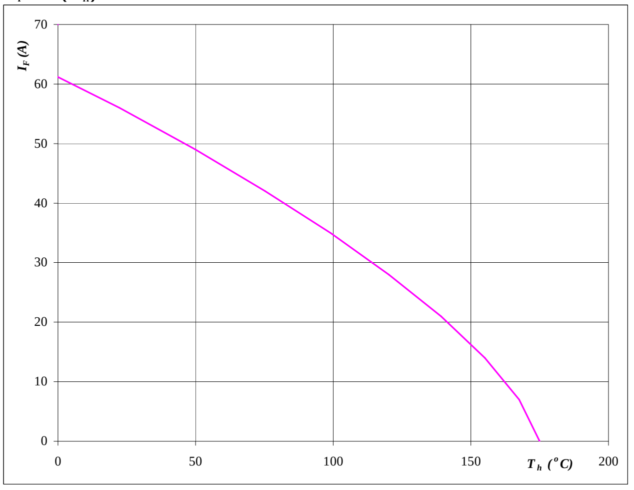
At

$T_j =$ 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

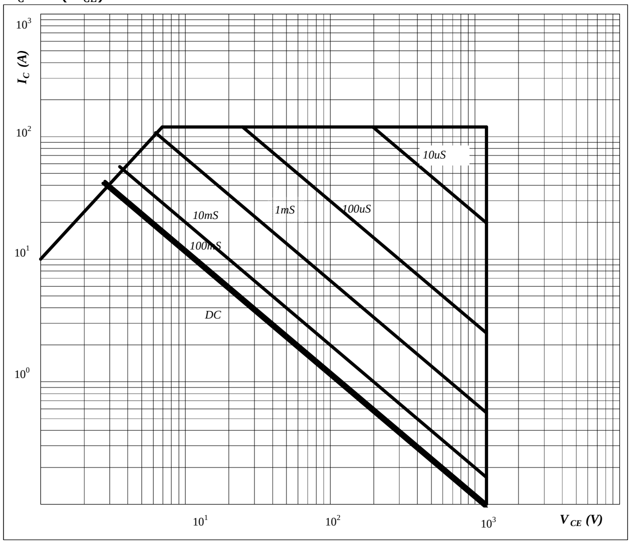
$T_j =$ 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



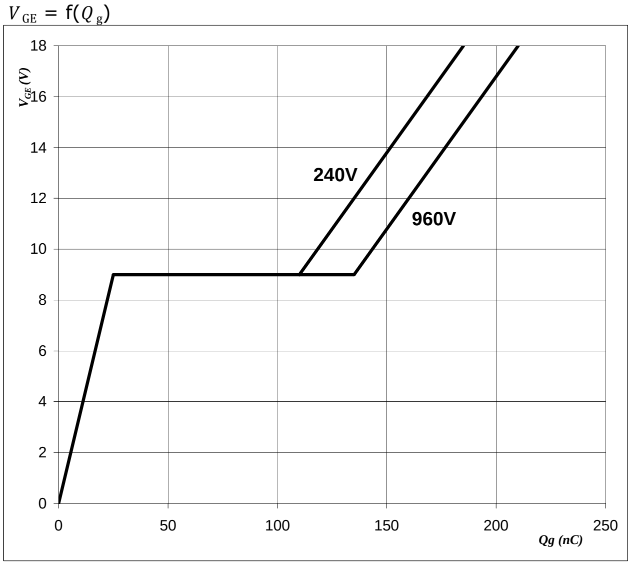
At

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

$V_{GE} = f(Q_g)$



At

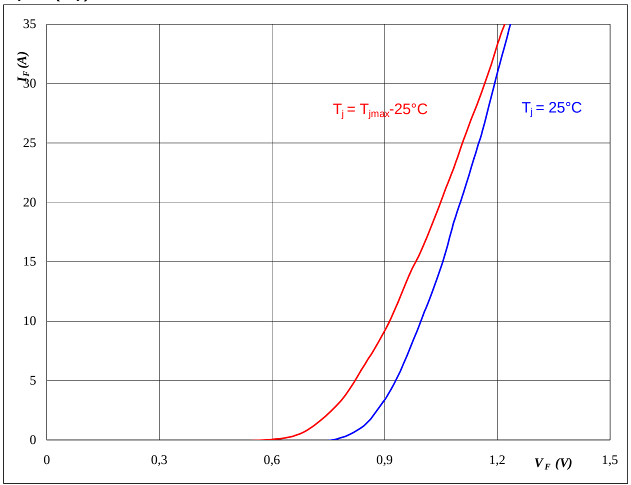
I_D =	24	A

Bypass Diode

Figure 1 Bypass Diode

Typical Diode forward current as a function of forward voltage

$I_F = f(V_F)$



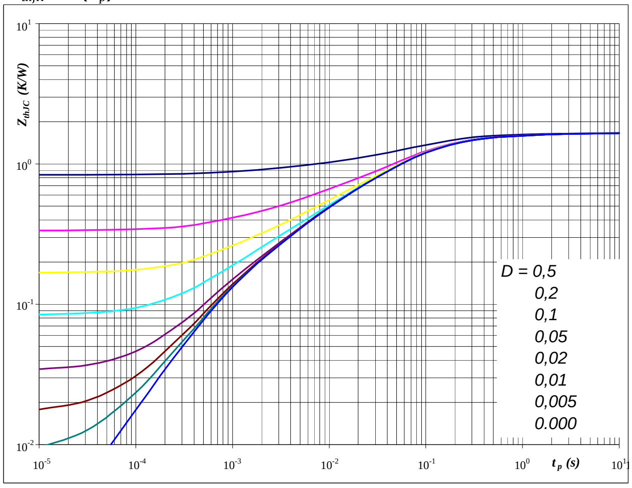
At

t_p = 250 µs

Figure 2 Bypass Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

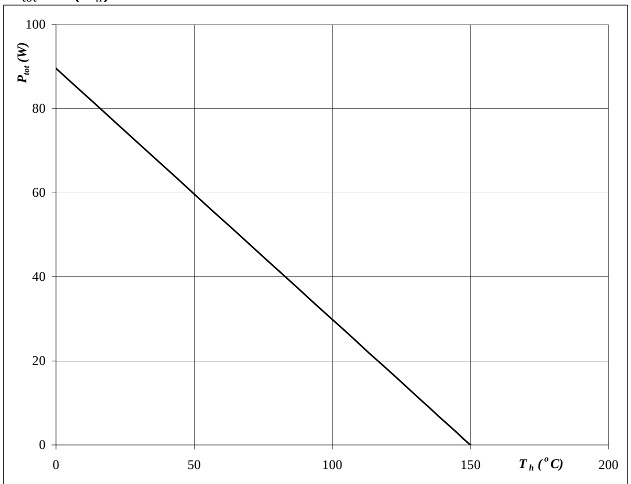
$D = t_p / T$

R_{thJH} = 1,674 K/W

Figure 3 Bypass Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



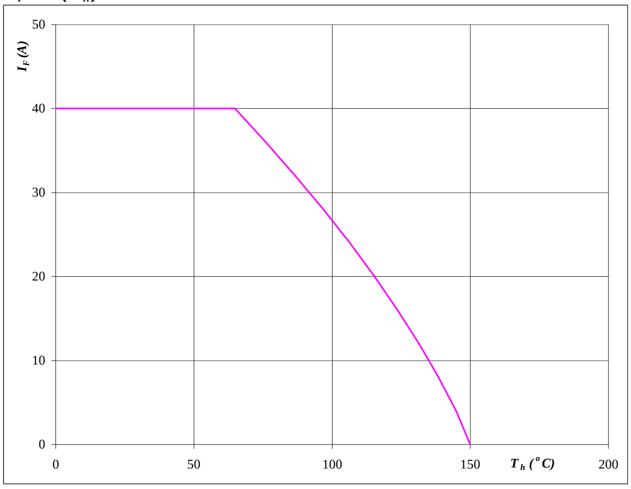
At

T_j = 150 ºC

Figure 4 Bypass Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



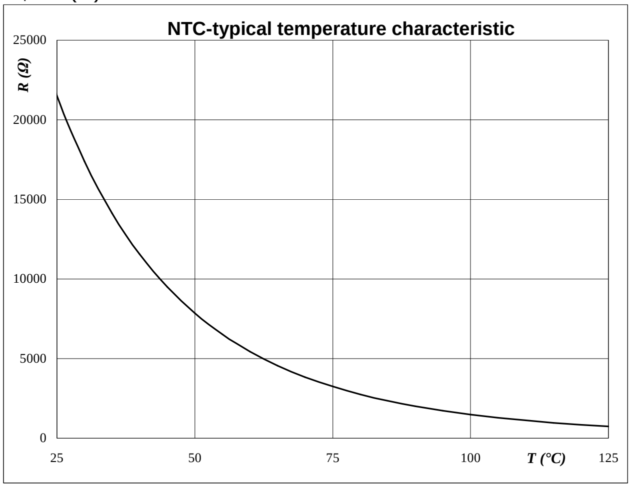
At

T_j = 150 ºC

Thermistor

Figure 1 Thermistor

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



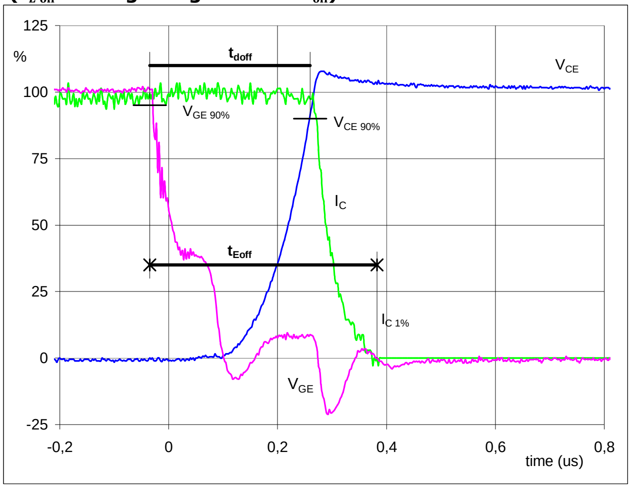
Switching Definitions BOOST IGBT

General conditions

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

Figure 1 Boost IGBT

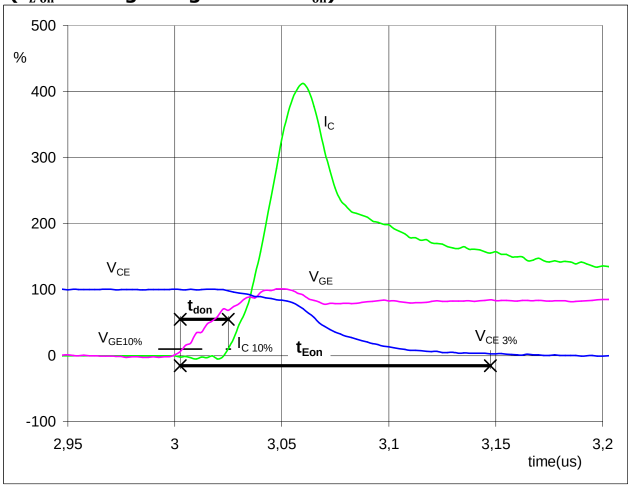
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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
$t_{E\,off}$ =	0,42	µs

Figure 2 Boost IGBT

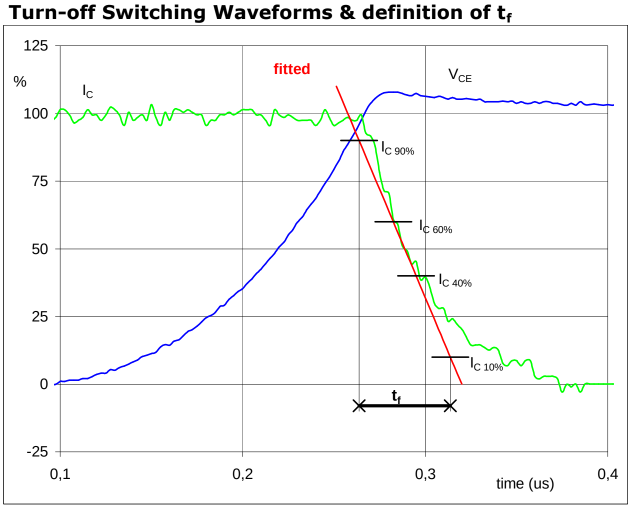
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	24	A
t_{don} =	0,02	µs
$t_{E\,on}$ =	0,14	µs

Figure 3 Boost IGBT

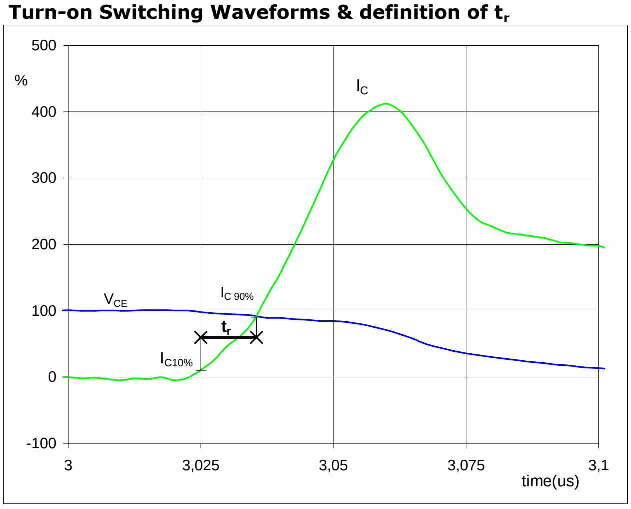
Turn-off Switching Waveforms & definition of t_f



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

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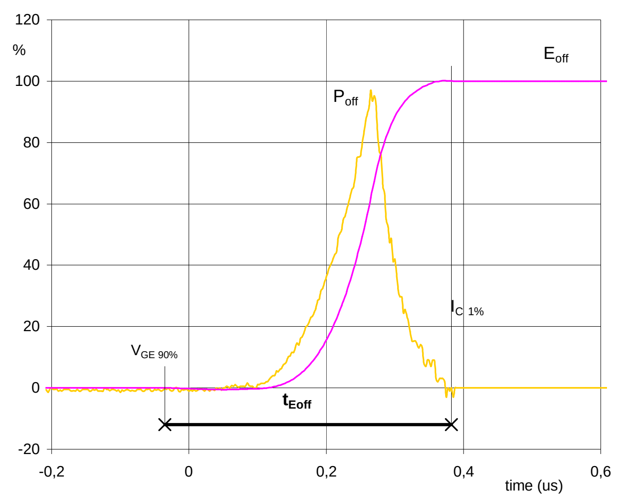
Switching Definitions BOOST IGBT

Figure 5 Boost IGBT

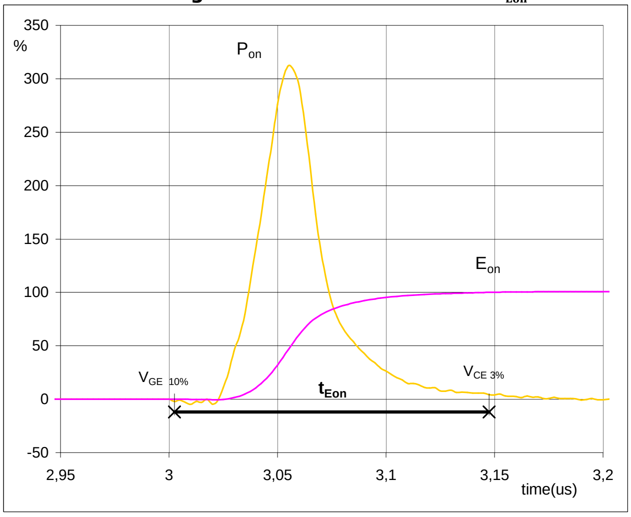
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	16,97	kW
E_{off} (100%) =	1,55	mJ
$t_{E\ off}$ =	0,42	μs

Figure 6 Boost IGBT

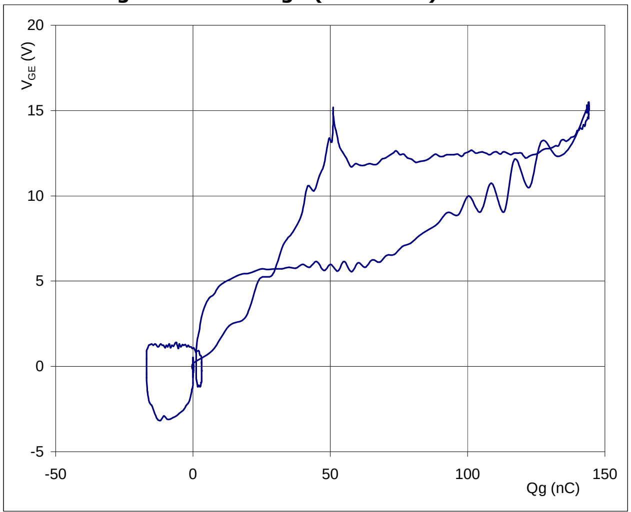
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	16,97	kW
E_{on} (100%) =	1,85	mJ
$t_{E\ on}$ =	0,14	μs

Figure 7 Boost IGBT

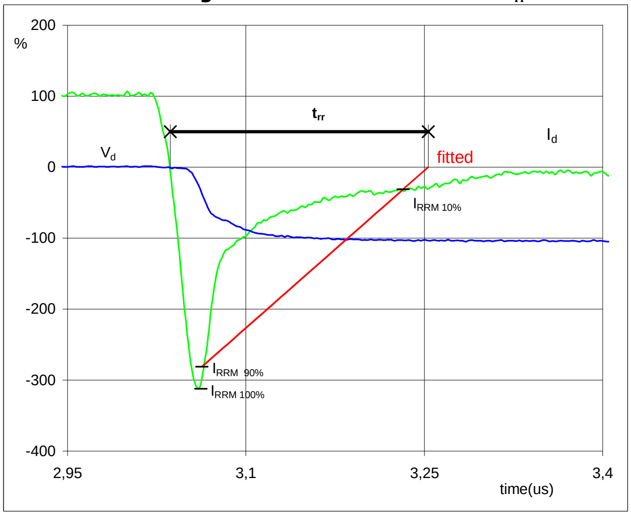
Gate voltage vs Gate charge (measured)



$V_{GE\ off}$ =	0	V
$V_{GE\ on}$ =	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}

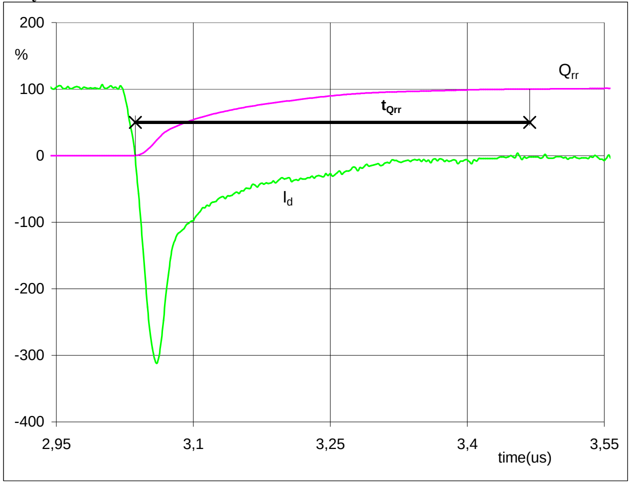


V_d (100%) =	700	V
I_d (100%) =	24	A
I_{RRM} (100%) =	-76	A
t_{rr} =	0,21	μs

Switching Definitions BOOST FWD

Figure 9 Boost FWD

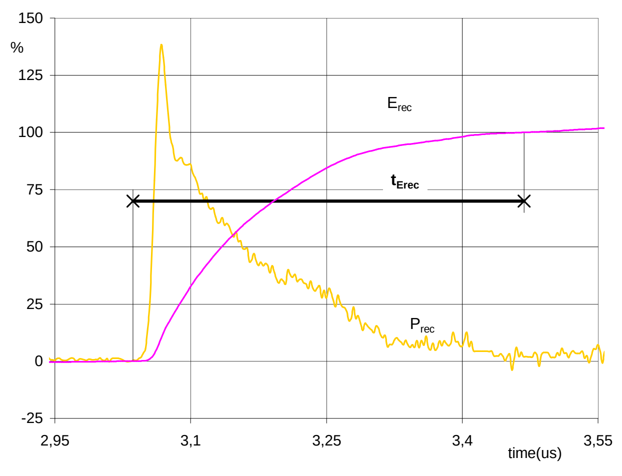
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	24	A
Q_{rr} (100%) =	4,94	μC
$t_{Q\,rr}$ =	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
$t_{E\,rec}$ =	0,43	μs

Ordering Code and Marking - Outline - Pinout

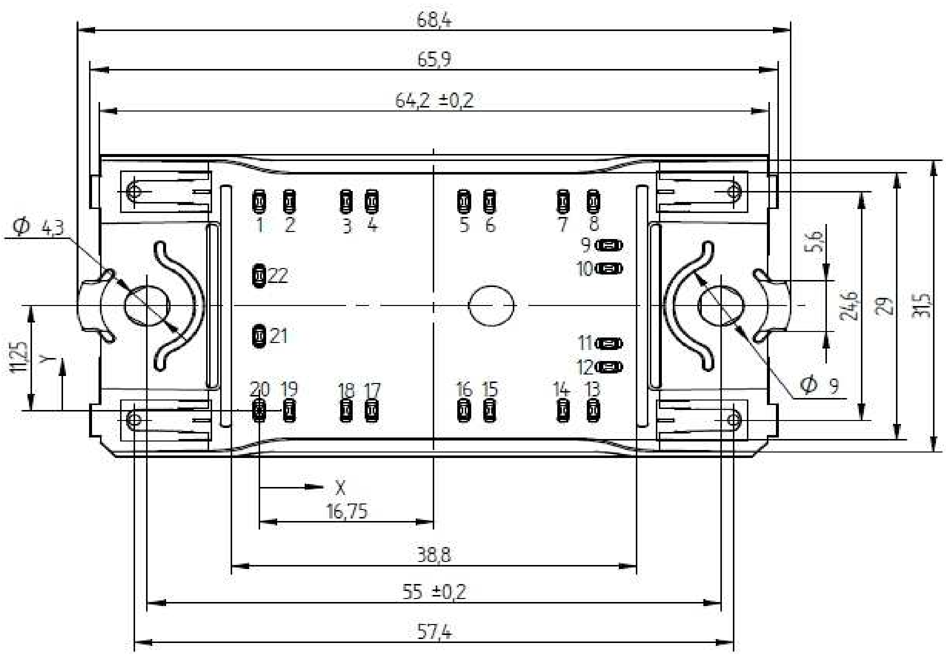
Ordering Code & Marking

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
without thermal paste 12mm housing	V23990-P629-L58-PM	P629-L58-PM	P629-L58-PM
without thermal paste 12mm housing with Press-fit pins	V23990-P629-L58Y-PM	P629-L58Y-PM	P629-L58Y-PM

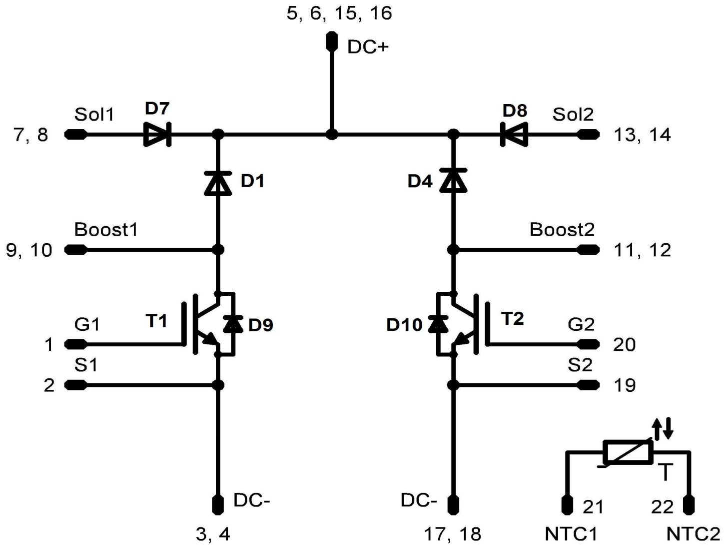
Outline

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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