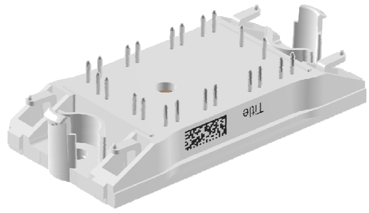
flow BOOST 0 — 650V/50A

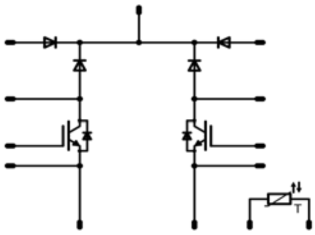
Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 650V IGBT and 650V Stealth Si boost diode
- Antiparallel IGBT protection diode with high current

flow 0 12mm housing



Target Applications
- solar inverter

Schematic



Types
- V23990-P623-L82-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}			1600	V
Forward average current	I_{FAV}	$T_j=T_j max$	T_h=80°C T_c=80°C	32 43	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	220	A
I2t-value	I^2t			200	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	42 64	W
Maximum Junction Temperature	$T_j max$			150	°C
Boost IGBT (T1 , T2)					
Collector-emitter break down voltage	V_{CES}			650	V
DC collector current	I_C	$T_j=T_j max$	T_h=80°C T_c=80°C	43 57	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j max$		150	A
Turn off safe operating area		$T_j \leq$ 175°C, $V_{CE} \leq$ 650		150	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	84 128	W
Gate-emitter peak voltage	V_{GE}			±20	V
Maximum Junction Temperature	$T_j max$			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost FWD (D1, D4)					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
Forward average current	I_{FAV}	$T_j=T_j$max	T_h=80°C T_c=80°C	51 64	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	225	A
I2t-value	I^2t	t_p=10ms	T_j=25°C	250	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		100	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	88 134	W
Maximum Junction Temperature	$T_j$max			175	°C
Boost Inverse Diode (D9 , D10)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_c=25°C		650	V
Forward average current	I_{FAV}	$T_j=T_j$max	T_h=80°C T_c=80°C	21 27	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	50	A
I2t-value	I^2t	t_p=10ms	T_j=25°C	12,5	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		20	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	42 63	W
Maximum Junction Temperature	$T_j$max			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		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	0,8	1,21 1,19	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				25	Tj=25°C Tj=125°C		0,92 0,80		V
Slope resistance (for power loss calc. only)	r_t				25	Tj=25°C Tj=125°C		0,012 0,015		Ω
Reverse current	I_r			1500		Tj=25°C Tj=125°C			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,67		K/W
Boost IGBT (T1 , T2)										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0005	Tj=25°C Tj=125°C	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25°C Tj=125°C	1	1,82 2,00	2,5	V
Collector-emitter cut-off	I_{CES}		0	650		Tj=25°C Tj=125°C			0,04	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=8 Ω Rgon=8 Ω	15	400	30	Tj=25°C Tj=125°C		23 22		ns
Rise time	t_r					Tj=25°C Tj=125°C		5 7		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		142 168		
Fall time	t_f					Tj=25°C Tj=125°C		3 7		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,370 0,598		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,147 0,285		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		3000		pF
Output capacitance	C_{oss}							50		
Reverse transfer capacitance	C_{rss}							11		
Gate charge	Q_{Gate}		15	520	50	Tj=25°C		120		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,13		K/W
Boost FWD (D1, D4)										
Forward voltage	V_F				50	Tj=25°C Tj=125°C	1	2,27 1,90	2,8	V
Reverse leakage current	I_{rm}			650		Tj=25°C Tj=125°C			15	μA
Peak recovery current	I_{RRM}	Rgon=8 Ω	15	400	30	Tj=25°C Tj=125°C		40 56		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		19 56		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		0,477 1,458		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,053 0,281		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		8359 3588		A/μs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,08		K/W

Characteristic Values

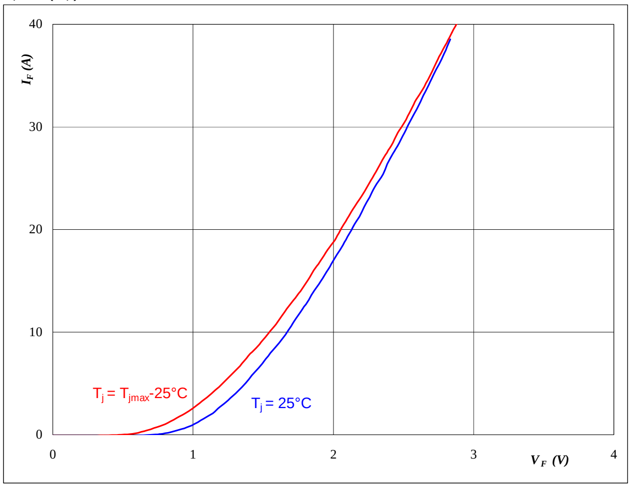
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost Inverse Diode (D9 , D10)										
Diode forward voltage	V_F				20	Tj=25°C Tj=125°C	1,00	1,67 1,54	2,00	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						2,28		K/W
Thermistor										
Rated resistance	R					T=25°C		21511		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=100°C	-4,5		+4,5	%
Power dissipation	P					T=25°C		210		mW
Power dissipation constant						T=25°C		3,5		mW/K
B-value	B(25/50)					T=25°C		3884		K
B-value	B(25/100)					T=25°C		3964		K
Vincotech NTC Reference									F	

Boost Inverse Diode (D9 , D10)

Figure 25 Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



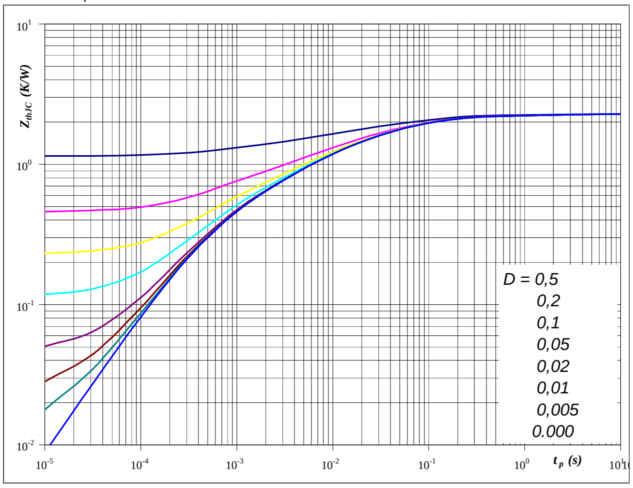
At

t_p =	250	µs

Figure 26 Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



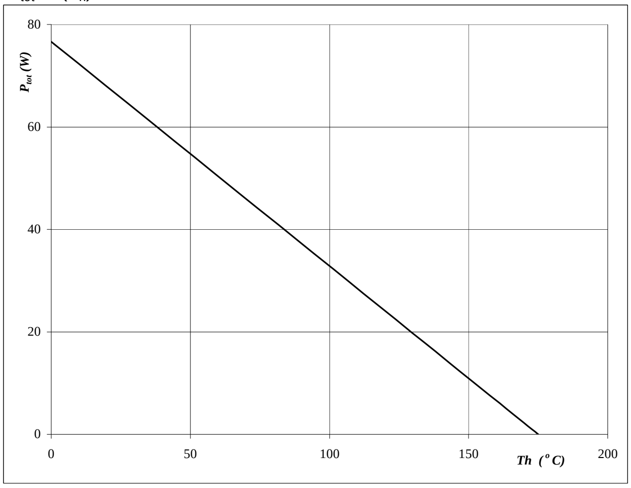
At

D =	tp / T	
R_{thJH} =	2,28	K/W

Figure 27 Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



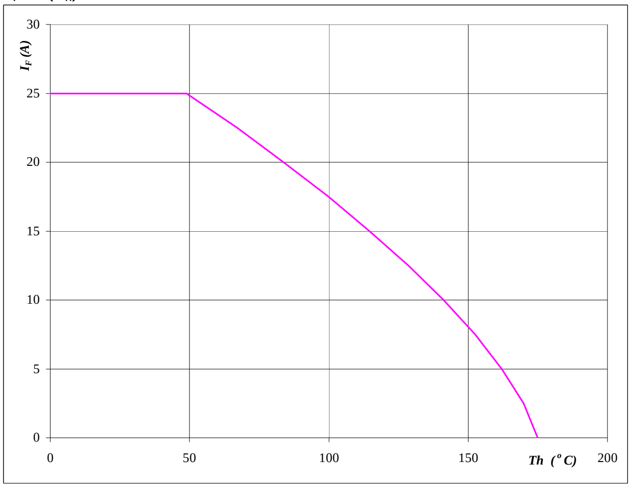
At

T_j =	175	ºC

Figure 28 Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

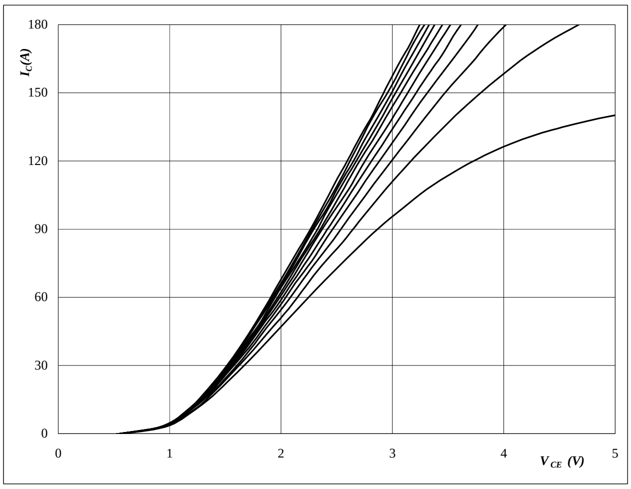
T_j =	175	ºC

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 1 BOOST IGBT

Typical output characteristics

$I_D = f(V_{DS})$



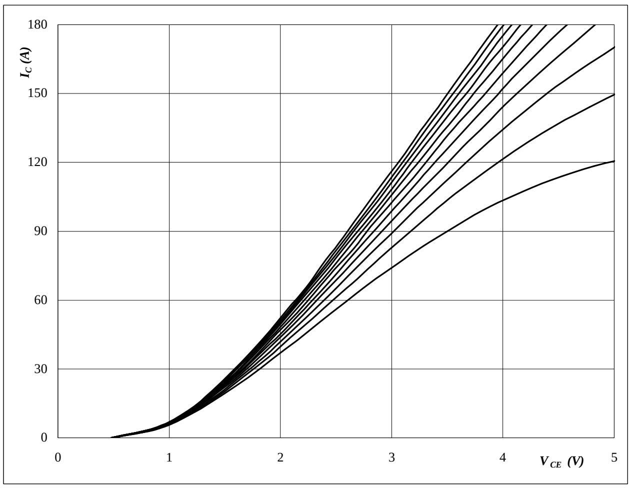
At

t_p =	250	µs
T_j =	25	°C
V_{GS} from	8 V to 18 V in steps of 1 V	

Figure 2 BOOST IGBT

Typical output characteristics

$I_D = f(V_{DS})$



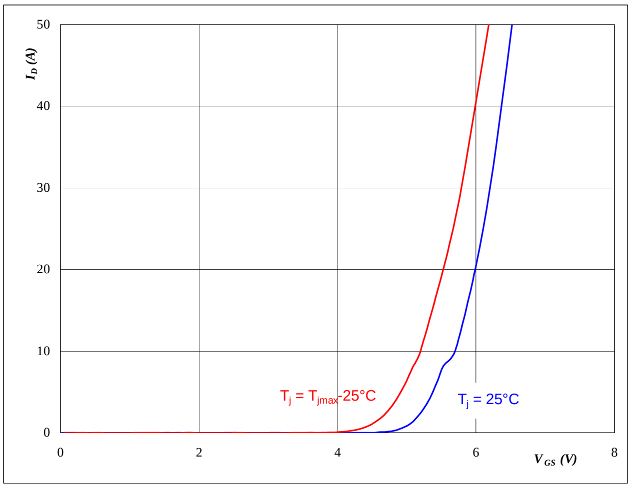
At

t_p =	250	µs
T_j =	125	°C
V_{GS} from	8 V to 18 V in steps of 1 V	

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_D = f(V_{GS})$



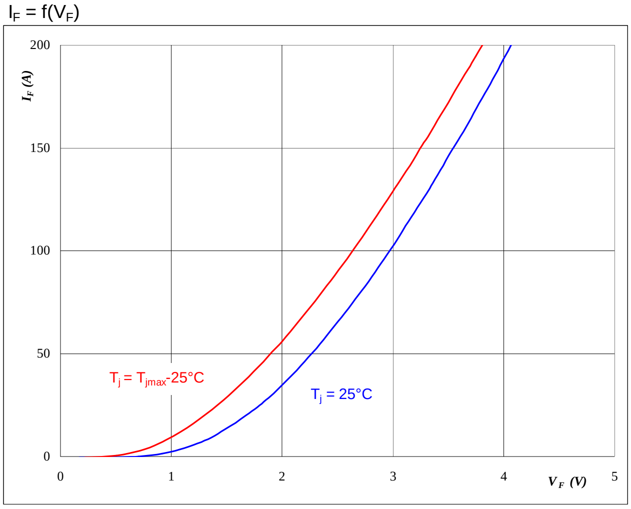
At

t_p =	100	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

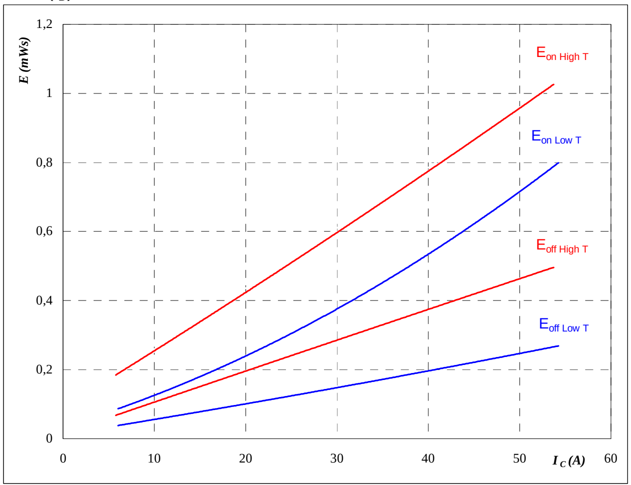
t_p =	250	µs

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 5 BOOST IGBT

Typical switching energy losses
as a function of collector current

E = f(I_D)



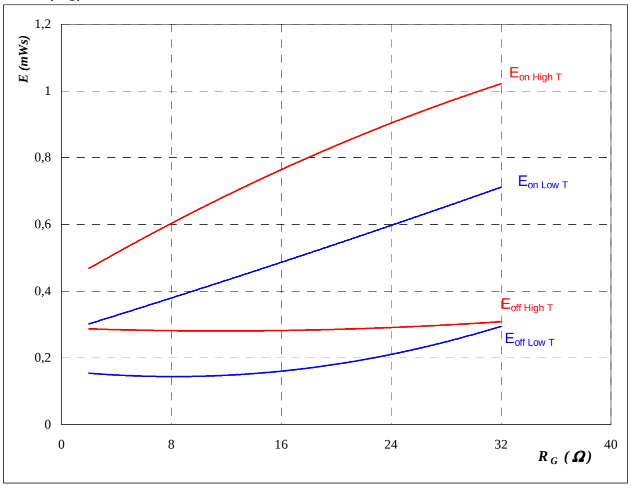
With an inductive load at

T_j =	25/126	°C
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 BOOST IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



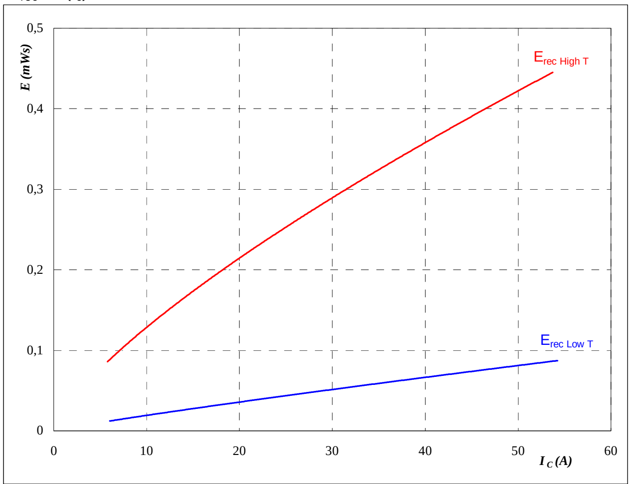
With an inductive load at

T_j =	25/126	°C
V_{DS} =	400	V
V_{GS} =	15	V
I_D =	30	A

Figure 7 BOOST FWD

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

E_{rec} = f(I_c)



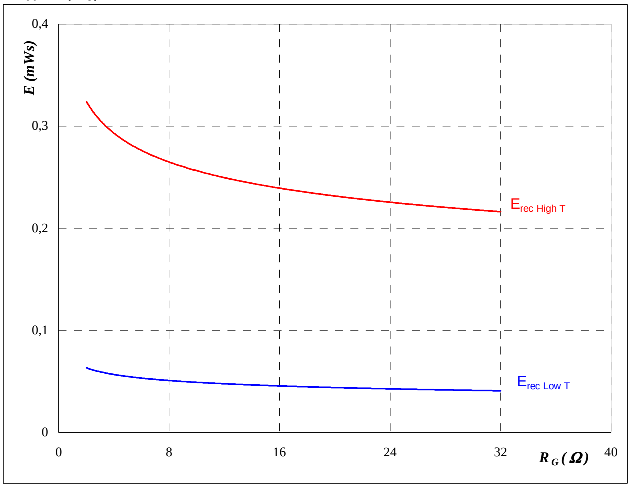
With an inductive load at

T_j =	25/126	°C
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 8 BOOST FWD

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

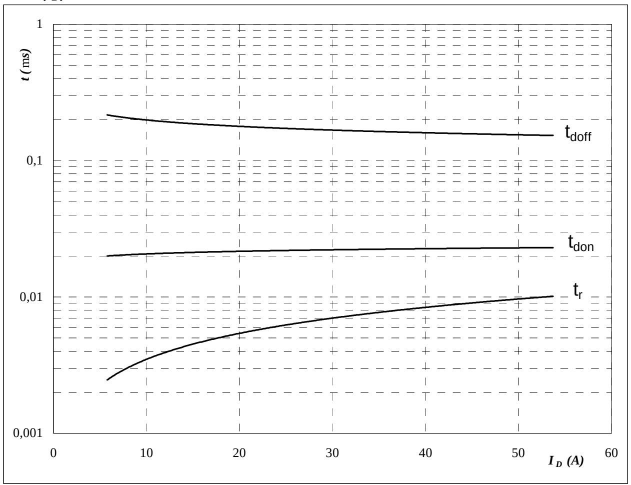
T_j =	25/126	°C
V_{DS} =	400	V
V_{GS} =	15	V
I_D =	30	A

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

t = f(I_D)



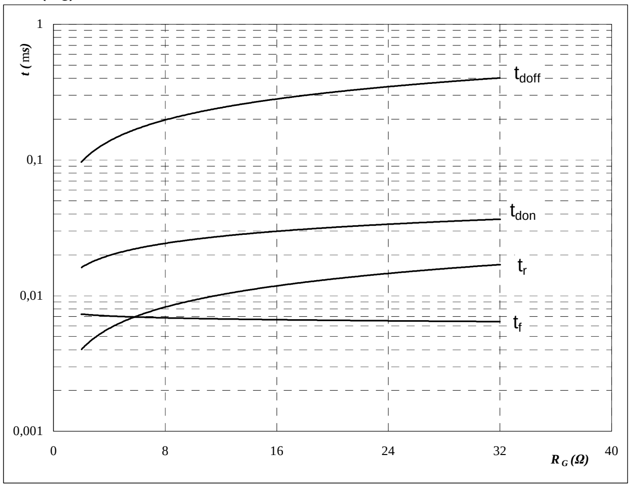
With an inductive load at

T_j =	126	°C
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



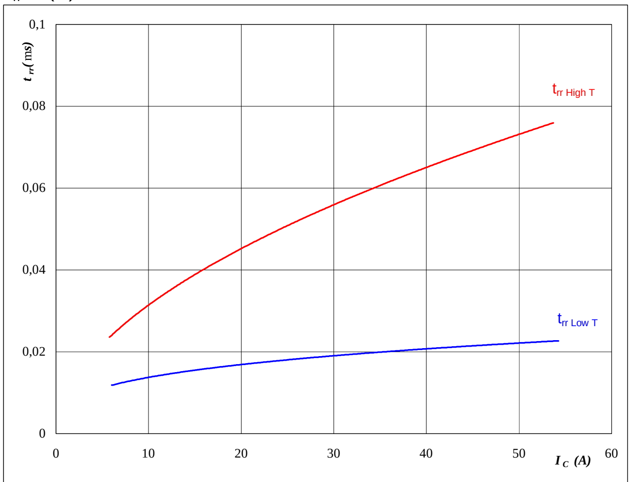
With an inductive load at

T_j =	126	°C
V_{DS} =	400	V
V_{GS} =	15	V
I_C =	30	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



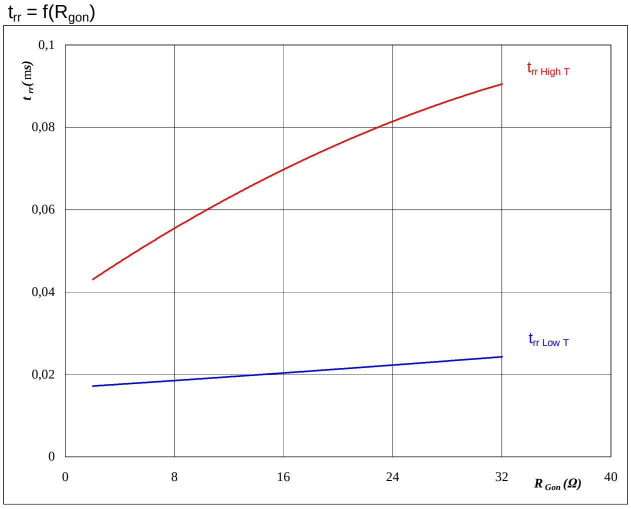
At

T_j =	25/126	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 12 BOOST FWD

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

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



At

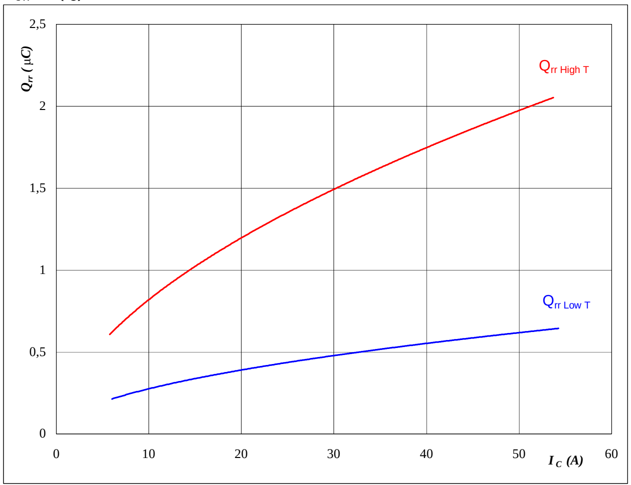
T_j =	25/126	°C
V_R =	400	V
I_F =	30	A
V_{GS} =	15	V

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



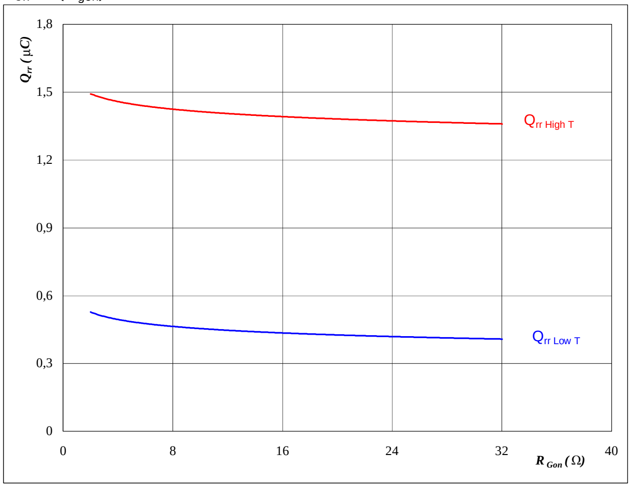
At

T_j =	25/126	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 14 BOOST FWD

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

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



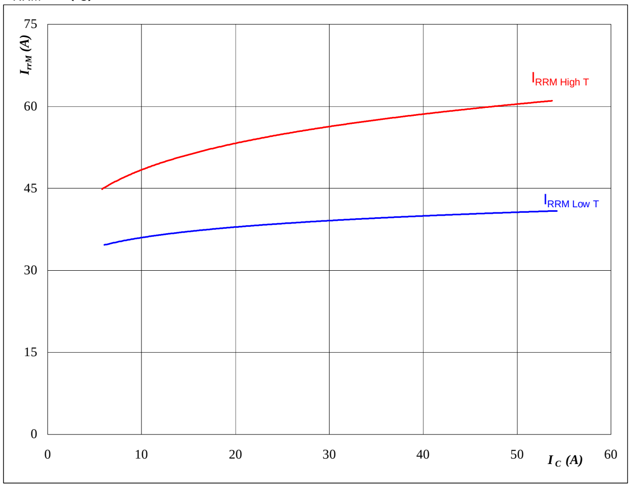
At

Tj =	25/126	°C
V_R =	400	V
I_F =	30	A
V_{GS} =	15	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



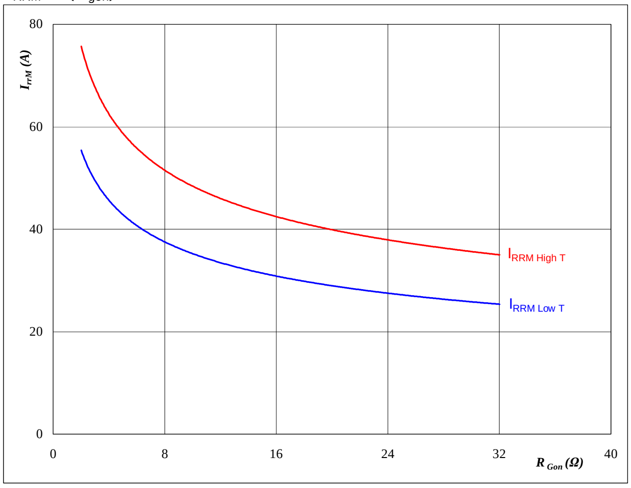
At

T_j =	25/126	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 16 BOOST FWD

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

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



At

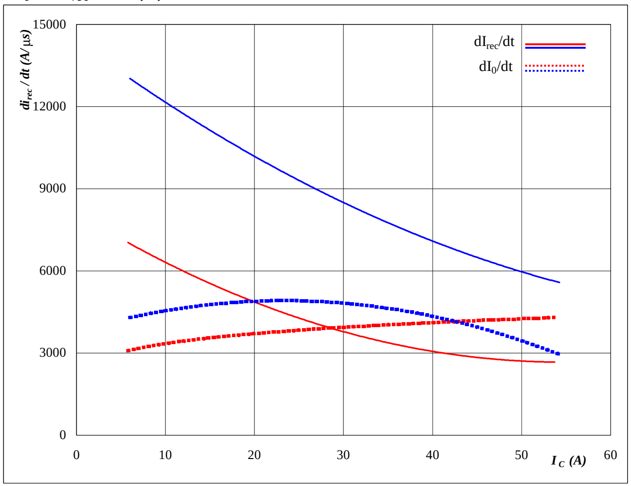
T_j =	25/126	°C
V_R =	400	V
I_F =	30	A
V_{GS} =	15	V

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 17 BOOST FWD

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

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



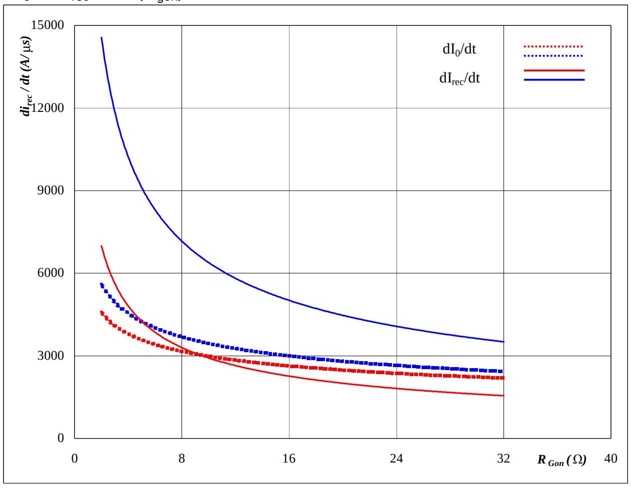
At

T_j =	25/126	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	8	Ω

Figure 18 BOOST FWD

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

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



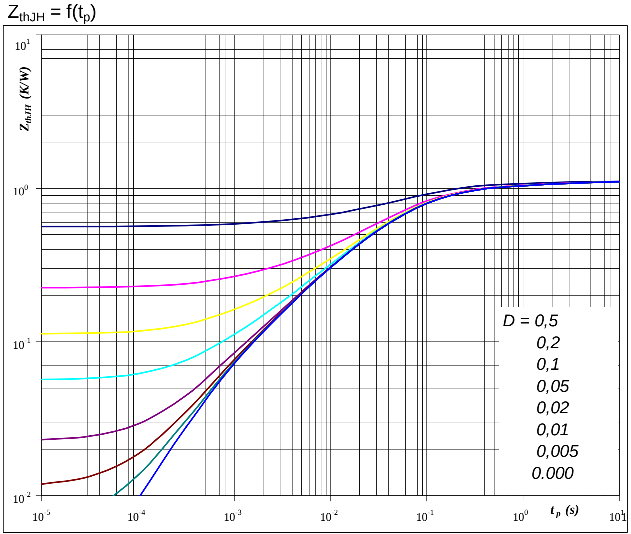
At

Tj =	25/126	°C
V_R =	400	V
I_F =	30	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} =	1,13	K/W

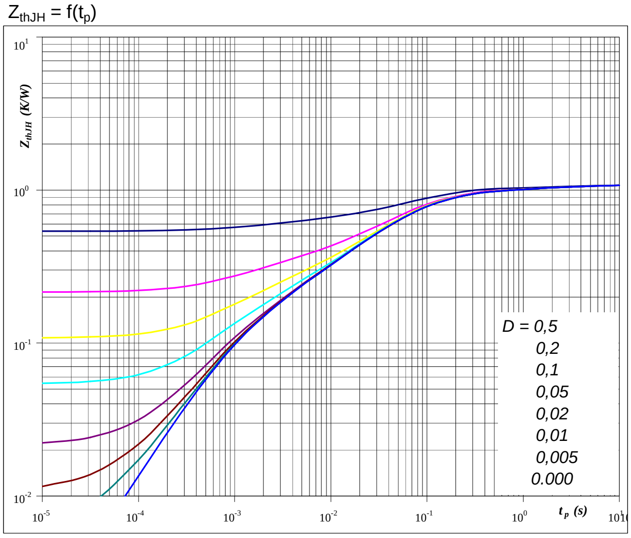
IGBT thermal model values

R (C/W)	Tau (s)
7,12E-02	8,15E+00
1,29E-01	6,00E-01
4,31E-01	9,13E-02
3,15E-01	2,59E-02
1,31E-01	5,80E-03
5,02E-02	8,53E-04

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} =	1,08	K/W

FWD thermal model values

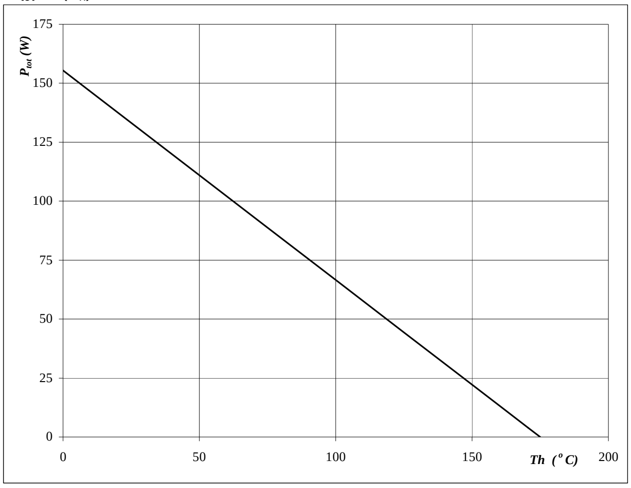
R (C/W)	Tau (s)
5,58E-02	4,07E+00
1,01E-01	6,75E-01
4,35E-01	9,24E-02
2,93E-01	2,59E-02
1,10E-01	4,04E-03
8,25E-02	8,42E-04

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



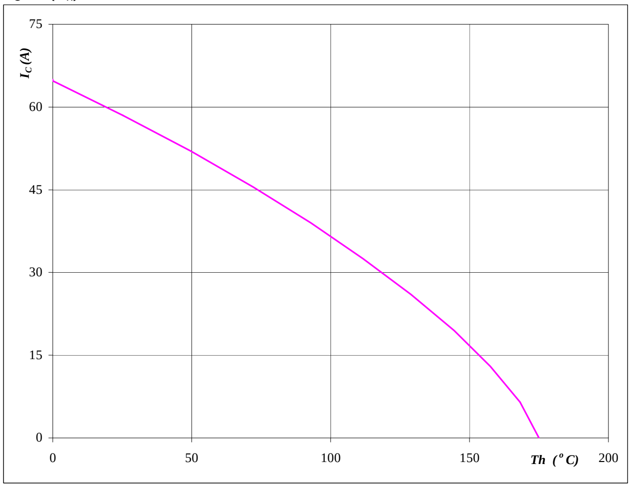
At

$T_j =$ 175 ºC

Figure 22 BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

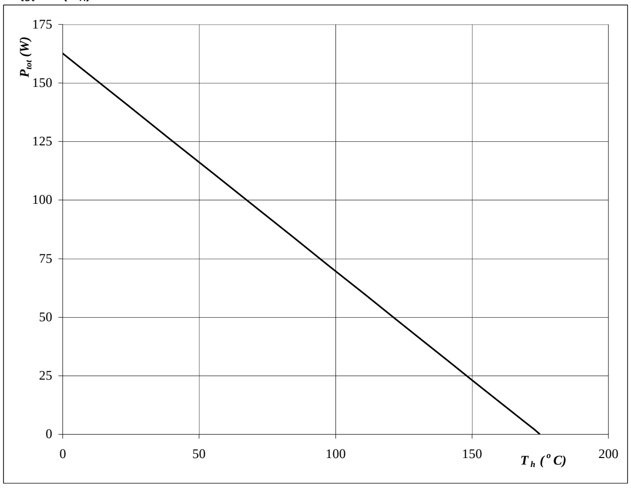
$T_j =$ 175 ºC

$V_{GS} =$ 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



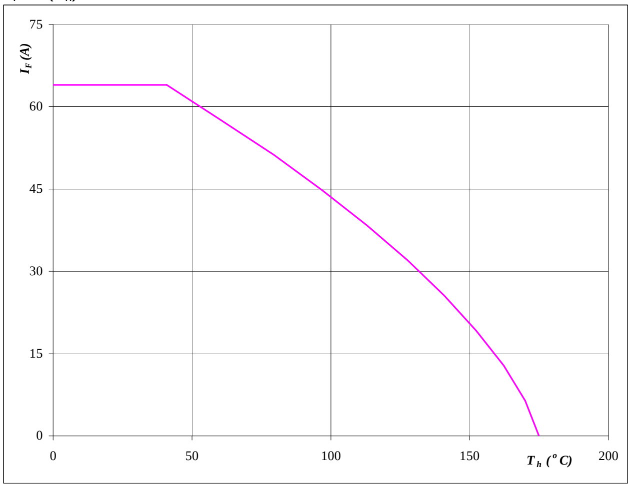
At

$T_j =$ 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

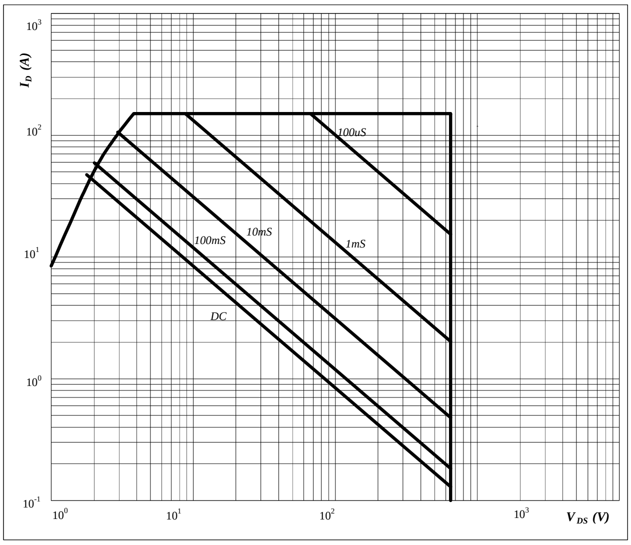
$T_j =$ 175 ºC

INPUT BOOST (T1 , T2 / D1 , D4)

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



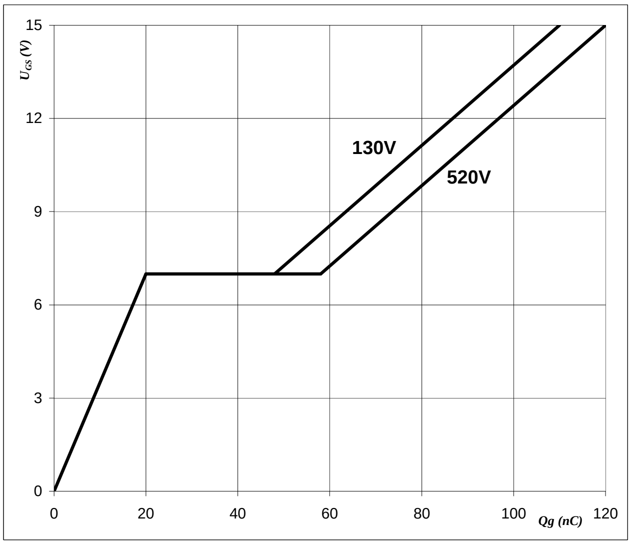
At

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

$V_{GS} = f(Qg)$



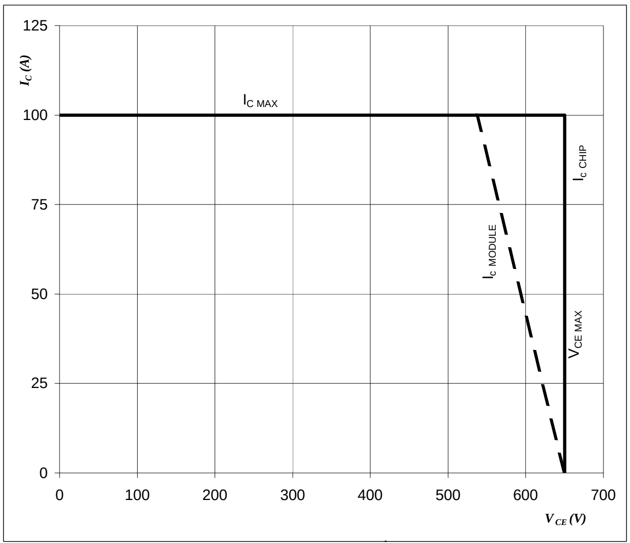
At

I_C =	50	A

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	T_{jmax}-25	ºC	R_{gon} =	8	Ω
$U_{ccminus}$=U_{ccplus}			R_{goff} =	8	Ω

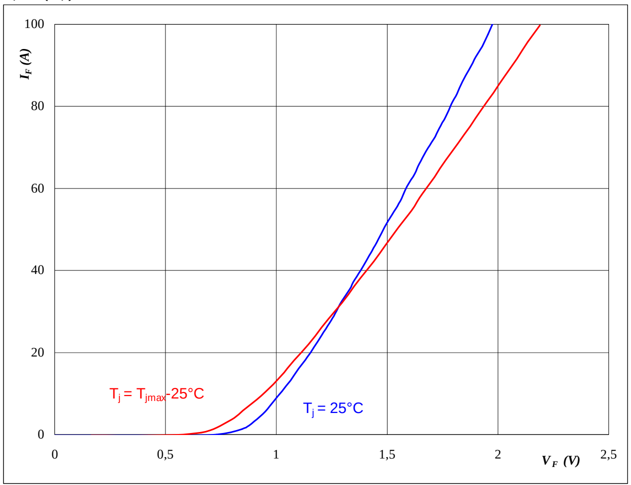
Switching mode : 3 level switching

Bypass Diode (D7 , D8)

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



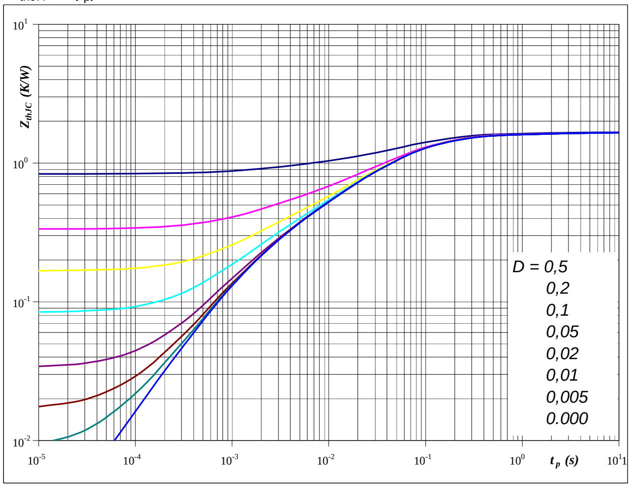
At

t_p =	250	µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



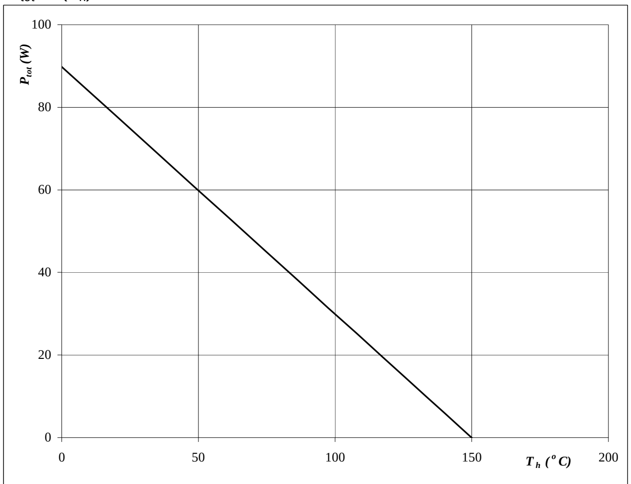
At

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

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



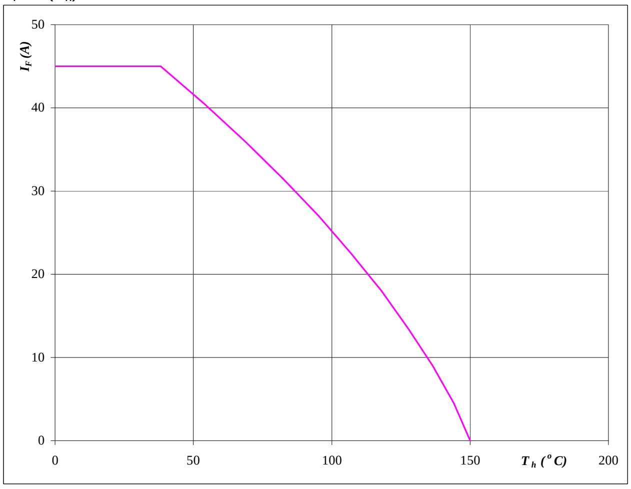
At

T_j =	150	ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



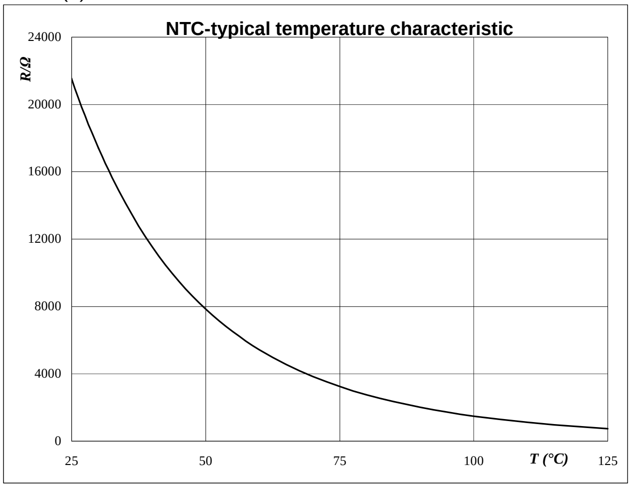
At

T_j =	150	ºC

Thermistor

Figure 1	Thermistor

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



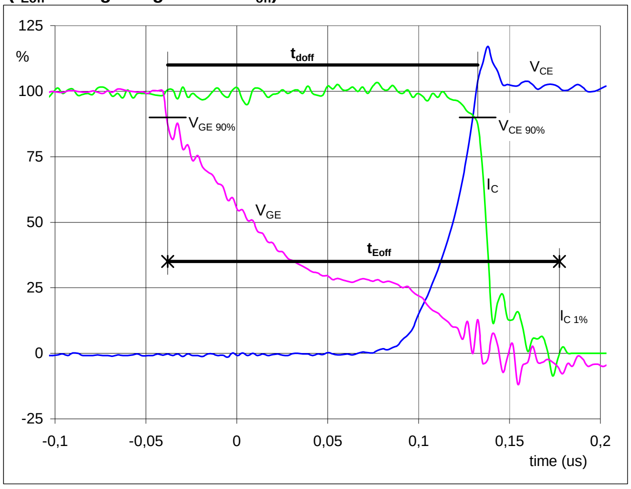
Switching Definitions INPUT BOOST

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Input Boost IGBT

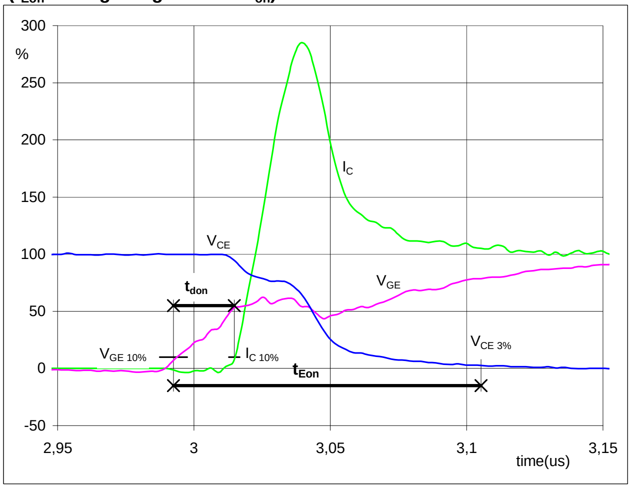
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{doff} =	0,168	μs
t_{Eoff} =	0,215	μs

Figure 2 Input Boost IGBT

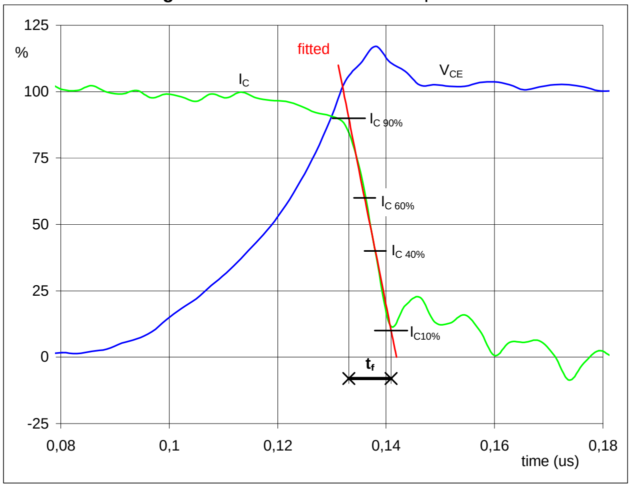
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{don} =	0,022	μs
t_{Eon} =	0,113	μs

Figure 3 Input Boost IGBT

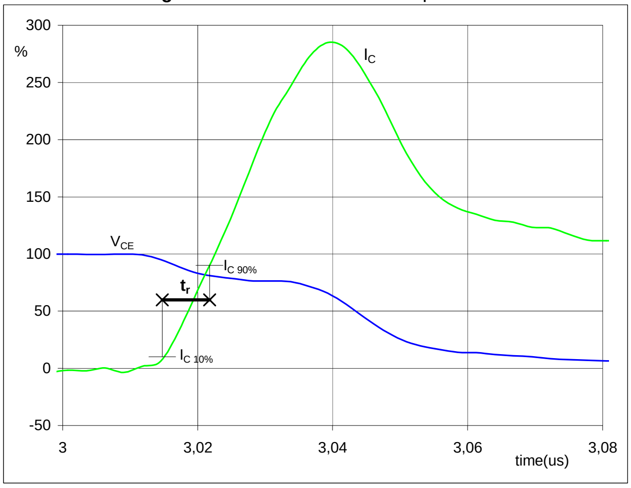
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	30	A
t_f =	0,007	μs

Figure 4 Input Boost IGBT

Turn-on Switching Waveforms & definition of t_r

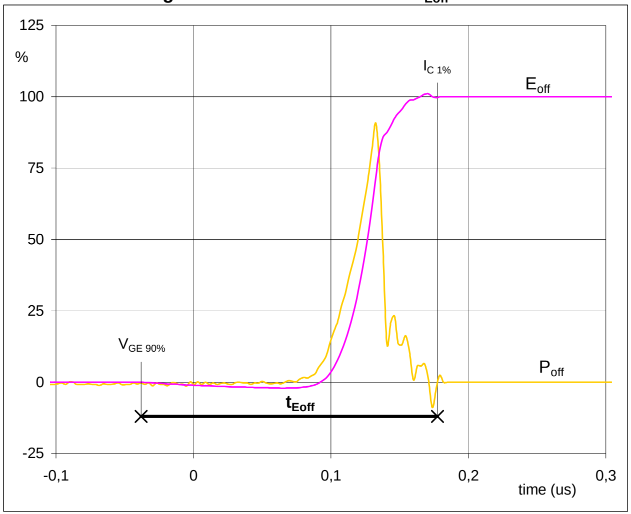


V_C (100%) =	400	V
I_C (100%) =	30	A
t_r =	0,007	μs

Switching Definitions INPUT BOOST

Figure 5 Input Boost IGBT

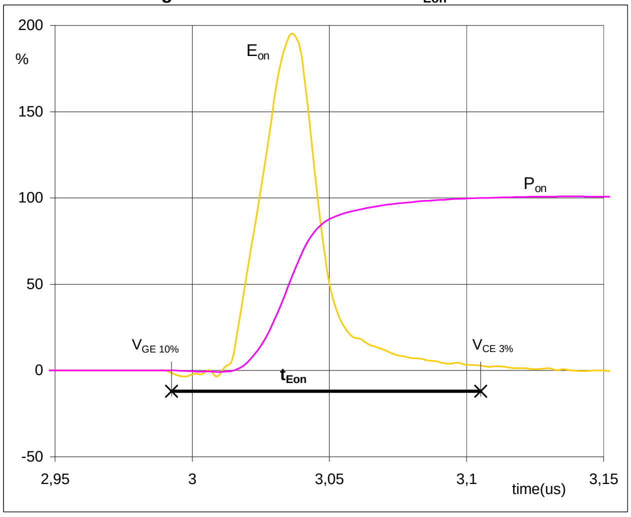
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	12,00	kW
E_{off} (100%) =	0,29	mJ
t_{Eoff} =	0,22	µs

Figure 6 Input Boost IGBT

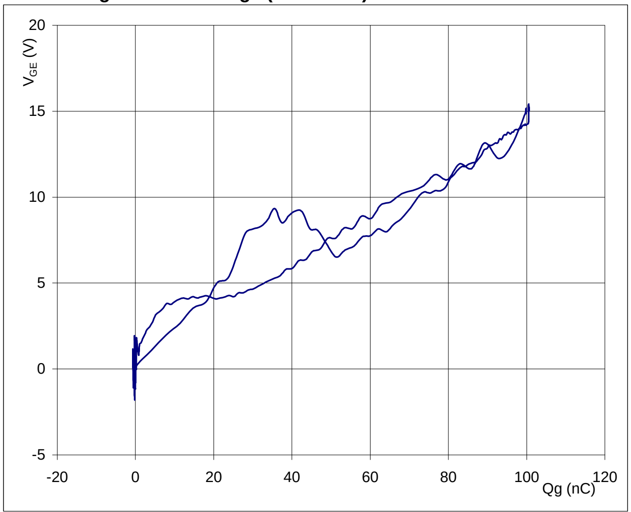
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	12,00	kW
E_{on} (100%) =	0,60	mJ
t_{Eon} =	0,11	µs

Figure 7 Input Boost IGBT

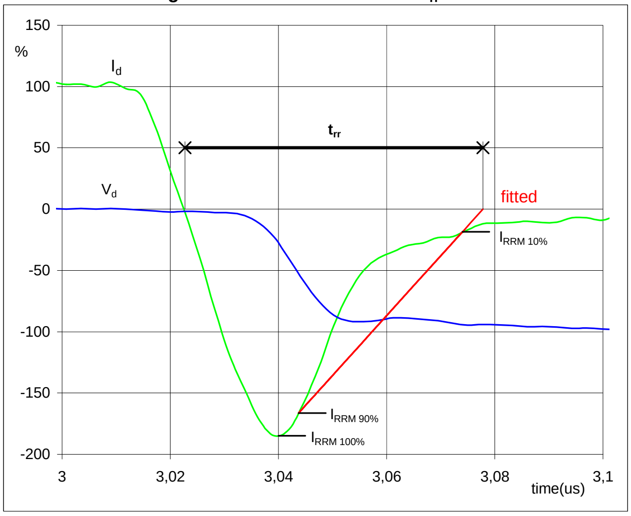
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
Q_g =	101	nC

Figure 8 Input Boost FWD

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

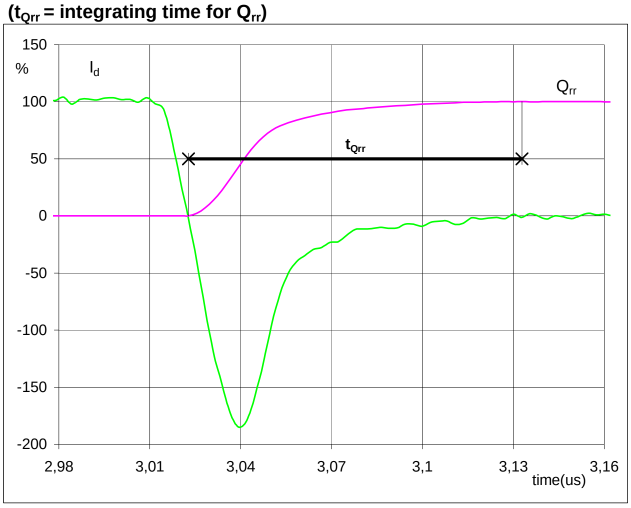


V_d (100%) =	400	V
I_d (100%) =	30	A
I_{RRM} (100%) =	-56	A
t_{rr} =	0,056	µs

Switching Definitions INPUT BOOST

Figure 9	Input Boost FWD

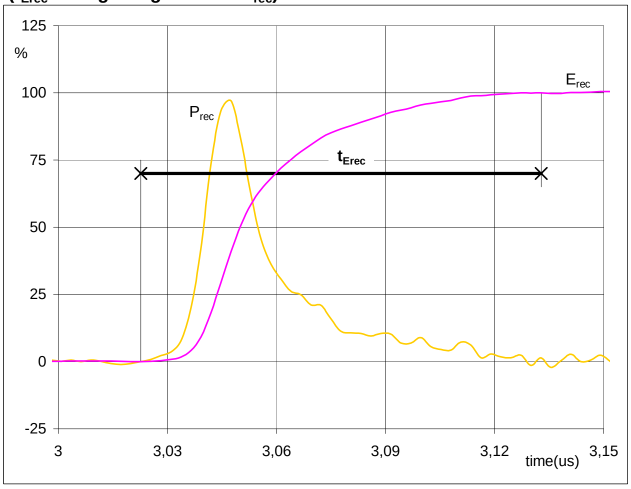
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	30	A
Q_{rr} (100%) =	1,46	μC
t_{Qrr} =	0,11	μs

Figure 10	Input Boost FWD

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



P_{rec} (100%) =	12,00	kW
E_{rec} (100%) =	0,28	mJ
t_{Erec} =	0,11	μs

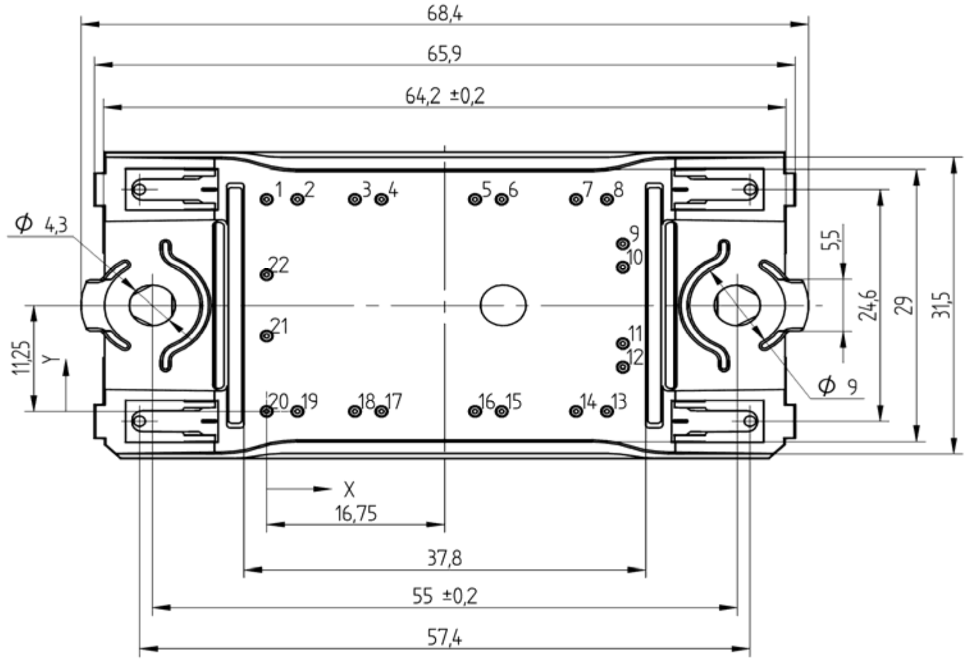
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

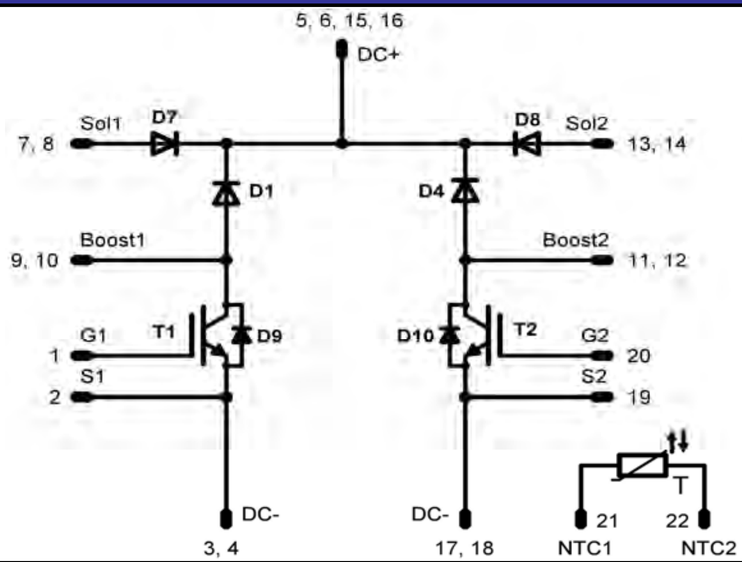
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P623-L82-PM	P623L82	P623L82
with thermal paste 12mm housing	V23990-P623-L82-/3/-PM	P623L82	P623L82

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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