Vincotech

flow BOOST 0 — 1200 V / 40 A

Features

- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V SiC diode
- Antiparallel IGBT protection diode with high current

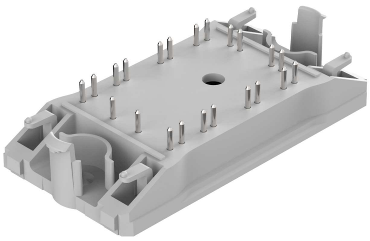
Target Applications

- solar inverter

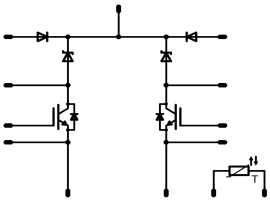
Types

- V23990-P629-F63-PM

***flow* 0 12mm housing**



Schematic



Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass diode & Boost IGBT protection diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	DC current	T_s = 80 °C T_c = 80 °C	34 45	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms		220	A
I^2t-value	I^2t			200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	42 63	W
Maximum Junction Temperature	T_{jmax}			150	°C
Boost IGBT					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	36 47	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		160	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	107 162	W
Gate-emitter peak voltage	V_{GE}			±25	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 600	μs V
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	27 33	A
Surge forward current	I_{FSM}	t_p limited by T_{jmax}		96	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	80 121	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…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				9,55	mm

Characteristic Values

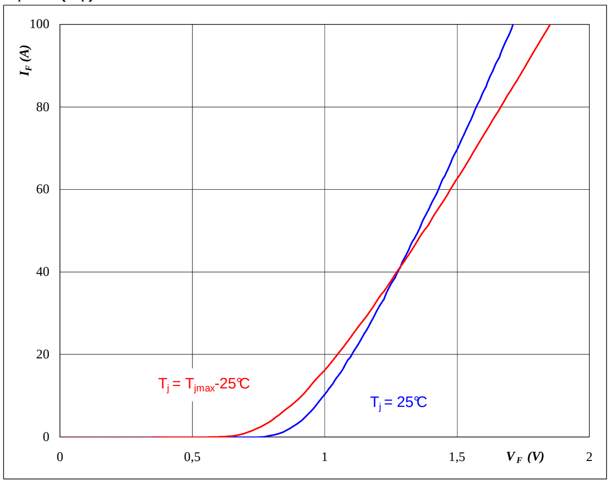
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max	
Bypass diode & Boost IGBT protection diode										
Forward voltage	V_F				25	25 125		1,15 1,11	1,21	V
Threshold voltage (for power loss calc. only)	V_{to}				25	25 125		0,92 0,82		V
Slope resistance (for power loss calc. only)	r_t				25	25 125		0,009 0,011		Ω
Reverse current	I_r			1600		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 um λ = 1 W/mK						1,67		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							1,10		
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00025	25	3,5	5,5	7,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125		2,89 3,09	3,2	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			1	mA
Gate-emitter leakage current	I_{GES}		±25	0		25 125			±250	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 4$ Ω $R_{gon} = 4$ Ω	15	600	40	25 125		27 26		ns
Rise time	t_r					25 125		10 10		
Turn-off delay time	$t_{d(off)}$					25 125		166 193		
Fall time	t_f					25 125		11 34		
Turn-on energy loss	E_{on}					25 125		0,41 0,51		mWs
Turn-off energy loss	E_{off}					25 125		0,76 1,45		
Input capacitance	C_{ies}	f = 1 MHz	0	30		25		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G		±15	600	40	25		220		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 um λ = 1 W/mK						0,65		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,43		
Boost FWD										
Forward voltage	V_F				22,5	25 125		1,67 2,28	1,8	V
Reverse leakage current	I_{rm}			1200		25 125			600	µA
Peak recovery current	I_{RRM}	$R_{gon} = 4$ Ω	15	600	40	25 125		24 23		A
Reverse recovery time	t_{rr}					25 125		10 10		ns
Reverse recovery charge	Q_{rr}					25 125		0,23 0,12		µC
Reverse recovered energy	E_{rec}					25 125		0,075 0,015		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		8579 6425		A/µs
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 um λ = 1 W/mK						1,19		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,78		
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1486$ Ω				100	-5		+5	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	B(25/50)	Tol. ±3 %				25		3950		K
B-value	B(25/100)	Tol. ±3 %				25		3996		K
Vincotech NTC Reference									B	

Boost Protection Diode Charateristics

Figure 1 Boost Protection Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



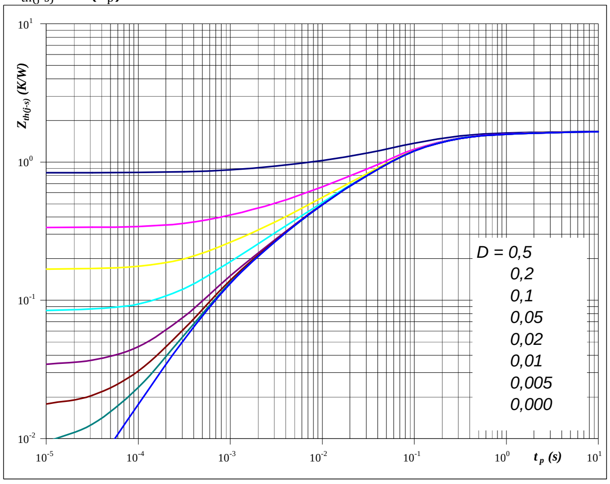
At

t_p = 250 µs

Figure 2 Boost Protection Diode

Diode transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

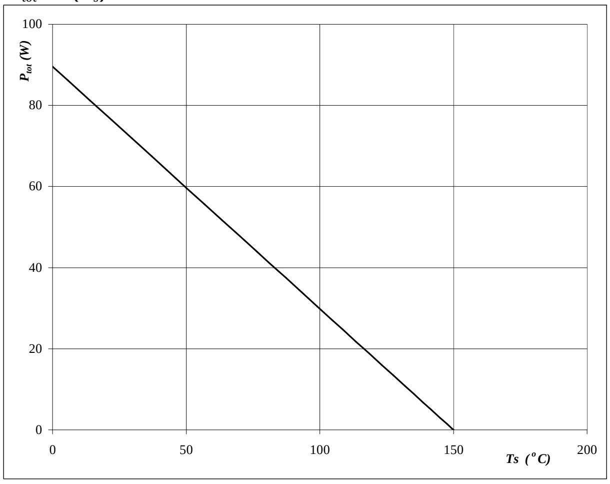
$D = t_p / T$

$R_{th(j-s)}$ = 1,67 K/W

Figure 3 Boost Protection Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



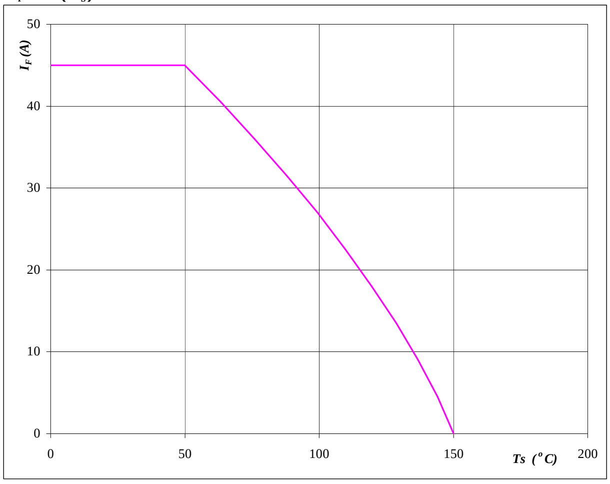
At

T_j = 150 ºC

Figure 4 Boost Protection Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

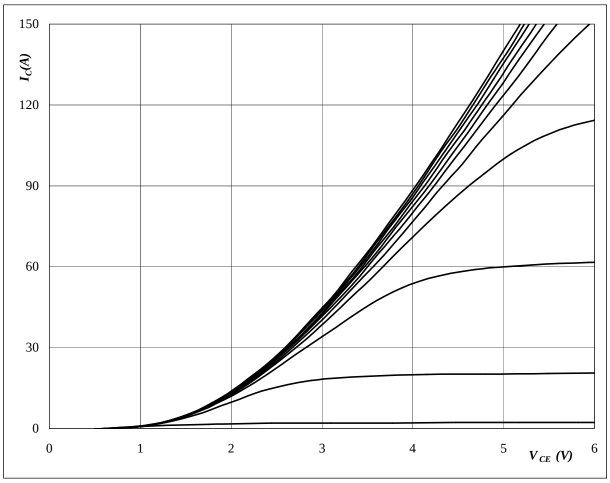
T_j = 150 ºC

BOOST Charateristics

Figure 1	BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



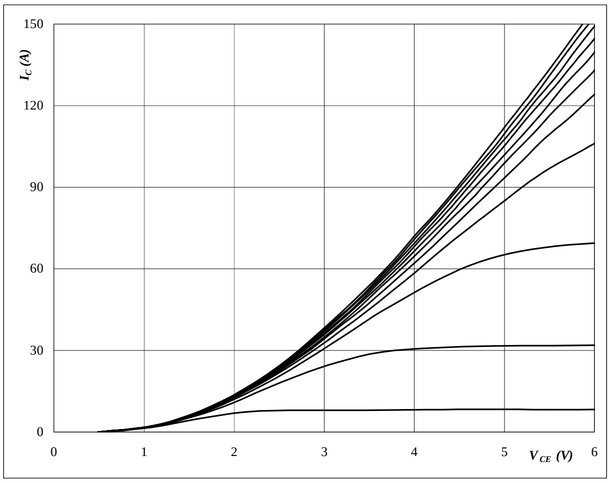
At

t_p =	250	μs
T_j =	25	°C
V_{CE} from	7 V to 17 V in steps of 1 V	

Figure 2	BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



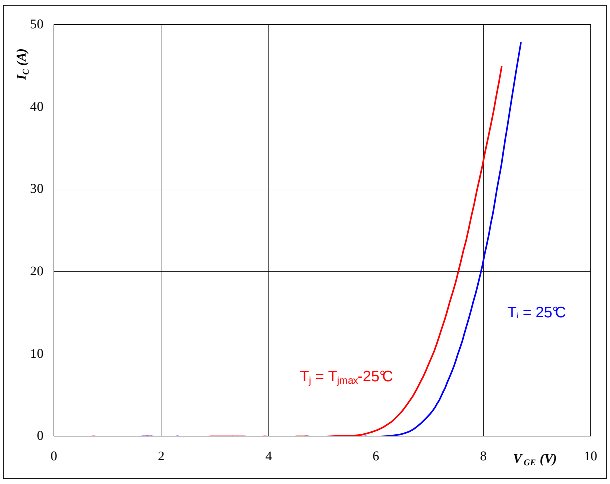
At

t_p =	250	μs
T_j =	125	°C
V_{CE} from	7 V to 17 V in steps of 1 V	

Figure 3	BOOST IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



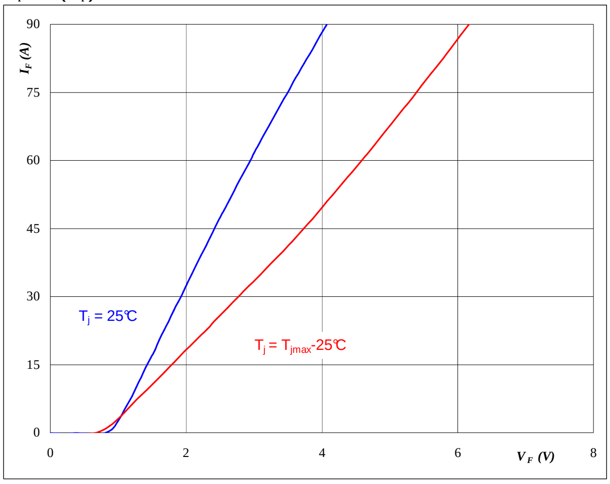
At

t_p =	250	μs
V_{CE} =	10	V

Figure 4	BOOST FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

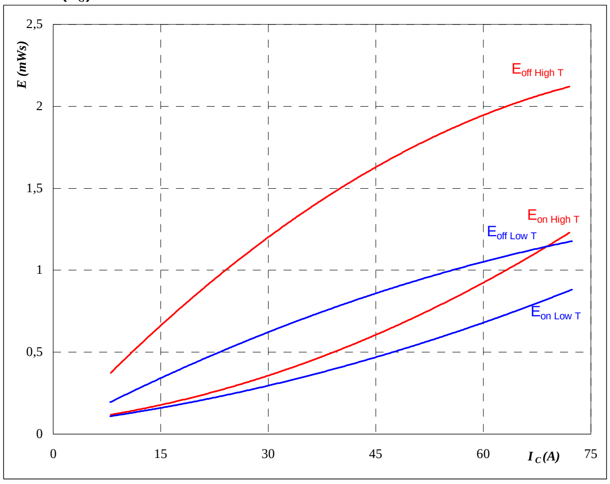
t_p =	250	μs

BOOST Charateristics

Figure 5	BOOST IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



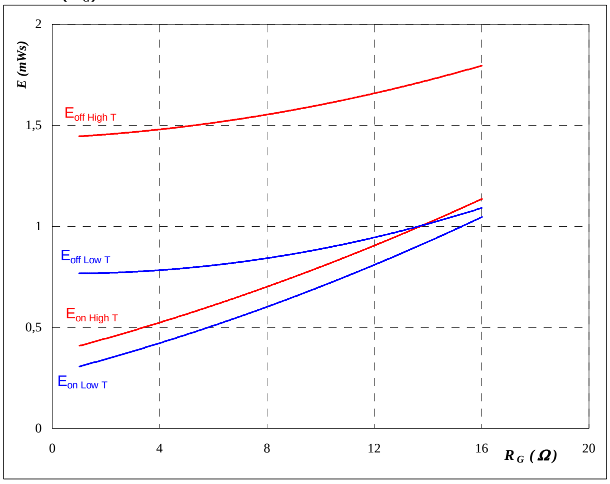
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6	BOOST IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



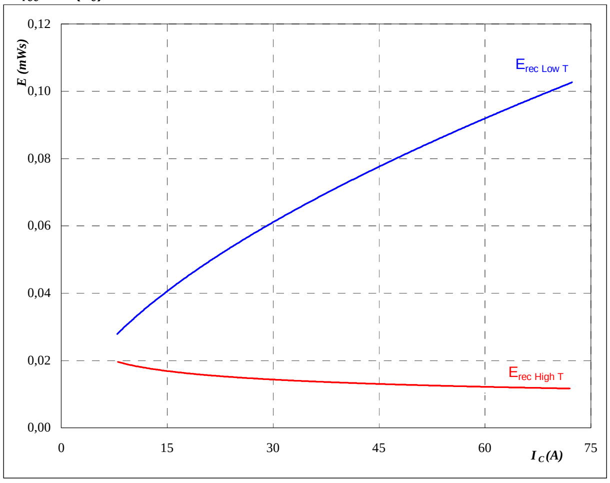
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

Figure 7	BOOST FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



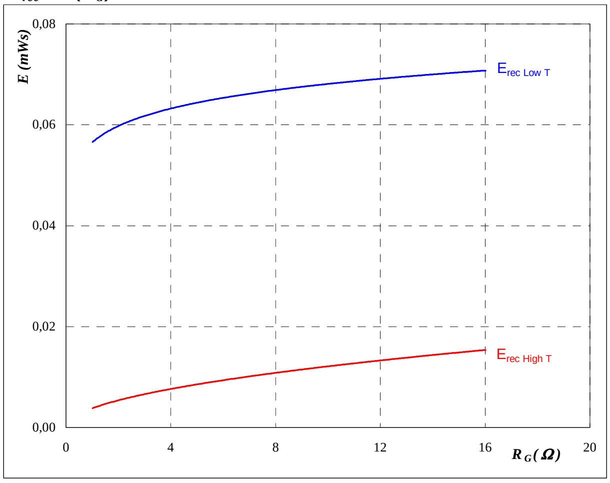
With an inductive load at

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	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

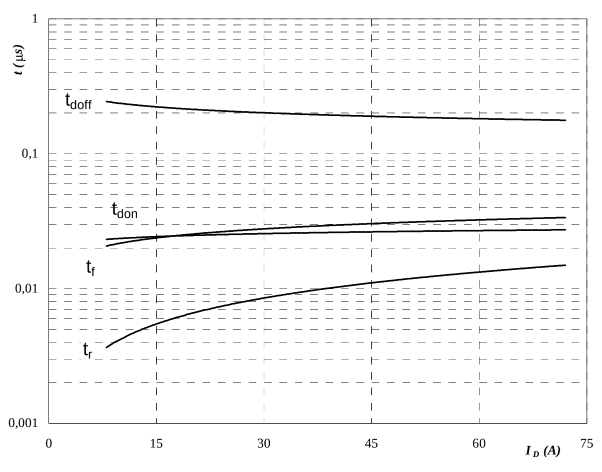
T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

BOOST Charateristics

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_D)$



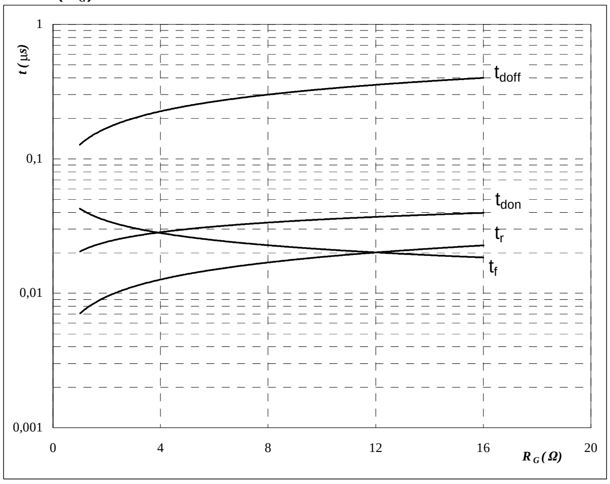
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



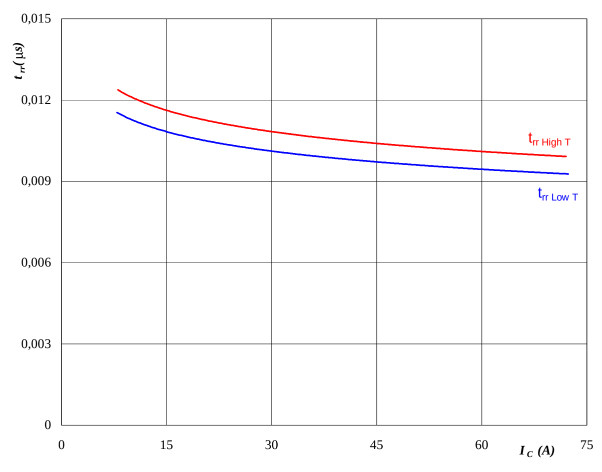
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	40	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



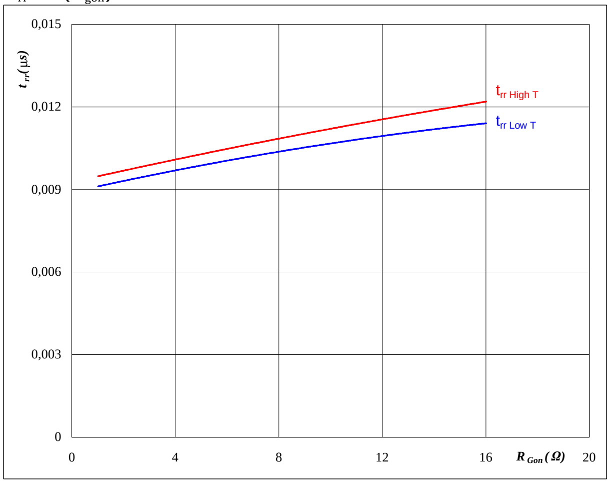
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 12 BOOST FWD

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

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



At

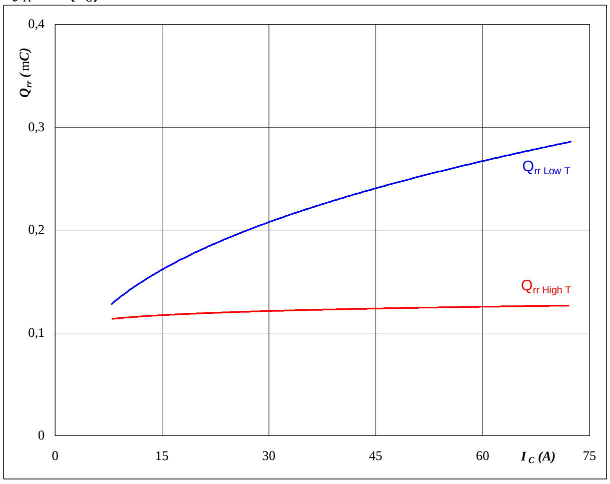
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

BOOST Charateristics

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



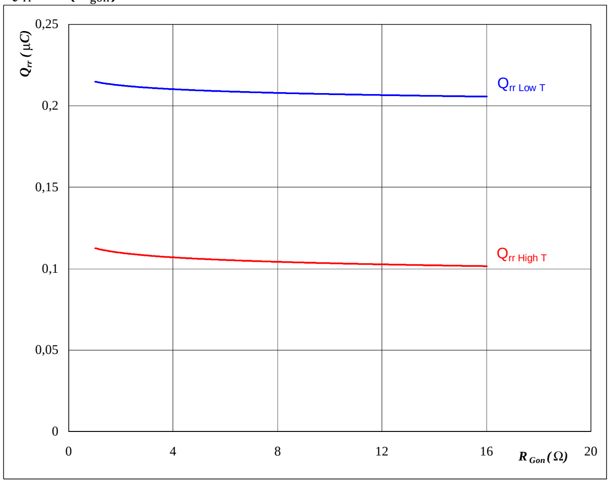
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 14 BOOST FWD

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

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



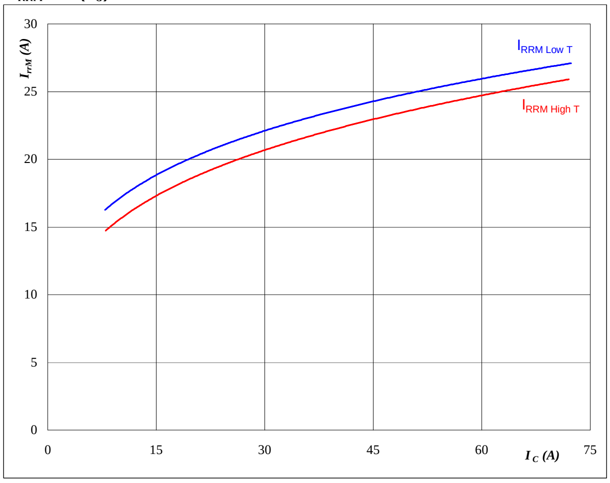
At

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

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



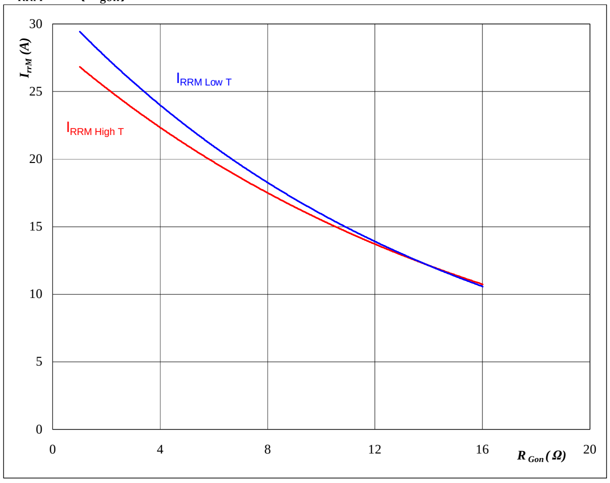
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 16 BOOST FWD

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

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



At

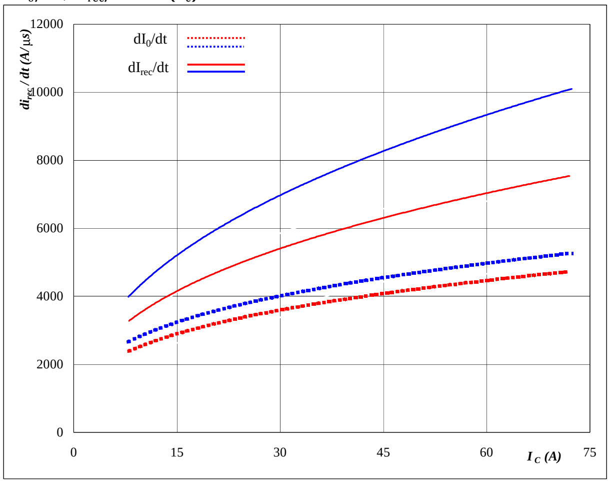
T_j =	25/125	°C
V_R =	600	V
I_F =	40	A
V_{GE} =	15	V

BOOST Charateristics

Figure 17 BOOST FWD

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

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



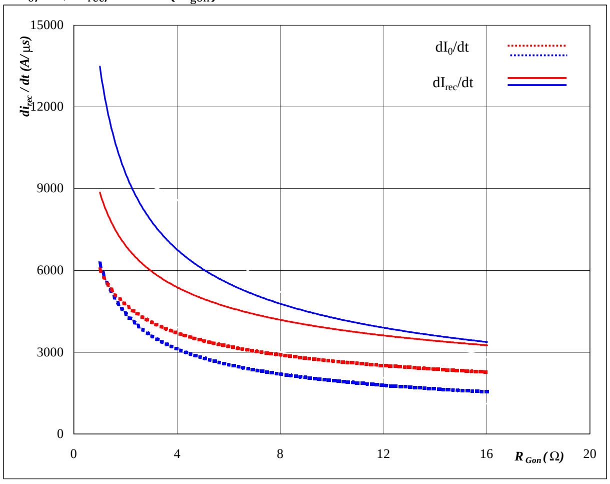
At

T_j =	25/125	°C
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 18 BOOST FWD

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

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



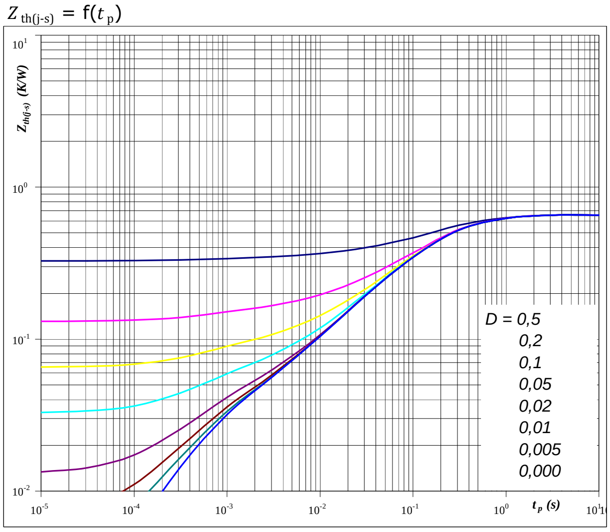
At

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

Figure 19 BOOST IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,65	K/W

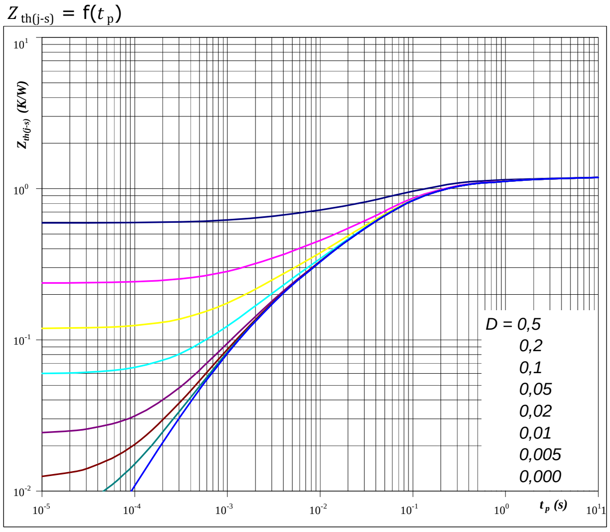
IGBT thermal model values

R (K/W)	Tau (s)
1,85E-01	5,43E-01
3,49E-01	1,22E-01
7,94E-02	1,84E-02
1,82E-02	2,92E-03
2,26E-02	5,23E-04

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	1,19	K/W

FWD thermal model values

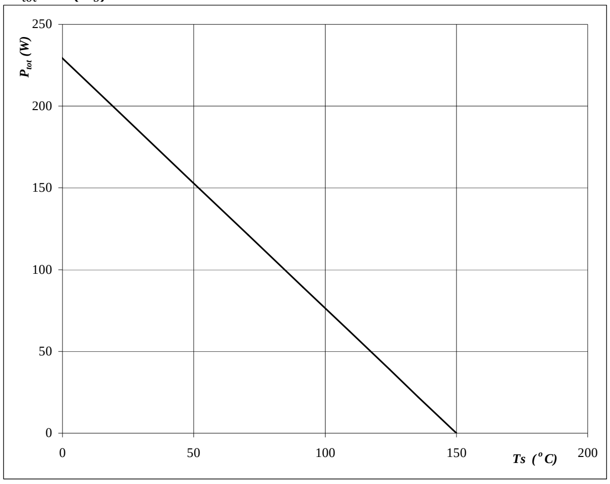
R (K/W)	Tau (s)
4,57E-02	4,5E+00
9,58E-02	8,86E-01
3,40E-01	1,49E-01
4,21E-01	4,66E-02
1,58E-01	1,05E-02
1,06E-01	2,34E-03

BOOST Charateristics

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



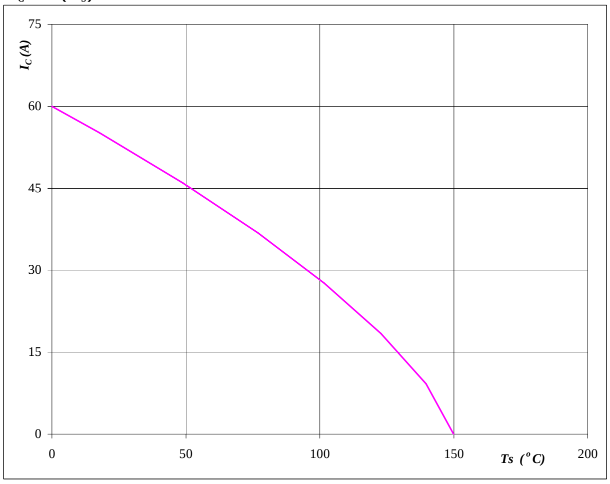
At

T_j = 150 ºC

Figure 22 BOOST IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

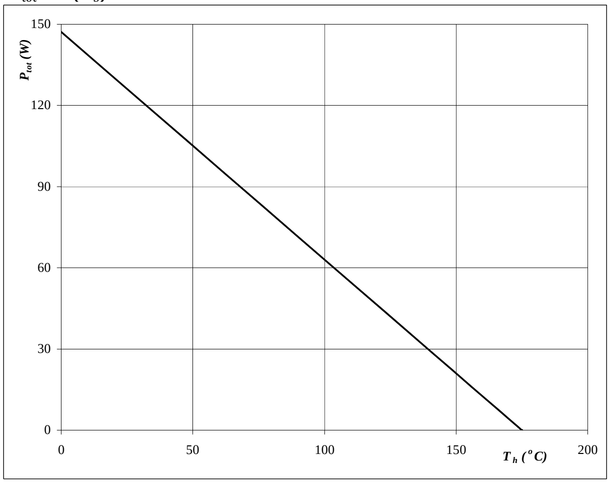
T_j = 150 ºC

V_{GS} = 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



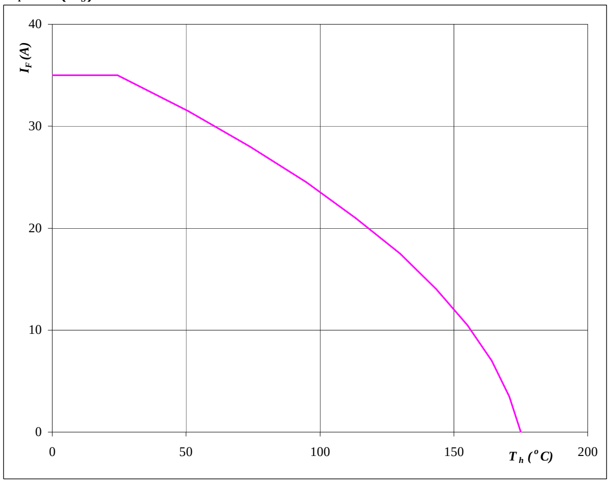
At

T_j = 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

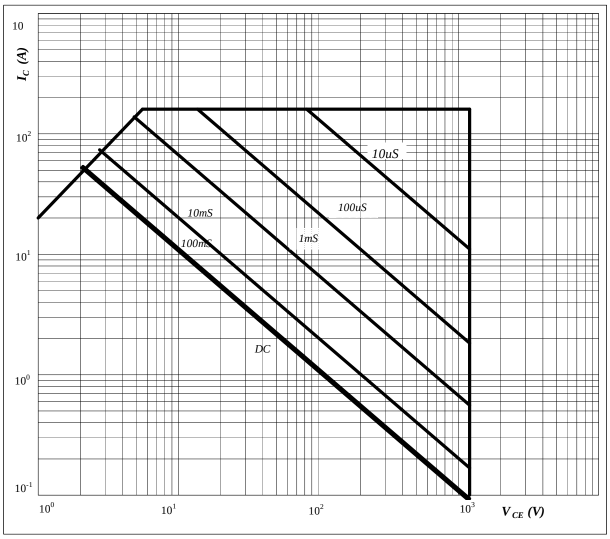
T_j = 175 ºC

BOOST Charateristics

Figure 25	BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_C = f(V_{CE})$



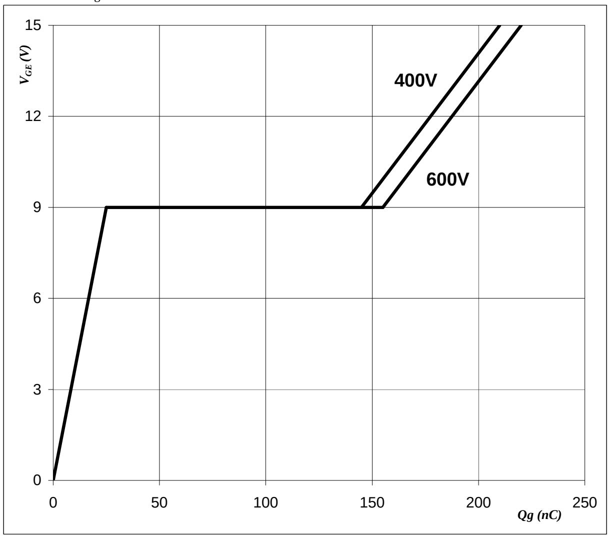
At

D =	single pulse	
T_S =	80	ºC
V_{CE}=	15	V
T_j =	T_{jmax}	ºC

Figure 26	BOOST IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

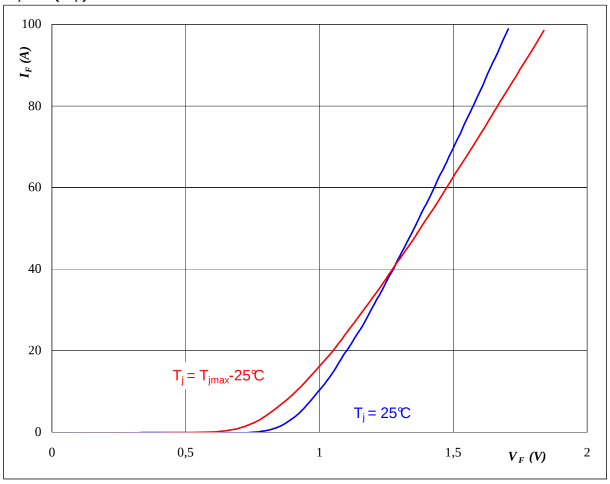
I_C =	40	A

Bypass Diode Charateristics

Figure 1 Bypass Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



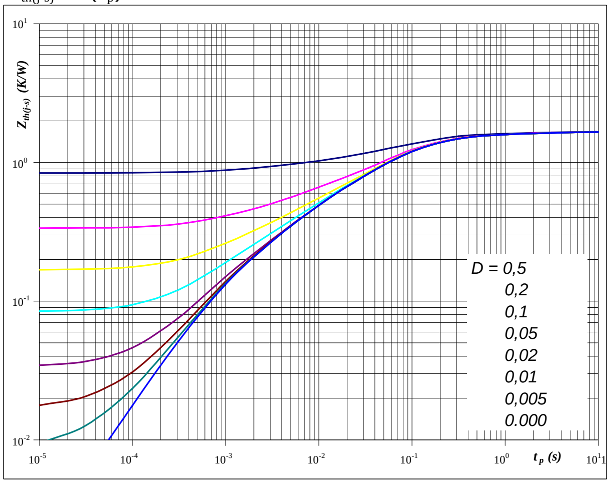
At

t_p = 250 µs

Figure 2 Bypass Diode

Diode transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

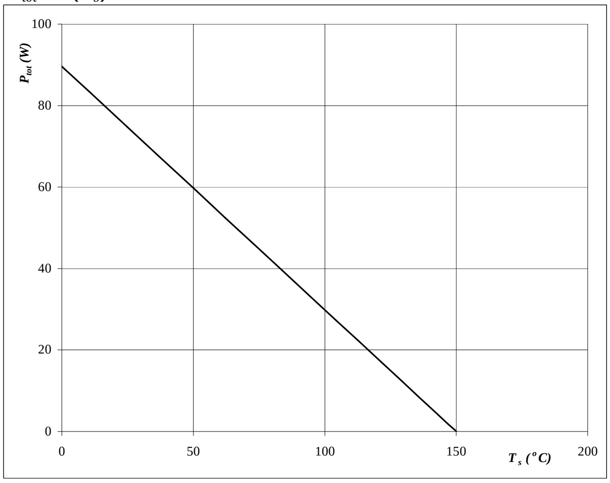
D = t_p / T

$R_{th(j-s)}$ = 1,67 K/W

Figure 3 Bypass Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



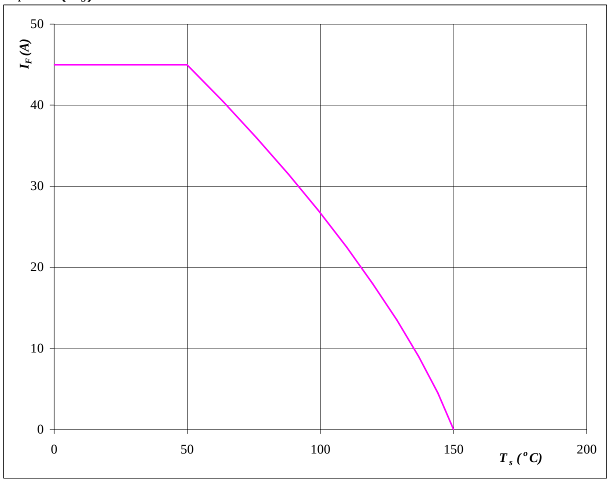
At

T_j = 150 ºC

Figure 4 Bypass Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



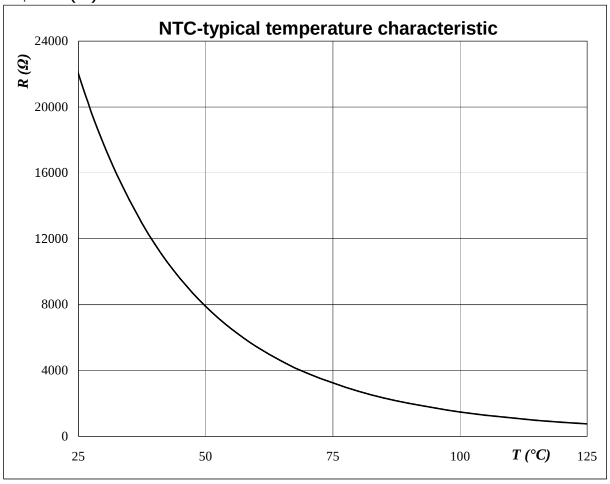
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

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



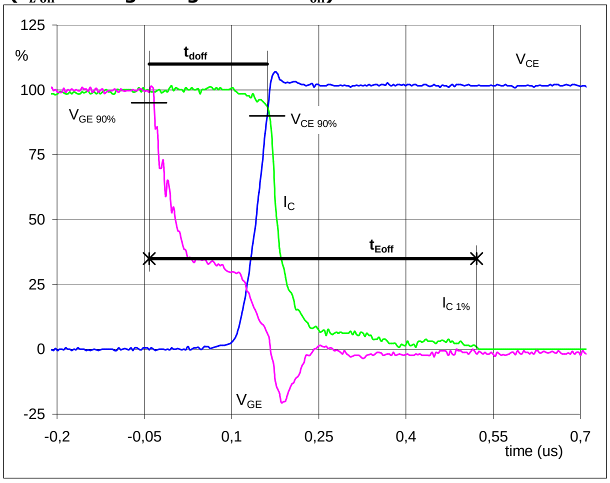
Boost Switching Definitions

General conditions

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

Figure 1 Inverter IGBT

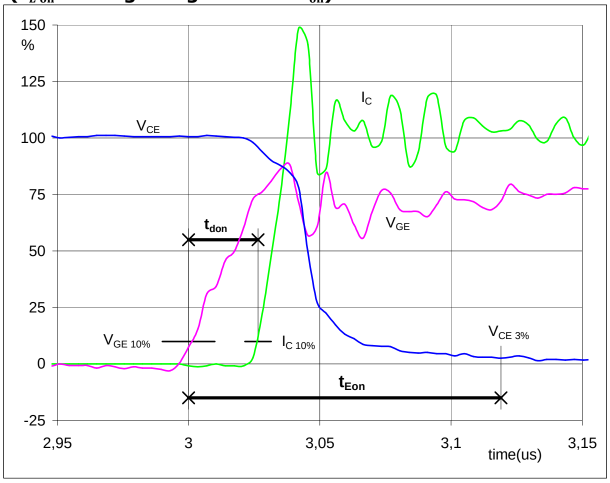
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{doff} =	0,19	μs
$t_{E\,off}$ =	0,56	μs

Figure 2 Inverter IGBT

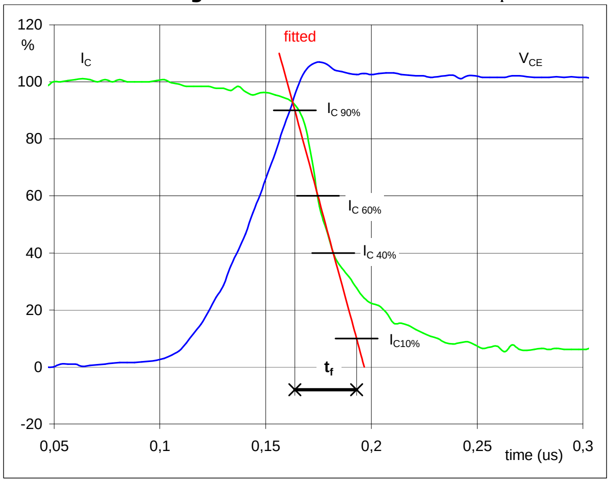
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{don} =	0,03	μs
$t_{E\,on}$ =	0,12	μs

Figure 3 Inverter IGBT

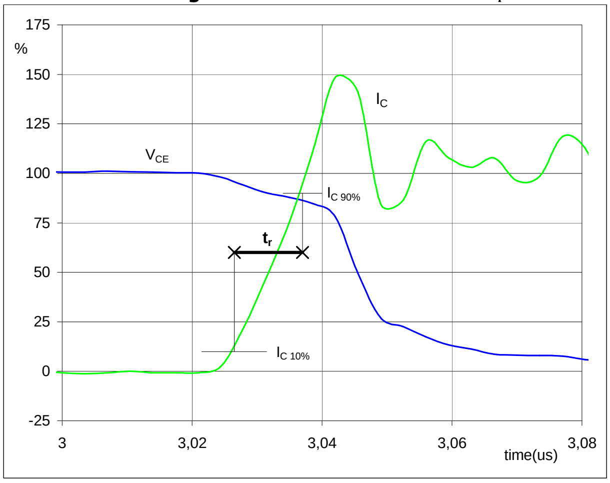
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	40	A
t_f =	0,03	μs

Figure 4 Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

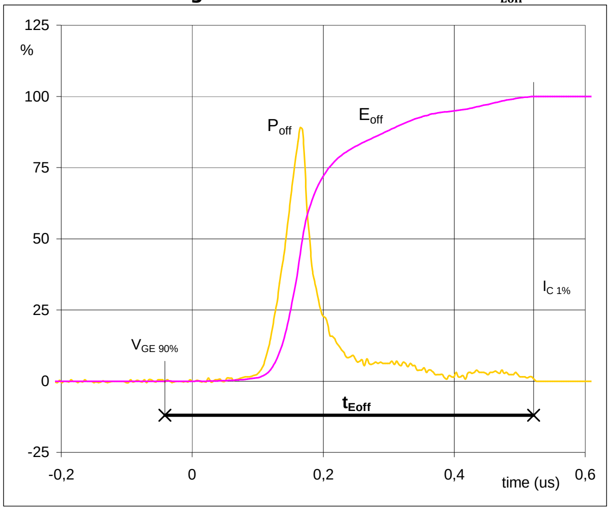


V_C (100%) =	600	V
I_C (100%) =	40	A
t_r =	0,01	μs

Boost Switching Definitions

Figure 5 Inverter IGBT

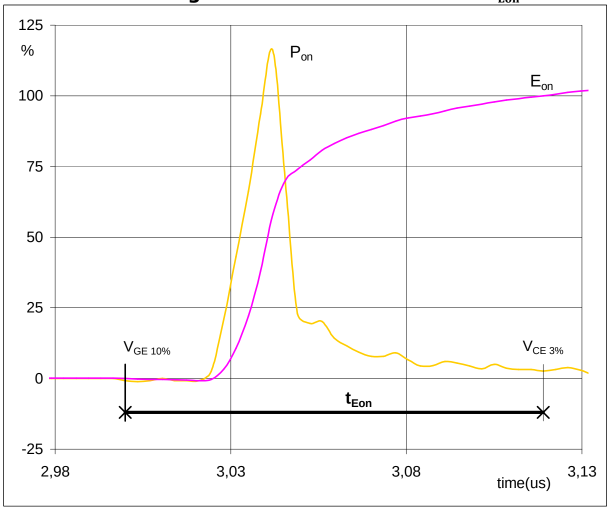
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 23,86 kW
E_{off} (100%) = 1,45 mJ
$t_{E\ off}$ = 0,56 μs

Figure 6 Inverter IGBT

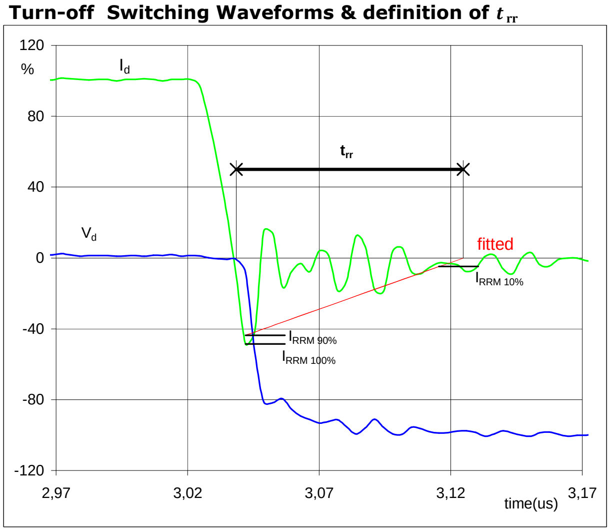
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 23,86 kW
E_{on} (100%) = 0,51 mJ
$t_{E\ on}$ = 0,12 μs

Figure 7 Output inverter FWD

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

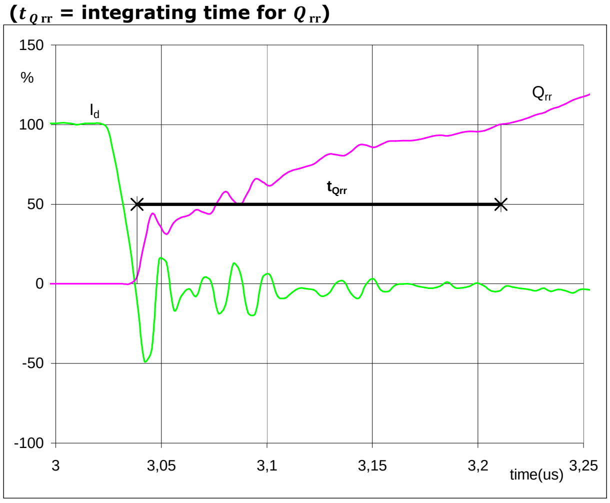


V_d (100%) = 600 V
I_d (100%) = 40 A
I_{RRM} (100%) = -23 A
t_{rr} = 0,01 μs

Boost Switching Definitions

Figure 8 Output inverter FWD

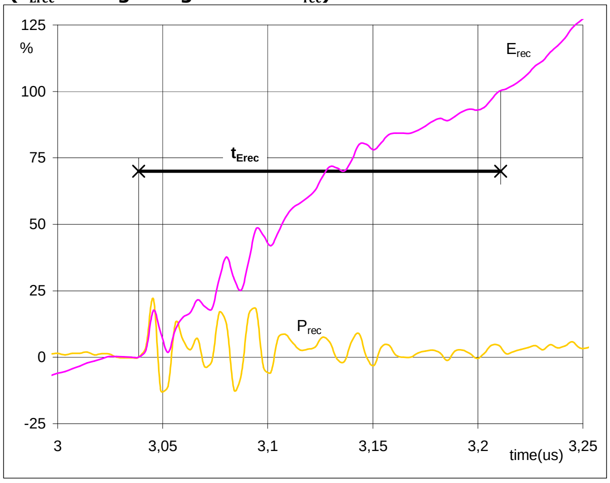
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	0,12	µC
$t_{Q\,rr}$ =	0,17	µs

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	23,86	kW
E_{rec} (100%) =	0,02	mJ
$t_{E\,rec}$ =	0,17	µs

Ordering Code and Marking - Outline - Pinout

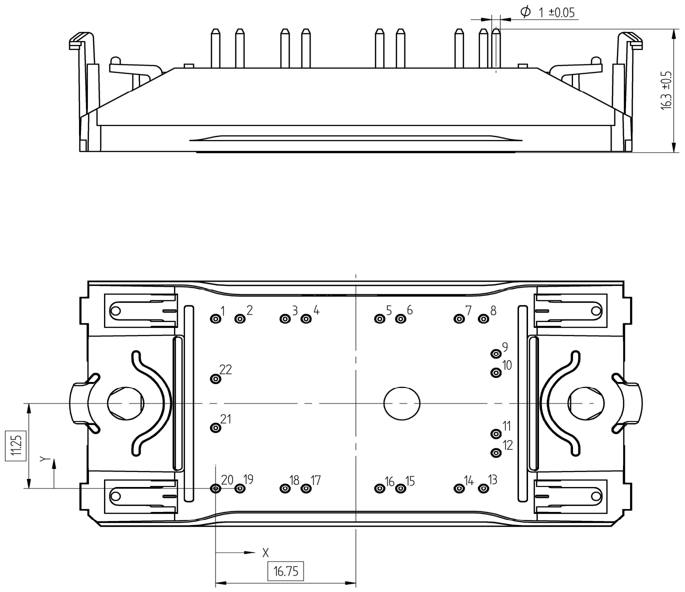
Ordering Code & Marking

Version					Ordering Code		
without thermal paste 12mm housing					V23990-P629-F63-PM		
	Text	VIN	Date code	Name&Ver	UL	Lot	Serial
		VIN	WWYY	NNNNNNNVV	UL	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

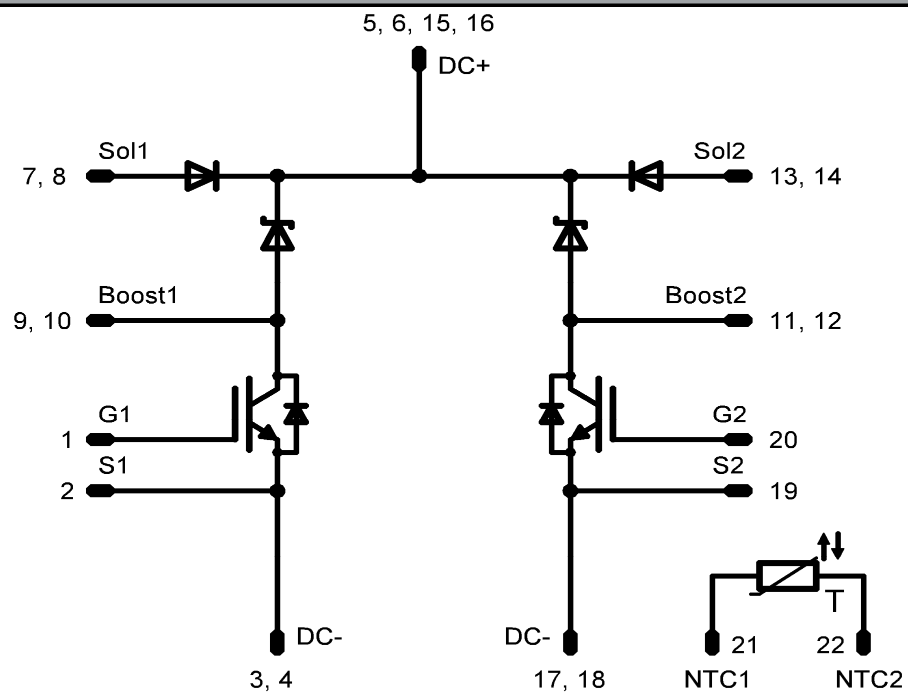
Pin table

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



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Packaging instruction					
Standard packaging quantity (SPQ)	**135**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-F63-PM-D3-14	22 Mar. 2016	New Style	All