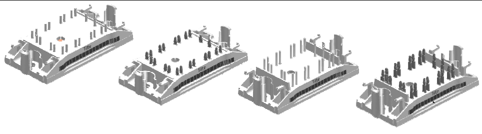
flow BOOST 0 — 1200 V / 40 A

Features

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

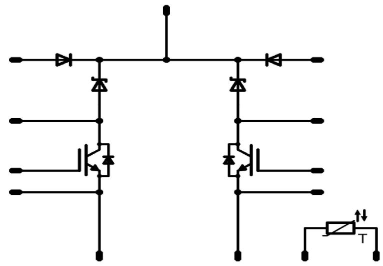
flow 0 housing



Target Applications

- solar inverter

Schematic



Types

- V23990-P629-L48-PM
- V23990-P629-L48Y-PM
- V23990-P629-L49-PM
- V23990-P629-L49Y-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
Mean forward current	I_{FAV}	$T_j=T_{jmax}$ T_s=80°C	34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms T_j=150°C	200	A
I^2t-value	I^2t		200	A^2s
Power dissipation	P_{tot}	$T_j=T_{jmax}$ T_s=80°C	42	W
Maximum Junction Temperature	T_{jmax}		150	°C
Input Boost IGBT (T1,T2)				
Collector-emitter break down voltage	V_{CES}		1200	V
DC collector current	I_C	$T_j=T_{jmax}$ T_s=80°C	41	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}	120	A
Turn off safe operating area		T_j≤150°C $V_{CE}<=V_{CES}$	80	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ T_s=80°C	113	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
Input Boost FWD (D1,D2,D4,D5)					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	$T_j=T_{jmax}$	T_s=80°C	18	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms	T_j=25°C	92	A
Repetitive peak forward current	I_{FRM}	Half Sine Wave		52	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$	T_s=80°C	50	W
Maximum Junction Temperature	T_{jmax}			175	°C
Input Boost Inv. Diode (D9,D10)					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	$T_j=T_{jmax}$	T_s=80°C	6	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		6	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$	T_s=80°C	26	W
Maximum Junction Temperature	T_{jmax}			150	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage		t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance		12mm housing with solder pins		min 9,55	mm
Clearance		12mm housing with pressfit pins		min 9,57	mm
Clearance		17mm housing		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 [°C]	Min	Typ	Max	
Bypass Diode (D7,D8)										
Forward voltage	V_F				25	25 125	0,7	1,15 1,11	1,4	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 0,012		Ω
Reverse current	I_r			1500		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,67		K/W
Input Boost IGBT (T1,T2)										
Gate emitter threshold voltage	$V_{GE(th)}$		$V_{GE}=V_{CE}$		0,0015	25 150	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 150	1,7	2,1 2,48	2,6	V
Collector-emitter cut-off	I_{CES}		0	1200		25 150			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		25 150			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					25 150		35 34,2		
Rise time	t_r					25 150		26,4 27,2		ns
Turn-off delay time	$t_{d(off)}$	R_{goff}=16 Ω R_{gon}=16 Ω	15	700	40	25 150		372,2 430,8		
Fall time	t_f					25 150		9,4 69,8		
Turn-on energy loss	E_{on}					25 150		2,061 2,19		mWs
Turn-off energy loss	E_{off}					25 150		1,78 3,039		
Input capacitance	C_{ies}							2360		
Output capacitance	C_{oss}	f=1MHz	0	25		25		230		pF
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G	f=1MHz	0	25	40	25		192		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						0,84		K/W
Input Boost FWD (D1,D2,D4,D5)										
Forward voltage	V_F				10	25 150	1	1,46 1,8	2	V
Reverse leakage current	I_{rm}			1200		25 150			300	μA
Peak recovery current	I_{RRM}					25 150		7,78 8,1		A
Reverse recovery time	t_{rr}					25 150		9,5 9,5		ns
Reverse recovery charge	Q_{rr}	R_{gon}=16 Ω	15	700	40	25 150		0,04 0,04		μC
Reverse recovered energy	E_{rec}					25 150		0,002 0,002		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		2480 2790		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,88		K/W
Input Boost Inv. Diode (D9,D10)										
Diode forward voltage	V_F				3	25 125		1,65 1,58		V
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						2,72		K/W

Characteristic Values

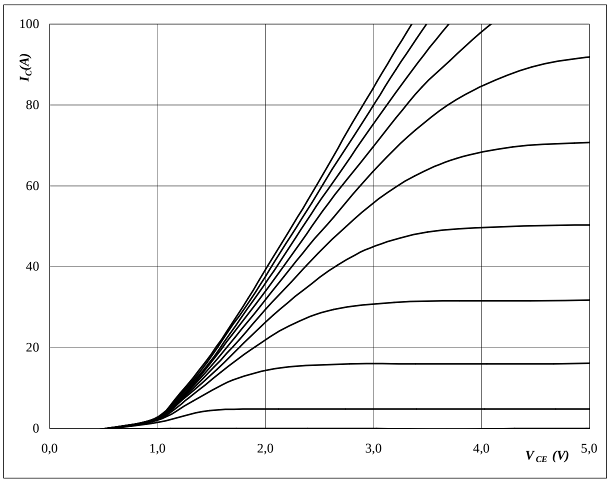
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		21,5		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100}=1486 Ω				25	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	B(25/50)					25		3884		K
B-value	B(25/100)					25		3964		K
Vincotech NTC Reference									F	

INPUT BOOST

Figure 1 BOOST IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

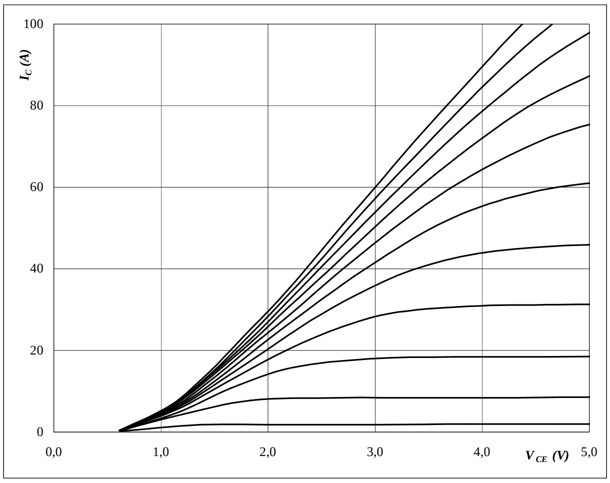
T_j = 25 °C

V_{GE} 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

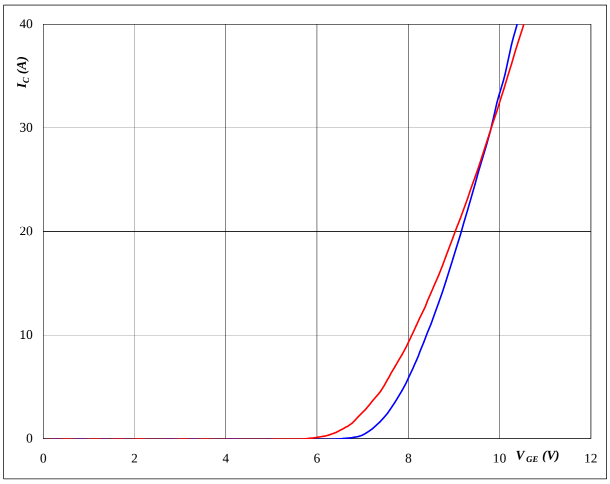
T_j = 125 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 BOOST IGBT

Typical transfer characteristics

$I_C = f(V_{GS})$



At

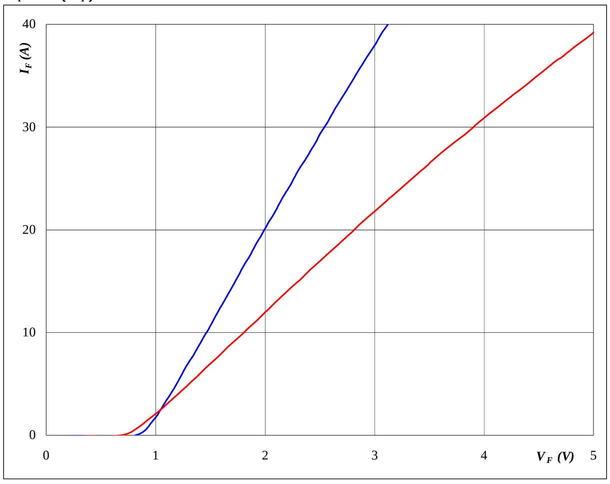
t_p = 250 µs T_j = 25/125 °C

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_j = 25/125 °C

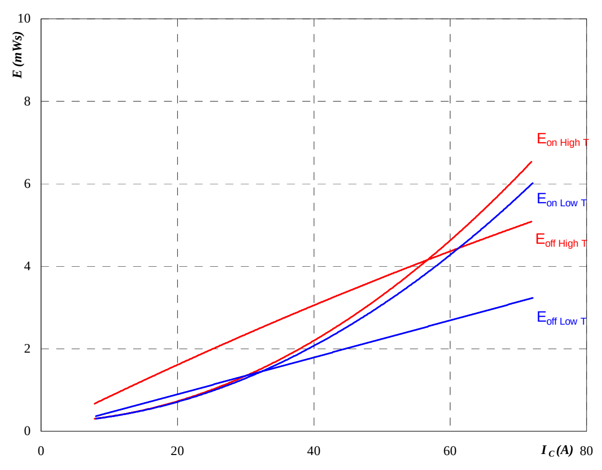
t_p = 250 µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



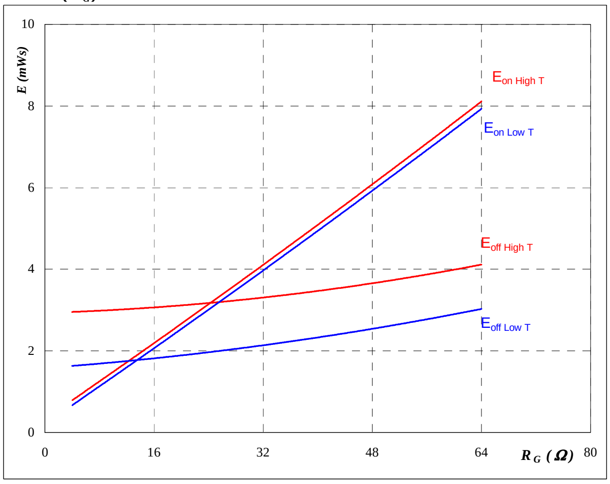
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6 BOOST IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



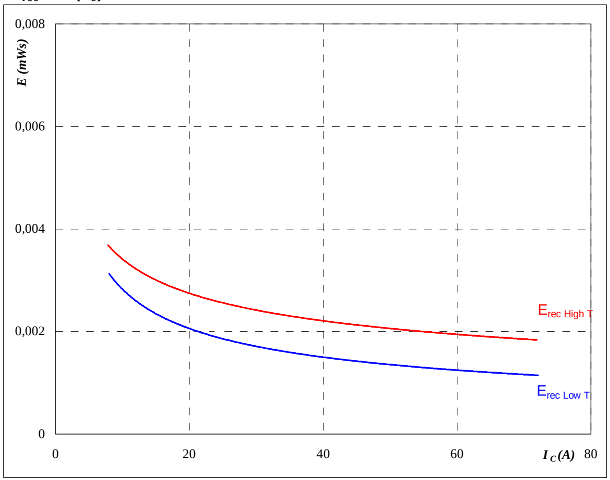
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
I_D =	40	A

Figure 7 BOOST FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



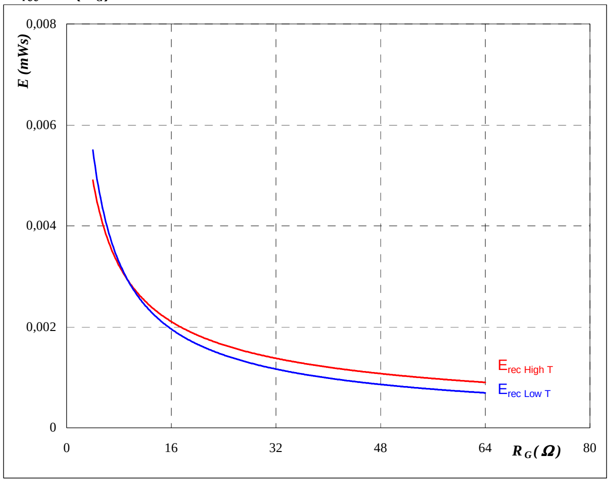
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	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

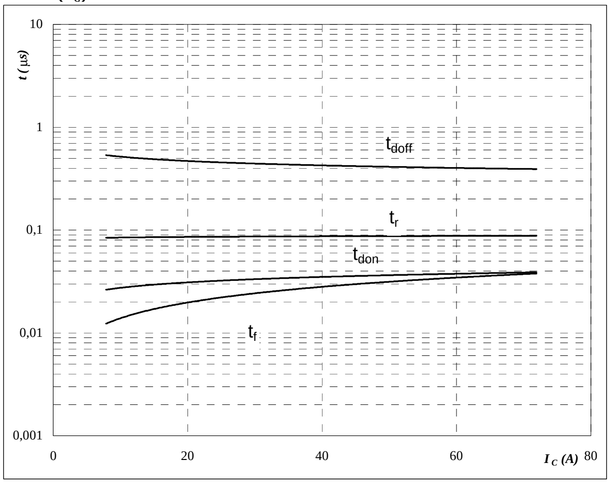
T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
I_C =	40	A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



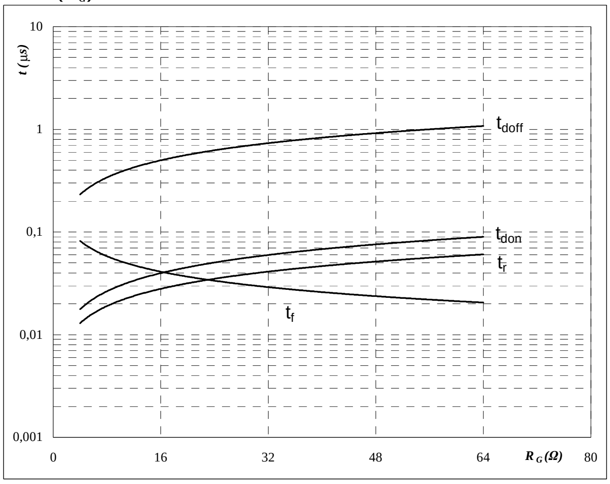
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



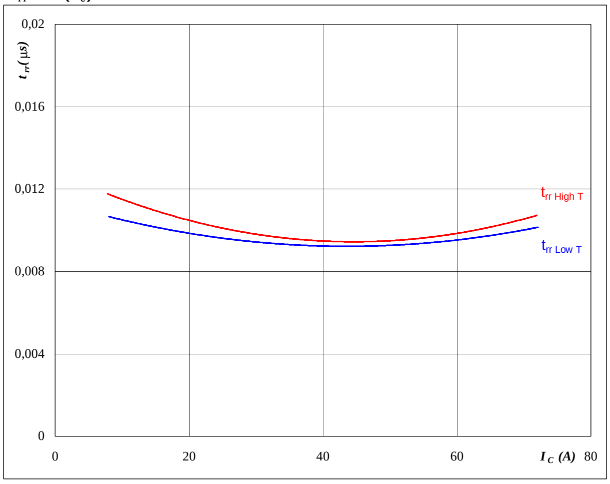
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
I_C =	40	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



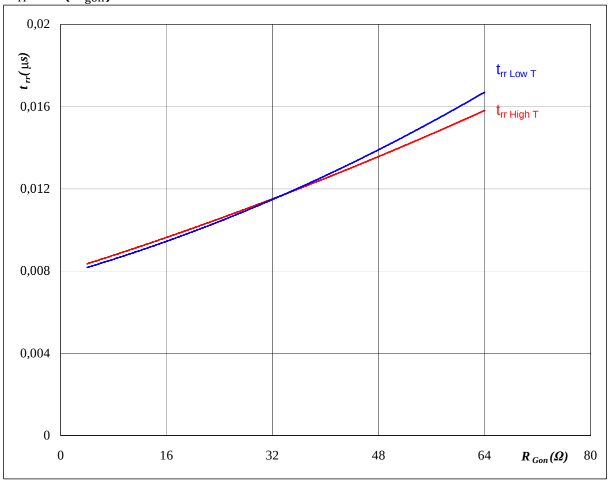
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 12 BOOST FWD

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

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



At

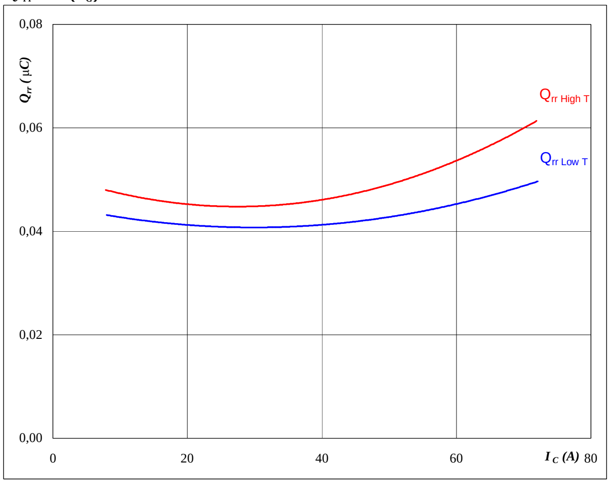
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	±15	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



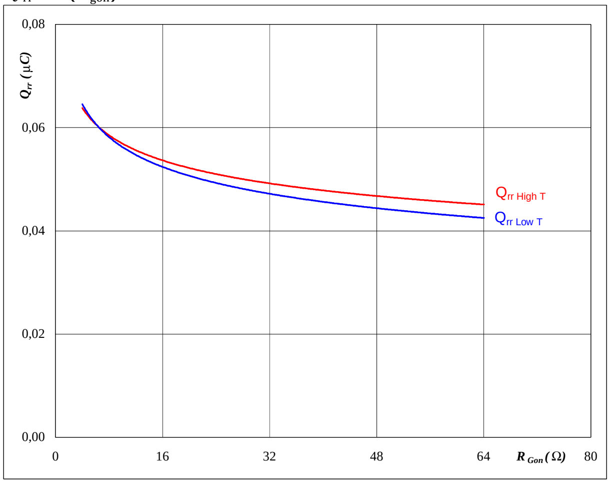
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 14 BOOST FWD

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

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



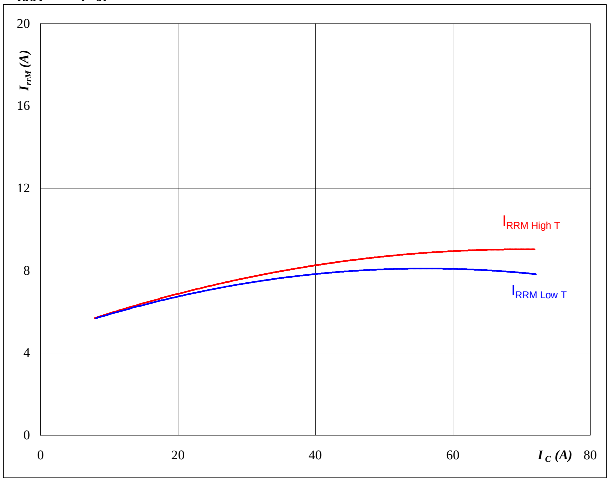
At

T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GS} =	±15	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



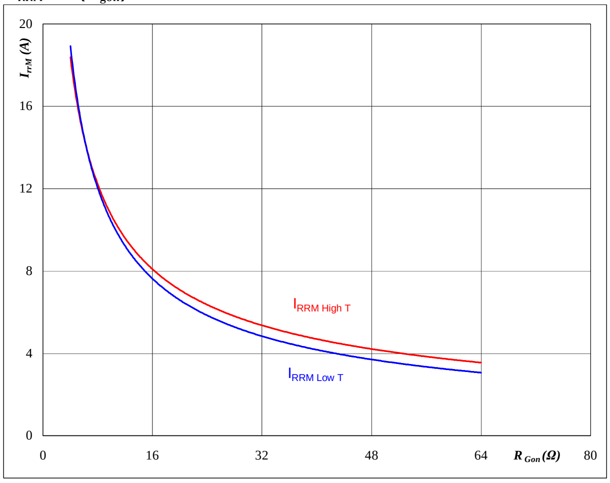
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 16 BOOST FWD

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

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



At

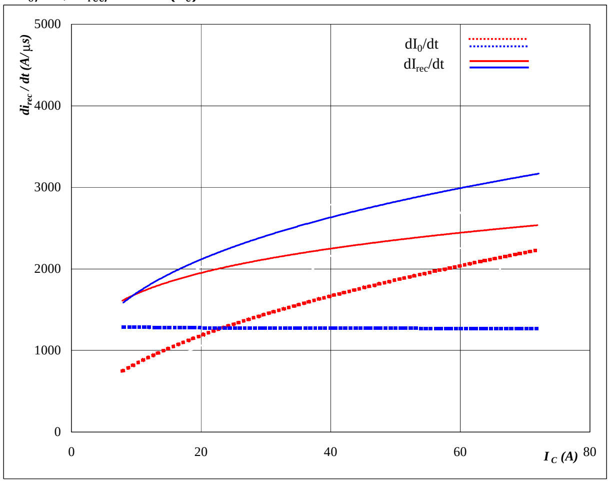
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	±15	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



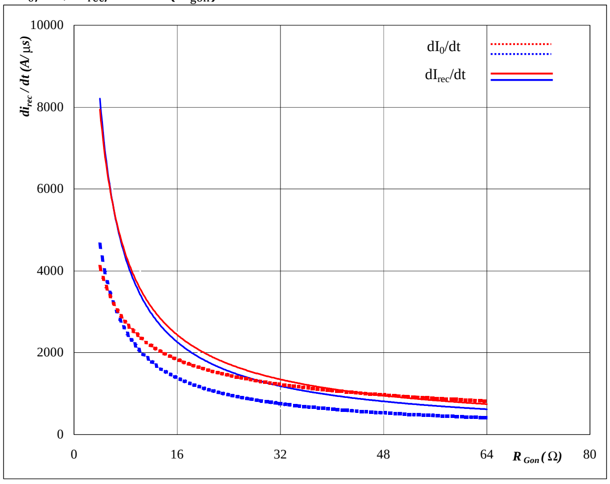
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 18 BOOST FWD

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

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



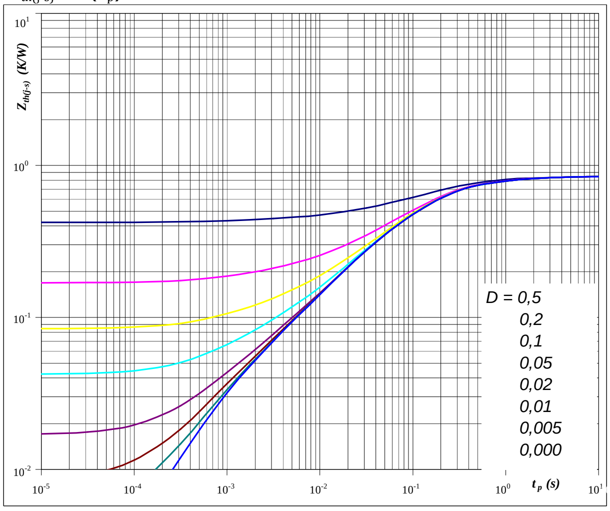
At

T_j =	25/125	°C
V_R =	700	V
I_F =	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	
$R_{th(j-s)}$ =	0,84	K/W

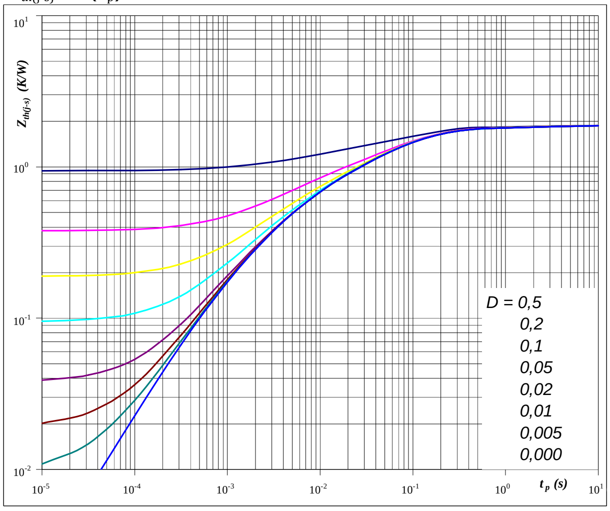
IGBT thermal model values

R (K/W)	τ (s)
1,07E-01	1,41E+00
3,91E-01	1,88E-01
2,23E-01	5,60E-02
9,23E-02	1,12E-02
2,99E-02	1,11E-03

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	
$R_{th(j-s)}$ =	1,88	K/W

FWD thermal model values

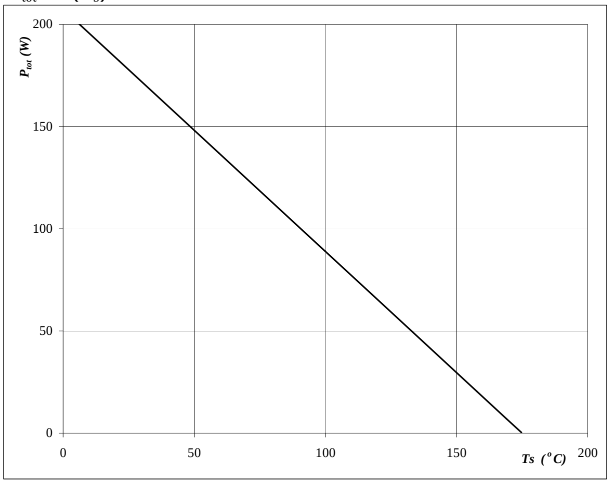
R (K/W)	τ (s)
5,58E-02	6,96E+00
1,47E-01	5,43E-01
8,94E-01	7,92E-02
4,33E-01	1,33E-02
2,94E-01	3,03E-03
5,99E-02	6,32E-04

INPUT BOOST

Figure 21 BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



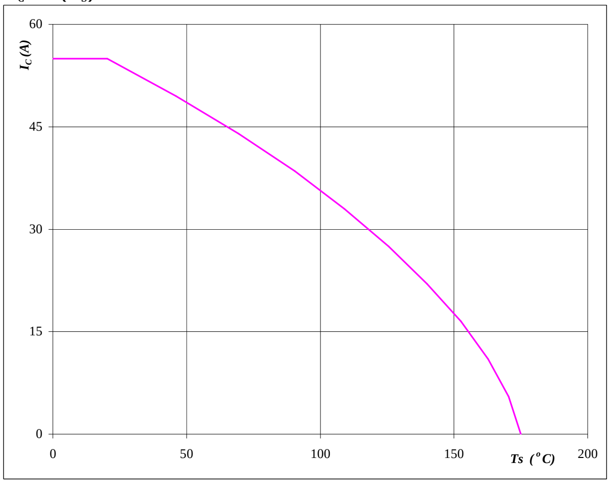
At

T_j = 175 ºC

Figure 22 BOOST IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_S)$



At

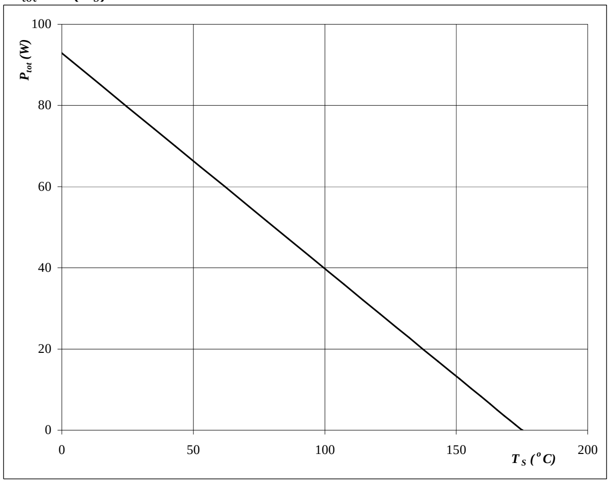
T_j = 175 ºC

V_{GE} = 15 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



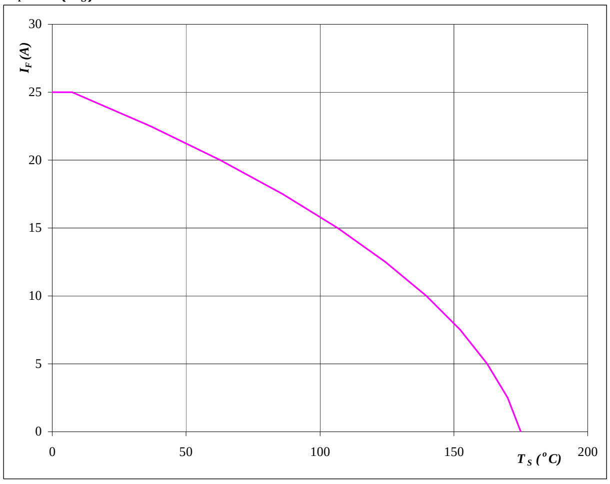
At

T_j = 175 ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_S)$



At

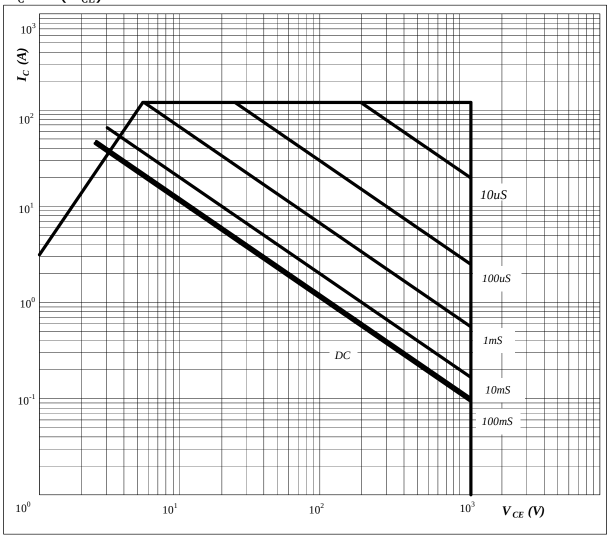
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



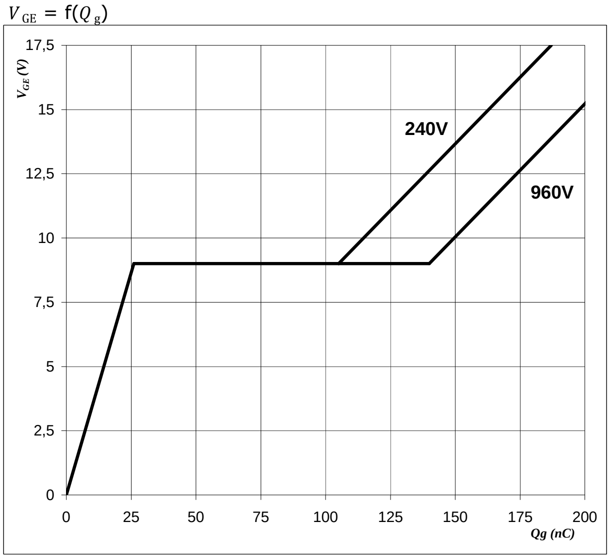
At

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

Figure 26 BOOST IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



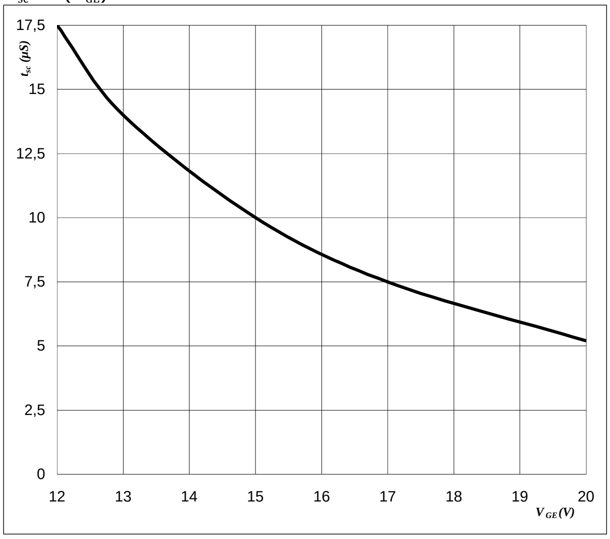
At

I_C =	40	A

Figure 27 Output inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



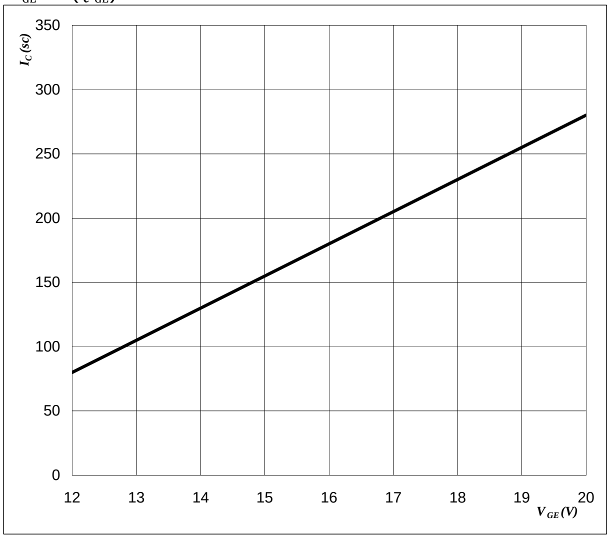
At

V_{CE} =	1200	V
T_j ≤	150	ºC

Figure 28 Output inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

$V_{GE} = f(Q_{GE})$



At

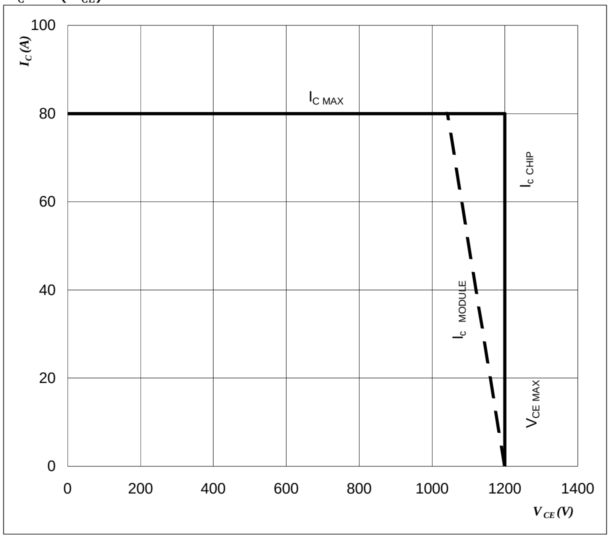
V_{CE} ≤	1200	V
T_j =	150	ºC

INPUT BOOST

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

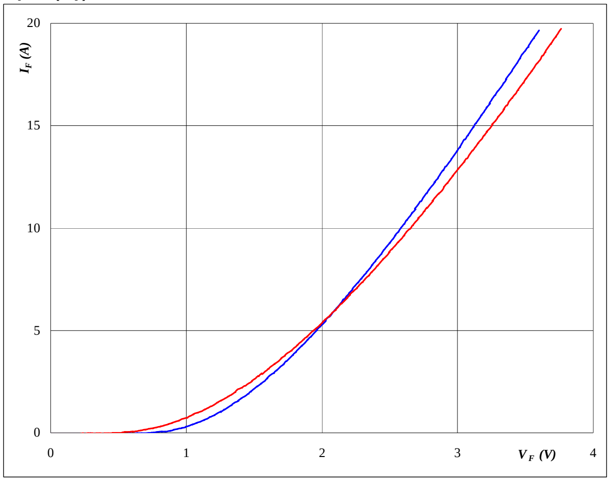
T_j =	T_{jmax}-25	ºC	R_{gon} =	16	Ω
			R_{goff} =	16	Ω

INPUT BOOST INV. Diode

Figure 1 INPUT BOOST INV. Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



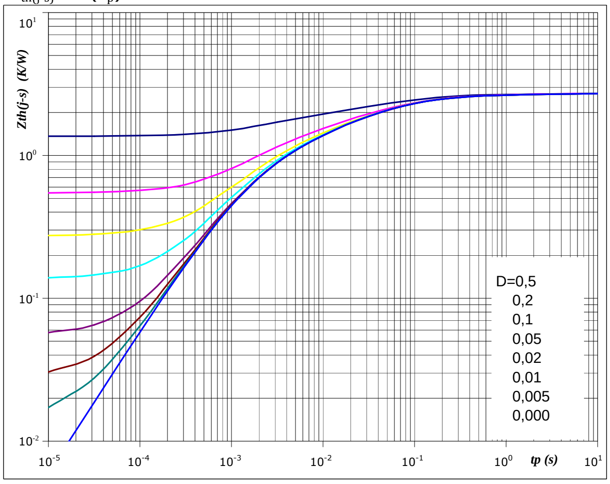
At

T_j =	25/125	°C
t_p =	250	μs

Figure 2 INPUT BOOST INV. Diode

Diode transient thermal impedance as a function of pulse width

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



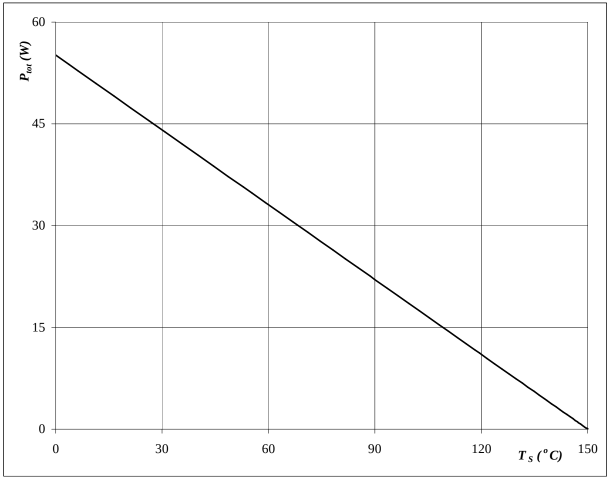
At

D =	t_p / T	
$R_{th(j-s)}$ =	2,72	K/W

Figure 3 INPUT BOOST INV. Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



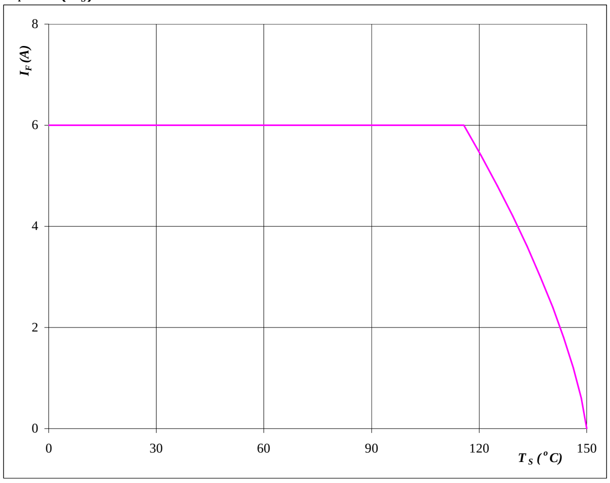
At

T_j =	150	ºC

Figure 4 INPUT BOOST INV. Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

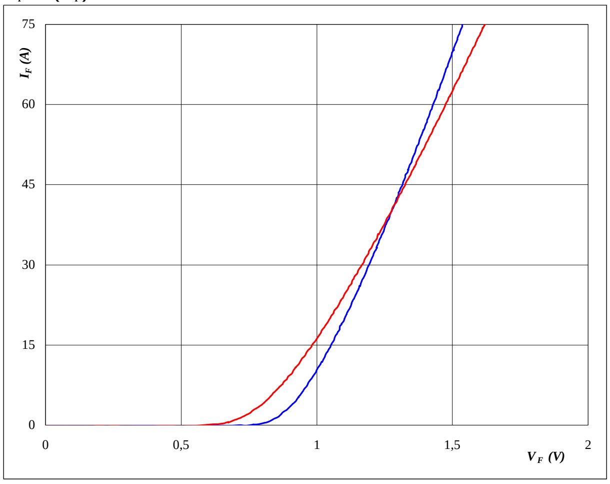
T_j =	150	ºC

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

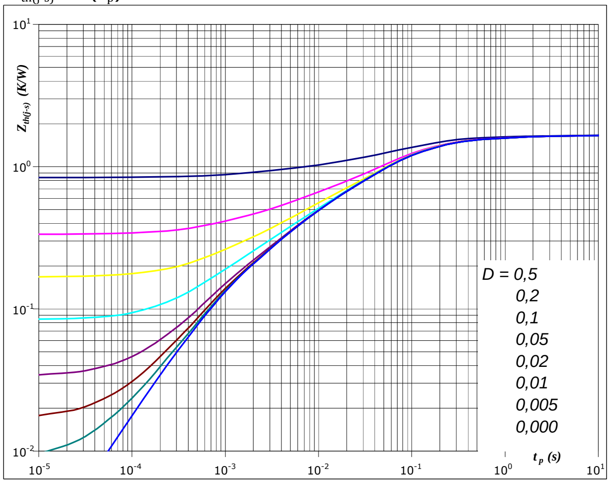
T_j = 25/125 °C

t_p = 250 µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

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



At

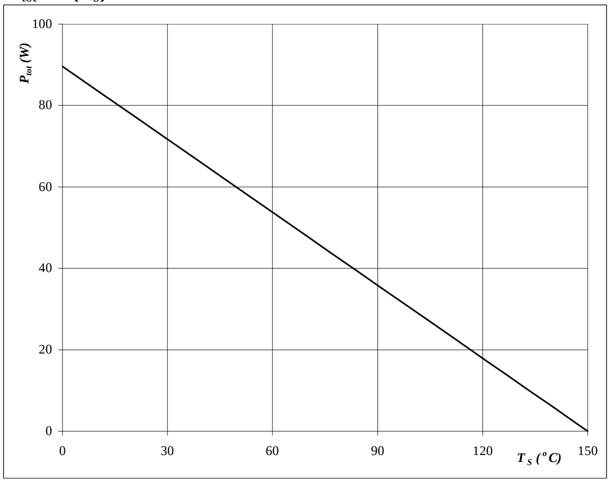
D = t_p / T

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

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_S)$



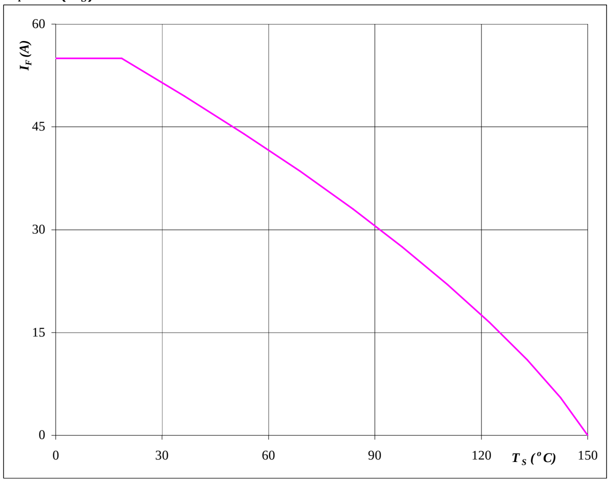
At

T_j = 150 ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_S)$



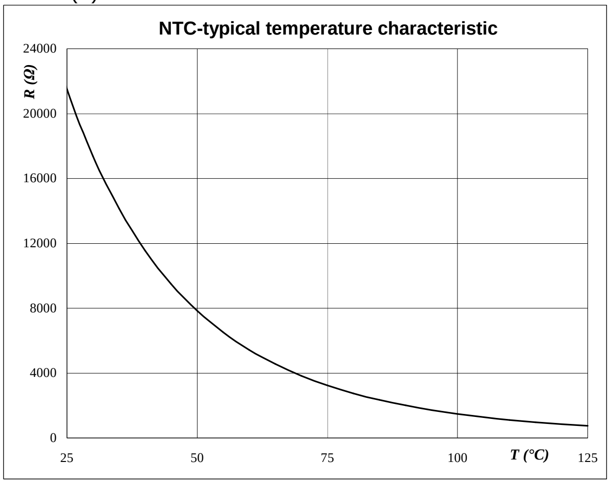
At

T_j = 150 ºC

Thermistor

Figure 1 Thermistor

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



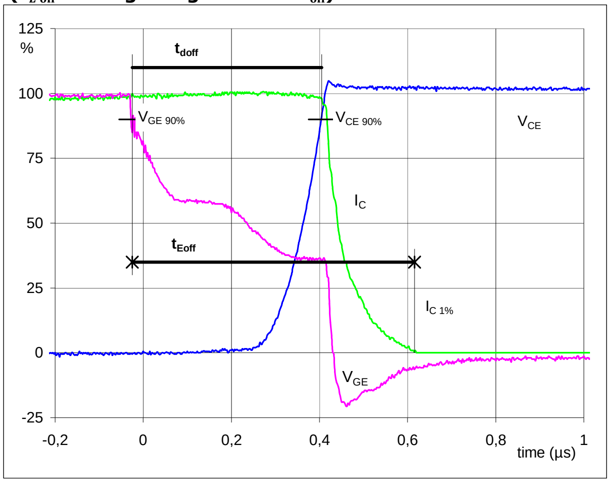
Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1 BOOST IGBT

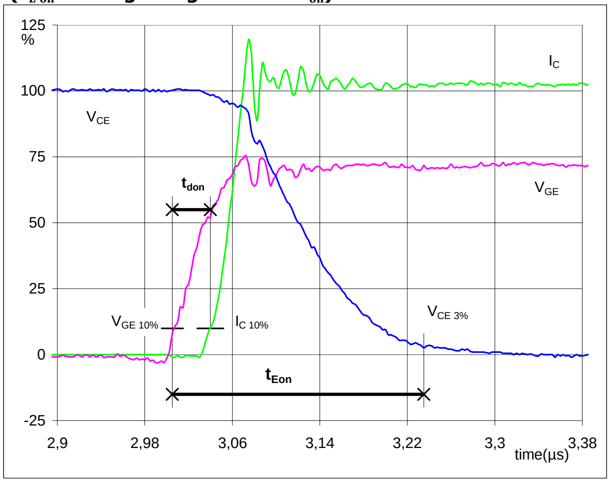
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{doff} =	0,43	µs
$t_{E\,off}$ =	0,64	µs

Figure 2 BOOST IGBT

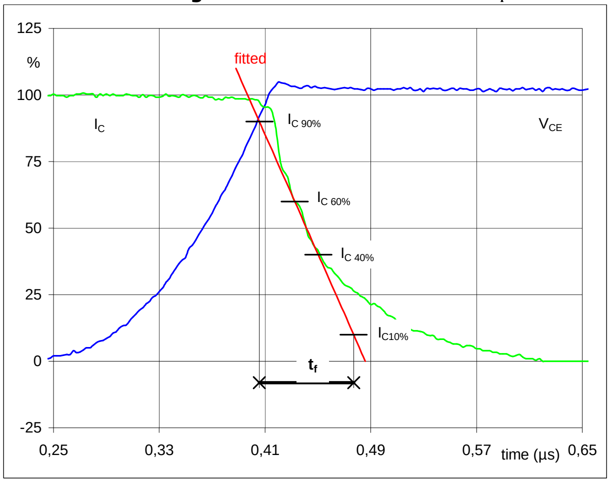
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{don} =	0,034	µs
$t_{E\,on}$ =	0,230	µs

Figure 3 BOOST IGBT

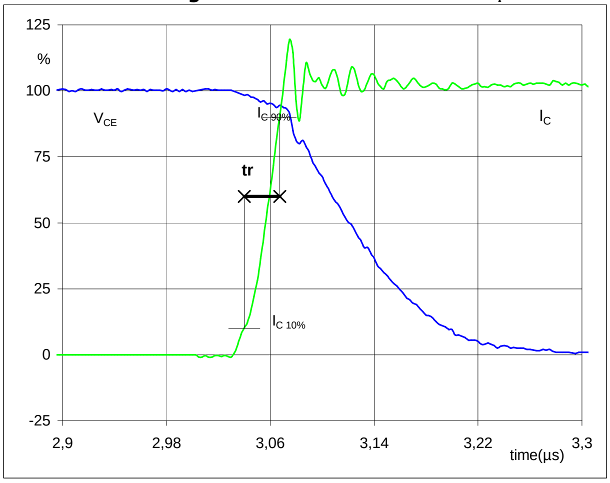
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	40	A
t_f =	0,07	µs

Figure 4 BOOST IGBT

Turn-on Switching Waveforms & definition of t_r

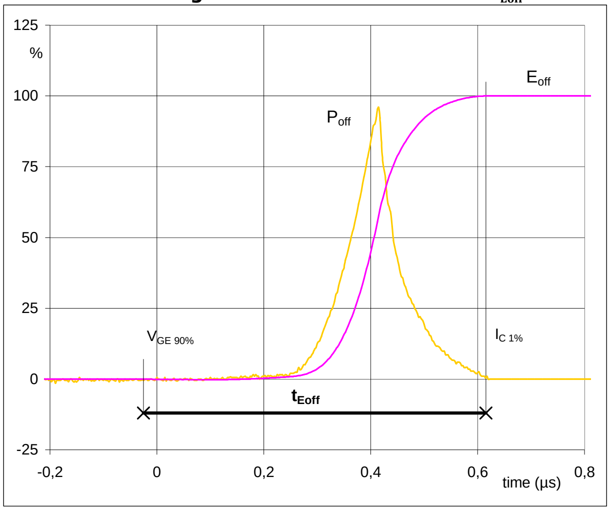


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,027	µs

Switching Definitions

Figure 5 BOOST IGBT

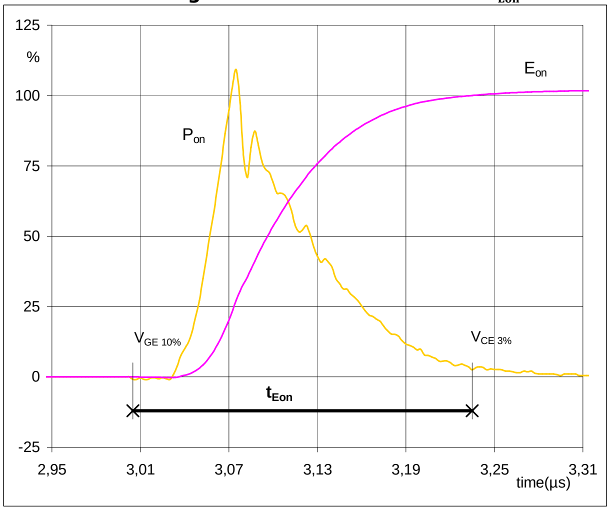
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	28,10	kW
E_{off} (100%) =	3,04	mJ
$t_{E\,off}$ =	0,64	µs

Figure 6 BOOST IGBT

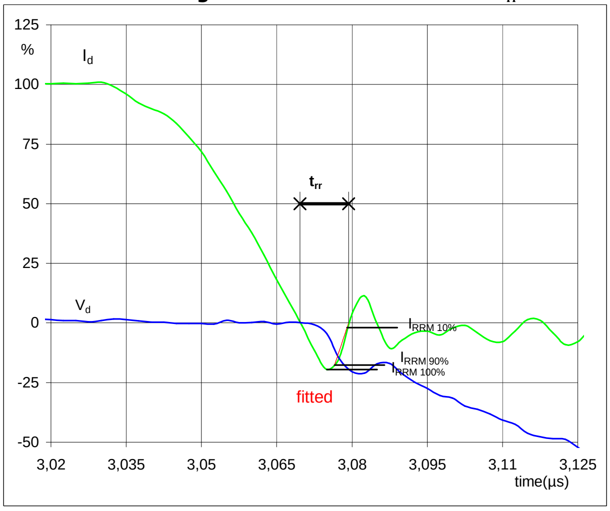
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	28,10	kW
E_{on} (100%) =	2,19	mJ
$t_{E\,on}$ =	0,23	µs

Figure 7 BOOST FWD

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

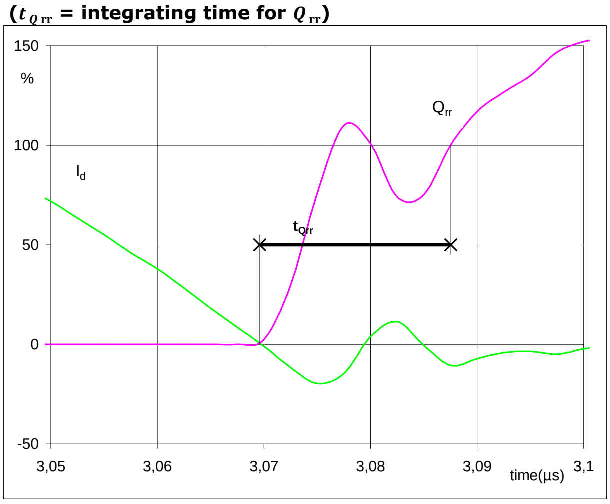


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-8	A
t_{rr} =	0,01	µs

Switching Definitions

Figure 8 BOOST FWD

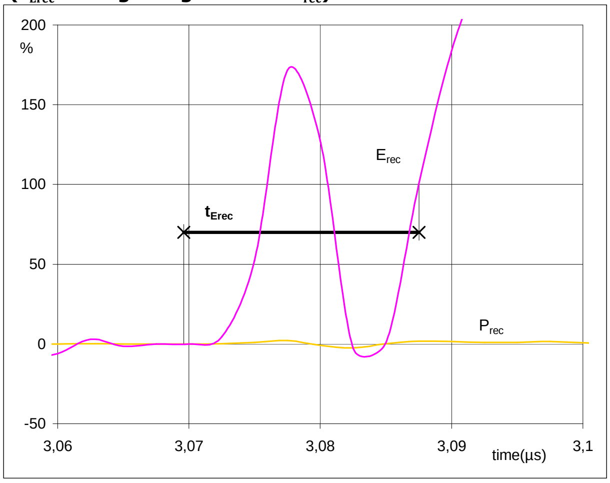
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	0,04	µC
$t_{Q\,rr}$ =	0,018	µs

Figure 9 BOOST FWD

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



P_{rec} (100%) =	28,10	kW
E_{rec} (100%) =	0,002	mJ
$t_{E\,rec}$ =	0,018	µs

Ordering Code and Marking - Outline - Pinout

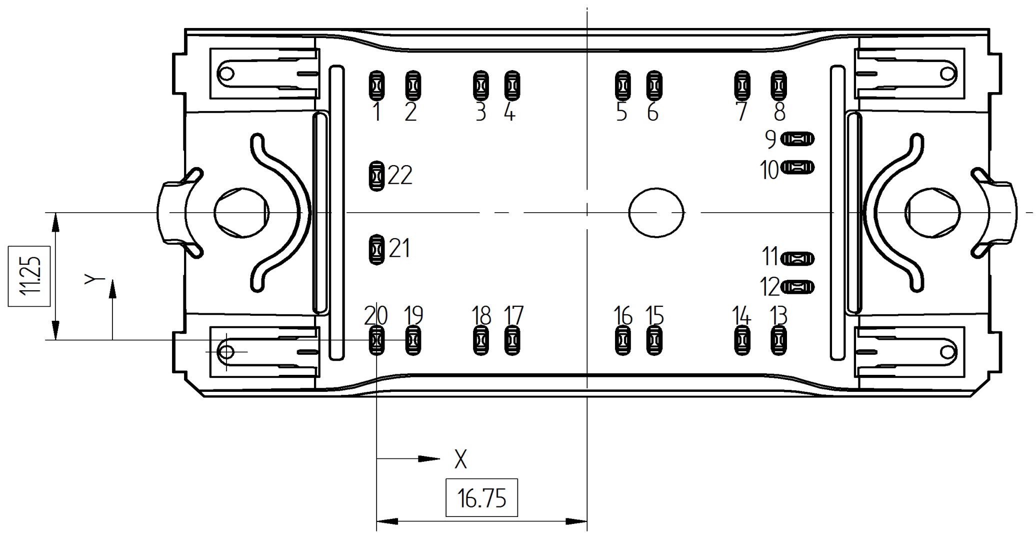
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
12mm housing with solder pins	V23990-P629-L48-PM	P629L48	P629L48
12mm housing with pressfit pins	V23990-P629-L48Y-PM	P629L48Y	P629L48Y
17mm housing with solder pins	V23990-P629-L49-PM	P629L49	P629L49
17mm housing with pressfit pins	V23990-P629-L49Y-PM	P629L49Y	P629L49Y

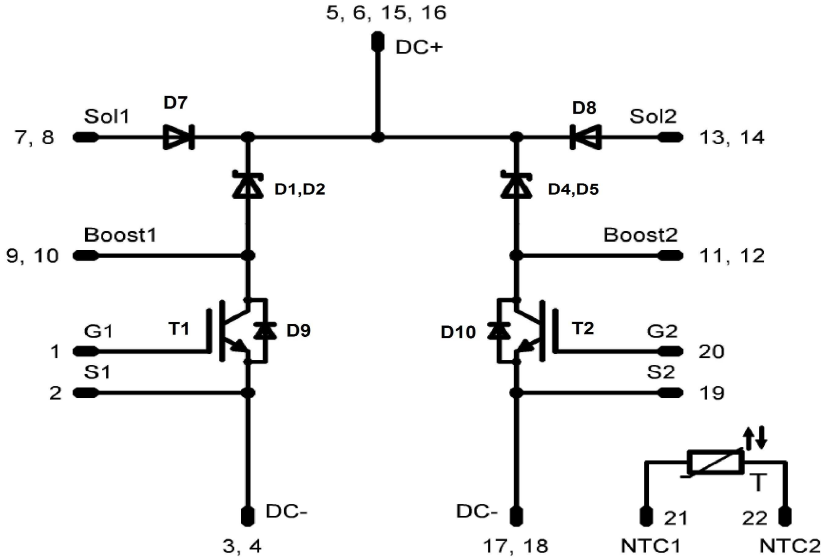
Outline

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



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.