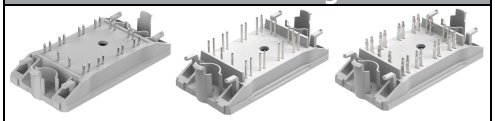
V23990-P629-L98-PM
V23990-P629-L99-PM
V23990-P629-L99Y-PM
datasheet

flow **BOOST 0** | **1200 V / 40 A**

Features

- Ultra fast switching frequency
- Low Inductance Layout
- Ultrafast 1200V IGBT and 1200V SiC diode
- Antiparallel IGBT protection diode with high current
- Thermal improved resistance with AlN substrate

flow 0 housing

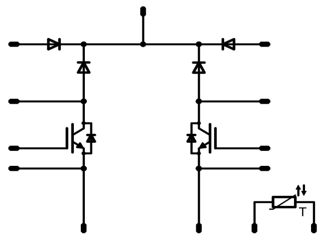


12mm solder pins | 17mm solder pins | 17mm Press-fit pins

Target Applications

- Solar inverter

Schematic



Types

- V23990-P629-L98-PM
- V23990-P629-L99-PM
- V23990-P629-L99Y-PM

Maximum Ratings

T_j = 25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Bypass Diode				
Repetitive peak reverse voltage	V_{RRM}		1600	V
Mean forward current	I_{FAV}	$T_j = T_{jmax}$ T_h = 80°C T_c = 80°C	45 45	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10ms T_j = 150°C	200	A
I2t-value	I^2t		200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_h = 80°C T_c = 80°C	68 102	W
Maximum Junction Temperature	T_{jmax}		150	°C
Boost Switch				
Collector-emitter break down voltage	V_{CES}		1200	V
DC collector current	I_C	$T_j = T_{jmax}$ T_h = 80°C T_c = 80°C	55 55	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	160	A
Turn off safe operating area		T_j ≤ 150°C V_{CE}<=V_{CES}	160	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_h = 80°C T_c = 80°C	202 306	W
Gate-emitter peak voltage	V_{GE}		25	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150°C V_{GE} = 15V	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 Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	$T_j = T_{jmax}$	T_h = 80°C T_c = 80°C	54 55	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10ms	T_j = 25°C	213	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		141	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_h = 80°C T_c = 80°C	154 234	W
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Prot. Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	$T_j = T_{jmax}$	T_h = 80°C T_c = 80°C	12 15	A
Surge non repetitive forward current	I_{FSM}	t_p = 10ms half sine wave		28	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_h = 80°C T_c = 80°C	33 49	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 / 17 mm housing		9,55 / 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										
Forward voltage	V_F				25	25 125	0,8	1,13 1,09	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}					25 125		0,93 0,80		V
Slope resistance (for power loss calc. only)	r_t					25 125		0,008 0,011		Ω
Reverse current	I_r			1500		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal foil thickness=76um Kunze foil KU-ALF5						1,04		K/W
Boost Switch										
Gate emitter threshold voltage	$V_{GE(th)}$		15		0,00025	25 125	3,5	5,5	7,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125	1	2,74 3,01	3,5	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			1	mA
Gate-emitter leakage current	I_{GES}		25			25 125			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff}=4 Ω R_{gon}=4 Ω	15	700	40	25 125		23,2 22,6		ns
Rise time	t_r					25 125		10 11,2		
Turn-off delay time	$t_{d(off)}$					25 125		186,4 215,8		
Fall time	t_f					25 125		11,1 32,3		
Turn-on energy loss	E_{on}					25 125		0,542 0,630		mWs
Turn-off energy loss	E_{off}					25 125		0,850 1,679		
Input capacitance	C_{ies}	f=1MHz		30		25		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G	f=1MHz		30		25		220	330	nC
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal foil thickness=76um Kunze foil KU-ALF5						0,35		K/W
Boost Diode										
Forward voltage	V_F				30	25 125	1	1,49 1,77	1,9	V
Reverse leakage current	I_{rm}			700		25 125			750	µA
Peak recovery current	I_{RRM}	R_{gon}=4 Ω	15	700	40	25 125		29,24 28,42		A
Reverse recovery time	t_{rr}					25 125		11,7 12,5		ns
Reverse recovery charge	Q_{rr}					25 125		0,187 0,19		µC
Reverse recovered energy	E_{rec}					25 125		0,026 0,028		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		7553 7097		A/µs
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal foil thickness=76um Kunze foil KU-ALF5						0,62		K/W

Characteristic Values

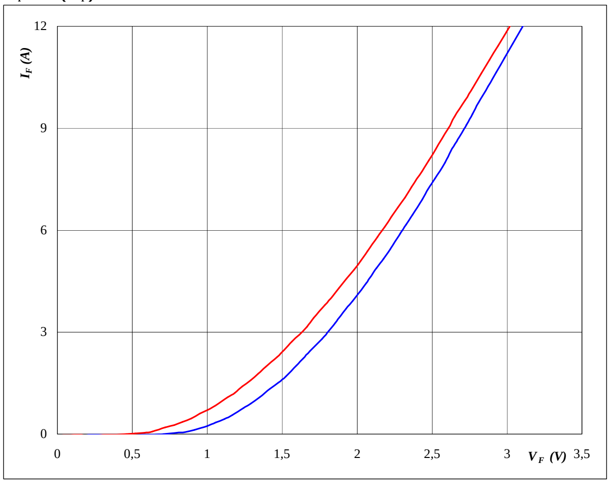
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Value Min	Value Typ	Value Max	Unit
Boost Prot. Diode										
Diode forward voltage	V_F				4	25 125		1,98 1,82		V
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	Thermal foil thickness=76um Kunze foil KU-ALF5						2,15		K/W
Thermistor										
Rated resistance	R					T=25		21511		Ω
Deviation of R100	$\Delta_{R/R}$	R_{100}=1486 Ω				T=100	-4,5		+4,5	%
Power dissipation	P					T=25		210		mW
Power dissipation constant						T=25		3,5		mW/K
B-value	B(25/50)					T=25		3884		K
B-value	B(25/100)					T=25		3964		K
Vincotech NTC Reference									F	

Boost Prot. Diode

Figure 25 Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



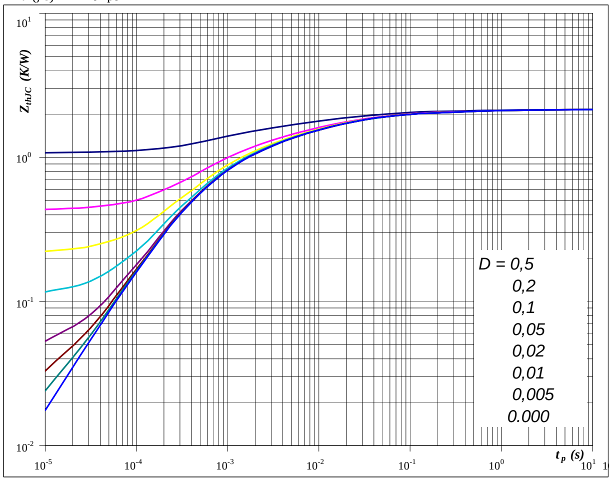
At

t_p = 250 µs T_j = 25/125 °C

Figure 26 Diode

Diode transient thermal impedance as a function of pulse width

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



At

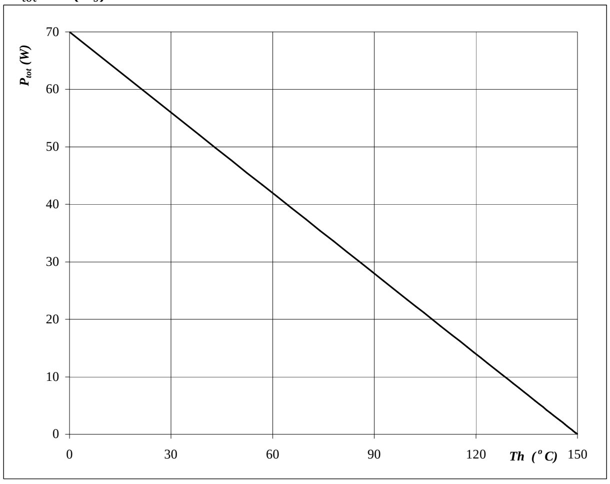
D = t_p / T

$R_{th(j-s)}$ = 2,15 K/W

Figure 27 Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



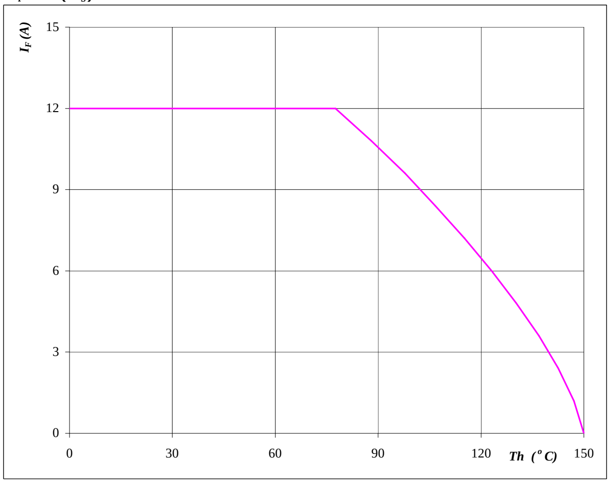
At

T_j = 150 ºC

Figure 28 Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

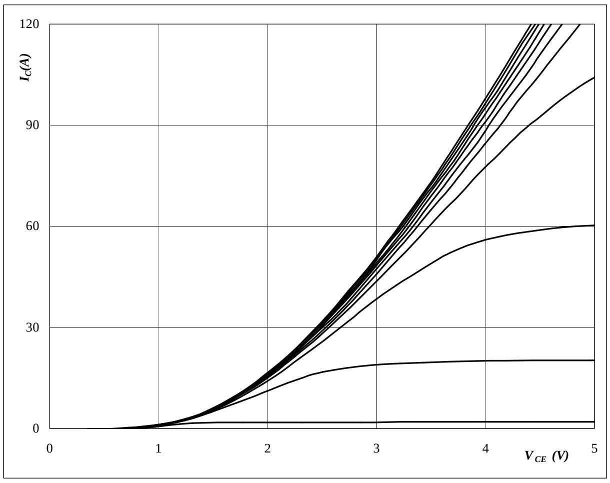
T_j = 150 ºC

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

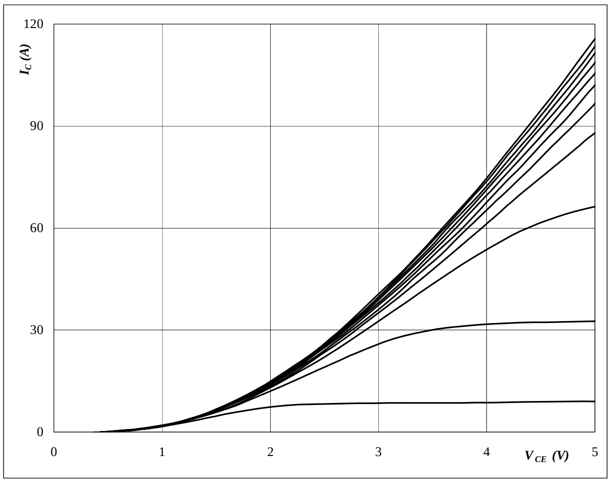
T_j = 25 °C

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

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

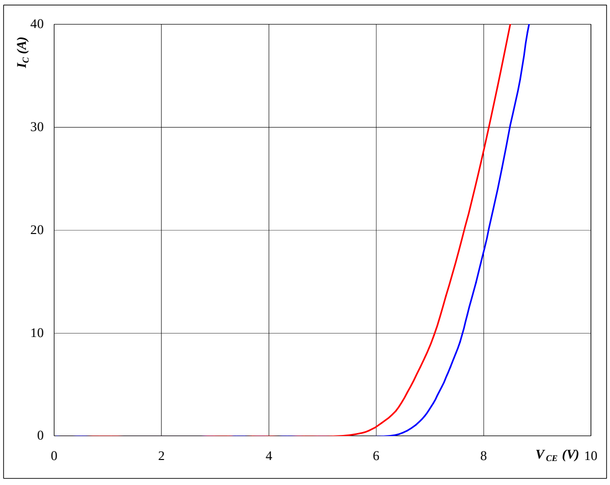
T_j = 126 °C

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

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{CE})$



At

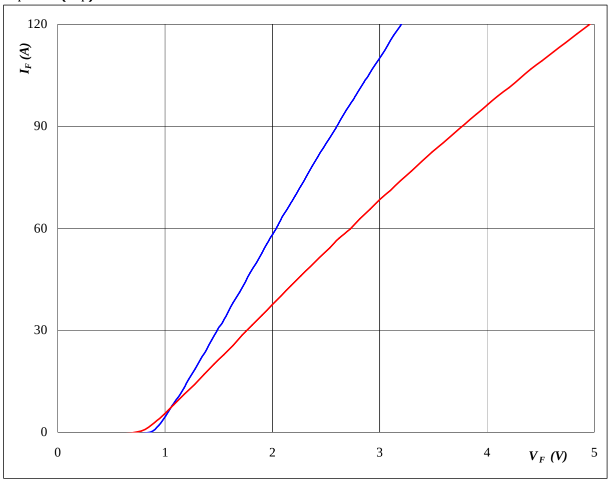
t_p = 100 µs T_j = 25/125 °C

V_{CE} = 10 V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

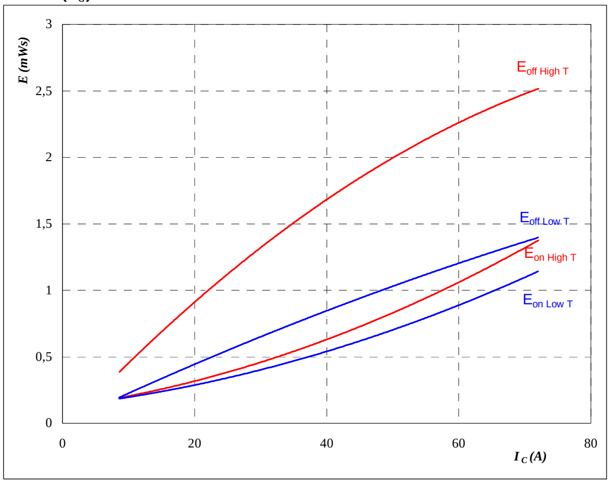
t_p = 250 µs T_j = 25/125 °C

Boost

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



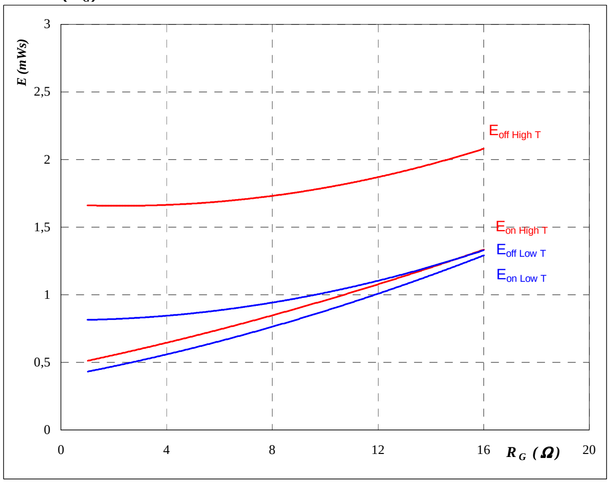
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



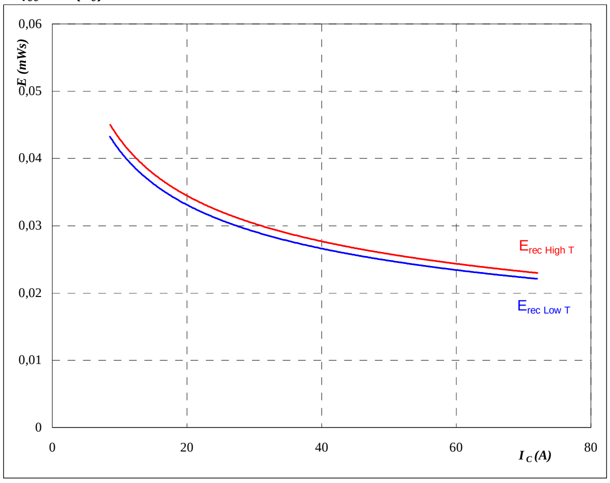
With an inductive load at

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

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



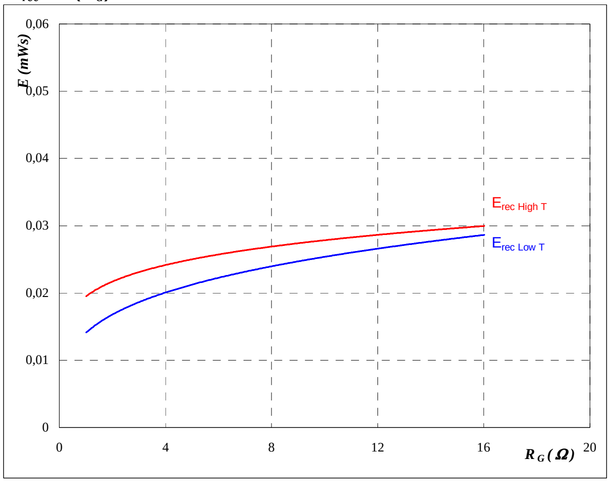
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8 FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



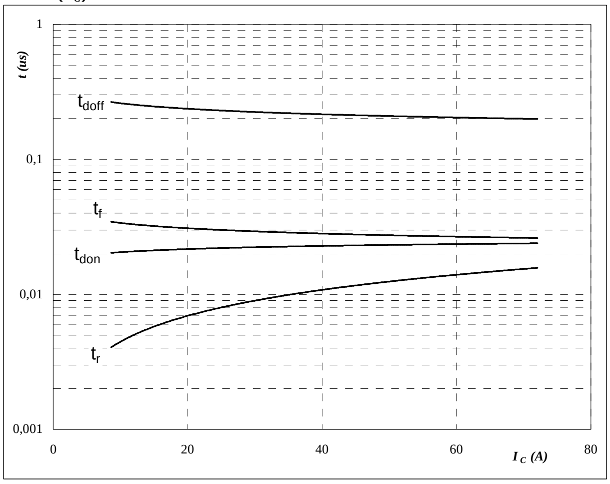
With an inductive load at

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

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



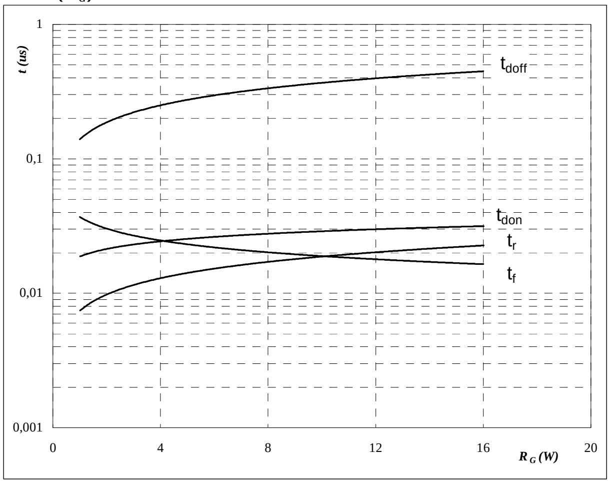
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



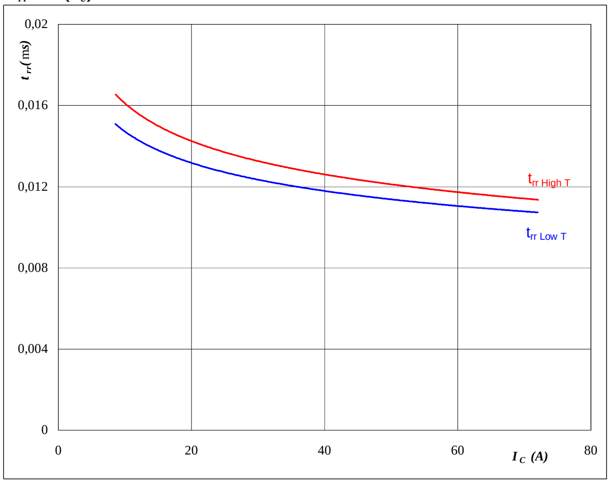
With an inductive load at

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

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



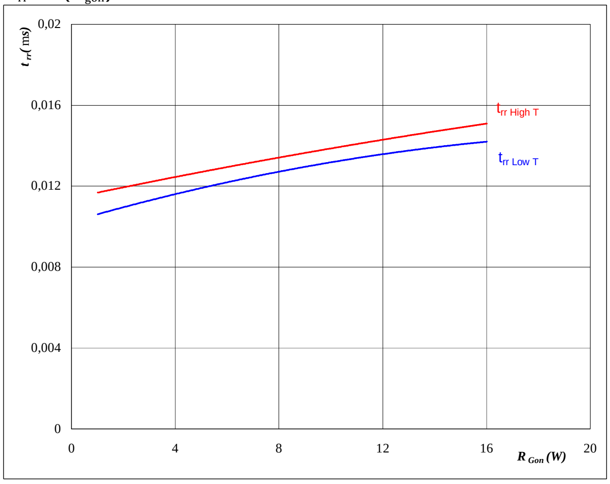
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 12 FWD

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

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



At

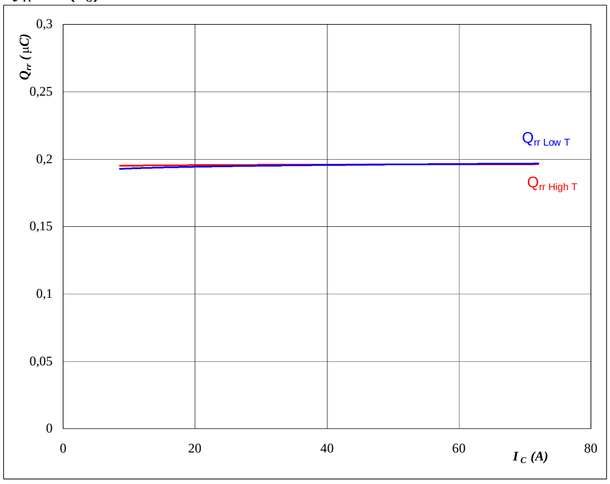
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



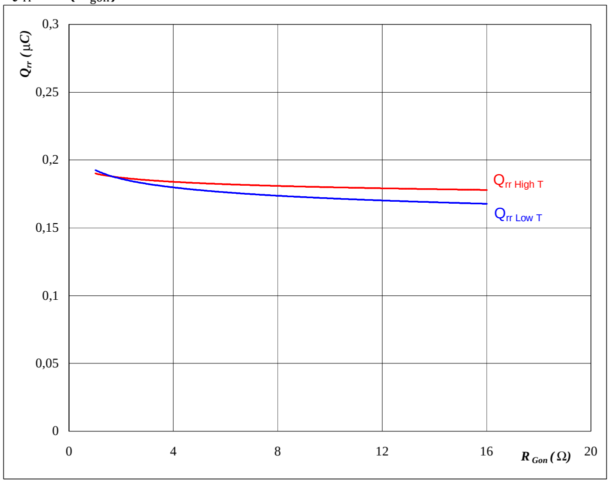
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 14 FWD

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

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



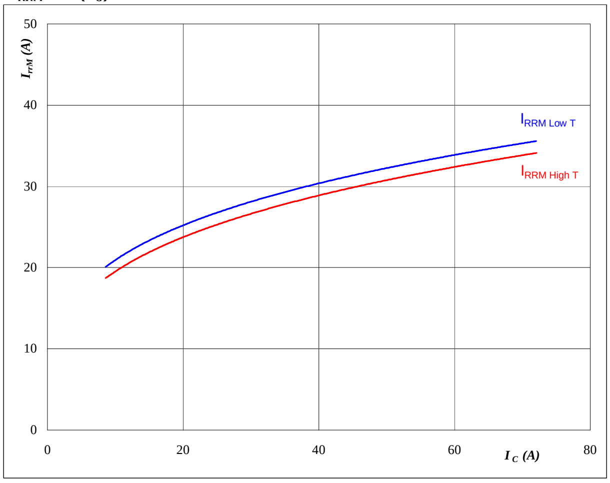
At

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

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



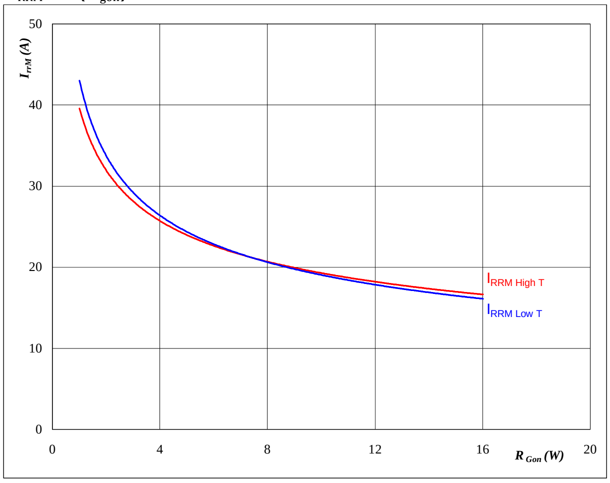
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 16 FWD

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

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



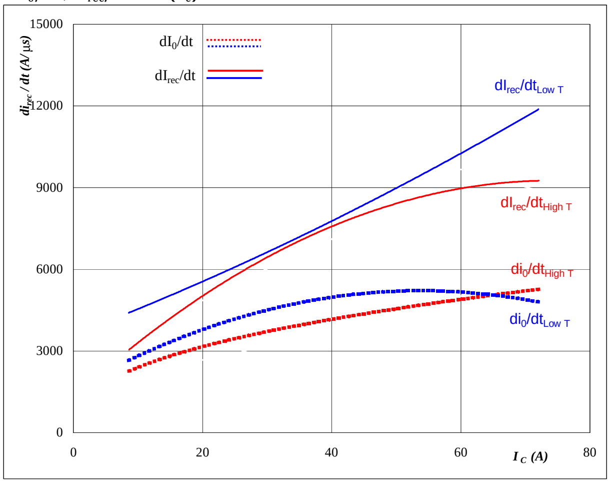
At

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

Figure 17 FWD

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

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



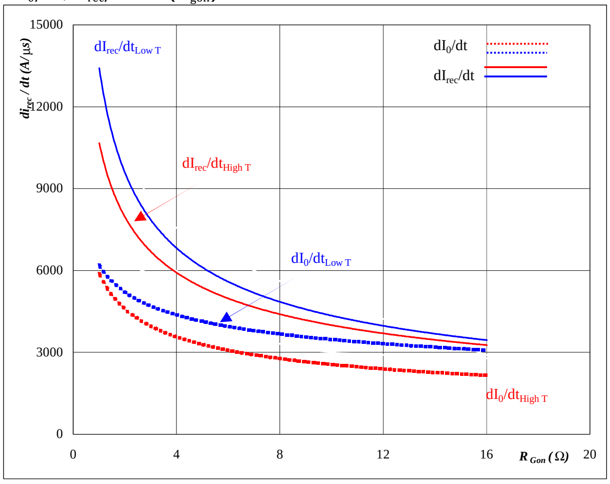
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 18 FWD

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

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



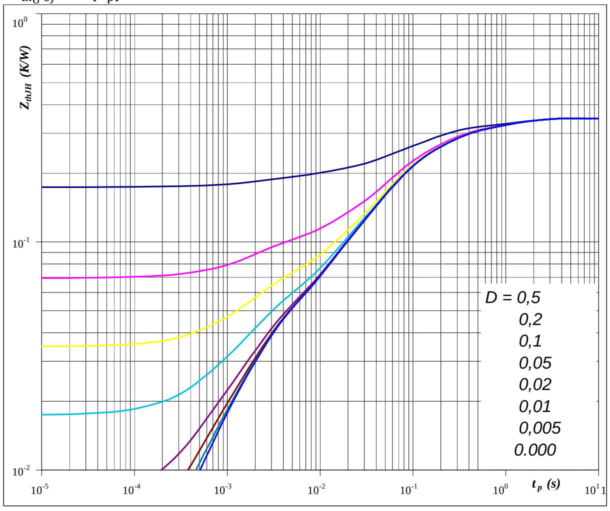
At

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

Figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,35	K/W

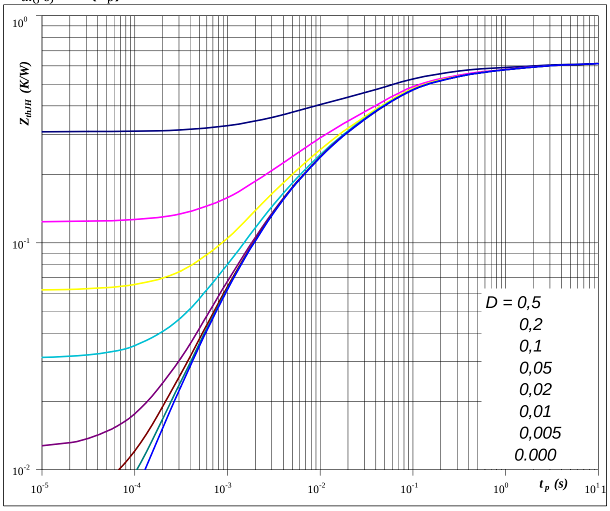
IGBT thermal model values

R (K/W)	τ (s)
0,080	0,780
0,161	0,100
0,072	0,030
0,035	0,002

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,62	K/W

FWD thermal model values

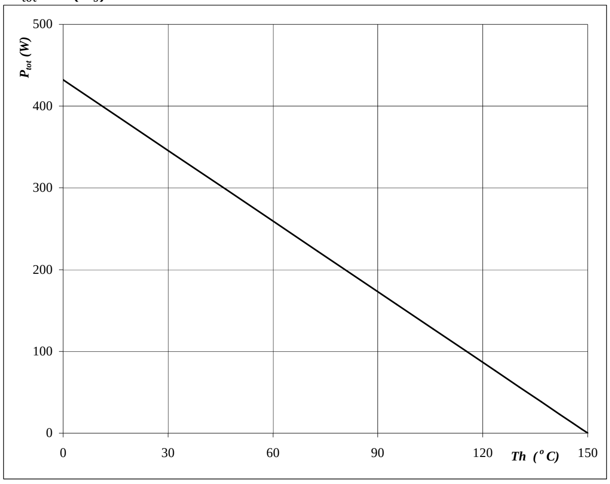
R (K/W)	τ (s)
0,042	2,693
0,072	0,483
0,218	0,064
0,128	0,017
0,125	0,004

Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



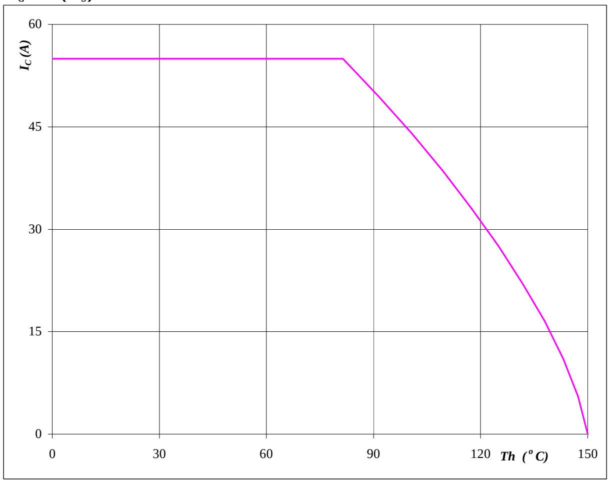
At

T_j = 150 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

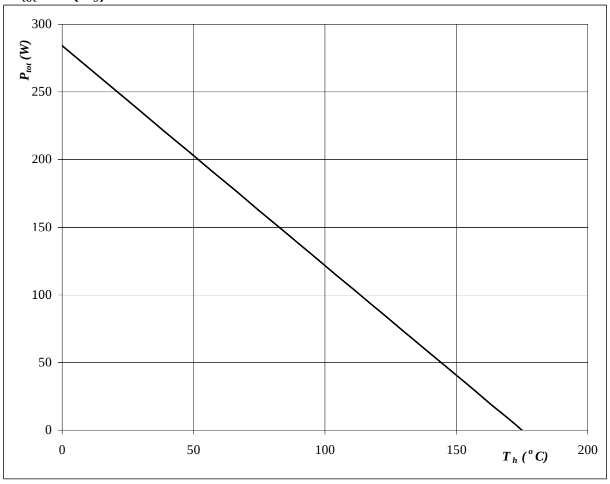
T_j = 150 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



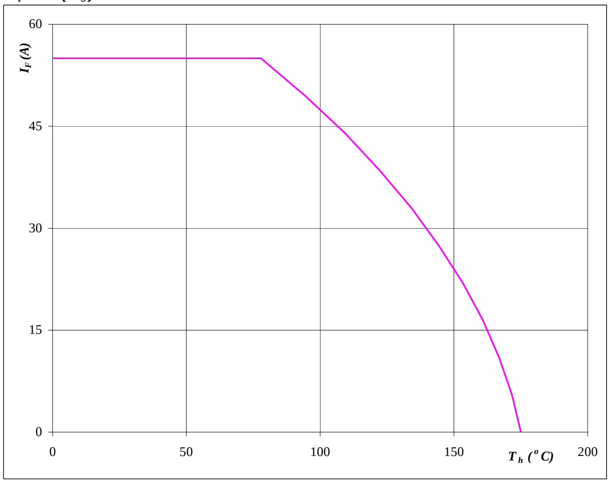
At

T_j = 175 ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



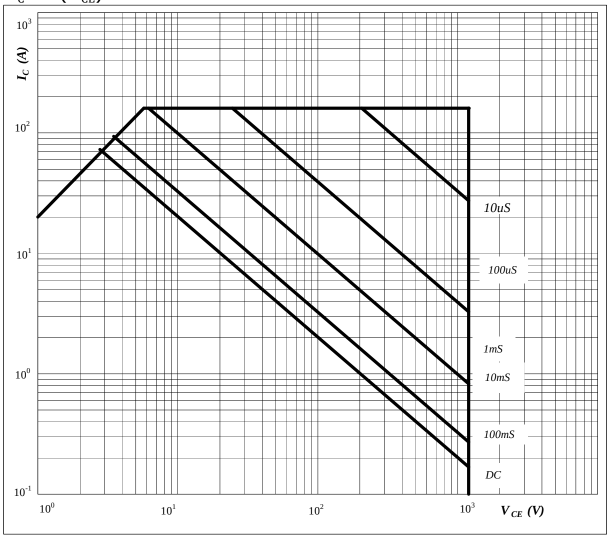
At

T_j = 175 ºC

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



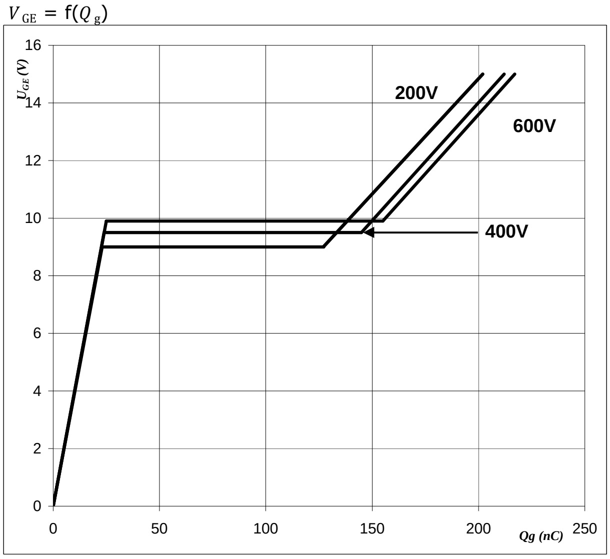
At

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

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



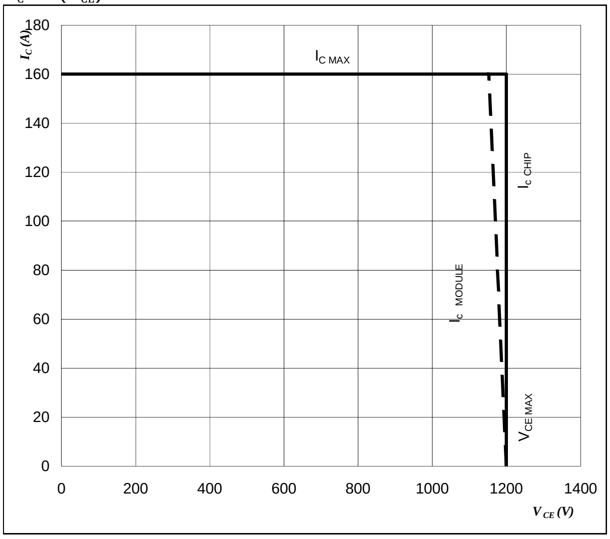
At

I_C = 40 A

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

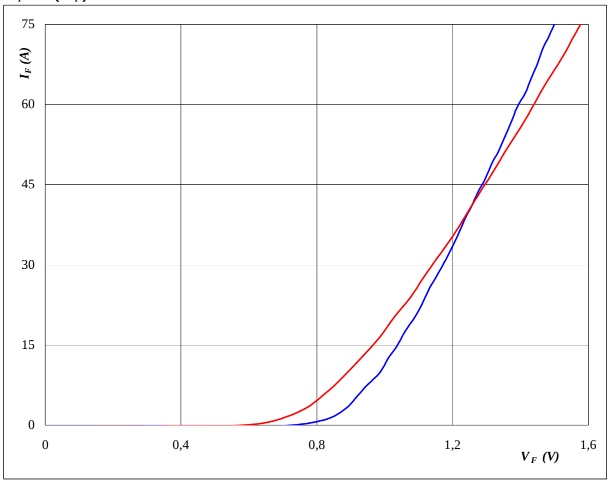
T_{vj} = 150 ºC

Bypass Diode

Figure 1 Rectifier

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

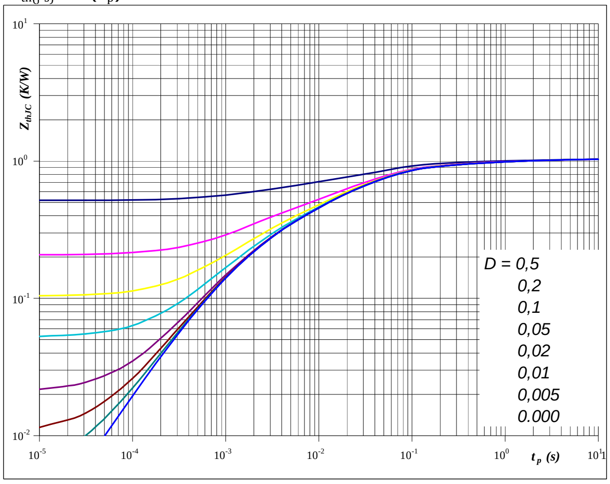
T_j = 25/125 °C

t_p = 250 µs

Figure 2 Rectifier

Diode transient thermal impedance as a function of pulse width

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



At

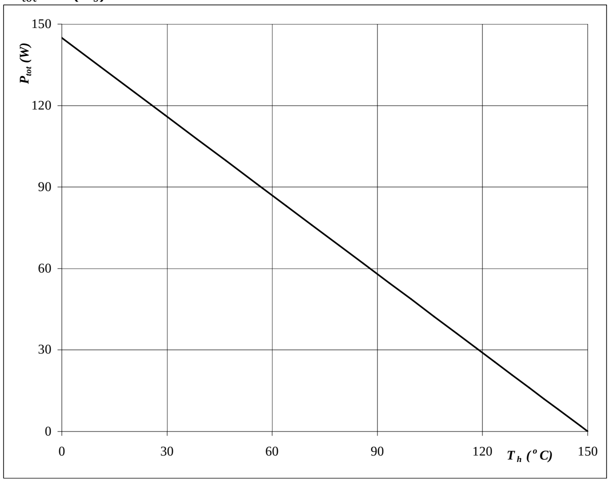
D = t_p / T

$R_{th(j-s)}$ = 1,04 K/W

Figure 3 Rectifier

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



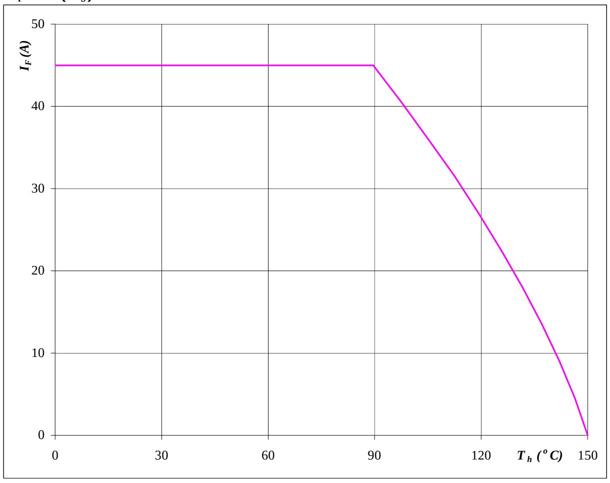
At

T_j = 150 ºC

Figure 4 Rectifier

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

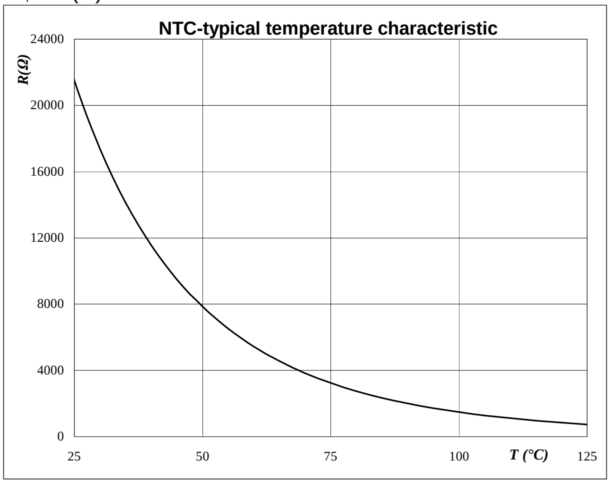
T_j = 150 ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



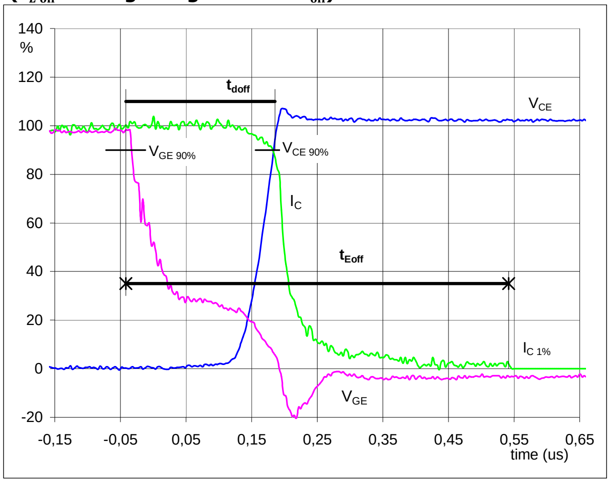
Switching Definitions Boost

General conditions

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

Figure 1 IGBT

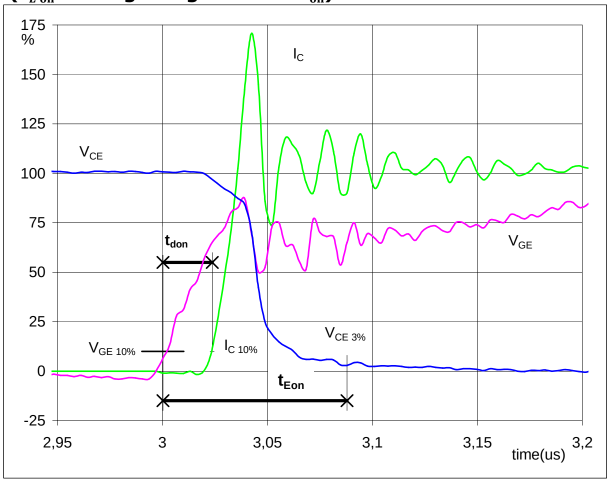
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{doff} =	0,216	μs
$t_{E\,off}$ =	0,583	μs

Figure 2 IGBT

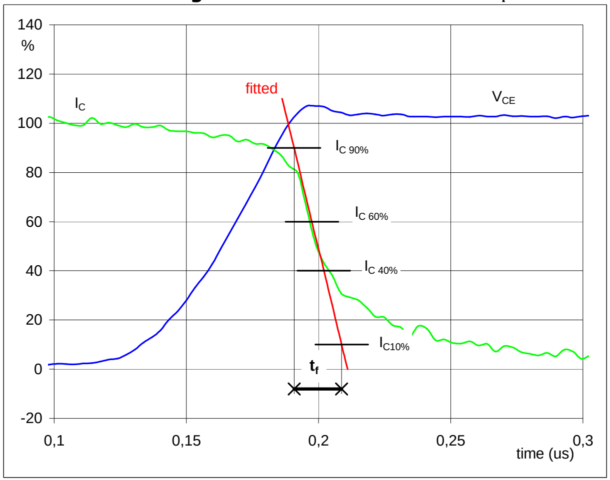
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{don} =	0,023	μs
$t_{E\,on}$ =	0,088	μs

Figure 3 IGBT

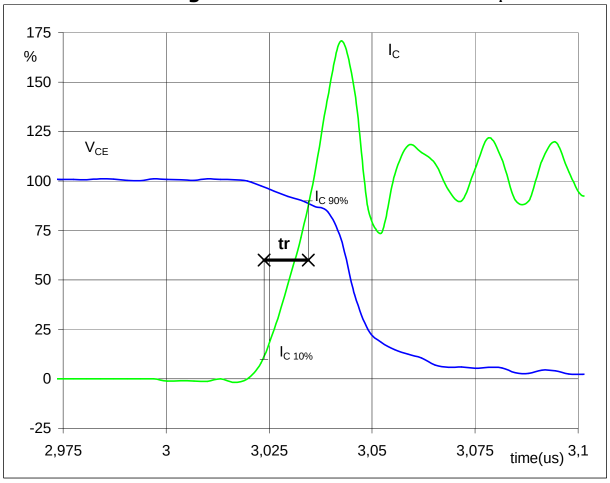
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	40	A
t_f =	0,032	μs

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

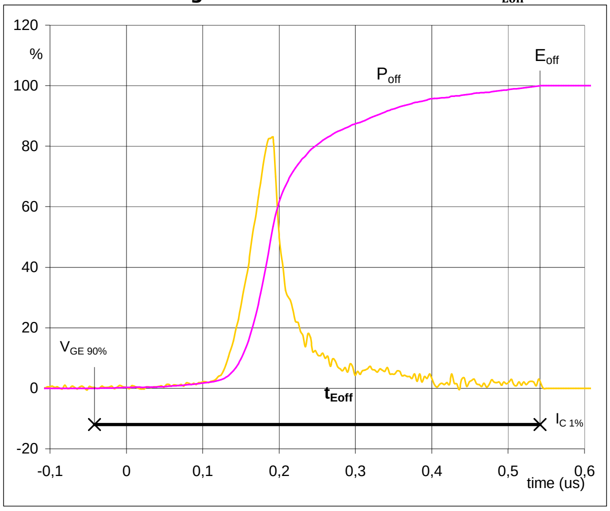


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,011	μs

Switching Definitions Boost

Figure 5 IGBT

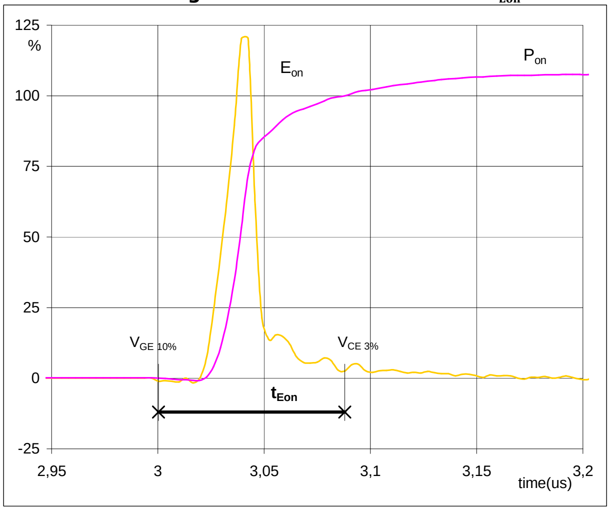
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	27,92	kW
E_{off} (100%) =	1,68	mJ
$t_{E\,off}$ =	0,583	μs

Figure 6 IGBT

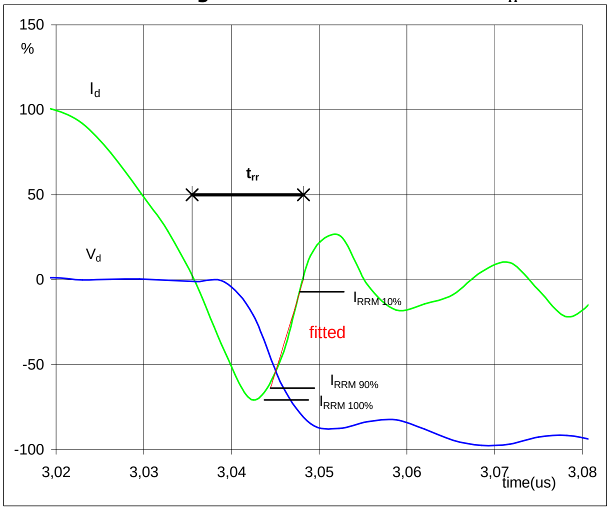
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	27,92	kW
E_{on} (100%) =	0,63	mJ
$t_{E\,on}$ =	0,0877	μs

Figure 7 FWD

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

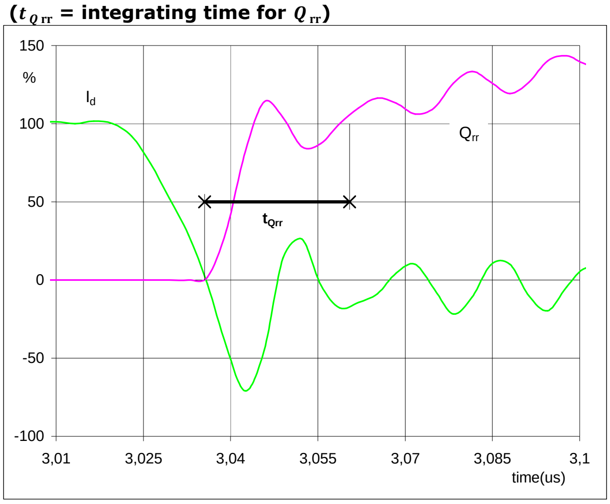


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-28	A
t_{rr} =	0,013	μs

Switching Definitions Boost

Figure 8 FWD

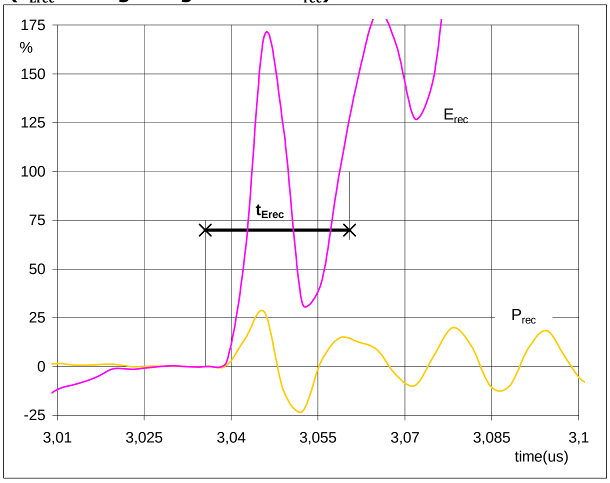
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) = 40 A
Q_{rr} (100%) = 0,19 µC
t_{Qrr} = 0,02 µs

Figure 9 FWD

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



P_{rec} (100%) = 27,92 kW
E_{rec} (100%) = 0,03 mJ
t_{Erec} = 0,02 µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing, solder pins	V23990-P629-L98-PM
without thermal paste 17mm housing, solder pins	V23990-P629-L99-PM
without thermal paste 17mm housing, Press-fit pins	V23990-P629-L99Y-PM

Text	VIN	Date code	Name&Ver	UL	Lot	Serial
	VIN	WWYY	NNNNNNVV	UL	LLLLL	SSSS
Datamatrix	Name&Ver	Lot number	Serial	Date code		
	NNNNNNVV	LLLLL	SSSS	WWYY		

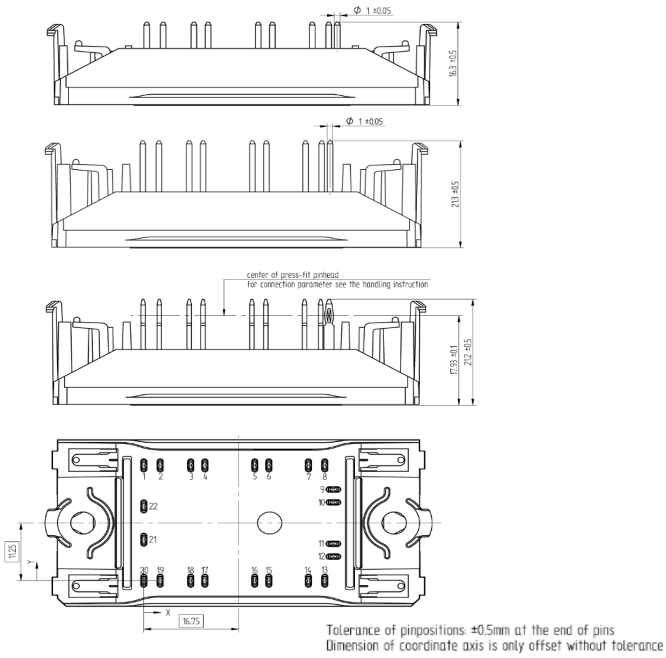
Outline

Pin table			
Pin	X	Y	Function
1	0	22,5	G25
2	2,9	22,5	S25
3	8,3	22,5	DC-Boost1
4	10,8	22,5	DC-Boost1
5	19,6	22,5	DC+Boost
6	22,1	22,5	DC+Boost
7	29,1	22,5	DC+In1
8	32	22,5	DC+In1
9	33,5	17,8	Boost1
10	33,5	15,3	Boost1
11	33,5	7,2	Boost2
12	33,5	4,7	Boost2
13	32	0	DC+In2
14	29,1	0	DC+In2
15	22,1	0	DC+Boost
16	19,6	0	DC+Boost
17	10,8	0	DC-Boost2
18	8,3	0	DC-Boost2
19	2,9	0	S27
20	0	0	G27
21	0	8	Therm1
22	0	14,5	Therm2

12mm housing
solder pins

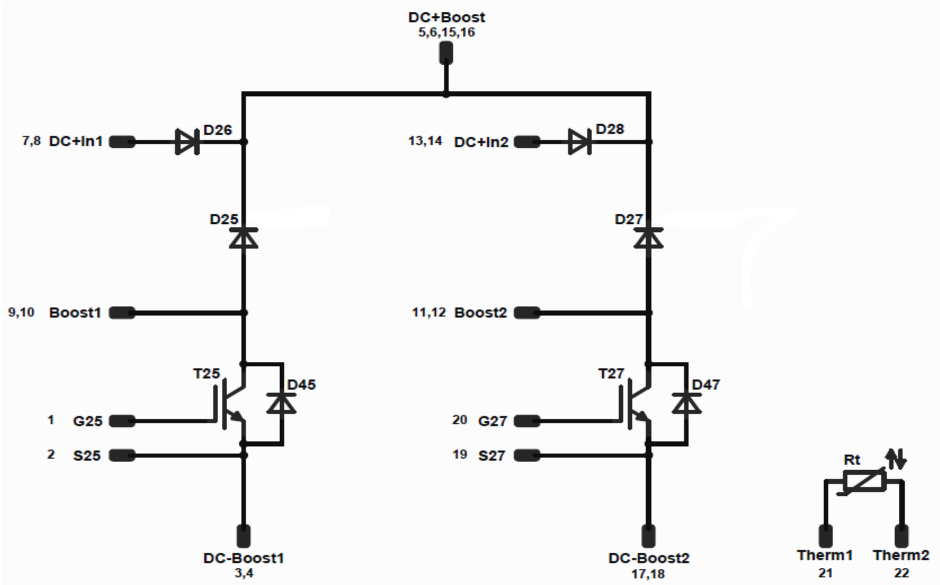
17mm housing
solder pins

17mm housing
Press-fit pins



Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T25,T27	IGBT	1200 V	40 A	Boost Switch	
D25,D27	FWD	1200 V	30 A	Boost Diode	
D45,D47	IGBT	1200 V	3 A	Boost Prot. Diode	
D26,D28	FWD	1600 V	25 A	Bypass Diode	
Rt	Thermistor			Thermistor	

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-L99x-D7-14	22 Jun. 2016	New brand, -L98 version added	all