V23990-P629-L48-PM V23990-P629-L48Y-PM V23990-P629-L49-PM V23990-P629-L49Y-PM

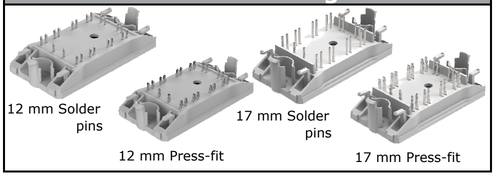
datasheet

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

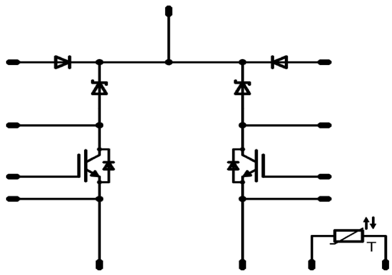
flow 0 housing



Target Applications

- solar inverter

Schematic



Types

- V23990-P629-L48-PM
- V23990-P629-L48Y-PM
- V23990-P629-L49-PM
- V23990-P629-L49Y-PM
- V23990-P629-L49-/3/-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_s = 80 °C	34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms T_j=150°C	200	A
I^2t-value	I^2t		200	A²s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	42	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_s = 80 °C	41	A
Repetitive peak 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} = 15 V	10 800	μs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Diode					
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 = 10 ms	T_c=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
Boost Prot. Diode					
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	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min 12,7	mm
Clearance		12mm housing with solder pins		min 9,55	mm
Comparative Tracking Index	CTI			>200	
Clearance		12mm housing with pressfit pins		min 9,57	mm
Comparative Tracking Index	CTI			>200	
Clearance		17mm housing		min 12,7	mm
Comparative Tracking Index	CTI			>200	

*100% tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Bypass Diode										
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			1600		25			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste}=3,4W/mK (PSX)						1,67		K/W
Boost Switch										
Gate emitter threshold voltage	$V_{GE(th)}$		$V_{GE}=V_{CE}$		0,0015	25	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125	1,7	2,1 2,48	2,6	V
Collector-emitter cut-off	I_{CES}		0	1200		25			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	15	700	40	25 125		35 34,2		ns
Rise time	t_r					25 125		26,4 27,2		
Turn-off delay time	$t_{d(off)}$					25 125		372,2 430,8		
Fall time	t_f					25 125		9,4 69,8		
Turn-on energy loss	E_{on}					25 125		2,061 2,19		mWs
Turn-off energy loss	E_{off}					25 125		1,78 3,039		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		2360		pF
Output capacitance	C_{oss}							230		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_G	f = 1 MHz	0	25	40	25		192		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste}=3,4W/mK (PSX)						0,84		K/W
Boost Diode										
Forward voltage	V_F				10	25 125	1	1,46 1,8	2	V
Reverse leakage current	I_{rm}			1200		25			300	μA
Peak recovery current	I_{RRM}	R_{gon} = 16 Ω	15	700	40	25 125		7,78 8,1		A
Reverse recovery time	t_{rr}					25 125		9,5 9,5		ns
Reverse recovery charge	Q_{rr}					25 125		0,04 0,04		μC
Reverse recovered energy	E_{rec}					25 125		0,002 0,002		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		2480 2790		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste}=3,4W/mK (PSX)						1,88		K/W
Boost Prot. Diode										
Diode forward voltage	V_F				3	25 125	0,70	1,65 1,58	2,40	V
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste}=3,4W/mK (PSX)						2,72		K/W

Characteristic Values

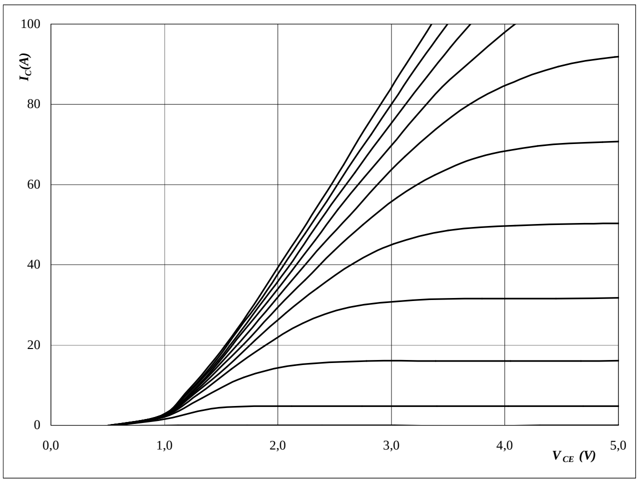
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22,0		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				25	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	B(25/50)	Tol. ±1%				25		3962		K
B-value	B(25/100)	Tol. ±1%				25		4000		K
Vincotech NTC Reference									I	

BOOST Charateristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

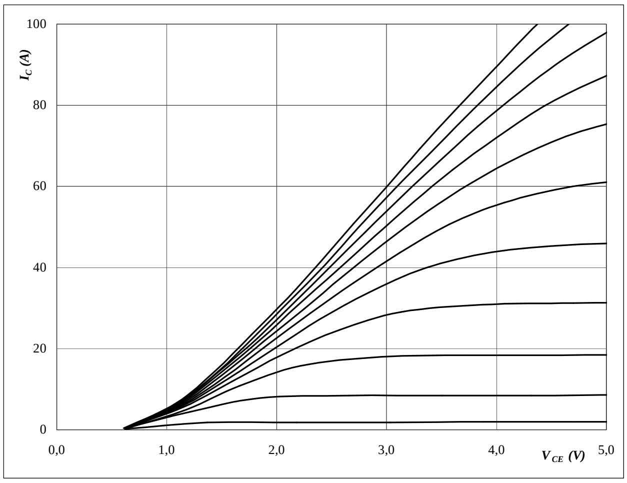
T_j = 25 °C

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

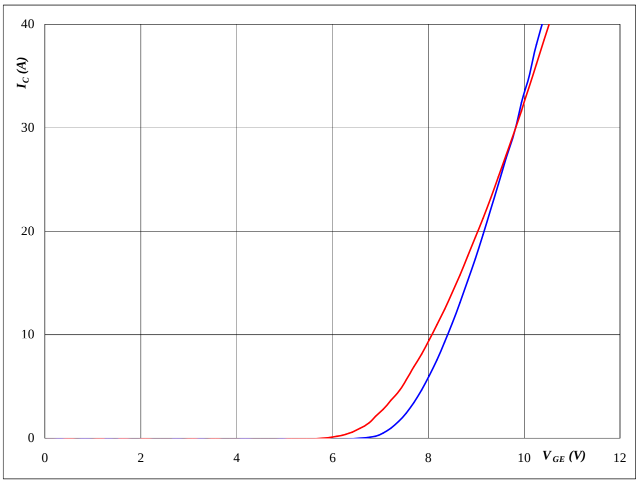
T_j = 125 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GS})$



At

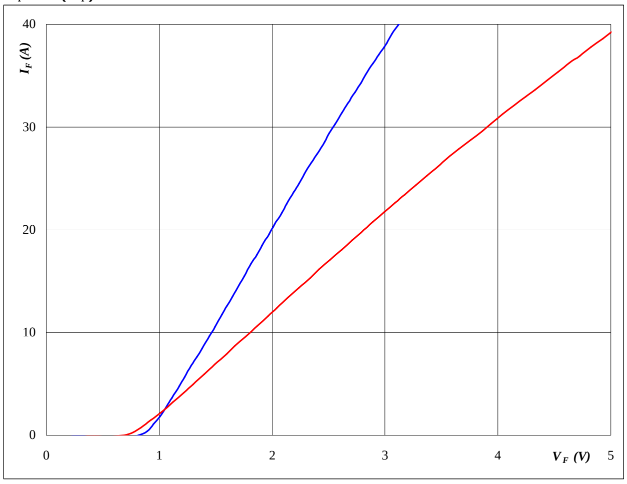
t_p = 250 µs T_j = 25/125 °C

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

T_j = 25/125 °C

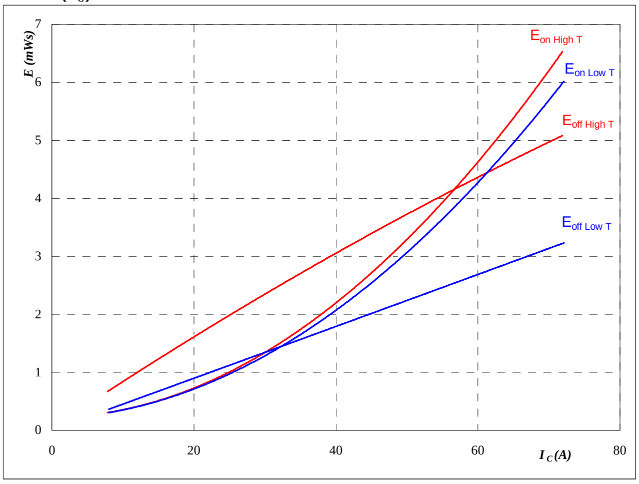
t_p = 250 µs

BOOST Charateristics

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



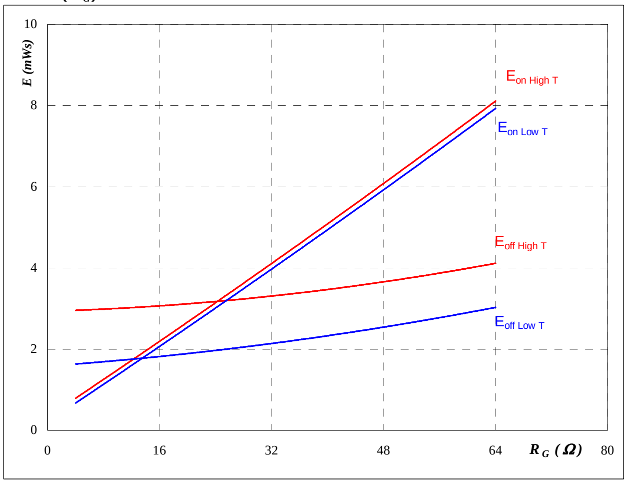
With an inductive load at

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

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



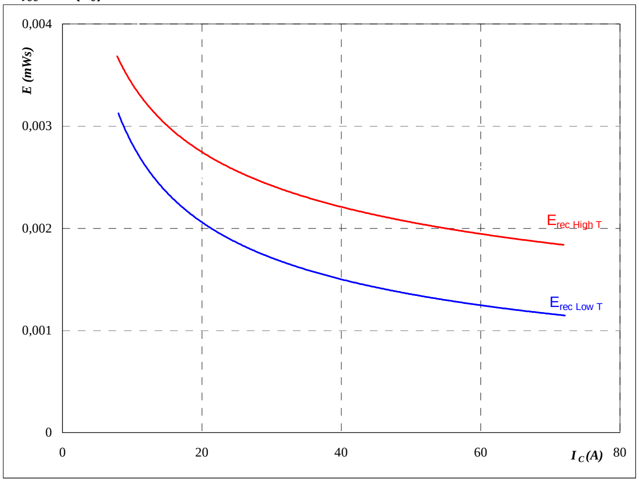
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



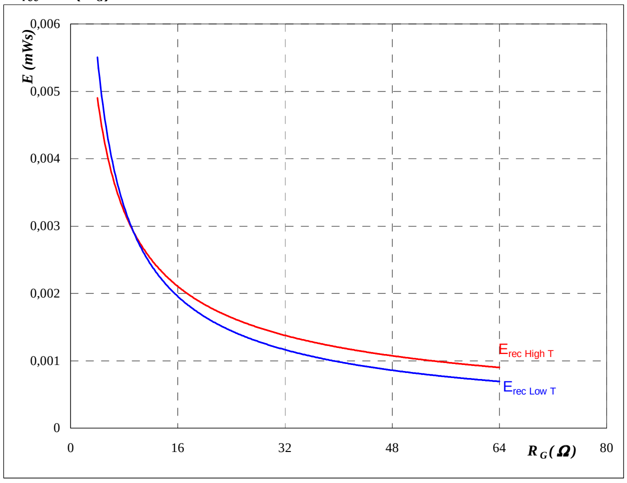
With an inductive load at

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

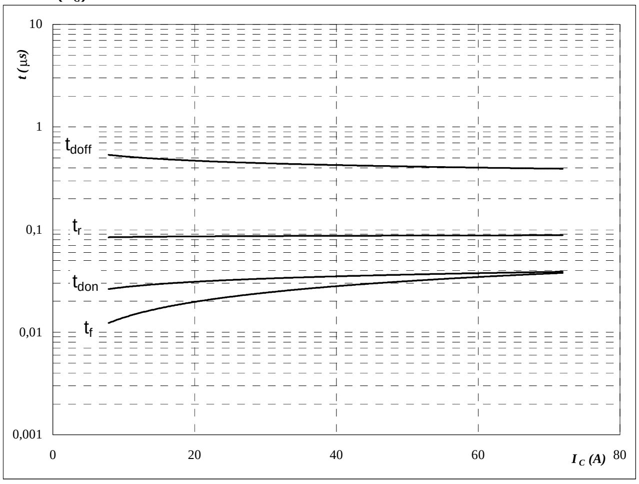
T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	±15	V
I_C =	40	A

BOOST Charateristics

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



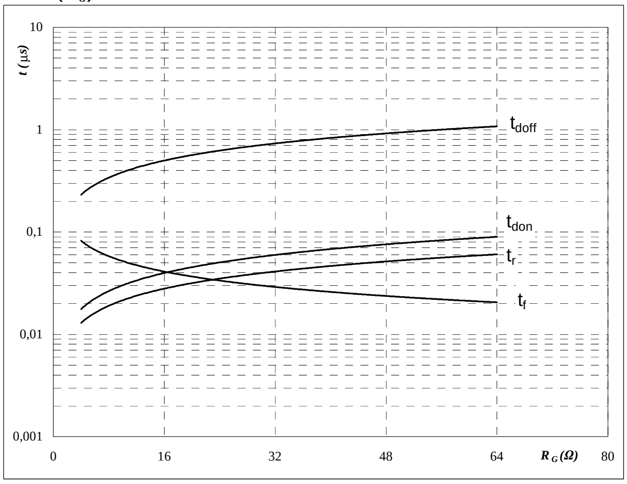
With an inductive load at

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

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



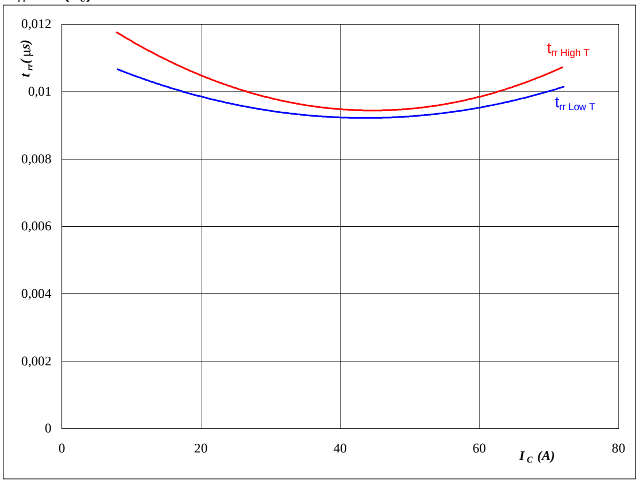
With an inductive load at

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

$t_{rr} = f(I_c)$



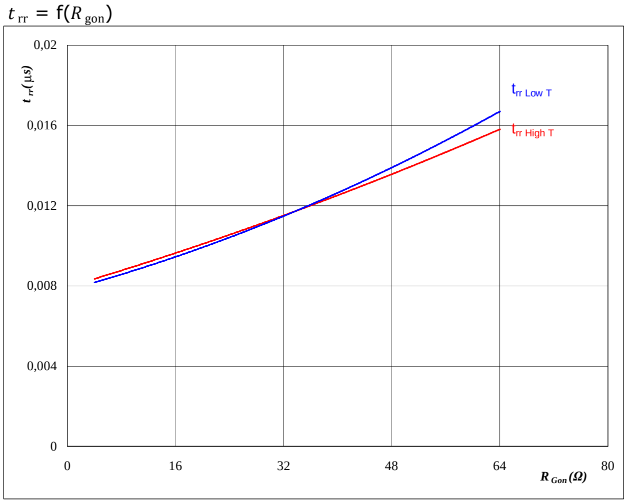
At

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

figure 12. **FWD**

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

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



At

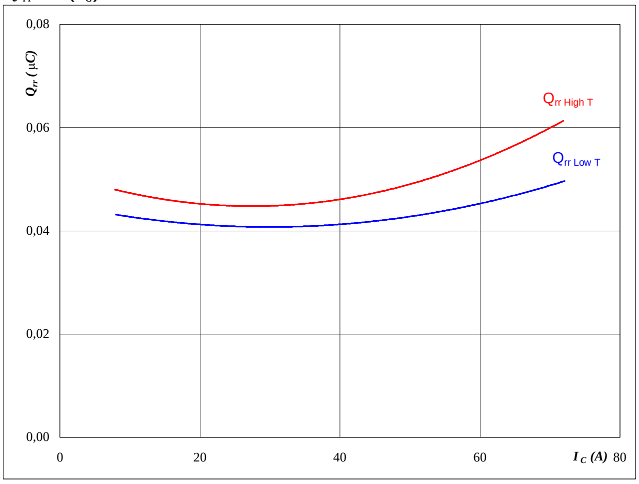
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	±15	V

BOOST Charateristics

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



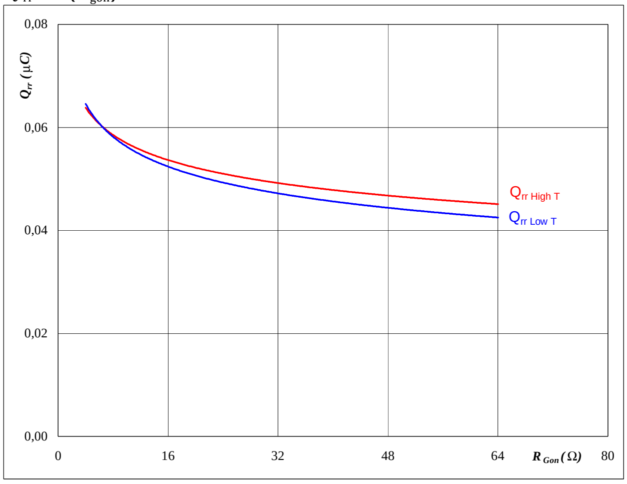
At

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

figure 14. **FWD**

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

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



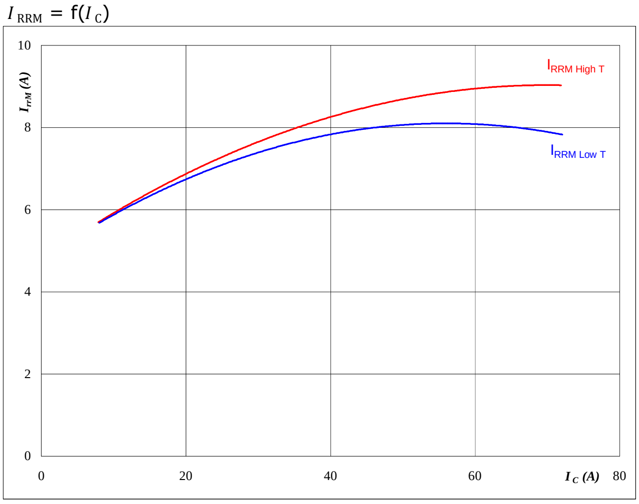
At

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

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



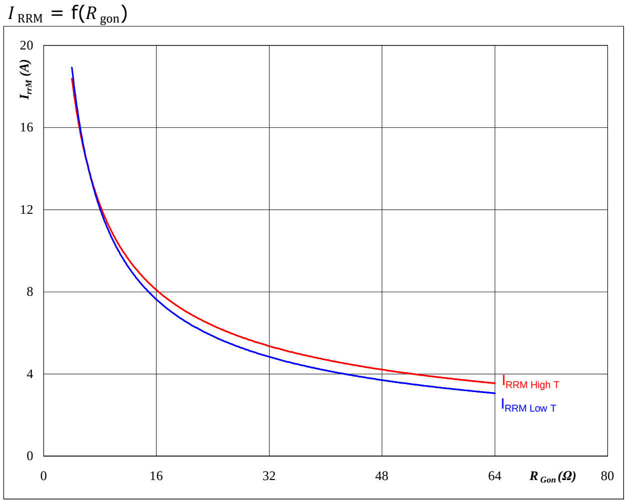
At

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

figure 16. **FWD**

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

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



At

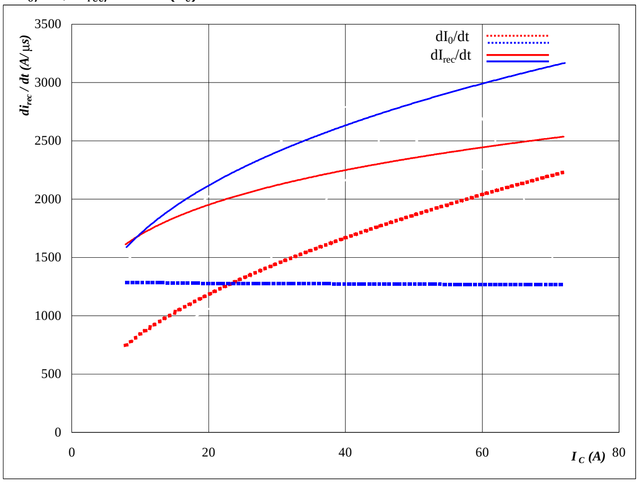
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	±15	V

BOOST Charateristics

figure 17. **FWD**

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

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



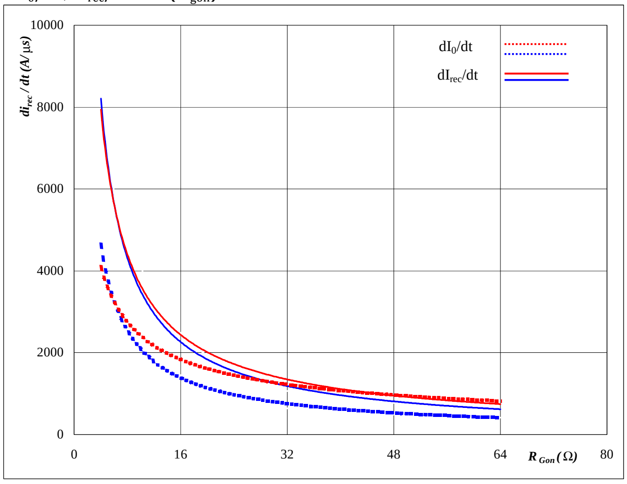
At

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

figure 18. **FWD**

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

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



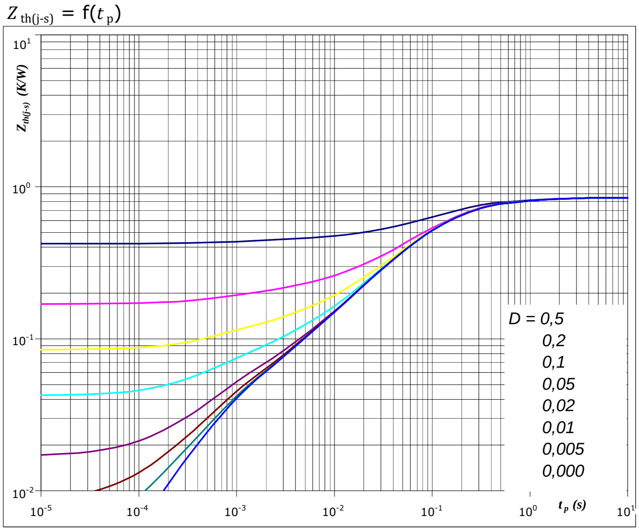
At

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	
$R_{th(j-s)}$ =	0,84	K/W

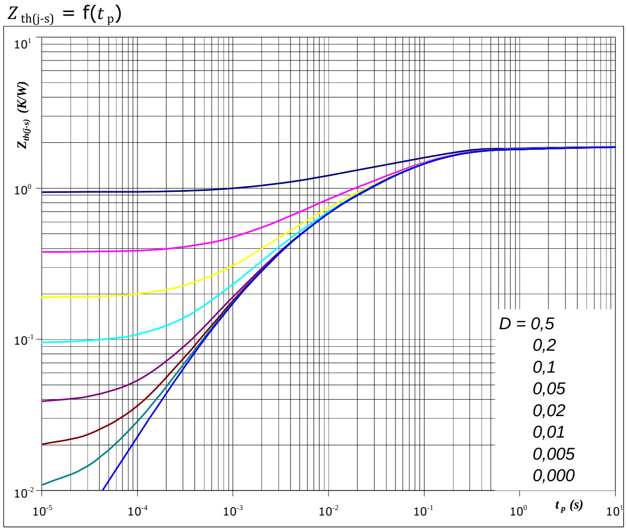
IGBT thermal model values

R (K/W)	T (s)
1,18E-01	8,20E-01
4,24E-01	1,32E-01
2,01E-01	4,79E-02
6,46E-02	9,26E-03
3,72E-02	8,03E-04

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

FWD thermal model values

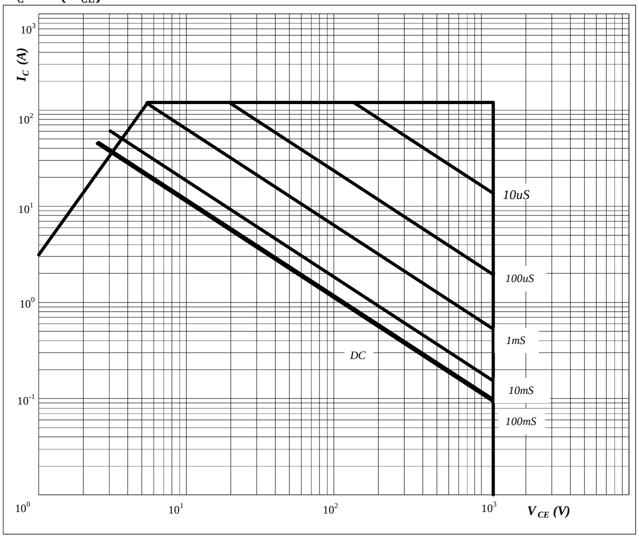
R (K/W)	T (s)
5,58E-02	6,96E+00
1,47E-01	5,43E-01
8,94E-01	7,92E-02
4,33E-01	1,33E-02
2,94E-01	3,03E-03
5,99E-02	6,32E-04

BOOST Charateristics

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



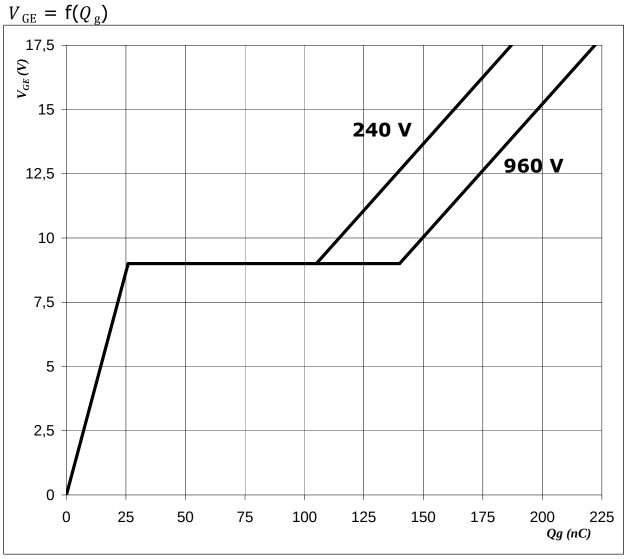
At

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

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



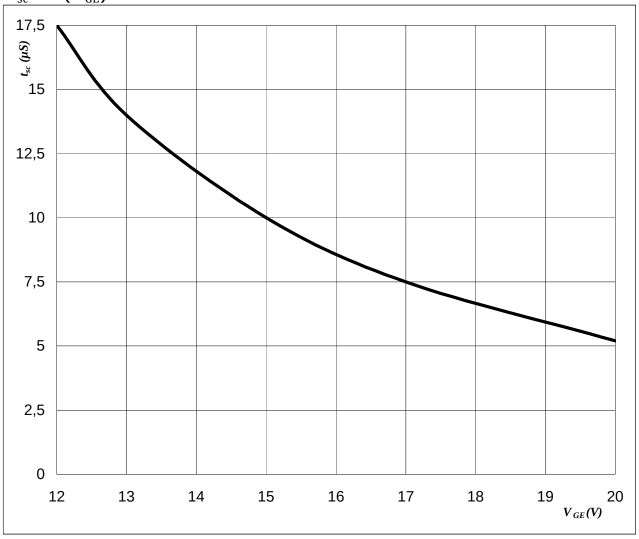
At

I_C =	40	A

figure 27. **IGBT**

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

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



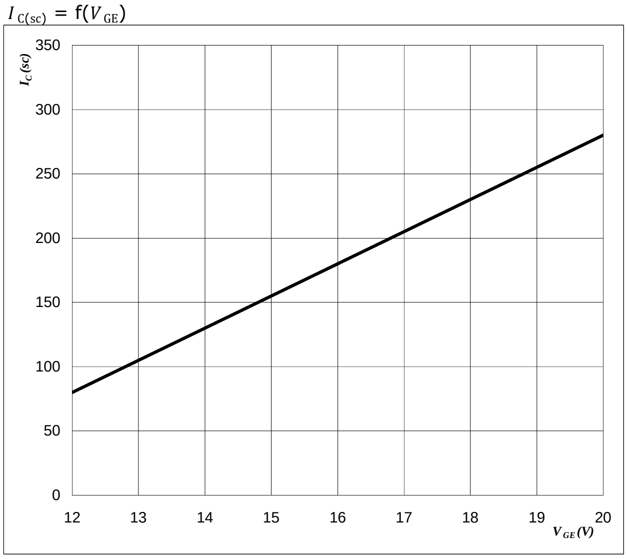
At

V_{CE} =	1200	V
T_j ≤	150	ºC

figure 28. **IGBT**

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

$I_{C(sc)} = f(V_{GE})$



At

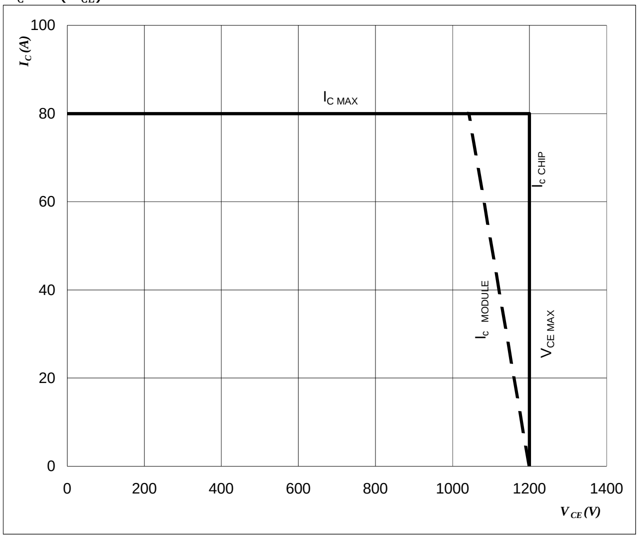
V_{CE} ≤	1200	V
T_j =	150	ºC

BOOST Charateristics

figure 29.	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

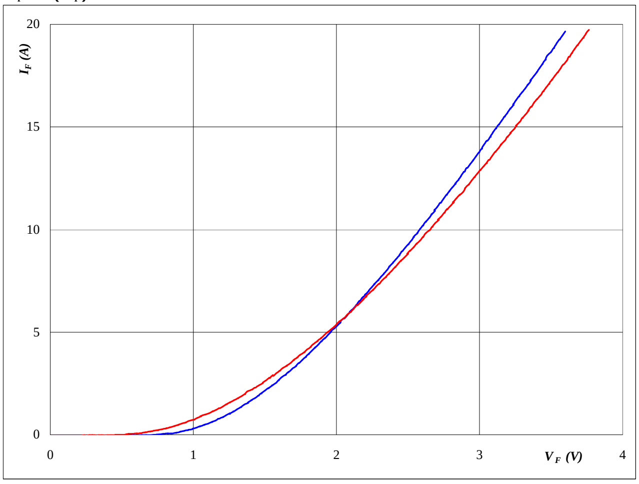
T_j =	T_{jmax}-25	ºC	R_{gon} =	16	Ω
			R_{goff} =	16	Ω

BOOST Inv. Diode Charateristics

figure 1. **BOOST INV. Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

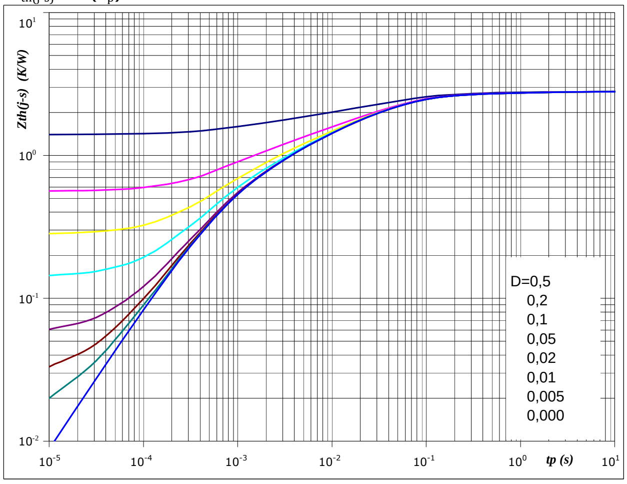
T_j = 25/125 °C

t_p = 250 µs

figure 2. **BOOST INV. Diode**

Diode transient thermal impedance as a function of pulse width

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



At

D = t_p / T

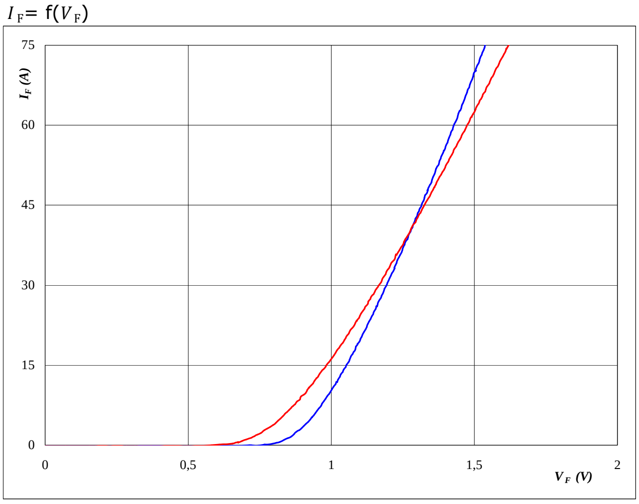
$R_{th(j\text{-}s)}$ = 2,80 K/W

Bypass Diode Charateristics

figure 1. **Bypass diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

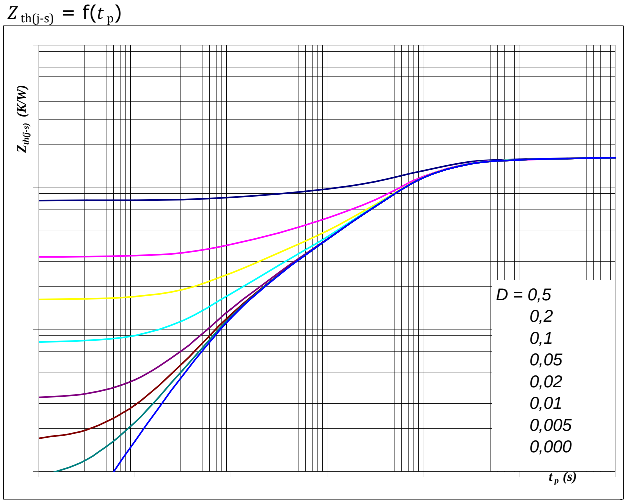
T_j = 25/125 °C

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

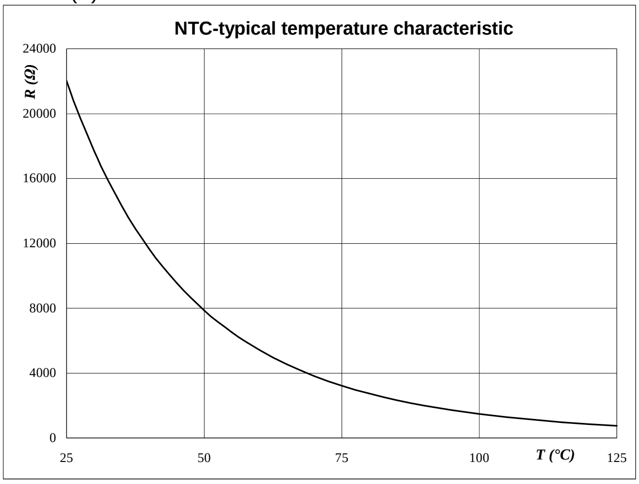
$R_{th(j\text{-}s)}$ = 1,61 K/W

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



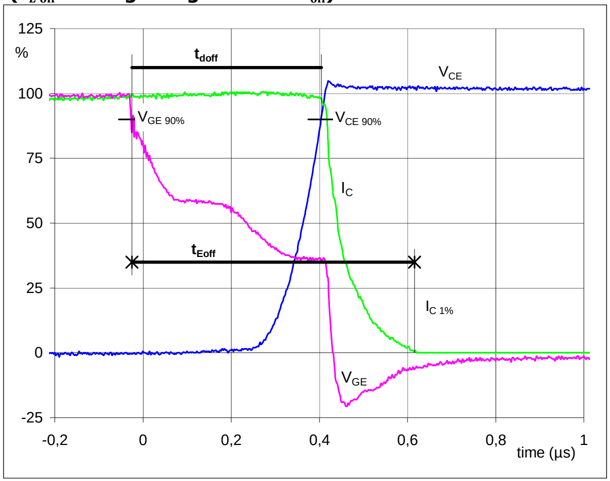
BOOST Switching Definitions

General conditions

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

figure 1. **IGBT**

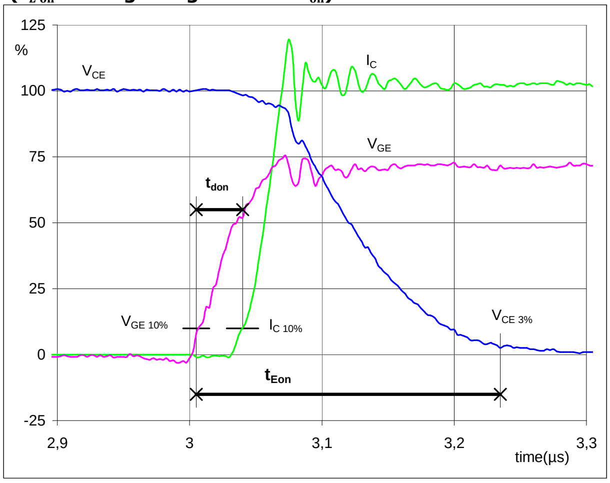
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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

figure 2. **IGBT**

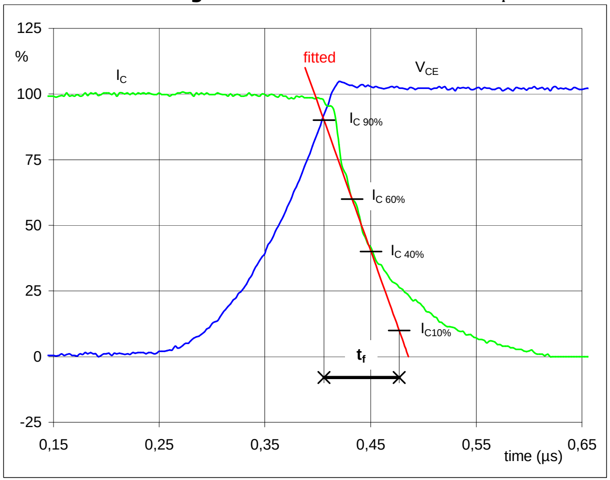
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



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

figure 3. **IGBT**

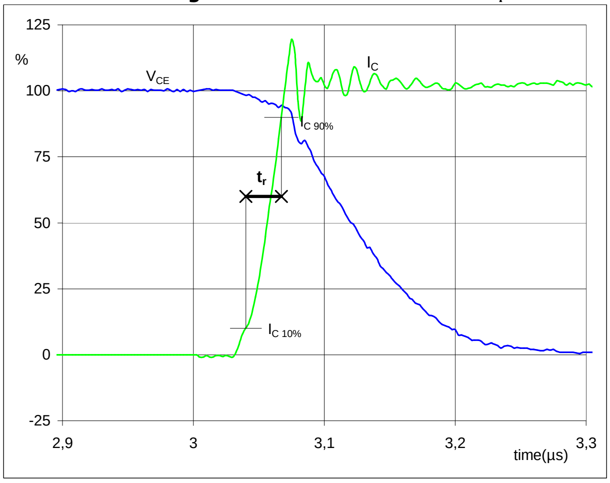
Turn-off Switching Waveforms & definition of t_f



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

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

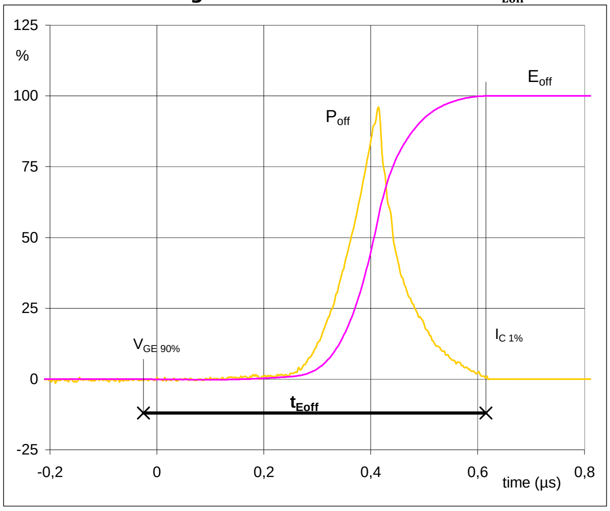


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,027	µs

BOOST Switching Definitions

figure 5. **IGBT**

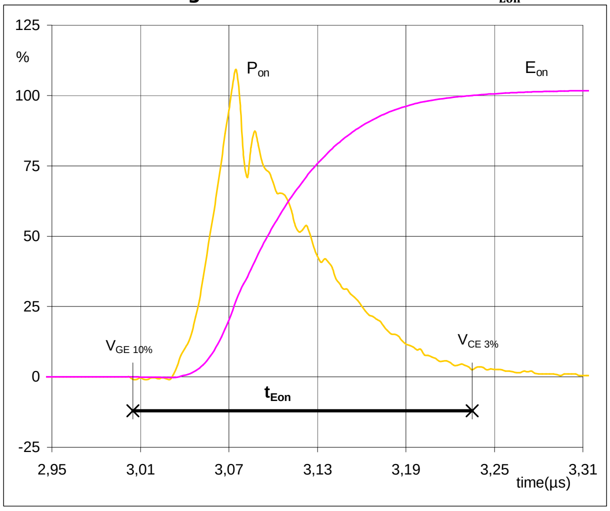
Turn-off Switching Waveforms & definition of t_{Eoff}



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

figure 6. **IGBT**

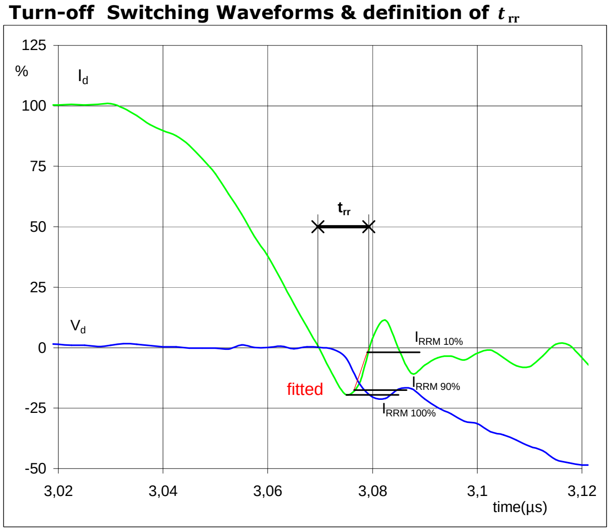
Turn-on Switching Waveforms & definition of t_{Eon}



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

figure 7. **FWD**

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

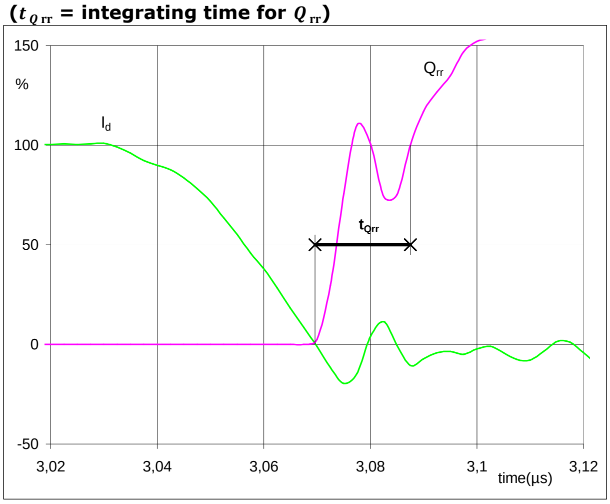


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-8	A
t_{rr} =	0,01	µs

BOOST Switching Definitions

figure 8.	FWD

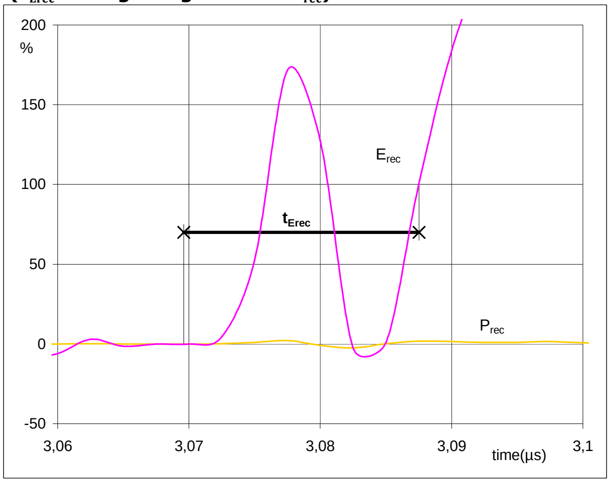
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



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

figure 9.	FWD

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

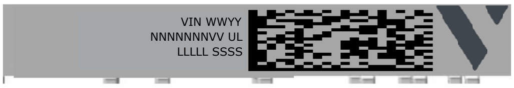


P_{rec} (100%) =	28,10	kW
E_{rec} (100%) =	0,002	mJ
$t_{E\,rec}$ =	0,018	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with Solder pins	V23990-P629-L48-PM
without thermal paste 12 mm housing with Press-fit	V23990-P629-L48Y-PM
without thermal paste 17 mm housing with Solder pins	V23990-P629-L49-PM
without thermal paste 17 mm housing with Press-fit	V23990-P629-L49Y-PM
with thermal paste 17 mm housing with Solder pins	V23990-P629-L49-/3/-PM

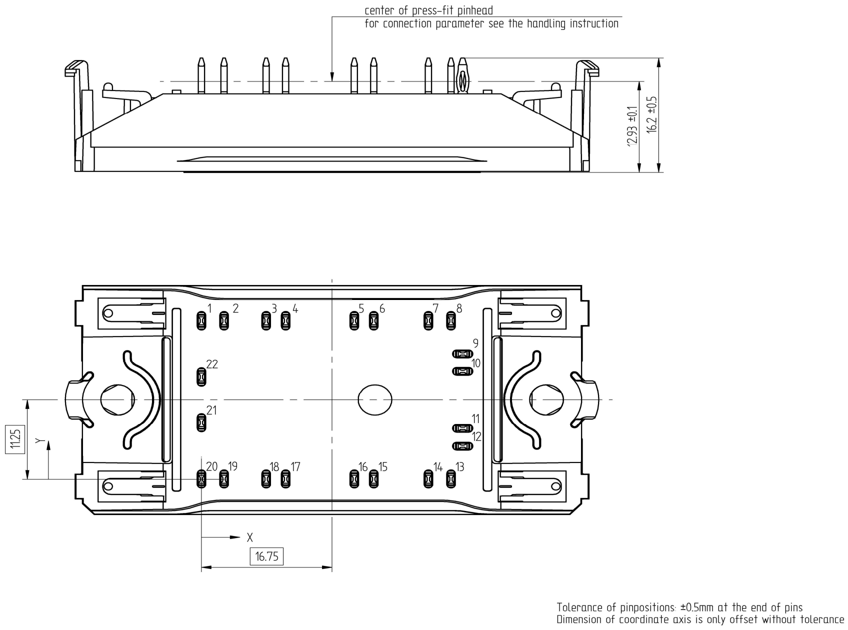


Text	VIN	Date code	Name&Ver	UL	Lot	Serial
	VIN	WWYY	NNNNNNVV	UL	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

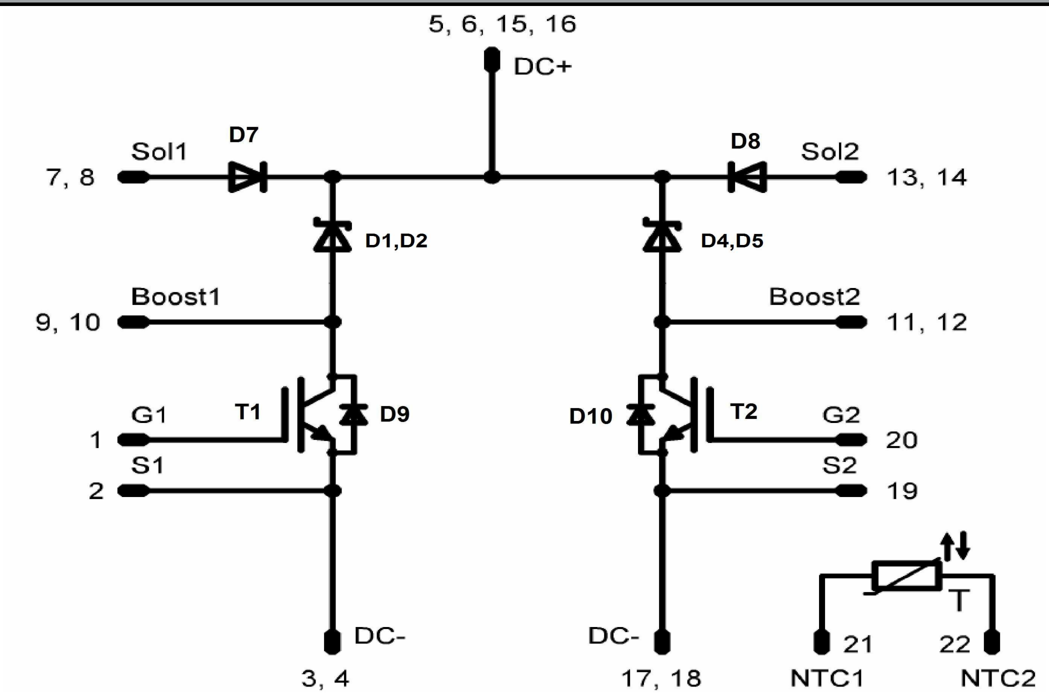
Outline

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



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2	IGBT	1200 V	40 A	Boost Switch	
D1, D2, D4, D5	FWD	1200 V	10 A	Boost FWD	
D7, D8	FWD	1200 V	25 A	Bypass Diode	
D9, D10	FWD	1200 V	3 A	Boost Protection Switch Diode	
NTC	NTC			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-L4*-PM-D4-14	16. Feb. 2018	New style, NTC changed	All