Vincotech

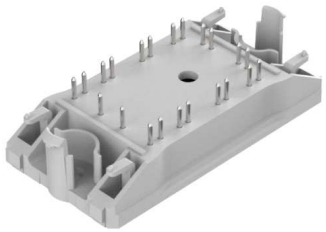
V23990-P629-L81-PM
datasheet

flow BOOST 0 SiC — 1200 V / 80 mΩ

Features

- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductive Layout
- 1200V SiC MOSFET (Rohm) and 1200V SiC diode (Rohm)
- Integrated bypass diode

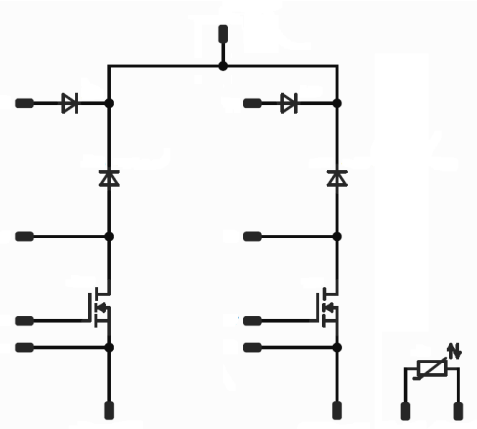
flow 0 12mm housing



Target applications

- Solar Inverter
- UPS

Schematic



Types

- V23990-P629-L81-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current	I_D	$T_j = T_{jmax}$	T_s= 80 °C	20	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		140	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	68	W
Gate-source voltage	V_{GSS}			-6/+22	V
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Condition	Value	Unit
Boost Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80°C$	19	A
Repetitive peak forward current	I_{FRM}		50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80°C$	56	W
Maximum Junction Temperature	T_{jmax}		175	°C
Bypass Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80°C$	33	A
Surge (non-repetitive) forward current	I_{FSM}	60 Hz Single Half Sine Wave $t_p = 8,3$ ms $T_j = 150°C$	200	A
Surge current capability	I^2t		200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80°C$	43	W
Maximum Junction Temperature	T_{jmax}		150	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…+(T_{jmax} - 25)	°C

Isolation Properties						
Isolation voltage	V_{isol}		DC voltage	t_p=2s	4000	V
Creepage distance					min 12,7	mm
Clearance					9,55	mm
Comparative Tracking Index	CTI				>200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j[°C]	Min	Typ	Max	
Boost Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		18		10	25 125 150		79 108 121	111	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,0044	25 125	1,7*	3	4**	V
Gate to Source Leakage Current	I_{GSS}		-6/+22	0		25 125			±100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25 125			10	µA
Internal gate resistance	r_g							9		Ω
Gate charge	Q_g		18	400	10	25		110		nC
Gate to source charge	Q_{GS}							24		
Gate to drain charge	Q_{GD}							38		
Short-circuit input capacitance	C_{iss}	f=1MHz	0	800		25		2070		pF
Short-circuit output capacitance	C_{oss}							80		
Reverse transfer capacitance	C_{rss}							20		

* V_{GS}=-6V for 100msec is applied. Measuring time: 2.5msec.
** V_{GS}=+22V for 100msec is applied. Measuring time: 2.5msec.

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4 W/mK						1,41		K/W

MOSFET Switching

Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	+16/0	700	16	25 125		15 14		ns
Rise time	t_r					25 125		8 7		
Turn-off delay time	$t_{d(off)}$					25 125		113 129		
Fall time	t_f					25 125		5 5		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,1 µC Q_{rFWD} = 0,1 µC				25 125		0,399 0,303		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,174 0,186		

Boost Diode

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j[°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				10	25 125 150		1,40 1,70 1,83	1,6	V
Reverse leakage current	I_r			1200		25 150			200	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,7		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 1914 A/µs di/dt = 2353 A/µs	+16/0	700	16	25 125		9 10		A
Reverse recovery time	t_{rr}					25 125		9 9		ns
Recovered charge	Q_r					25 125		0,083 0,102		µC
Reverse recovered energy	E_{rec}					25 125		0,018 0,029		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		3218 3711		A/µs

Bypass Diode

Static										
Forward voltage	V_F				25	25 125		1,22 1,21	1,9	V
Reverse leakage current	I_r			1600		25 150			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,61		K/W

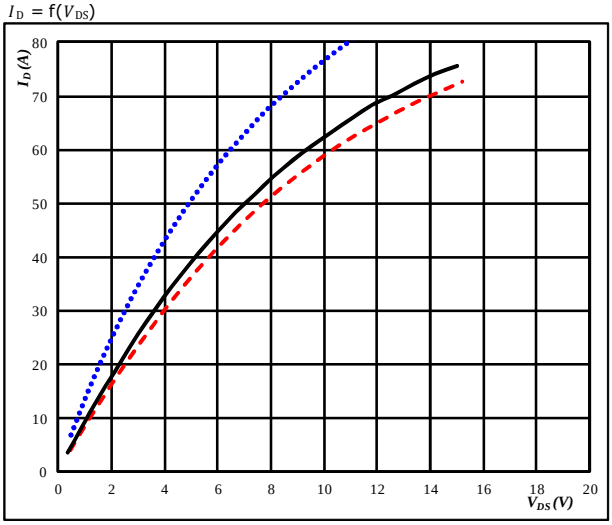
Thermistor

Rated resistance	R					25		21,5		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-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	

Boost Switch Characteristics

Typical output characteristics **MOSFET**

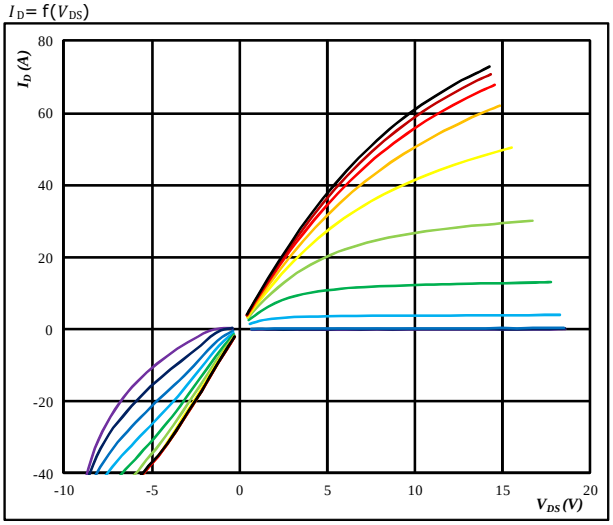
$I_D = f(V_{DS})$



t_p =	250	µs		25 °C
V_{GS}=	18	V	T_j:	125 °C
				150 °C

Typical output characteristics **MOSFET**

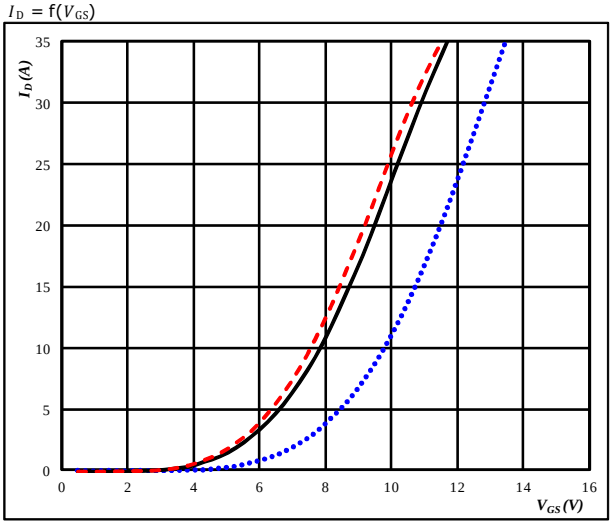
$I_D = f(V_{DS})$



t_p =	250	µs
T_j =	150	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

Typical transfer characteristics **MOSFET**

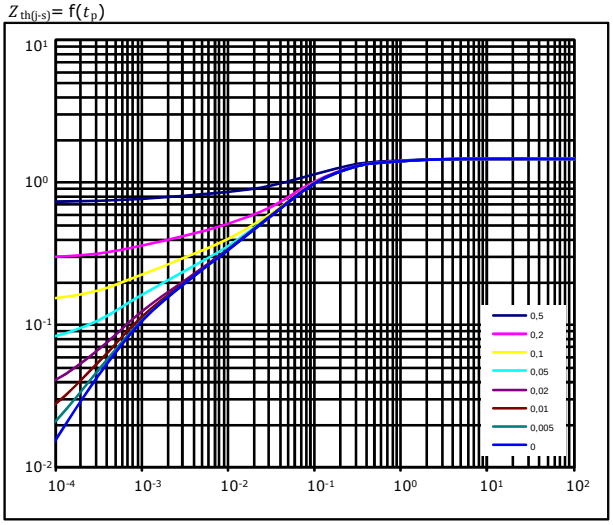
$I_D = f(V_{GS})$



t_p =	100	µs		25 °C
V_{DS} =	10	V	T_j:	125 °C
				150 °C

Transient thermal impedance as a function of pulse width **MOSFET**

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



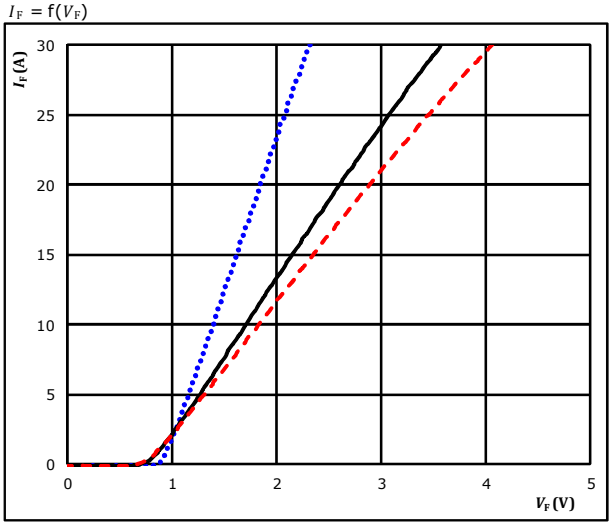
D =	t_p / T	
$R_{th(j-s)}$ =	1,48	K/W

R (K/W)	Tau(s)
1,30E-01	1,00E+00
4,11E-01	1,66E-01
7,09E-01	6,11E-02
1,27E-01	5,50E-03
1,00E-01	8,02E-04

Boost Diode Characteristics

Typical forward characteristics **FWD**

$I_F = f(V_F)$

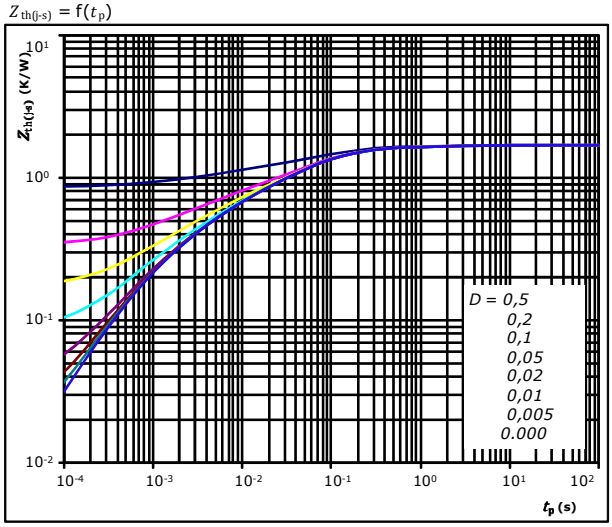


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width **FWD**

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



D = t_p / T

$R_{th(j-s)}$ = 1,7 K/W

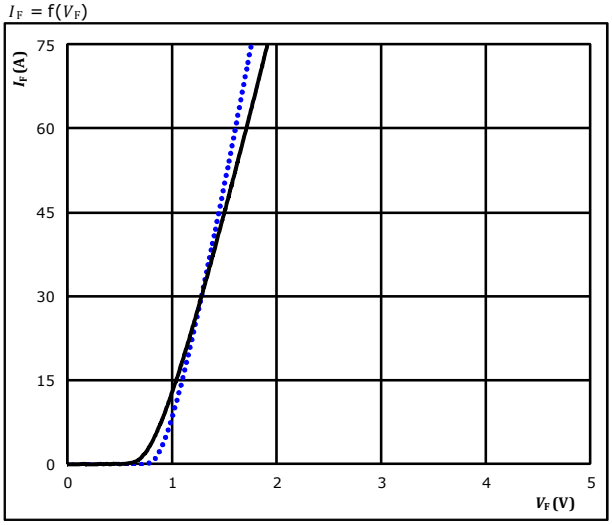
FWD thermal model values

R (K/W)	τ (s)
4,5560E-02	3,2070E+00
1,6530E-01	3,8810E-01
7,8640E-01	6,5190E-02
3,2730E-01	1,1130E-02
2,5420E-01	2,7080E-03
1,2040E-01	6,1510E-04

Bypass Diode Characteristics

Typical forward characteristics **Bypass diode**

$I_F = f(V_F)$

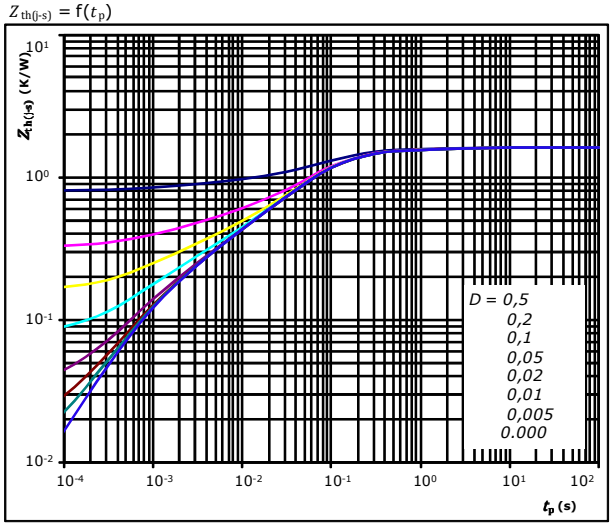


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width **Bypass diode**

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



D = t_p / T

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

Diode thermal model values

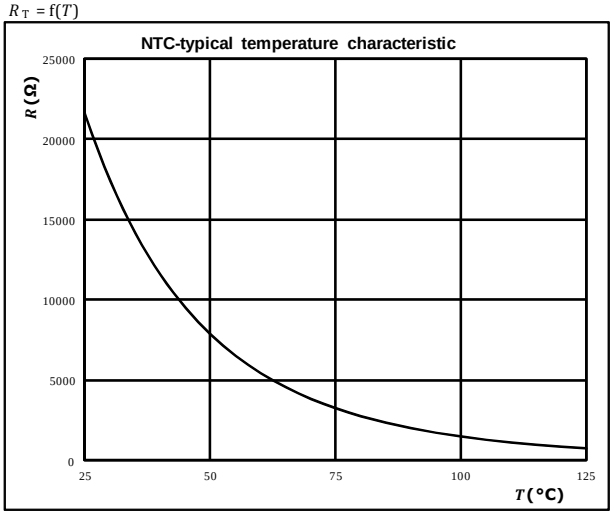
R (K/W)	τ (s)
6,7170E-02	2,7200E+00
1,4760E-01	4,1400E-01
8,6760E-01	8,3320E-02
2,5310E-01	2,8890E-02
1,6900E-01	5,1460E-03
1,0640E-01	9,0980E-04

Thermistor

Thermistor typical temperature characteristic

Typical NTC characteristic as a function of temperature

$R_T = f(T)$

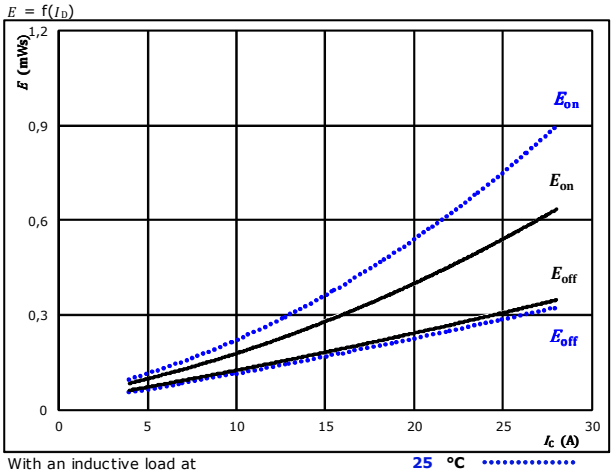


Boost Switching Characteristics

Figure 1. **MOSFET**

Typical switching energy losses as a function of collector current

$E = f(I_D)$



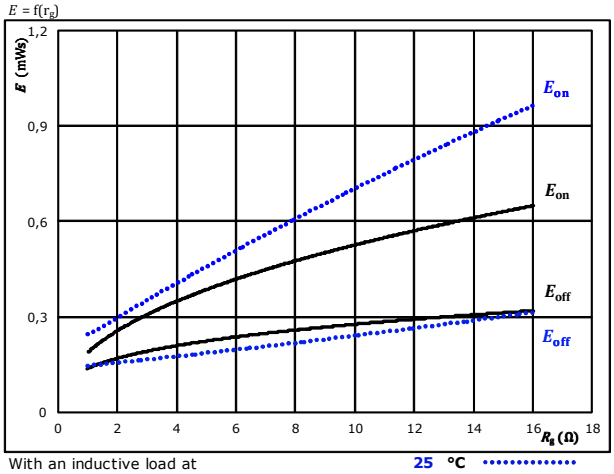
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C
V_{GS} =	+16/0	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

Figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



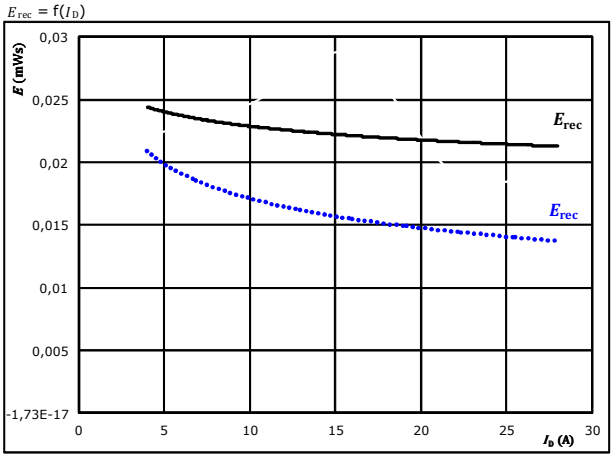
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C
V_{GS} =	+16/0	V		125 °C
I_D =	16	A		150 °C

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_D)$



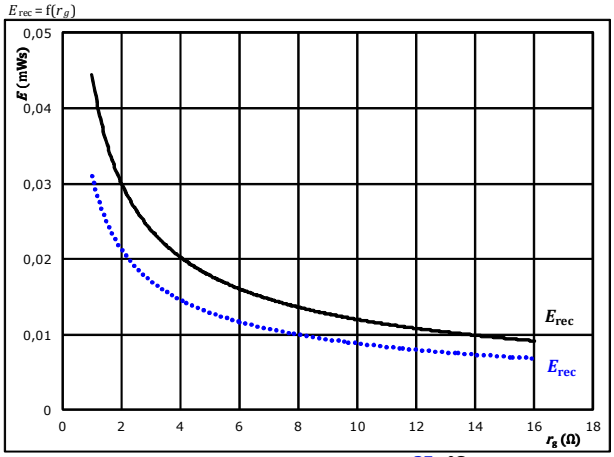
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C
V_{GS} =	+16/0	V		125 °C
R_{gon} =	4	Ω		150 °C

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

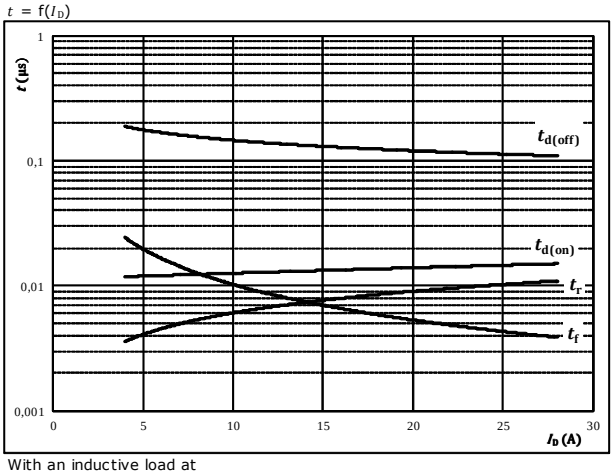
V_{DS} =	700	V	T_j:	25 °C
V_{GS} =	+16/0	V		125 °C
I_D =	16	A		150 °C

Boost Switching Characteristics

Figure 5. **MOSFET**

Typical switching times as a function of collector current

$t = f(I_D)$



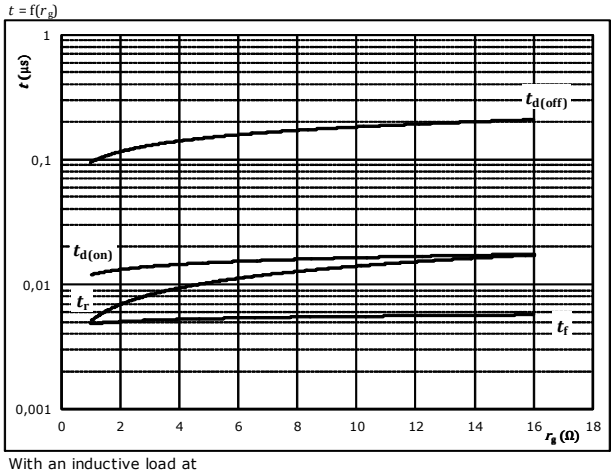
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	+16/0	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(r_g)$



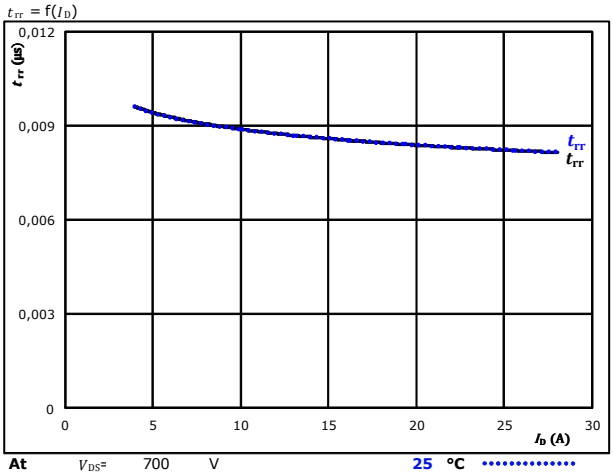
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	+16/0	V
I_D =	16	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_D)$

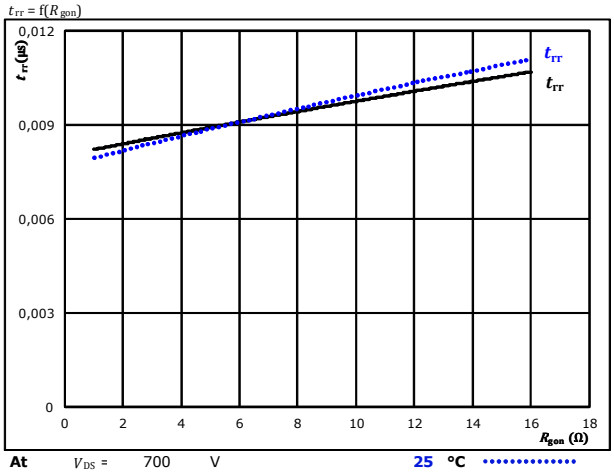


At					
V_{DS}=	700	V		25 °C	•••••••••••••••
V_{GS} =	+16/0	V	T_j:	125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –

Figure 8. **FWD**

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

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



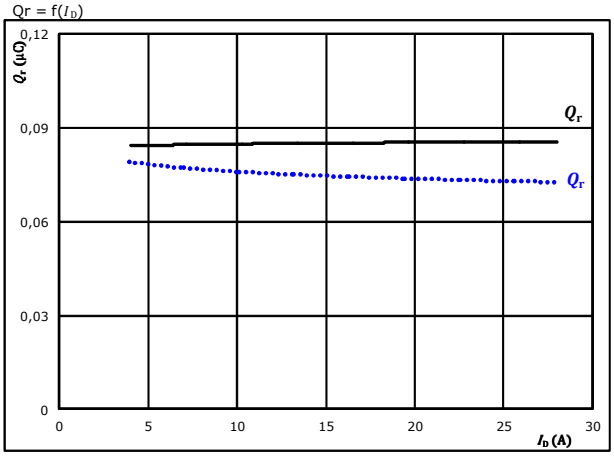
At					
V_{DS} =	700	V		25 °C	•••••••••••••••
V_{GS} =	+16/0	V	T_j:	125 °C	———
I_D =	16	A		150 °C	– – – –

Boost Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

Qr = f(I_D)

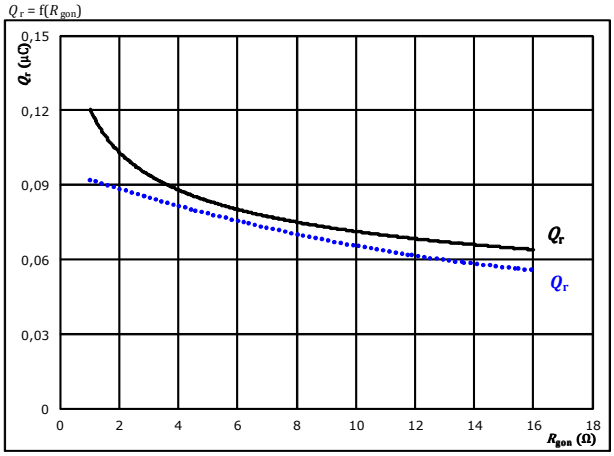


A	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	R_{gon} =	4	Ω		150 °C	

Figure 10. **FWD**

Typical recoved charge as a function of MOSFET turn on gate resistor

Q_r = f(R_{gon})

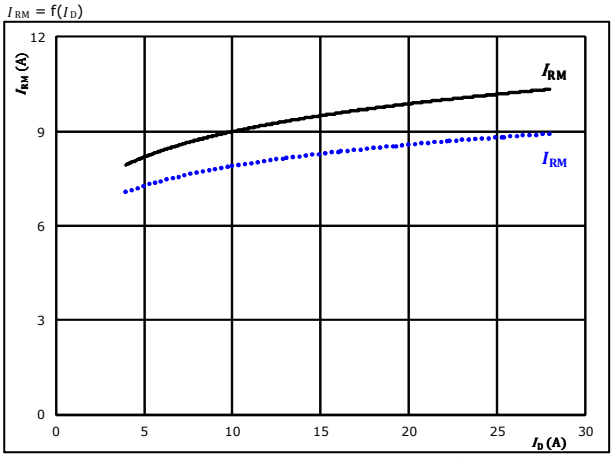


At	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	I_D =	16	A		150 °C	

Figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

I_{RM} = f(I_D)

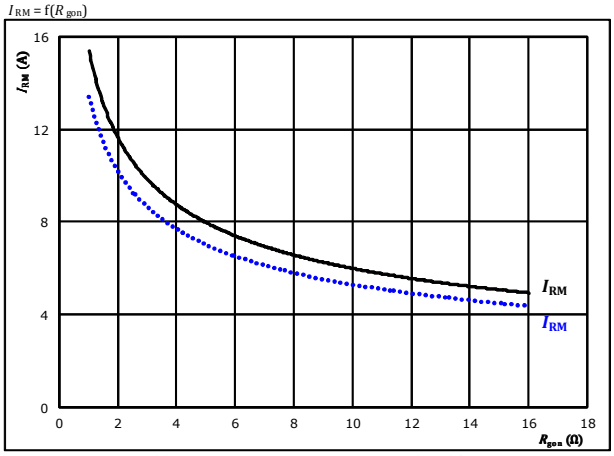


At	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	R_{gon} =	4	Ω		150 °C	

Figure 12. **FWD**

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

I_{RM} = f(R_{gon})



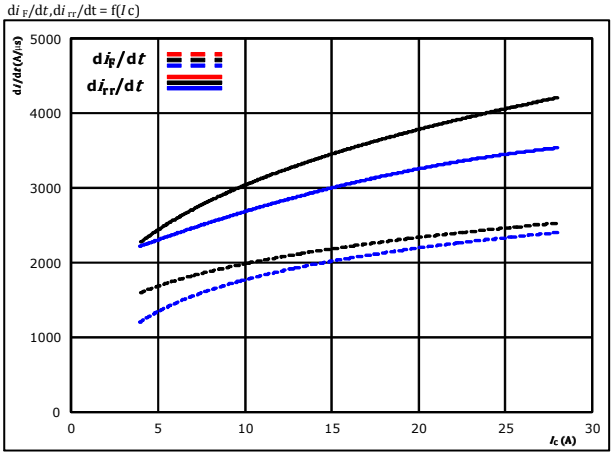
At	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	I_D =	16	A		150 °C	

Boost Switching Characteristics

Figure 13. **FWD**

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

$di_F/dt, di_{rr}/dt = f(I_C)$

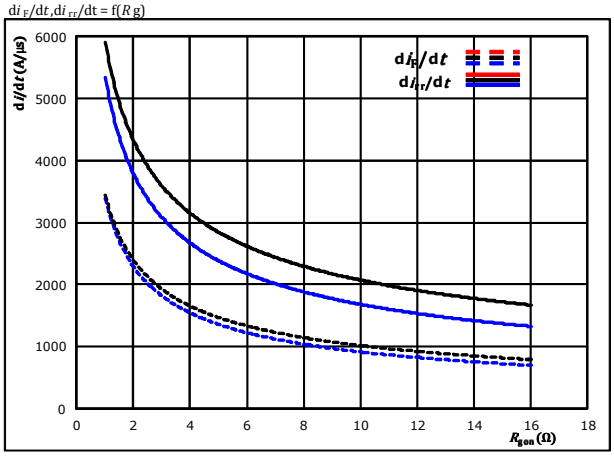


At	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	R_{gon} =	4	Ω		150 °C	

Figure 14. **FWD**

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

$di_F/dt, di_{rr}/dt = f(R_g)$



At	V_{DS} =	700	V		25 °C	
	V_{GS} =	+16/0	V	T_j:	125 °C	
	I_D =	16	A		150 °C	

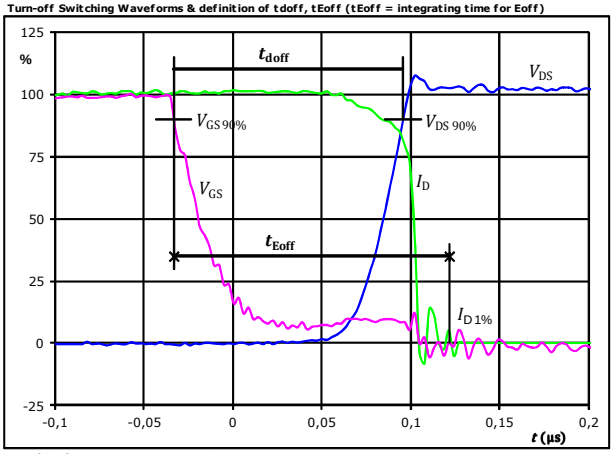
Boost Switching Definitions

General conditions

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

Figure 1. MOSFET

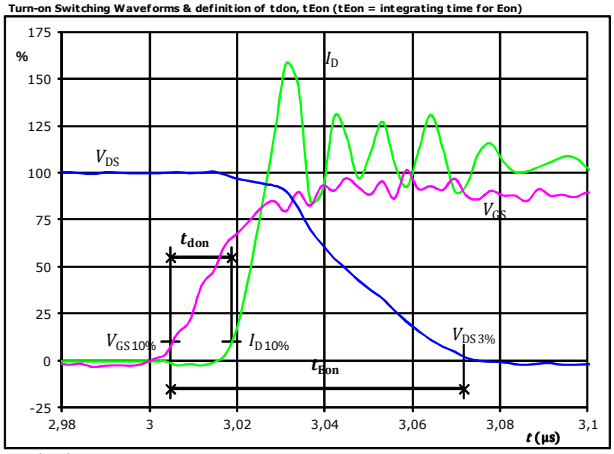
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



V_{GS} (0%) =	0	V
V_{GS} (100%) =	16	V
V_{DS} (100%) =	700	V
I_D (100%) =	16	A
t_{doff} =	0,129	µs
t_{Eoff} =	0,155	µs

Figure 2. MOSFET

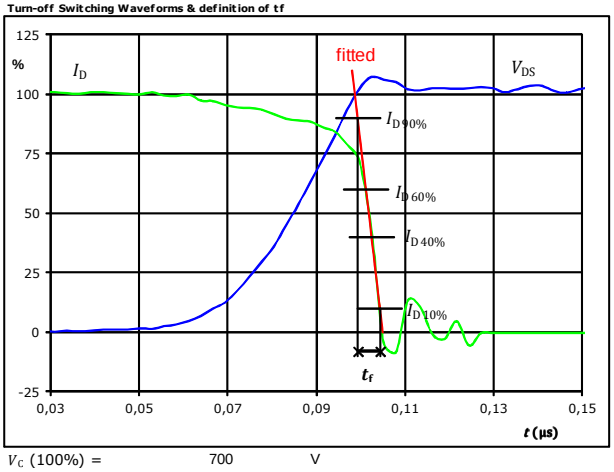
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



V_{GS} (0%) =	0	V
V_{GS} (100%) =	16	V
V_{DS} (100%) =	700	V
I_D (100%) =	16	A
t_{don} =	0,014	µs
t_{Eon} =	0,067	µs

Figure 3. MOSFET

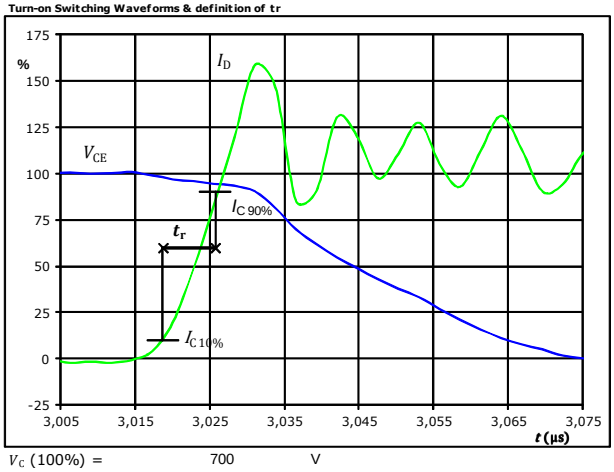
Turn-off Switching Waveforms & definition of tf



V_C (100%) =	700	V
I_D (100%) =	16	A
t_f =	0,005	µs

Figure 4. MOSFET

Turn-on Switching Waveforms & definition of tr

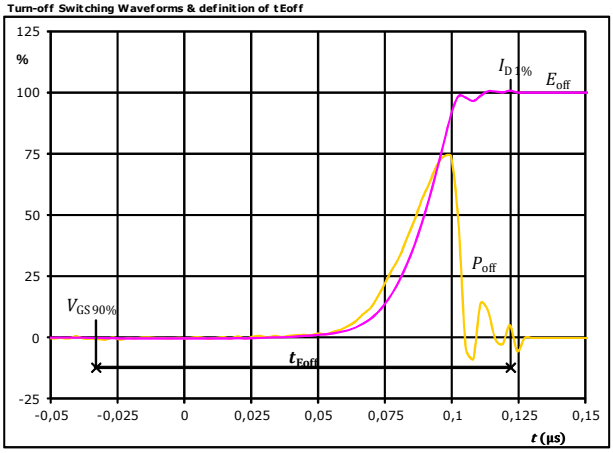


V_C (100%) =	700	V
I_D (100%) =	16	A
t_r =	0,007	µs

Boost Switching Definitions

Figure 5. **MOSFET**

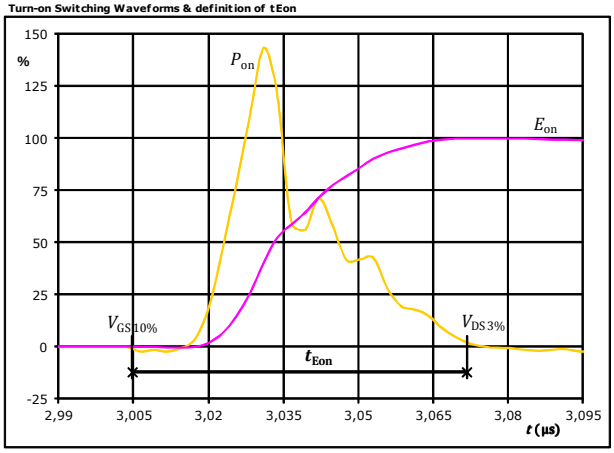
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	11,08	kW
E_{off} (100%) =	0,19	mJ
t_{Eoff} =	0,155	µs

Figure 6. **MOSFET**

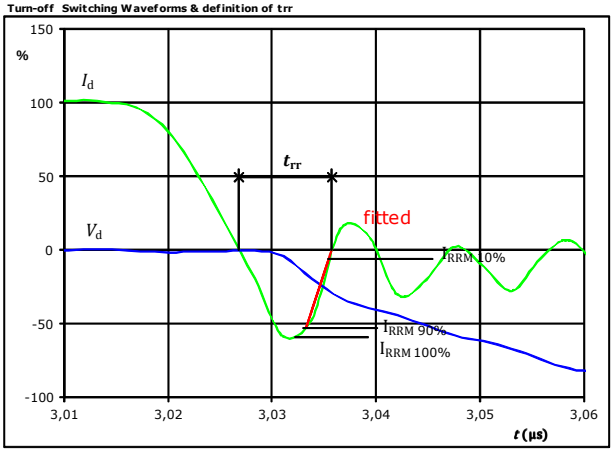
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	11,08	kW
E_{on} (100%) =	0,30	mJ
t_{Eon} =	0,067	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

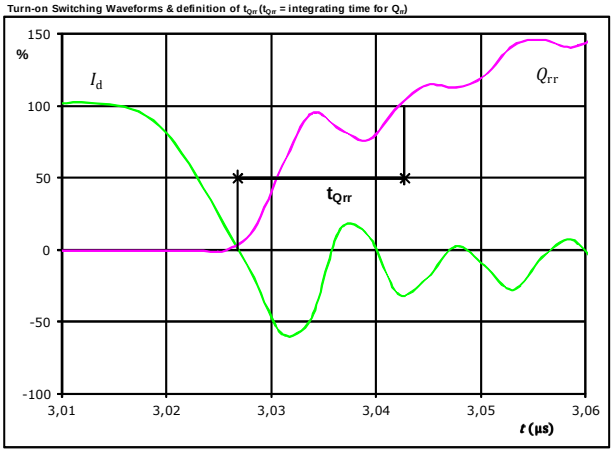


V_d (100%) =	700	V
I_d (100%) =	16	A
I_{RRM} (100%) =	-10	A
t_{rr} =	0,009	µs

Boost Switching Definitions

Figure 8. **FWD**

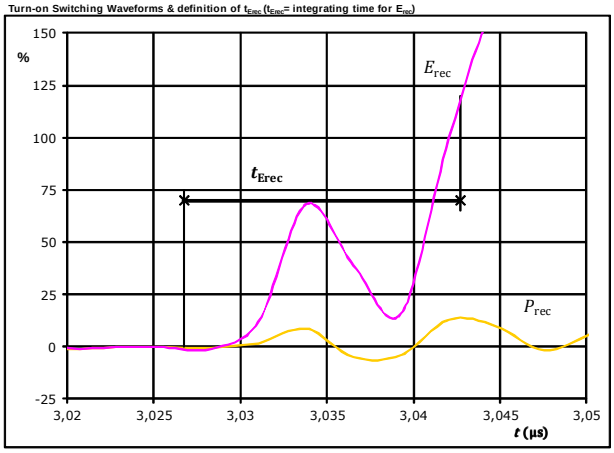
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	16	A
Q_{rr} (100%) =	0,10	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%) =	11,08	kW
E_{rec} (100%) =	0,03	mJ
t_{Erec} =	0,02	µs

Vincotech

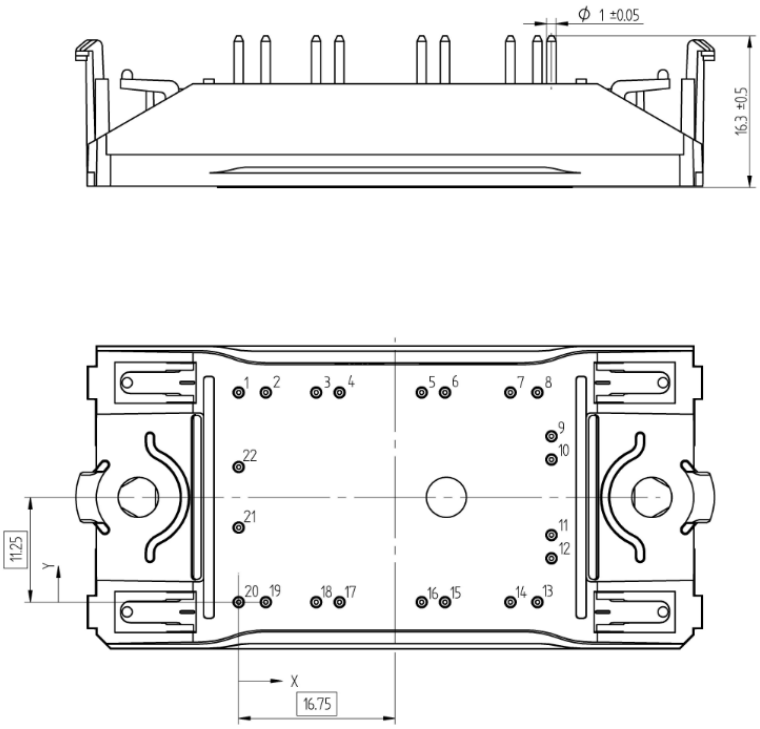
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing and solder pins	V23990-P629-L81-PM

Text	**Vinco**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	Vinco	WWYY	NNNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

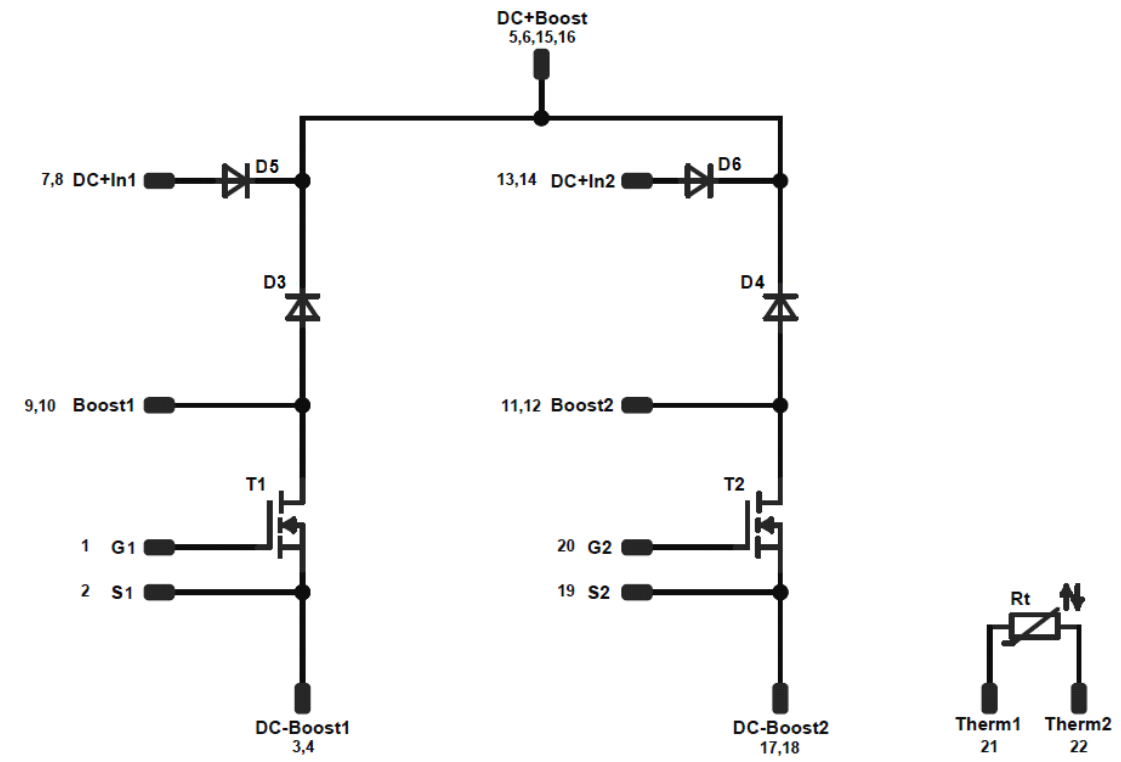
Outline

Pin table [mm]			
Pin	X	Y	Function
1	0	22,5	G1
2	2,9	22,5	S1
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	S2
20	0	0	G2
21	0	8	Therm1
22	0	14,5	Therm2



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2	MOSFET	1200V	80mΩ	Boost Switch	
D1,D3	FWD	1200V	10A	Boost Diode	
D5,D6	Rectifier	1600V	25A	Bypass Diode	
Rt	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.

Document No.:	Date:	Modification:	Pages
V23990-P629-L81-D1-14	19 Nov. 2015		