Vincotech

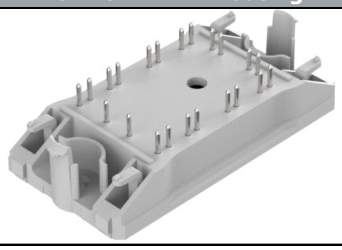
V23990-P629-L83-PM
datasheet

flow BOOST 0 SIC — **1200 V / 80 mΩ**

Features

- High efficient dual booster
- Ultra fast switching frequency
- Low Inductive layout
- 1200V Cree SiC MOSFET and 1200 V SiC diode

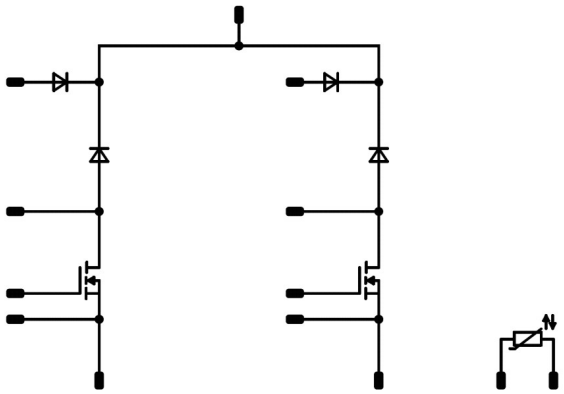
flow 0 12 mm housing



Target applications

- Charging Stations
- Solar Inverters
- UPS

Schematic



Types

- V23990-P629-L83-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	18	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	80	A
Avalanche energy, single pulse	E_{AS}	I_D = 20 A V_{DD} = 50 V	1000	mJ
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	58	W
Gate-source voltage	V_{GSS}	dynamic*	-10/+25	V
Maximum Junction Temperature	T_{jmax}		175	°C

*See figure 6. at page 7.

Maximum Ratings

T_j = 25 °C, unless otherwise specified

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	18	A
Repetitive peak forward current	I_{FRM}		52	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80°C	50	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}	50 Hz Single Half Sine Wave t_p = 10 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 Test Voltage* t_p = 2 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			min. 12,7	mm
Clearance			9,55	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		20		20	25 125 150		84 132 150	98	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	V_{GS} = V_{DS}		10	0	25	2,4	2,6	4	V
Gate to Source Leakage Current	I_{GSS}		-10/+25	0		25			250	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			100	µA
Internal gate resistance	r_g							4,6		Ω
Gate charge	Q_g							62		
Gate to source charge	Q_{GS}		-5/20	800	20	25		15		nC
Gate to drain charge	Q_{GD}							23		
Short-circuit input capacitance	C_{iss}							950		
Short-circuit output capacitance	C_{oss}	f = 1MHz	0	1000		25		80		pF
Reverse transfer capacitance	C_{rss}							7,6		
Reverse Diode Static										
Forward voltage	V_{SD}	V_{GS} = -5 V			10	25		3,30		V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4 W/K						1,65		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125 150		14 13 13		
Rise time	t_r	R_{goff} = 4 Ω R_{gon} = 4 Ω				25 125 150		8 8 8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		63 73 75		
Fall time	t_f		0/16	700	32	25 125 150		10 9 10		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,2 µC				25 125 150		0,480 0,461 0,455		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,237 0,277 0,289		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Diode										
Static										
Forward voltage	V_F				10	25 125		1,46 1,80	1,8	V
Reverse leakage current	I_r			1200		25			300	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,88		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 5700 A/µs di/dt = 4480 A/µs di/dt = 6481 A/µs	0/16	350	32	25 125 150		27 27 27		A
Reverse recovery time	t_{rr}					25 125 150		10 10 10		ns
Recovered charge	Q_r					25 125 150		0,173 0,179 0,182		µC
Reverse recovered energy	E_{rec}					25 125 150		0,031 0,034 0,036		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		9403 8609 11614		A/µs
ByPass Diode										
Static										
Forward voltage	V_F				25	25 125		1,21 1,21	1,22	V
Reverse leakage current	I_r			1600		25 145			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

Characteristic Values

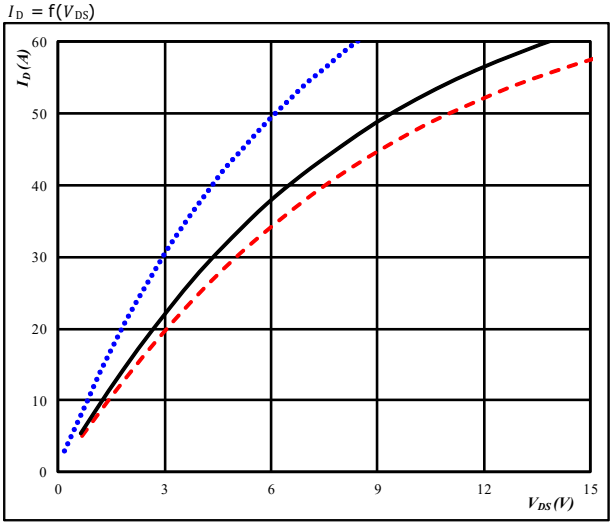
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
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 Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

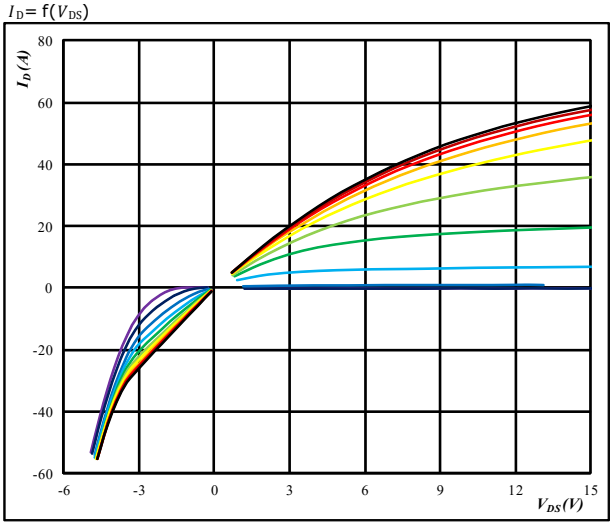


t_p =	250	µs		25 °C
V_{GS}=	20	V	T_j:	125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

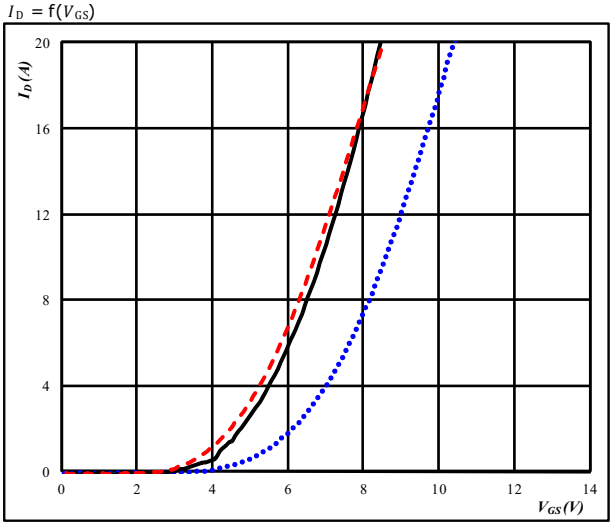


t_p =	250	µs
T_j =	150	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

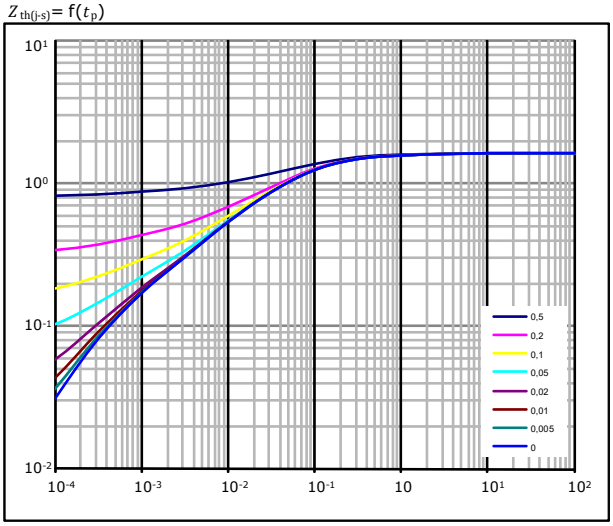


t_p =	100	µs		25 °C
V_{DS} =	10	V	T_j:	125 °C
				150 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,65	K/W

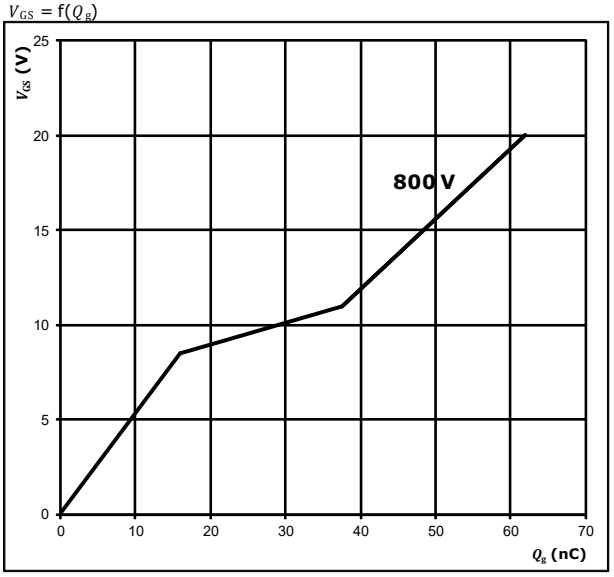
R (K/W)	τ (s)
8,39E-02	2,23E+00
2,20E-01	2,63E-01
7,21E-01	6,39E-02
3,37E-01	1,40E-02
1,50E-01	3,28E-03
1,00E-01	4,05E-04

Boost Switch Characteristics

figure 5. **MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



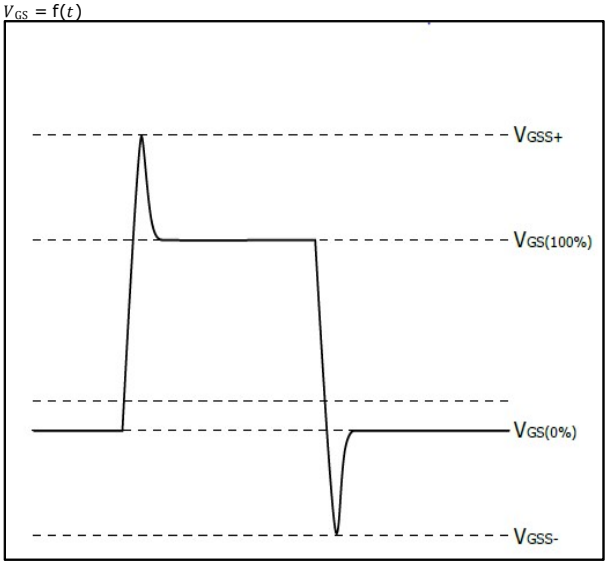
At

I_D= 20 A

figure 6. **MOSFET**

Gate maximum operating boundaries

$V_{GS} = f(t)$



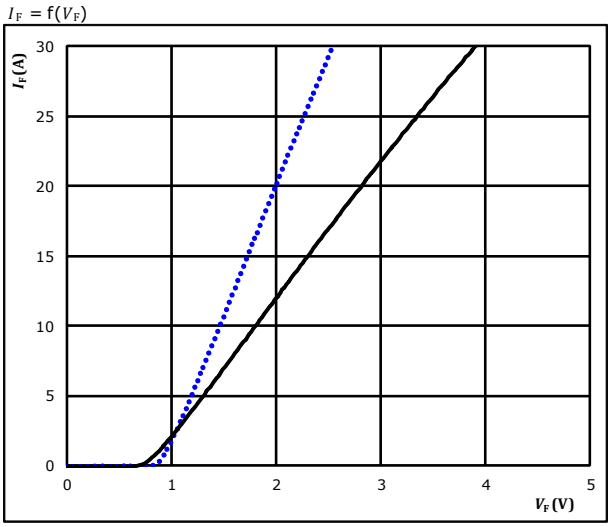
At

V_{GSS+} = 25 V
$V_{GS(100\%)}$ = 20 V
$V_{GS(0\%)}$ = -5 V
V_{GSS-} = -10 V

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics



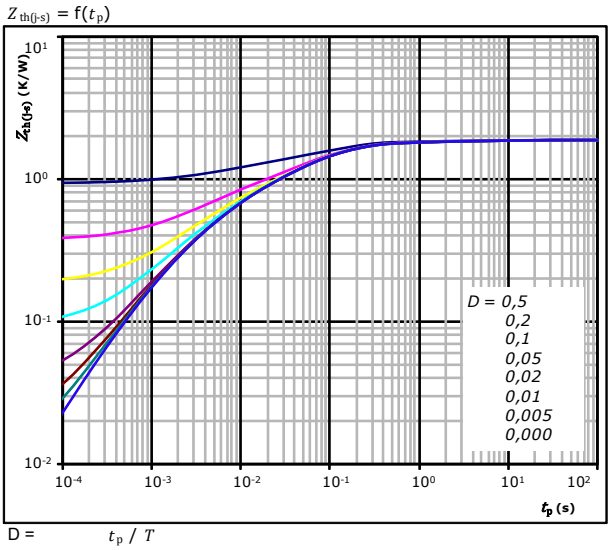
t_p = 250 µs

T_j: 25 °C

125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

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

FWD thermal model values

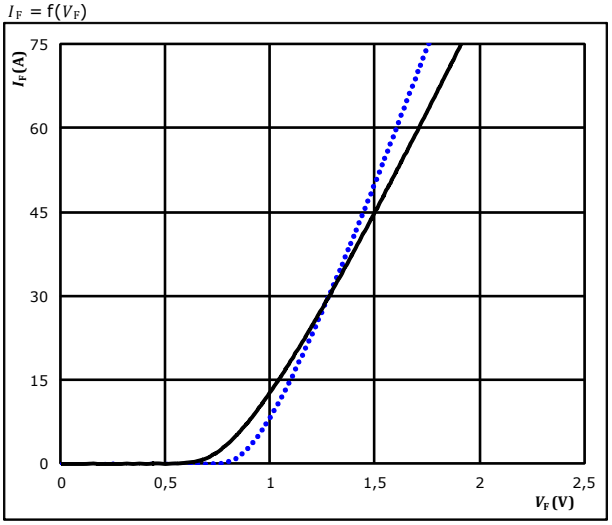
R (K/W)	τ (s)
5,58E-02	6,96E+00
1,47E-01	5,43E-01
8,94E-01	7,92E-02
4,33E-01	1,33E-02
2,94E-01	3,03E-03
5,99E-02	6,32E-04

ByPass Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



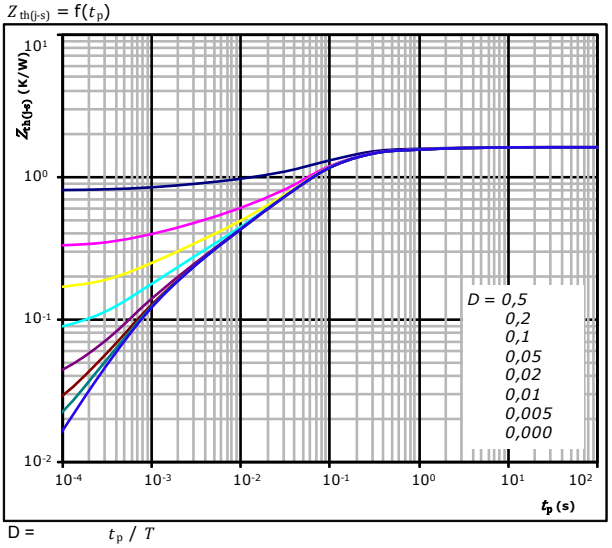
t_p = 250 µs 25 °C

T_j: 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

Diode thermal model values

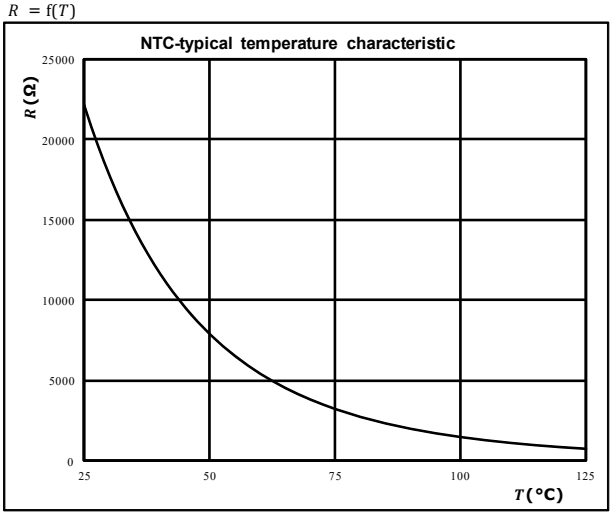
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

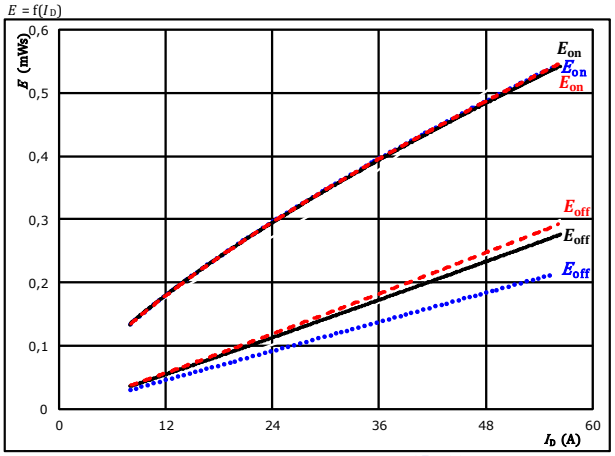


Boost Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



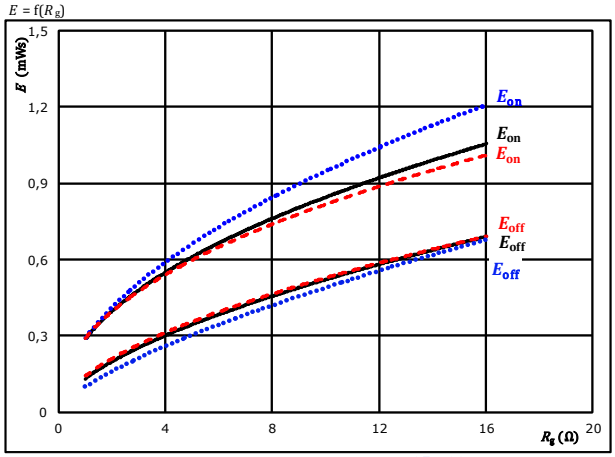
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	
V_{GS} =	16/0	V		125 °C	
R_{gon} =	1	Ω		150 °C	
R_{goff} =	1	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



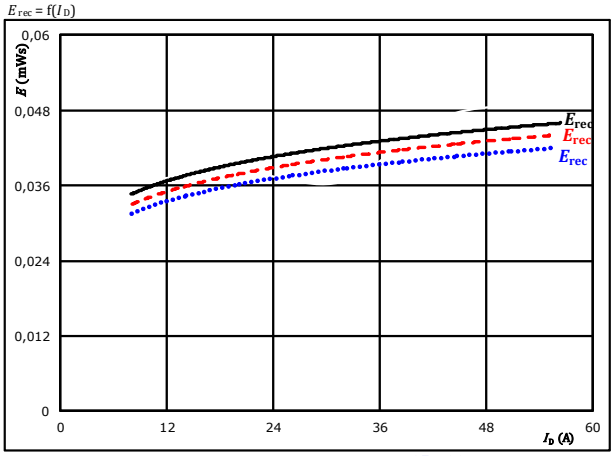
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	
V_{GS} =	16/0	V		125 °C	
I_D =	32	A		150 °C	

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



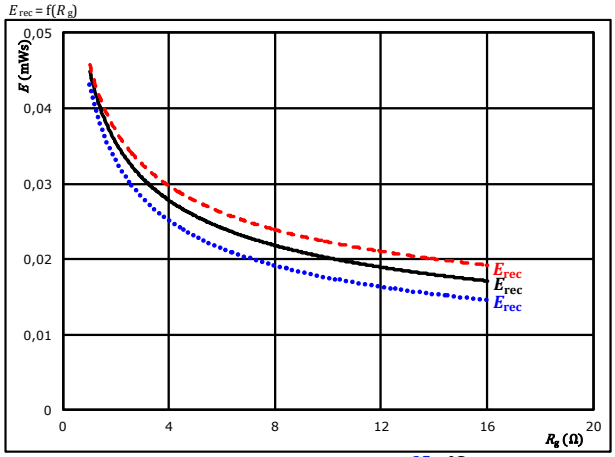
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	
V_{GS} =	16/0	V		125 °C	
R_{gon} =	1	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

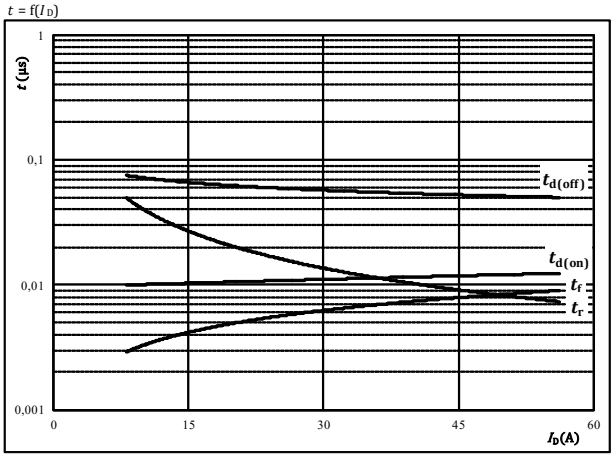
V_{DS} =	700	V	T_j:	25 °C	
V_{GS} =	16/0	V		125 °C	
I_D =	32	A		150 °C	

Boost Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



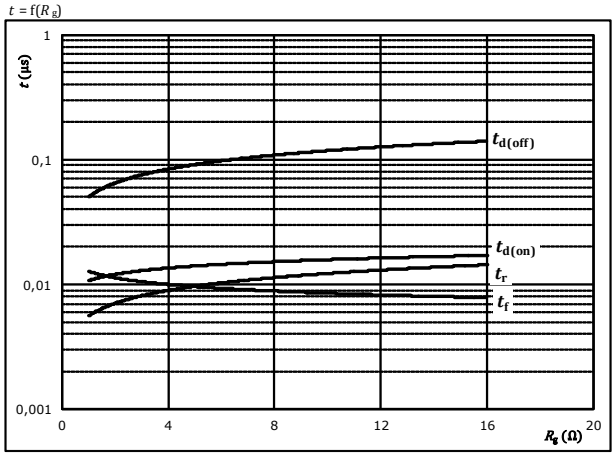
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	16/0	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



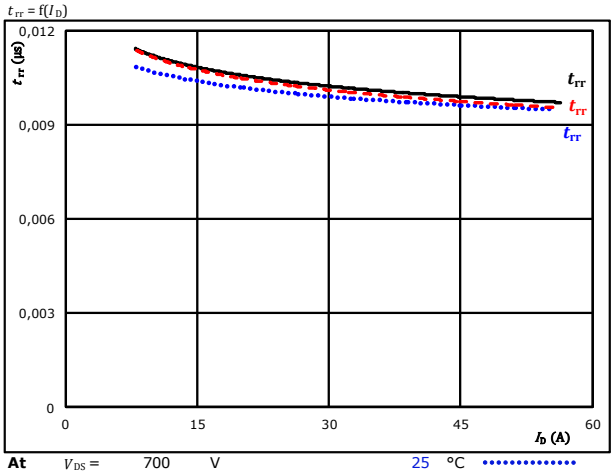
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	16/0	V
I_D =	32	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

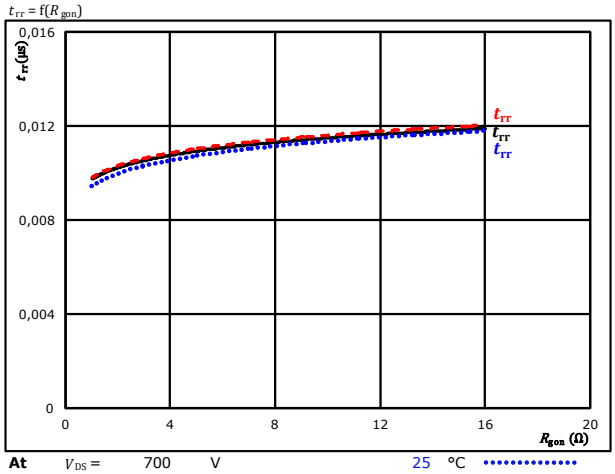


At	V_{DS} =	700	V		25 °C
	V_{GS} =	16/0	V	T_j:	125 °C
	R_{gon} =	1	Ω		150 °C

figure 8. **FWD**

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

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



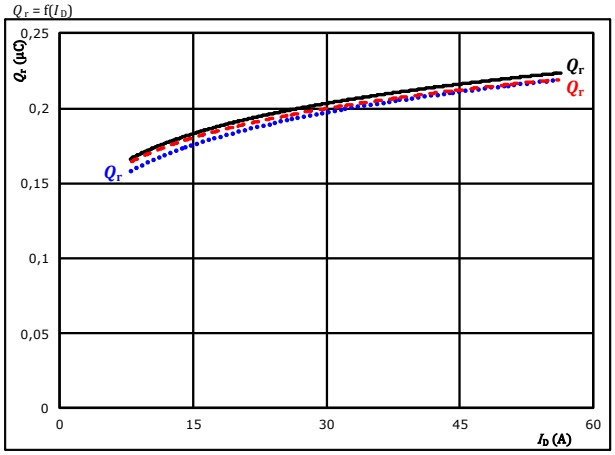
At	V_{DS} =	700	V		25 °C
	V_{GS} =	16/0	V	T_j:	125 °C
	I_D =	32	A		150 °C

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

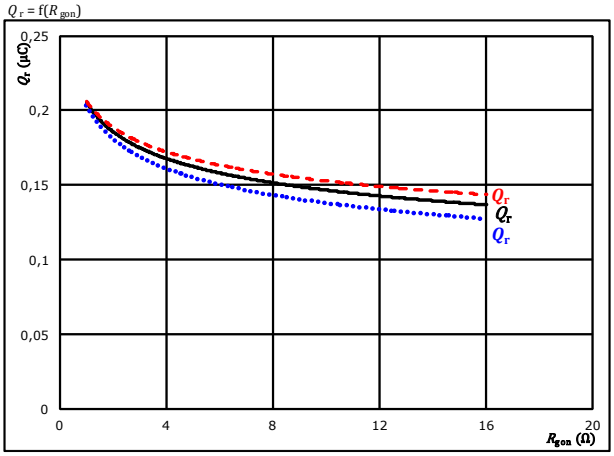


At						
V_{DS} =	700	V		25	°C	·····
V_{GS} =	16/0	V	T_j:	125	°C	———
R_{gon} =	1	Ω		150	°C	- - -

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

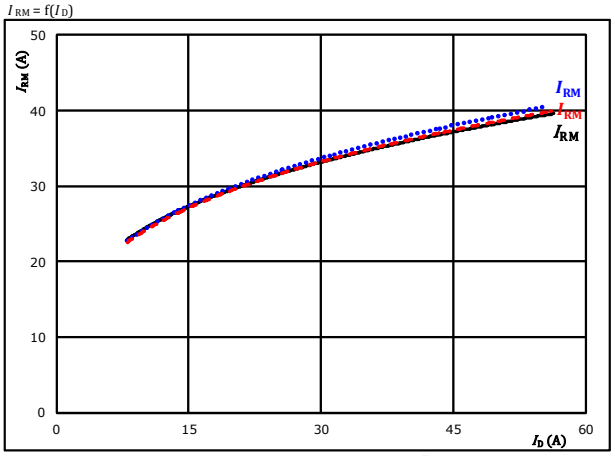


At						
V_{DS} =	700	V		25	°C	·····
V_{GS} =	16/0	V	T_j:	125	°C	———
I_D =	32	A		150	°C	- - -

figure 11. **FWD**

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

$I_{RM} = f(I_D)$

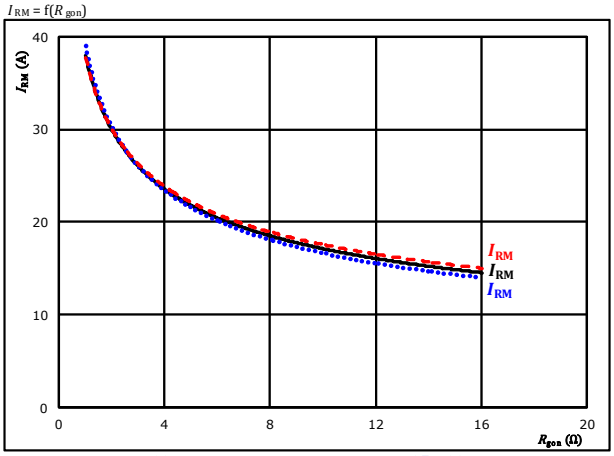


At						
V_{DS} =	700	V		25	°C	·····
V_{GS} =	16/0	V	T_j:	125	°C	———
R_{gon} =	1	Ω		150	°C	- - -

figure 12. **FWD**

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

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



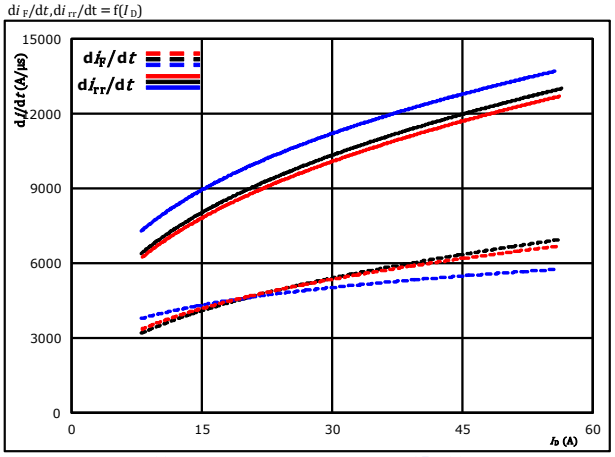
At						
V_{DS} =	700	V		25	°C	·····
V_{GS} =	16/0	V	T_j:	125	°C	———
I_D =	32	A		150	°C	- - -

Boost Switching Characteristics

figure 13. **FWD**

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

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

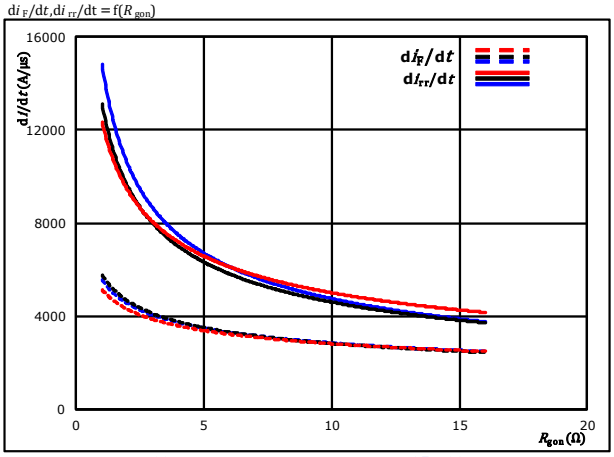


At	V_{DS} =	700	V		
	V_{GS} =	16/0	V	T_j:	25 °C / 125 °C / 150 °C
	R_{gon} =	1	Ω		

figure 14. **FWD**

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

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

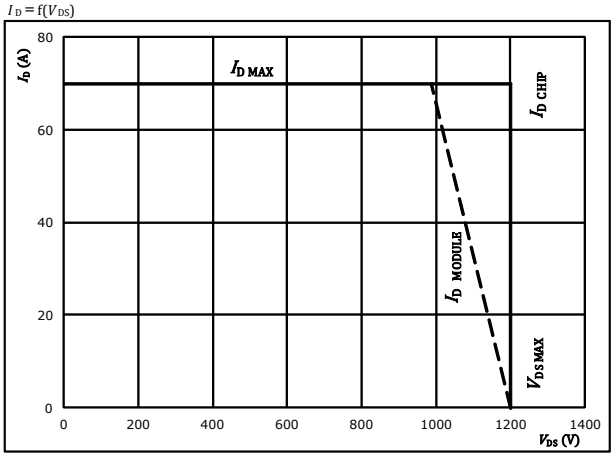


At	V_{DS} =	700	V		
	V_{GS} =	16/0	V	T_j:	25 °C / 125 °C / 150 °C
	I_D =	32	A		

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At

T_j =	175	°C	
R_{gon} =	1	Ω	
R_{goff} =	1	Ω	

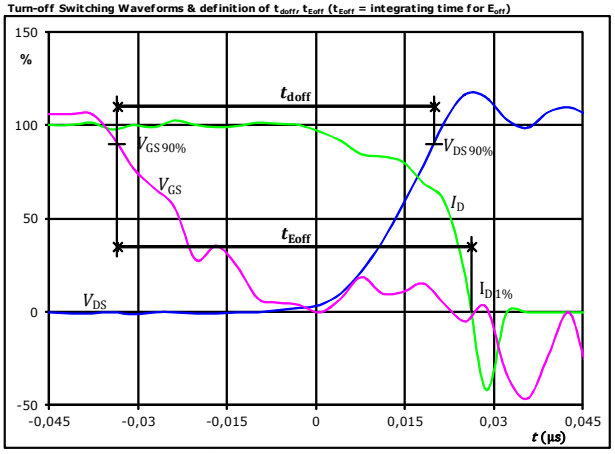
Boost Switching Characteristics

General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1. MOSFET

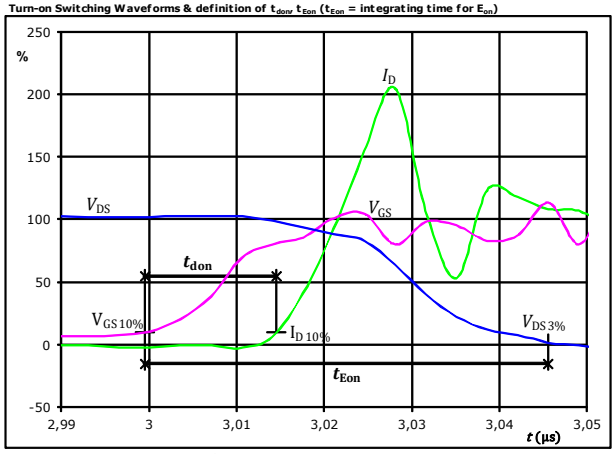
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	16	V
$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_{doff} =	0,055	µs
t_{Eoff} =	0,060	µs

figure 2. MOSFET

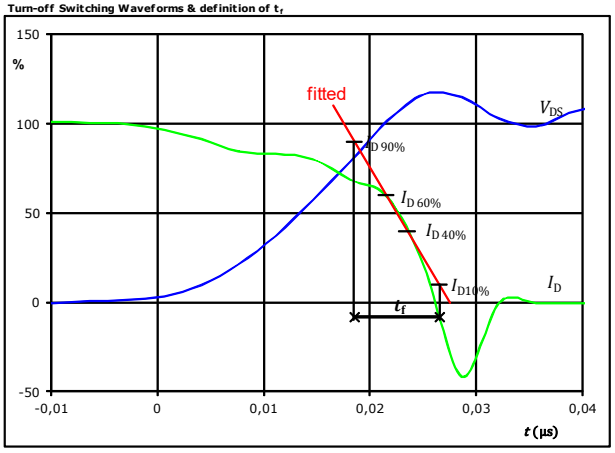
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	16	V
$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_{don} =	0,012	µs
t_{Eon} =	0,046	µs

figure 3. MOSFET

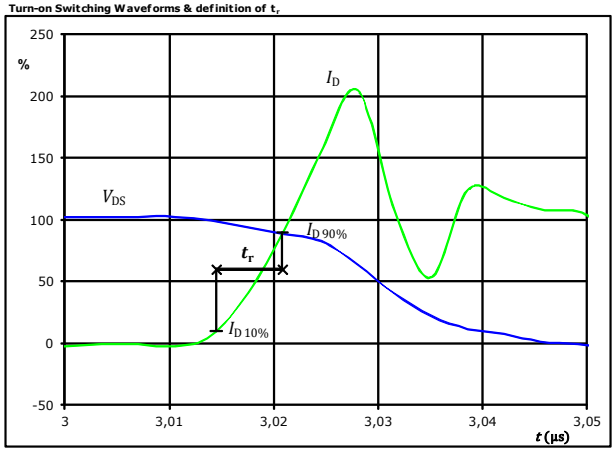
Turn-off Switching Waveforms & definition of t_f



$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_f =	0,011	µs

figure 4. MOSFET

Turn-on Switching Waveforms & definition of t_r

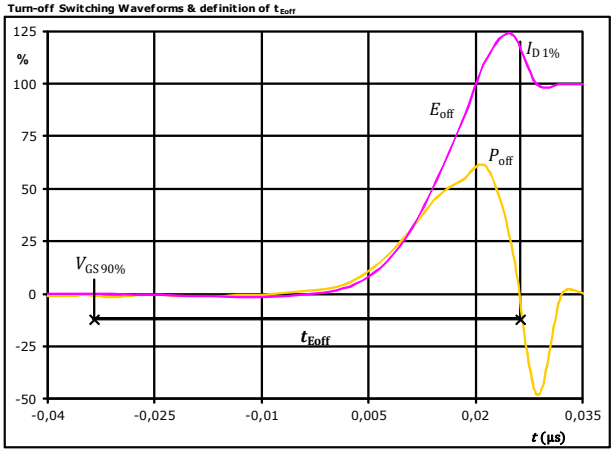


$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_r =	0,006	µs

Boost Switching Characteristics

figure 5. **MOSFET**

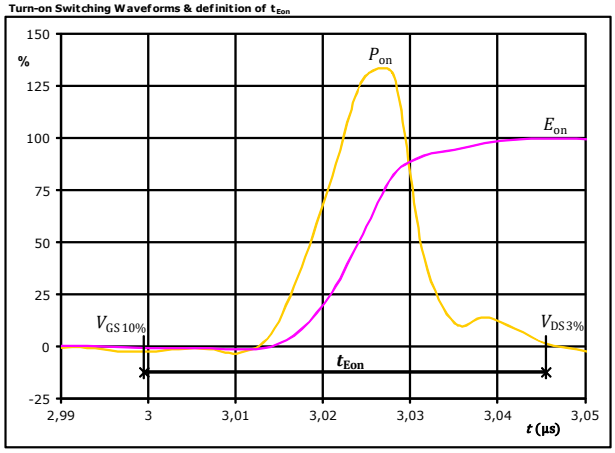
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	22,29	kW
$E_{off}(100\%)$ =	0,14	mJ
t_{Eoff} =	0,06	µs

figure 6. **MOSFET**

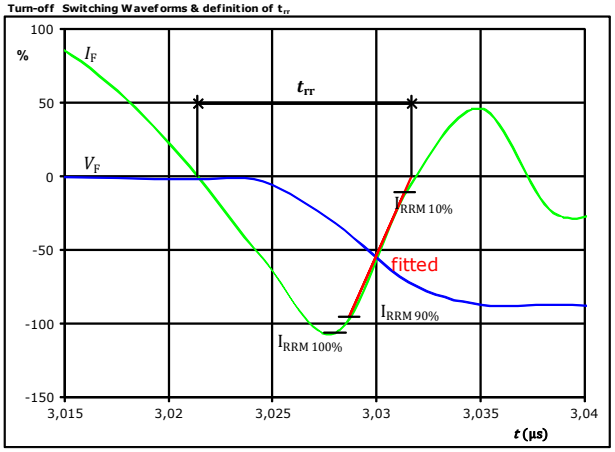
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	22,29	kW
$E_{on}(100\%)$ =	0,34	mJ
t_{Eon} =	0,05	µs

figure 7. **FWD**

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

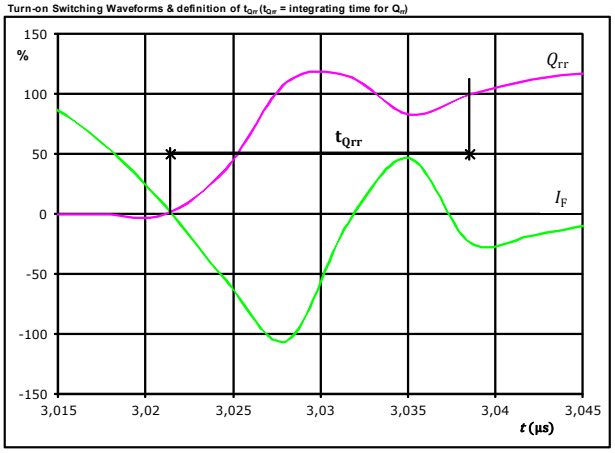


$V_F(100\%)$ =	700	V
$I_F(100\%)$ =	32	A
$I_{RRM}(100\%)$ =	-33	A
t_{rr} =	0,010	µs

Boost Switching Characteristics

figure 8. **FWD**

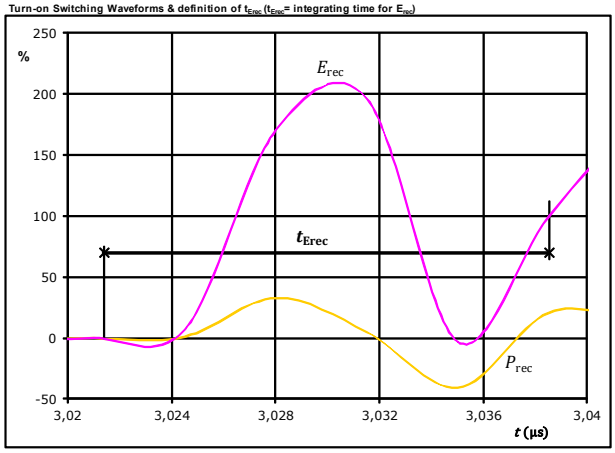
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_F (100%) =	32	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%) =	22,29	kW
E_{rec} (100%) =	0,04	mJ
t_{Erec} =	0,02	µs

Vincotech

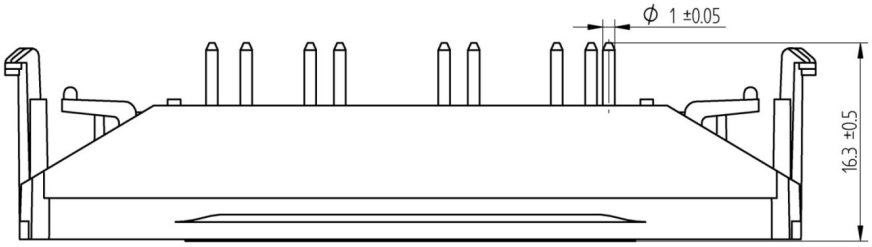
Ordering Code & Marking

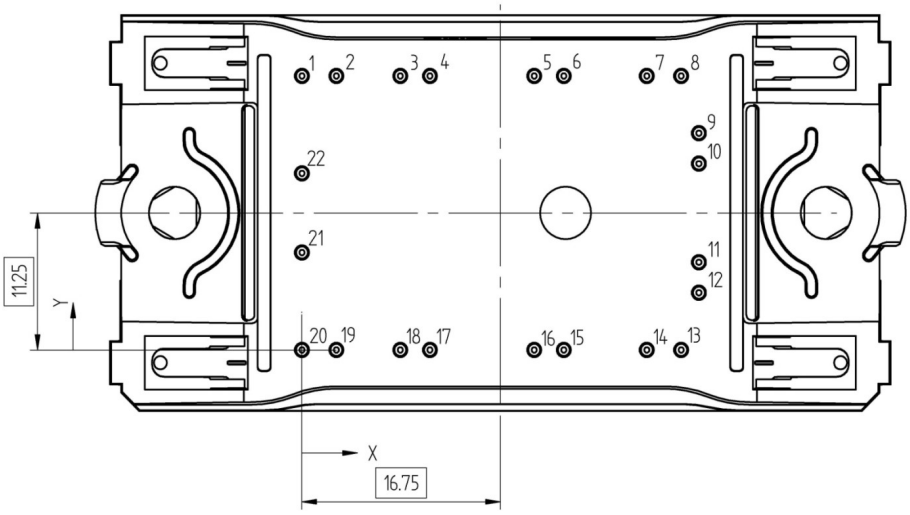
Version	Ordering Code
without thermal paste 12mm housing with solder pins	V23990-P629-L83-PM
with thermal paste 12mm housing with solder pins	V23990-P629-L83-/3/-PM

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

Outline

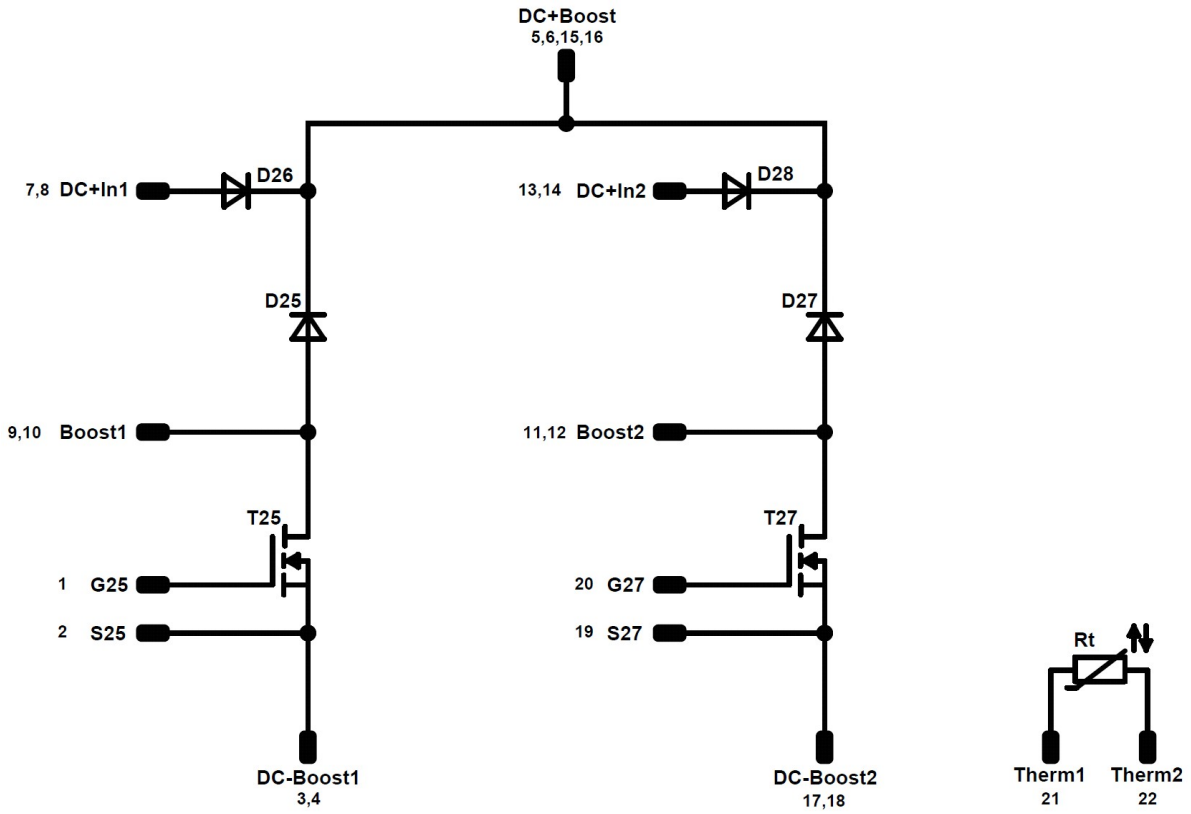
Pin table			
Pin	X	Y	Function
1	0	22,5	G25
2	2,9	22,5	S25
3	8,3	22,5	DC-Boost1
4	10,8	22,5	DC-Boost1
5	19,6	22,5	DC+Boost
6	22,1	22,5	DC+Boost
7	29,1	22,5	DC+In1
8	32	22,5	DC+In1
9	33,5	17,8	Boost1
10	33,5	15,3	Boost1
11	33,5	7,2	Boost2
12	33,5	4,7	Boost2
13	32	0	DC+In2
14	29,1	0	DC+In2
15	22,1	0	DC+Boost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





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
T25, T27	MOSFET	1200 V	80 mΩ	Boost Switch	
D25, D27	FWD	1200 V	10 A	Boost Diode	
D26, D28	Rectifier	1600 V	25 A	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.

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-L83-D1-14	24 Aug. 2017		