V23990-P629-L43

datasheet

_flow_BOOST 0 dual **1200 V / 50 A**

Topology features

- Kelvin Emitter for improved switching performance
- Dual Booster
- Bypass Diode
- Open Emitter configuration
- Temperature sensor

Component features

- Easy paralleling
- High speed switching
- Low switching losses

Housing features

- Base isolation: Al_2O_3
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

Extra features

- with SiC Diode

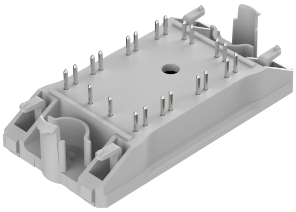
Target applications

- Solar Inverters

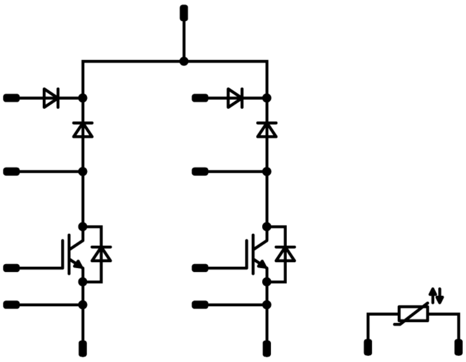
Types

- V23990-P629-L43

flow 0 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Boost Switch

Parameter	Symbol	Conditions	Value	Unit
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ T_s = 80 °C	51	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	144	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V T_j = 150 °C	10	µs
Maximum junction temperature	T_{jmax}		175	°C

Boost Diode

Parameter	Symbol	Conditions	Value	Unit
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	31	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	84	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms T_j = 110 °C	156	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	81	W
Maximum junction temperature	T_{jmax}		175	°C

Boost Sw. Protection Diode

Parameter	Symbol	Conditions	Value	Unit
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	38	A
Surge (non-repetitive) forward current	I_{FSM}	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	47	W
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
ByPass Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	38	A
Surge (non-repetitive) forward current	I_{FSM}	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	47	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
Creepage distance			>12,7	mm
Clearance			9,55	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Values**			**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										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0017	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125	1,78	2,14 2,57	2,42[(1)]	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							4		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		2770		pF
Reverse transfer capacitance	C_{res}							160		pF
Gate charge	Q_g		±15		0	25		380		nC
Thermal										
Thermal resistance junction to sink[(2)]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						0,66		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	0/15	700	50	25 125 150		49 49,31 40,1		ns
Rise time	t_r					25 125 150		24,17 26,34 27,29		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		306,35 367,94 384,41		ns
Fall time	t_f					25 125 150		40,23 88,97 106,18		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,088 µC Q_{rFWD}=0,088 µC Q_{rFWD}=0,086 µC				25 125 150		2,02 2,36 2,55		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,2 3,67 4,2		mWs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Boost Diode										
Static										
Forward voltage	V_F				15	25 125 150		1,35 1,57 1,65	1,8(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25		12	1500	μA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,17		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=2754 A/μs di/dt=2044 A/μs di/dt=1920 A/μs	0/15	700	50	25 125 150		12,76 12,85 12,56		A
Reverse recovery time	t_{rr}					25 125 150		11,51 11,88 11,83		ns
Recovered charge	Q_r					25 125 150		0,088 0,088 0,086		μC
Reverse recovered energy	E_{rec}					25 125 150		$5,833 \times 10^{-3}$ $4,577 \times 10^{-3}$ $7,051 \times 10^{-3}$		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4344,58 3913,85 3671,68		A/μs

Characteristic Values

Parameter	Symbol	Conditions					Values			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 Sw. Protection Diode										
Static										
Forward voltage	V_F				8	25 125		0,96 0,865	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			100	μA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,49		K/W
ByPass Diode										
Static										
Forward voltage	V_F				8	25 125		0,96 0,865	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			100	μA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,49		K/W

Characteristic Values

Parameter	**Symbol**	**Conditions**					**Values**			**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										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R25	$\Delta_{R/R}$	R_{25} = 22 kΩ				25	-5		5	%
Deviation of R100		R_{100} = 1486 Ω				100	-12		14	
Power dissipation	P							200		mW
Power dissipation constant	d					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3950		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3998		K
Vincotech Thermistor Reference									B	

(1) Value at chip level

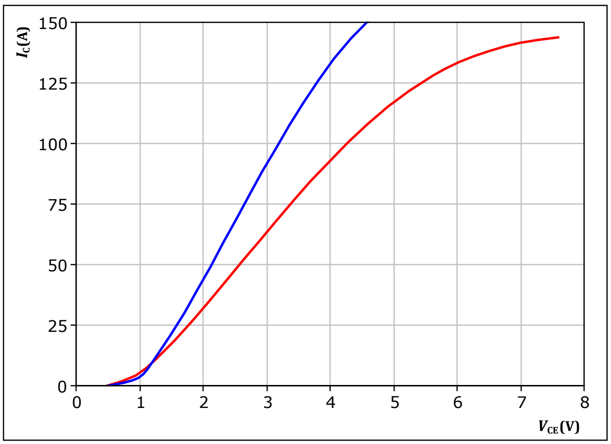
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



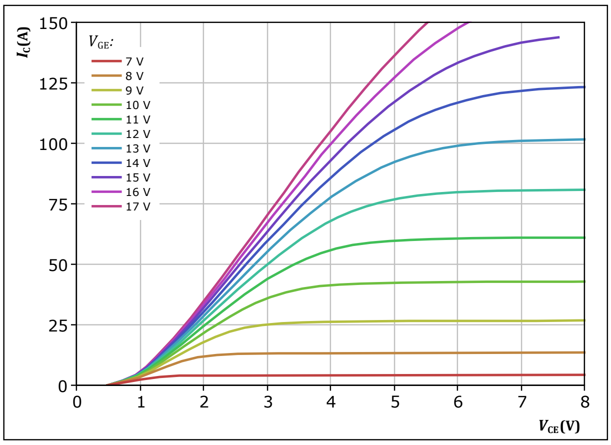
t_p = 250 µs
V_{GE} = 15 V

T_j: 25 °C
125 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

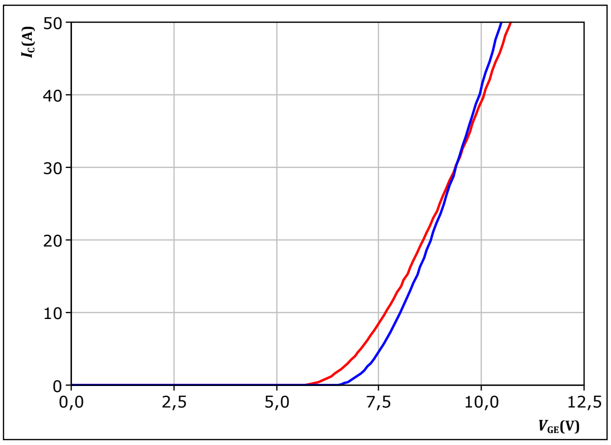


t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



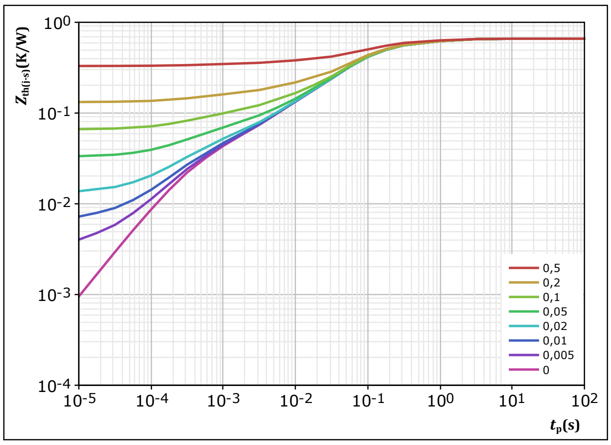
t_p = 250 µs
V_{CE} = 10 V

T_j: 25 °C
125 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,66 K/W

IGBT thermal model values

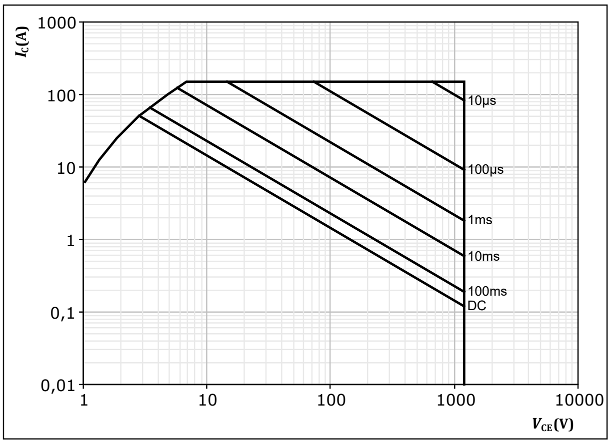
R (K/W)	τ (s)
8,54E-02	1,27E+00
1,79E-01	1,86E-01
3,14E-01	6,03E-02
5,28E-02	4,65E-03
2,90E-02	3,68E-04

Boost Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



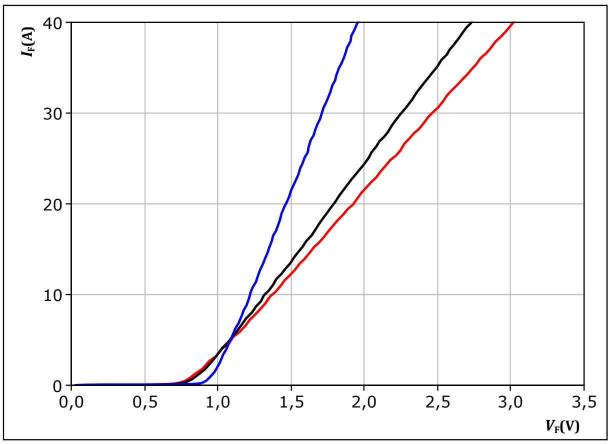
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Boost Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



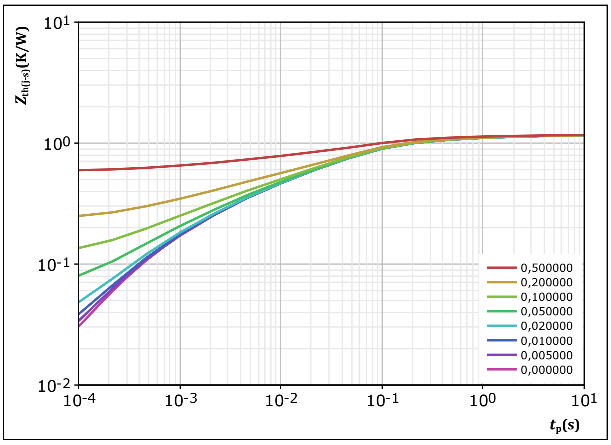
t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,166 K/W

FWD thermal model values

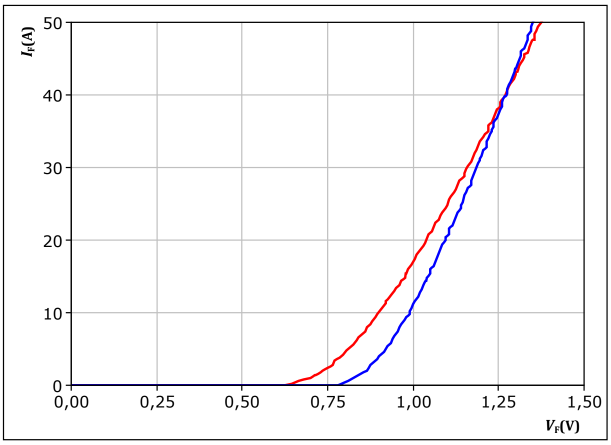
R (K/W)	τ (s)
2,54E-02	2,92E+01
7,91E-02	1,79E+00
1,72E-01	2,39E-01
4,53E-01	5,11E-02
2,07E-01	9,05E-03
1,58E-01	1,92E-03
8,15E-02	3,71E-04

Boost Sw. Protection Diode Characteristics

figure 8. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



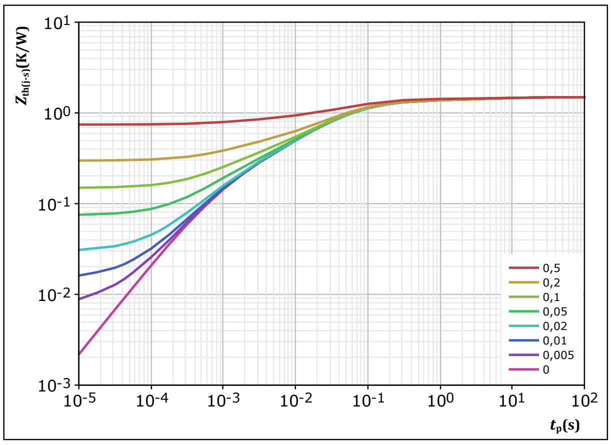
t_p = 250 μs

T_j: 25 °C
125 °C

figure 9. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,487 K/W

Rectifier thermal model values

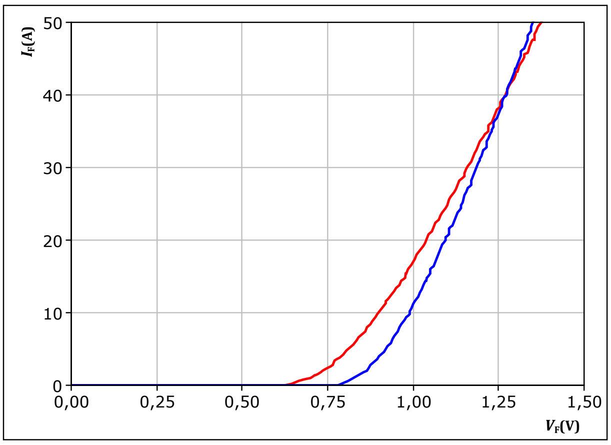
R (K/W)	τ (s)
1,10E-01	7,06E+00
1,38E-01	3,93E-01
6,16E-01	6,84E-02
3,90E-01	1,63E-02
1,63E-01	2,51E-03
7,11E-02	5,88E-04

ByPass Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



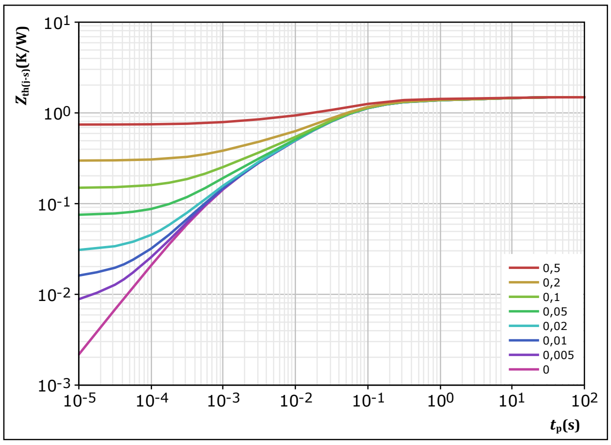
t_p = 250 µs

T_j: 25 °C
125 °C

figure 11. **Rectifier**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,487 K/W

Rectifier thermal model values

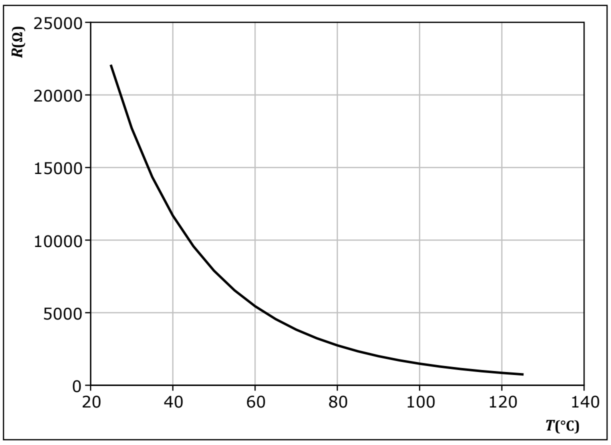
R (K/W)	τ (s)
1,10E-01	7,06E+00
1,38E-01	3,93E-01
6,16E-01	6,84E-02
3,90E-01	1,63E-02
1,63E-01	2,51E-03
7,11E-02	5,88E-04

Thermistor Characteristics

figure 12. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

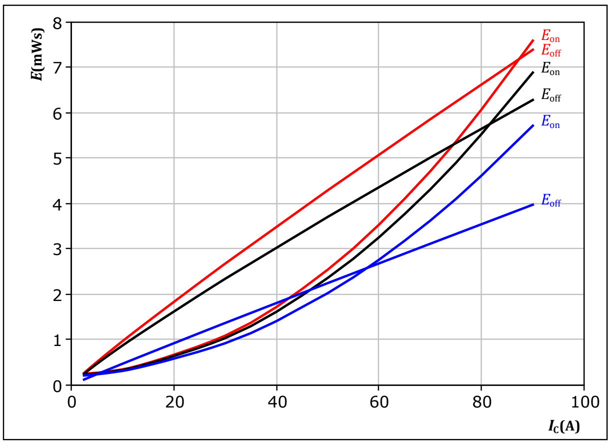


Boost Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

$E = \mathrm{f}(I_C)$



With an inductive load at

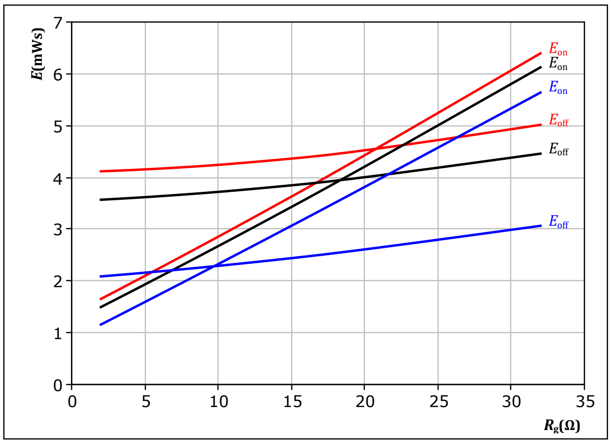
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω
R_{goff} = 8 Ω

T_j:
25 °C
125 °C
150 °C

figure 14. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = \mathrm{f}(R_g)$



With an inductive load at

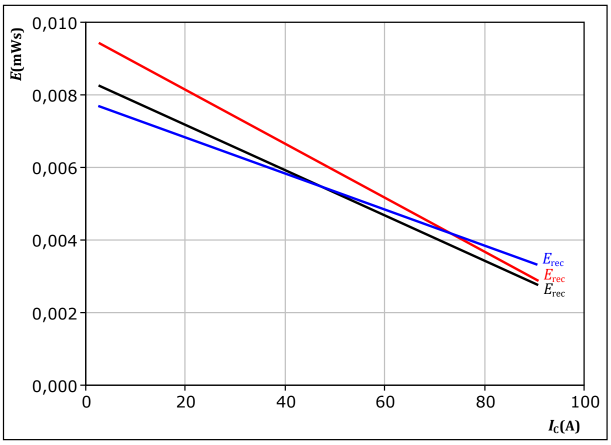
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

T_j:
25 °C
125 °C
150 °C

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = \mathrm{f}(I_C)$



With an inductive load at

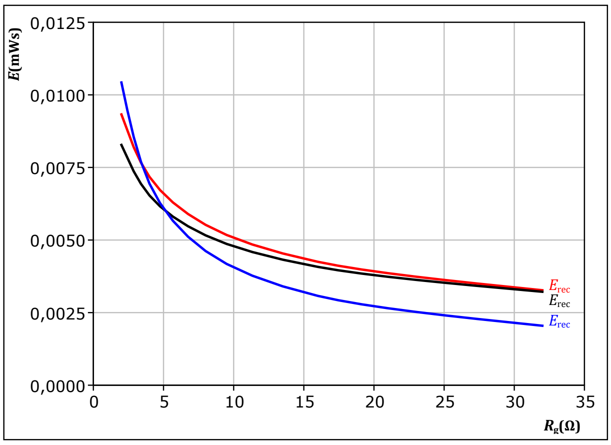
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω

T_j:
25 °C
125 °C
150 °C

figure 16. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = \mathrm{f}(R_g)$



With an inductive load at

V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

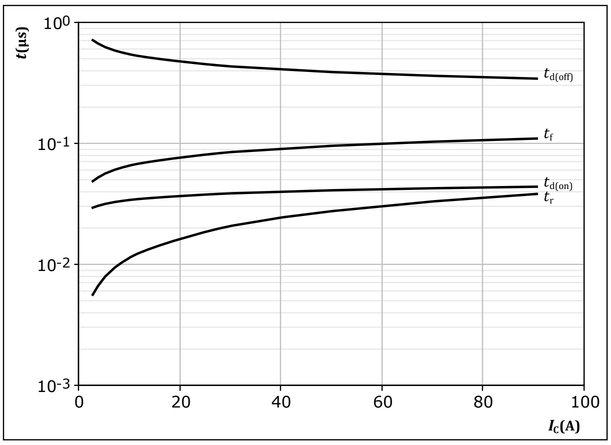
T_j:
25 °C
125 °C
150 °C

Boost Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



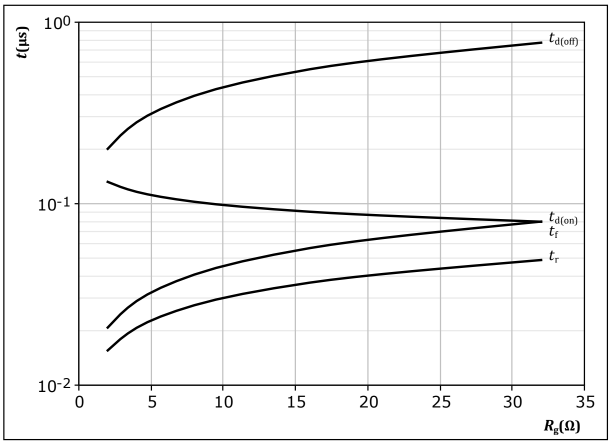
With an inductive load at

T_j = 150 °C
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω
R_{goff} = 8 Ω

figure 18. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



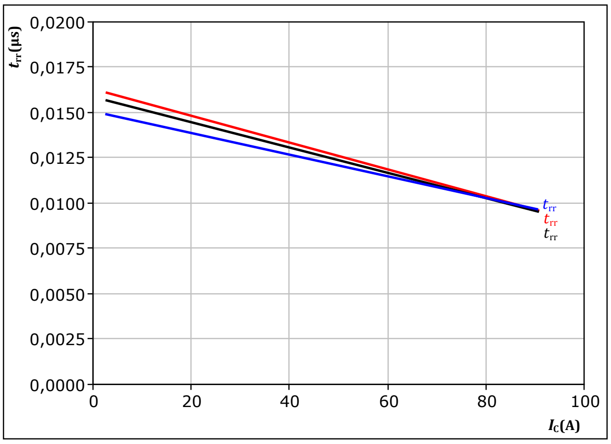
With an inductive load at

T_j = 150 °C
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

figure 19. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

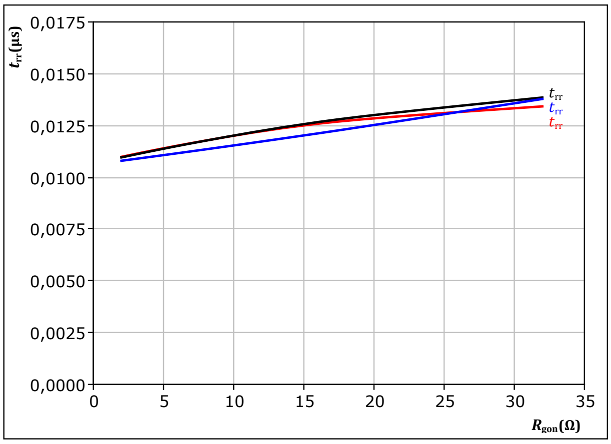
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω

T_j:
25 °C
125 °C
150 °C

figure 20. **FWD**

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

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



With an inductive load at

V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

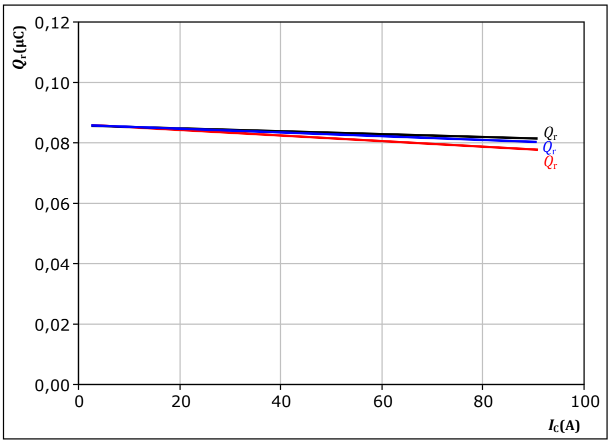
T_j:
25 °C
125 °C
150 °C

Boost Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

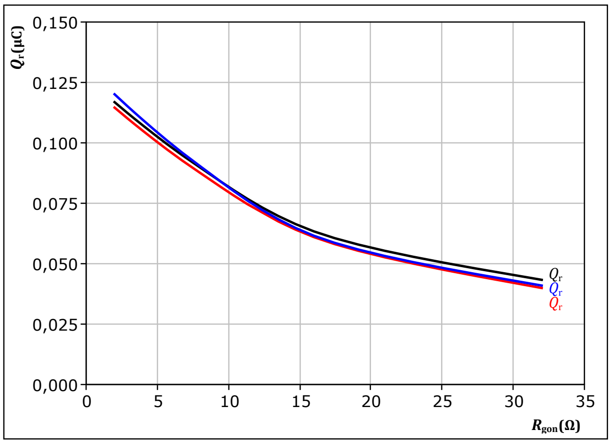
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω

T_j: 25 °C
125 °C
150 °C

figure 22. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

Q_r = f(R_{gon})



With an inductive load at

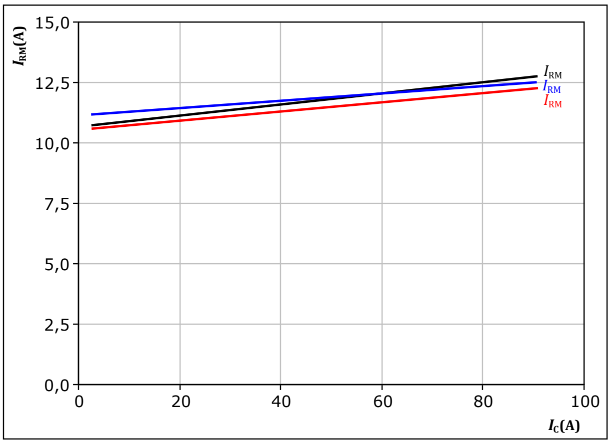
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

T_j: 25 °C
125 °C
150 °C

figure 23. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

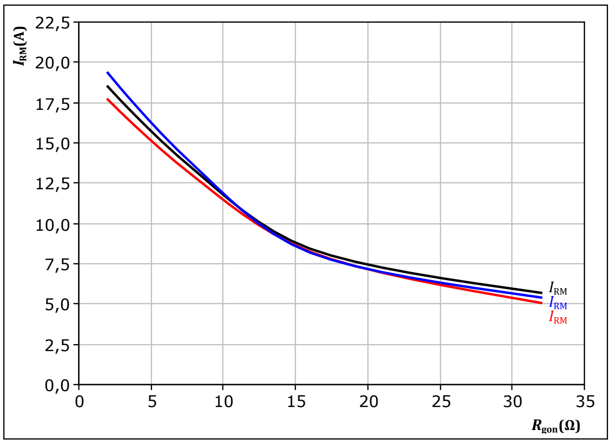
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω

T_j: 25 °C
125 °C
150 °C

figure 24. **FWD**

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

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



With an inductive load at

V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

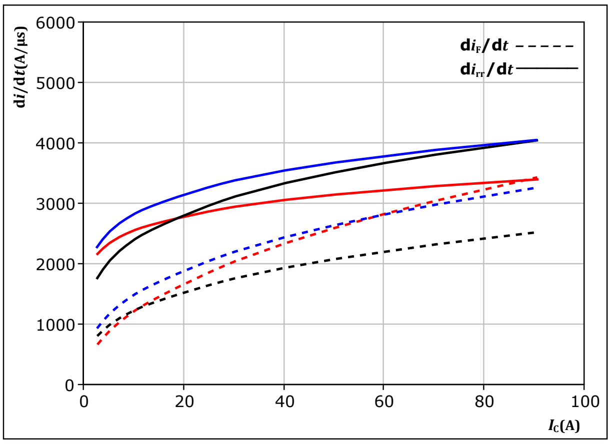
T_j: 25 °C
125 °C
150 °C

Boost Switching Characteristics

figure 25. **FWD**

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

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



With an inductive load at

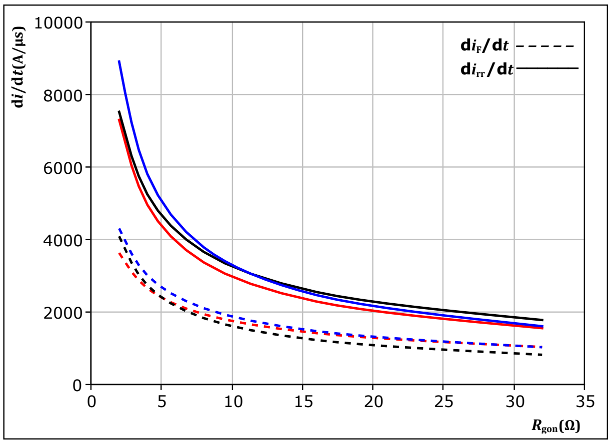
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 8 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 26. **FWD**

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

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



With an inductive load at

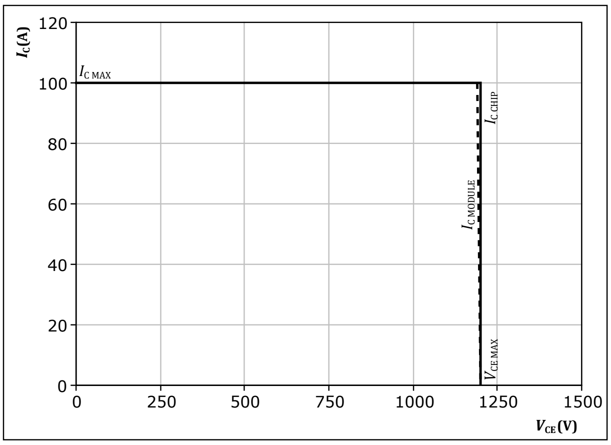
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 50 A

T_j: 25 °C, 125 °C, 150 °C

figure 27. **IGBT**

Reverse bias safe operating area

$I_C = f(\ V_{CE})$



At T_j = 150 °C
R_{gon} = 8 Ω
R_{goff} = 8 Ω

Boost Switching Definitions

figure 28. **IGBT**

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

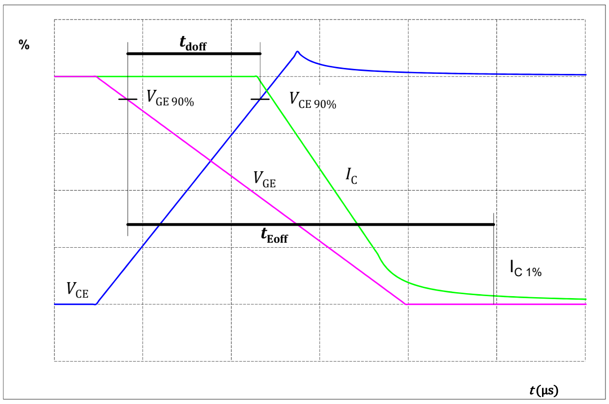


figure 29. **IGBT**

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

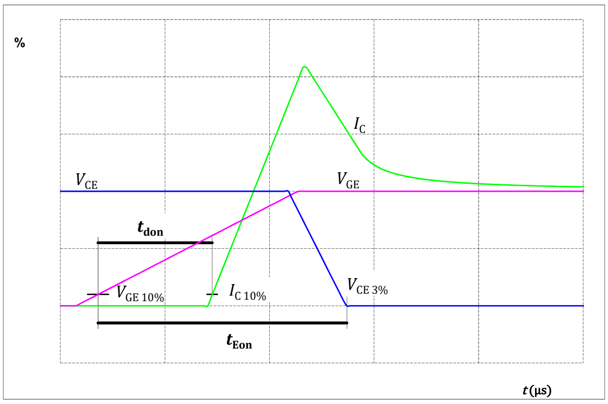


figure 30. **IGBT**

Turn-off Switching Waveforms & definition of t_f

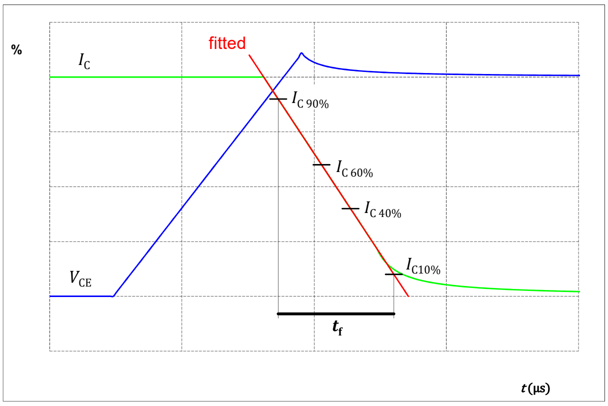
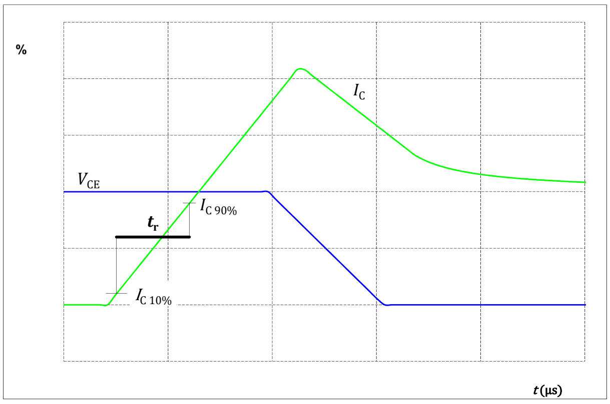


figure 31. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 32. **FWD**

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

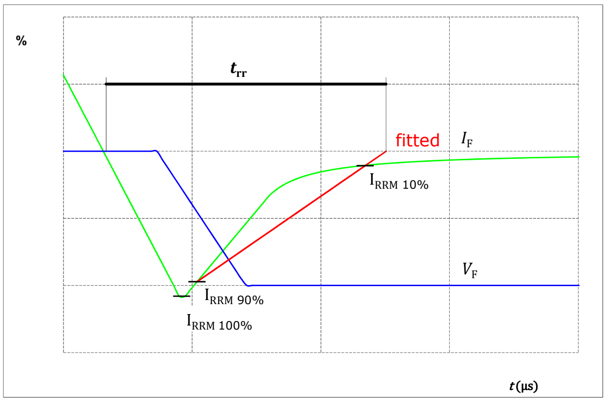
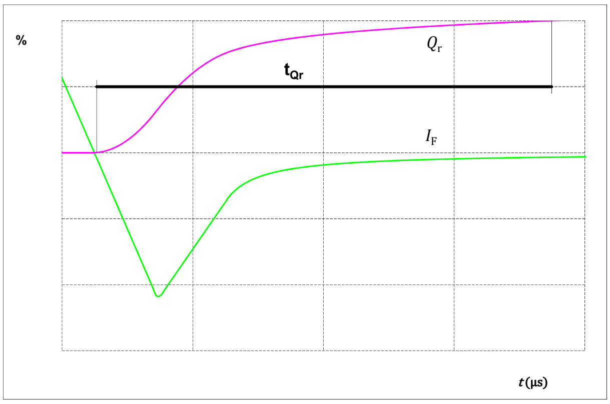


figure 33. **FWD**

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



Ordering Code

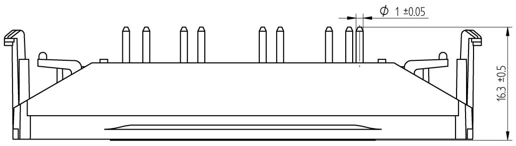
Version	Ordering Code
Without thermal paste	V23990-P629-L43
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P629-L43-/7/

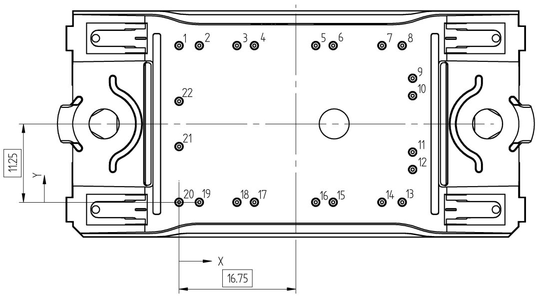
Marking

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

Outline

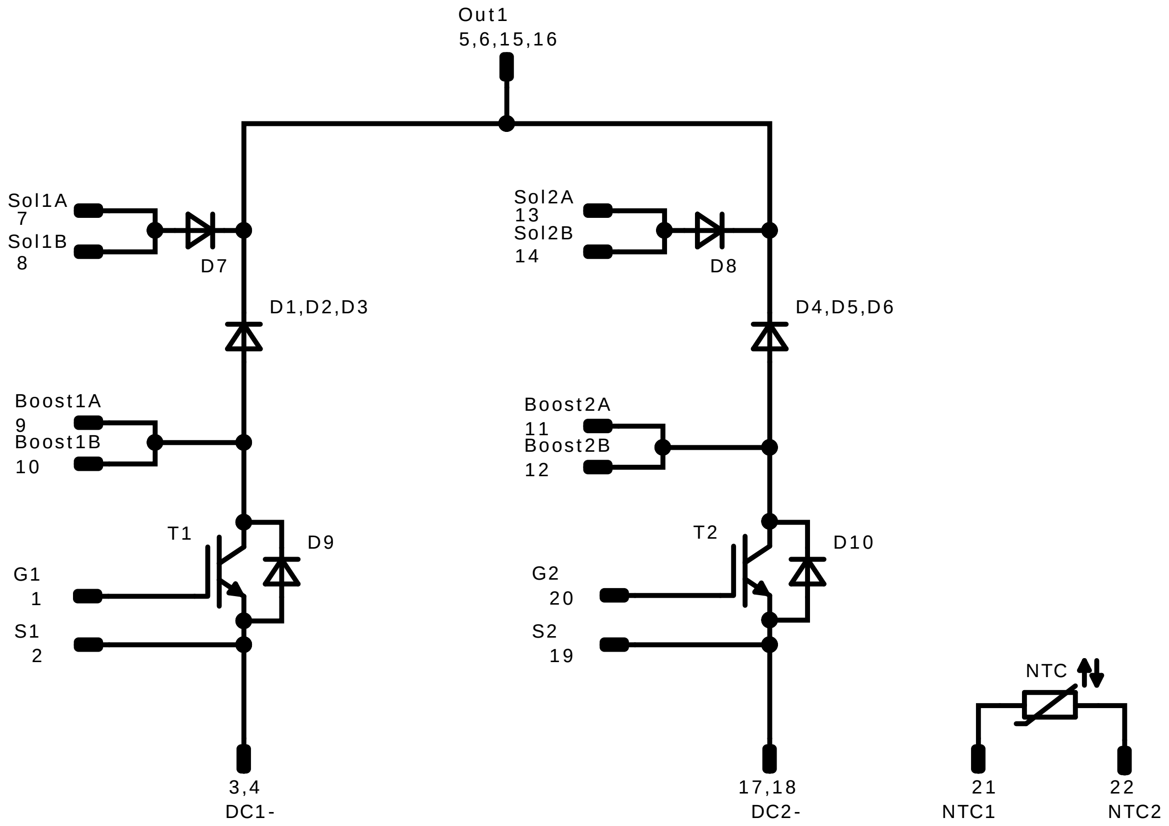
Pin table [mm]			
Pin	X	Y	Function
1	0	22,5	G1
2	2,9	22,5	S1
3	8,3	22,5	DC1-
4	10,8	22,5	DC1-
5	19,6	22,5	Out1
6	22,1	22,5	Out1
7	29,1	22,5	Sol1A
8	32	22,5	Sol1B
9	33,5	17,8	Boost1A
10	33,5	15,3	Boost1B
11	33,5	7,2	Boost2A
12	33,5	4,7	Boost2B
13	32	0	Sol2A
14	29,1	0	Sol2B
15	22,1	0	Out1
16	19,6	0	Out1
17	10,8	0	DC2-
18	8,3	0	DC2-
19	2,9	0	S2
20	0	0	G2
21	0	8	NTC1
22	0	14,5	NTC2





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	IGBT	1200 V	50 A	Boost Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	15 A	Boost Diode	
D9, D10	Rectifier	1600 V	18 A	Boost Sw. Protection Diode	
D7, D8	Rectifier	1600 V	18 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.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-L43-D8-14	27 May. 2025	Change Boost Diode according to PCN-2025-001	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.