



Vincotech

V23990-P629-L43 datasheet

flowBOOST 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

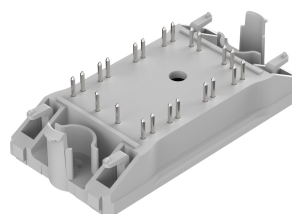
Target applications

- solar inverter

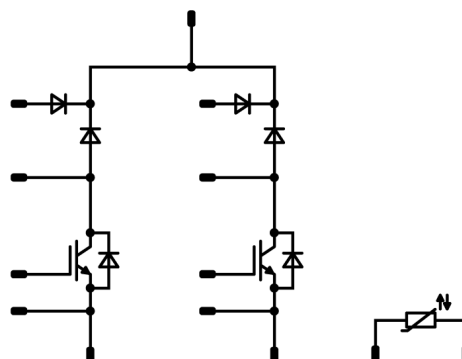
Types

- V23990-P629-L43

flow 0 12 mm housing



Schematic





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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

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

Boost Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	29	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	78	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 25\text{ °C}$	138	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	81	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Boost Sw. Protection Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	W
Maximum junction temperature	T_{jmax}		150	$^{\circ}\text{C}$



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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
ByPass Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			9,55	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production



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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}	$f = 1 \text{ Mhz}$	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⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,66		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	0/15	700	40	25 125		27,2 26,6		ns
Rise time	t_r					25 125		14,4 17		ns
Turn-off delay time	$t_{d(off)}$					25 125		255,8 319,6		ns
Fall time	t_f					25 125		46,87 56,98		ns
Turn-on energy (per pulse)	E_{on}					25 125		1,05 1,22		mWs
Turn-off energy (per pulse)	E_{off}					25 125		1,54 2,43		mWs



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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 Diode

Static

Forward voltage	V_F				15	25 125		1,42 1,69	1,8 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25		60	450	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,17		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=4015$ A/μs $di/dt=3013$ A/μs	0/15	700	40	25 125		16,78 15,44		A
Reverse recovery time	t_{rr}					25 125		9,11 9,45		ns
Recovered charge	Q_r					25 125		0,243 0,213		μC
Reverse recovered energy	E_{rec}					25 125		0,093 0,074		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		6570 5559		A/μs

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⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,49		K/W
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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	

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⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,49		K/W
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Thermistor

Static

Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1486$ 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.



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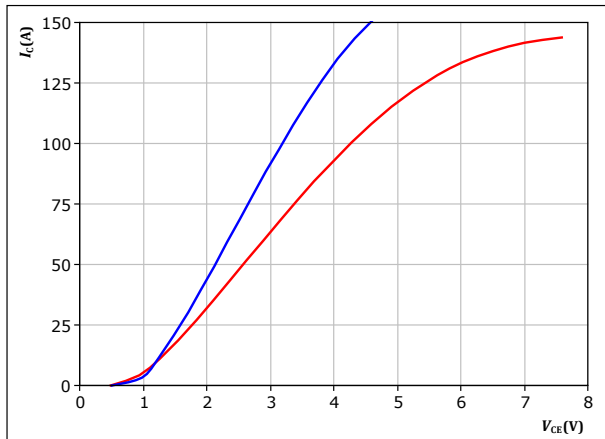
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Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

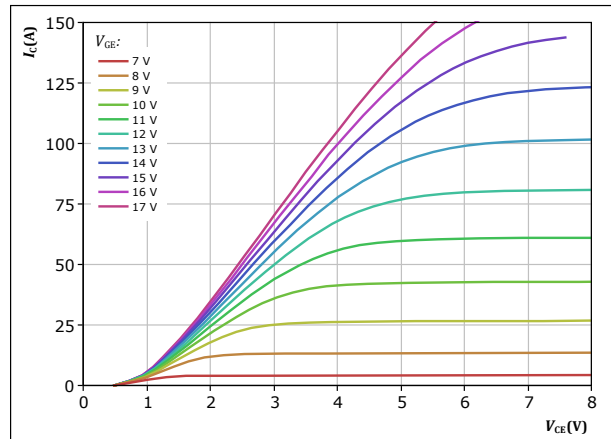


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$

figure 2. IGBT

Typical output characteristics

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

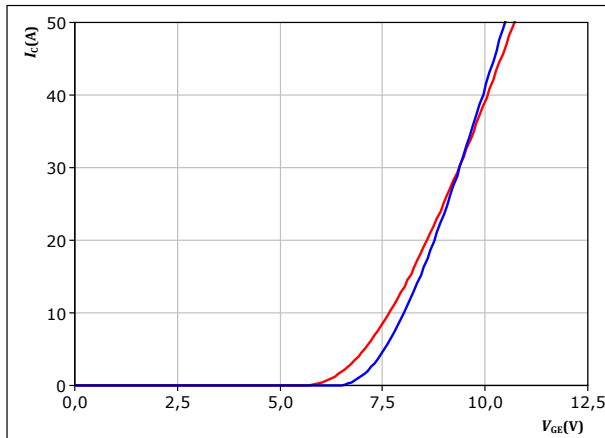


$t_p = 250 \mu s$
 $T_j = 125 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

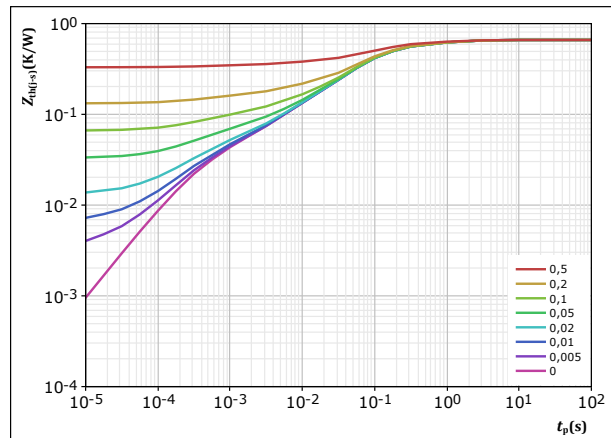


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$

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

$R (K/W)$	$\tau (s)$
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



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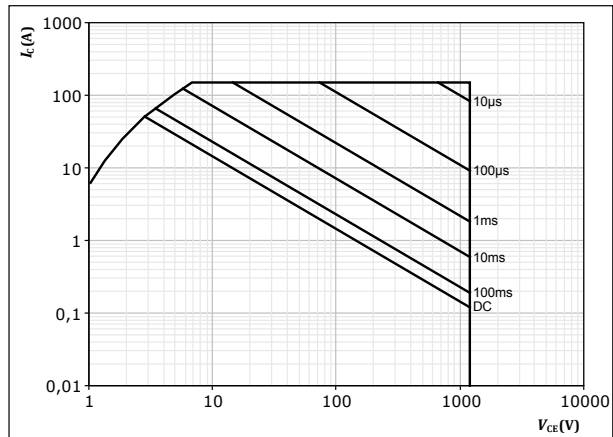
Boost Switch Characteristics

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}



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Boost Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

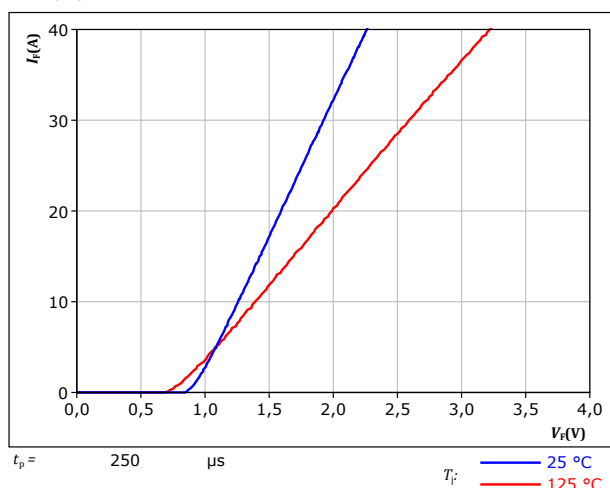
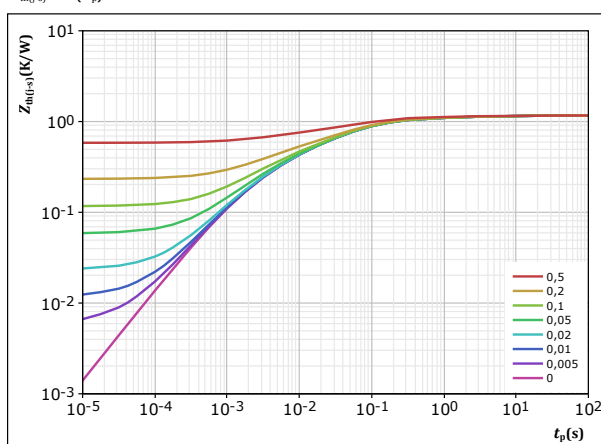


figure 7.

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)	
4,26E-02	9,80E+00	
1,01E-01	8,15E-01	
3,83E-01	9,79E-02	
3,08E-01	2,61E-02	
2,33E-01	5,37E-03	
9,82E-02	1,21E-03	



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Boost Sw. Protection Diode Characteristics

figure 8.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

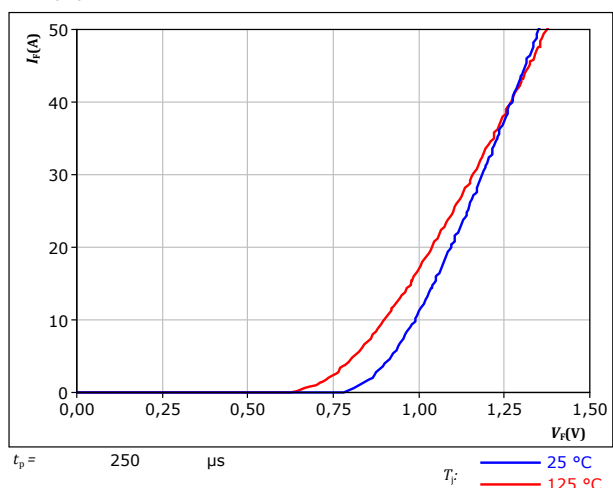
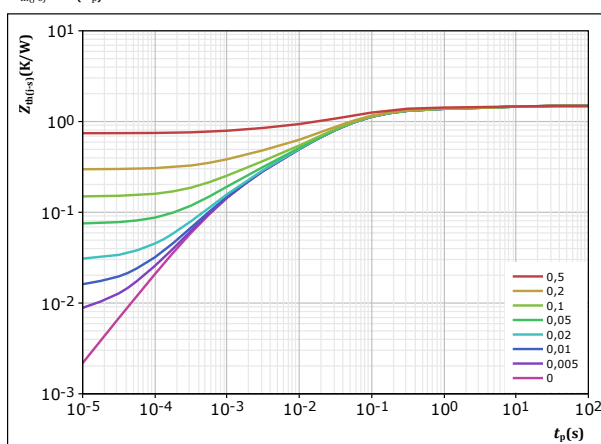


figure 9.

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

$$I_F = f(V_F)$$

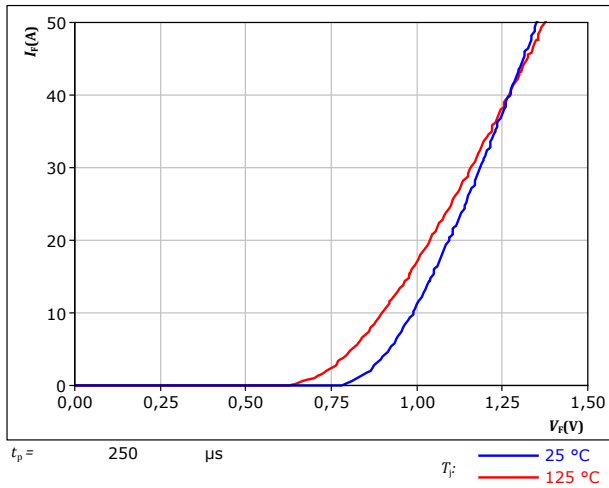
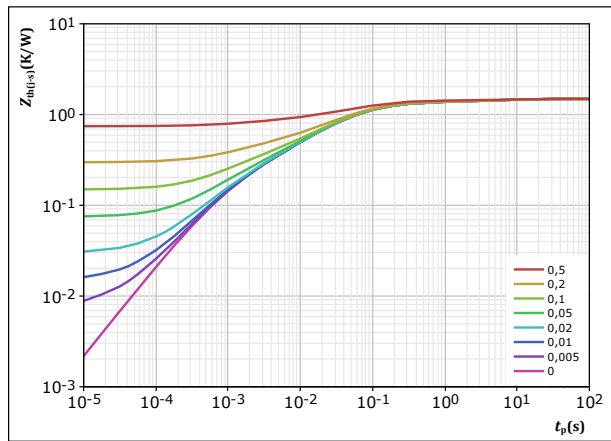


figure 11.

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	



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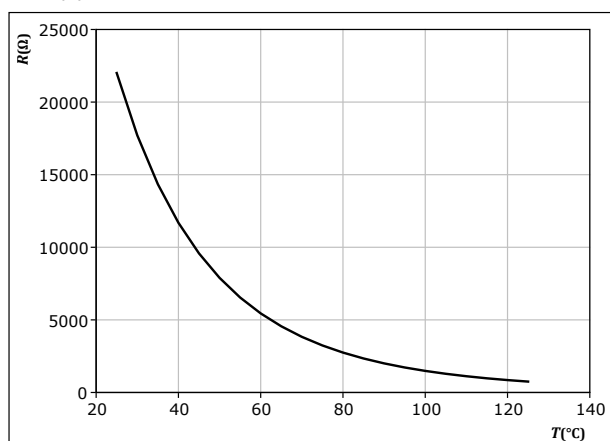
Thermistor Characteristics

figure 12.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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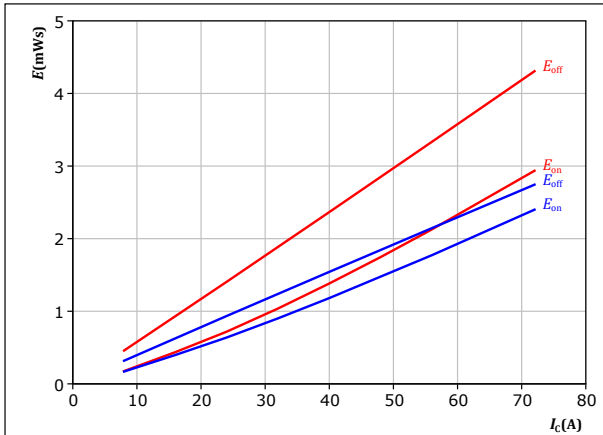
Boost Switching Characteristics

figure 13.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

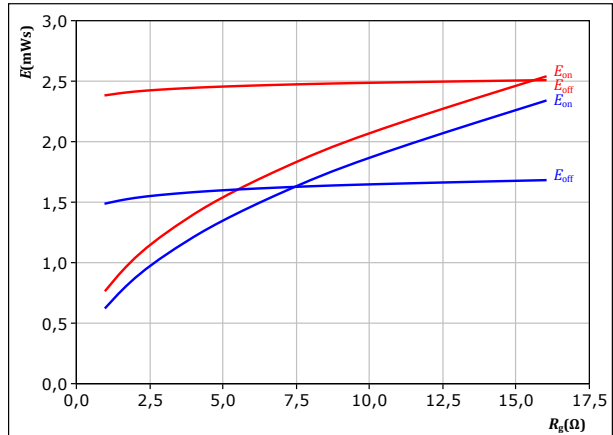
T_j : — 25 °C
— 125 °C

figure 14.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 40$ A

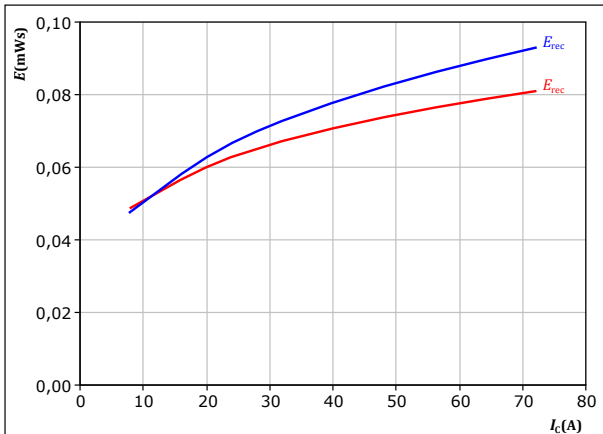
T_j : — 25 °C
— 125 °C

figure 15.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 4$ Ω

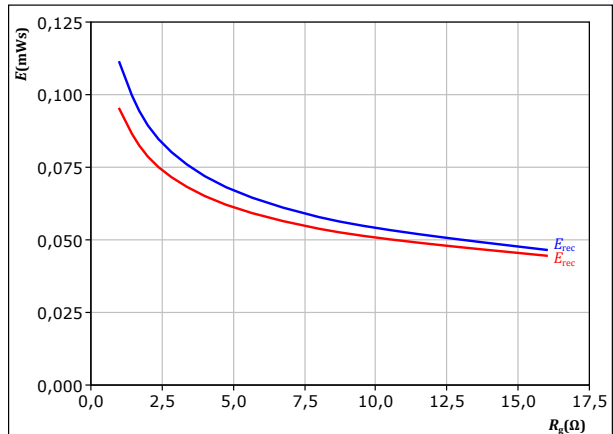
T_j : — 25 °C
— 125 °C

figure 16.

FWD

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

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 40$ A

T_j : — 25 °C
— 125 °C



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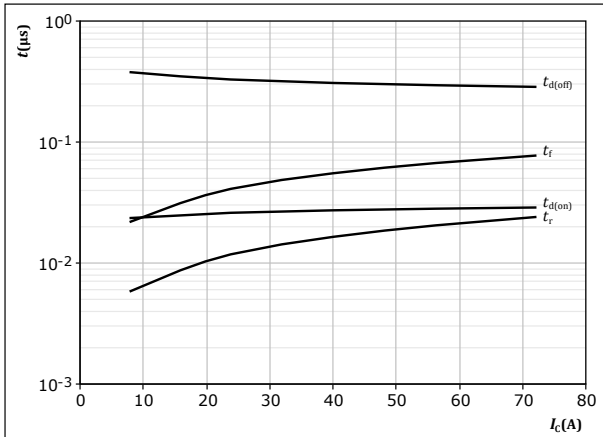
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Boost Switching Characteristics

figure 17.

IGBT

Typical switching times as a function of collector current
 $t = f(I_C)$



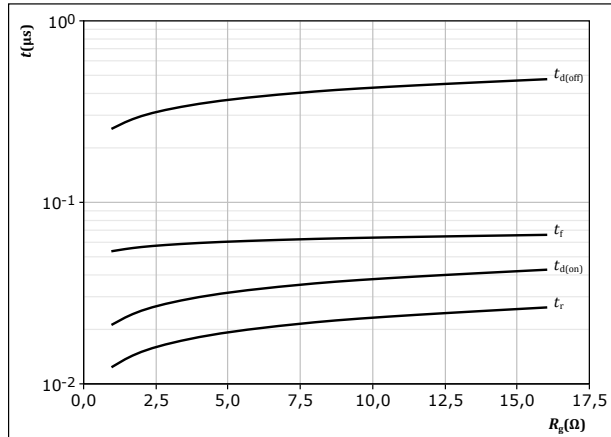
With an inductive load at

$T_j = 125$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

figure 18.

IGBT

Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



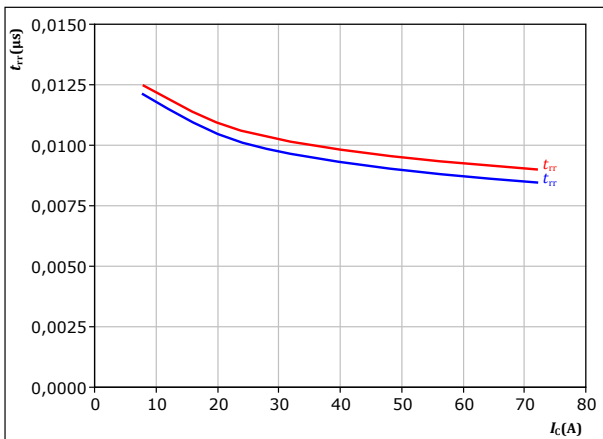
With an inductive load at

$T_j = 125$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 40$ A

figure 19.

FWD

Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_C)$



With an inductive load at

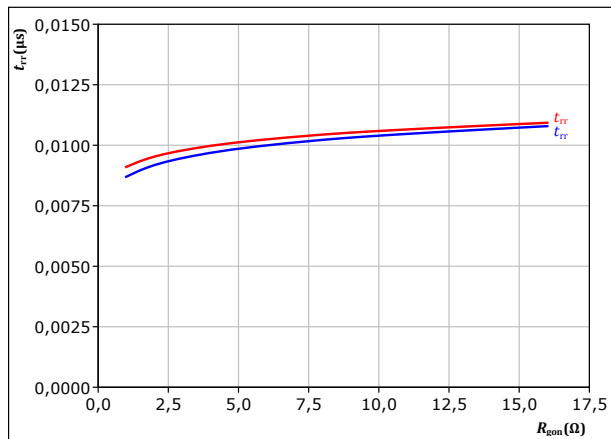
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 4$ Ω

T_j : — 25 °C
— 125 °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
 $I_C = 40$ A

T_j : — 25 °C
— 125 °C



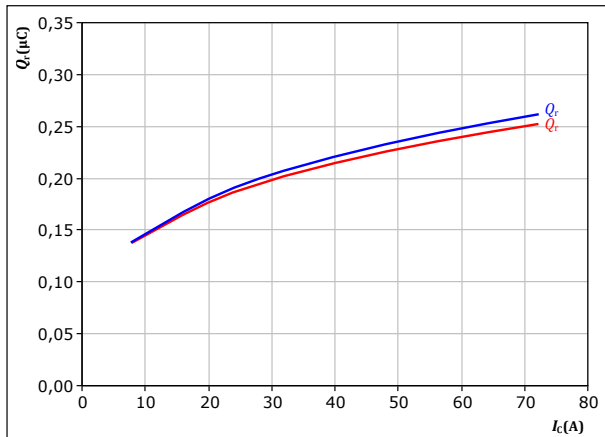
Boost Switching Characteristics

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
 $R_{gon} = 4$ Ω

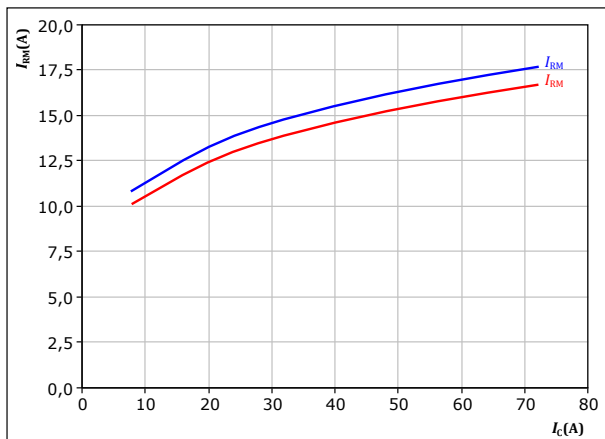
T_j : — 25 °C
— 125 °C

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
 $R_{gon} = 4$ Ω

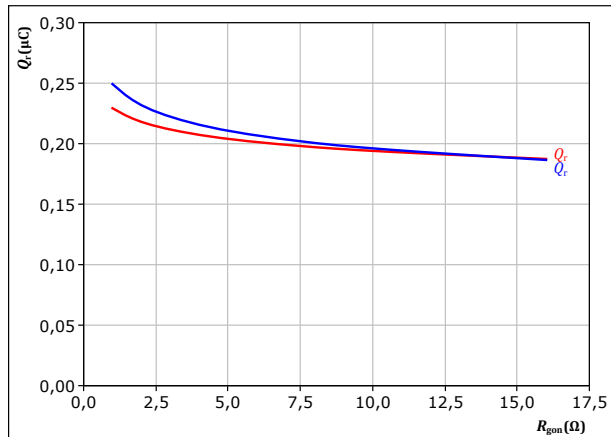
T_j : — 25 °C
— 125 °C

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
 $I_c = 40$ A

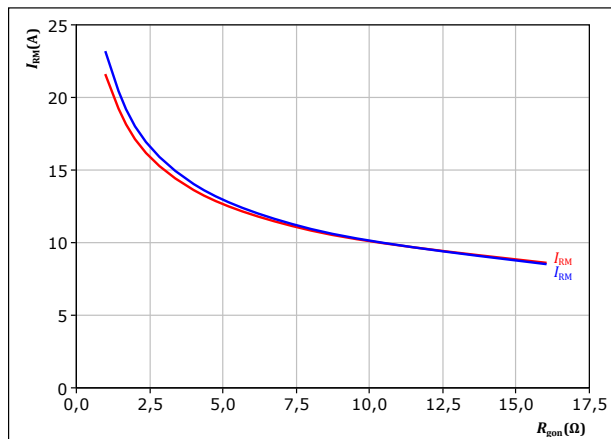
T_j : — 25 °C
— 125 °C

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
 $I_c = 40$ A

T_j : — 25 °C
— 125 °C



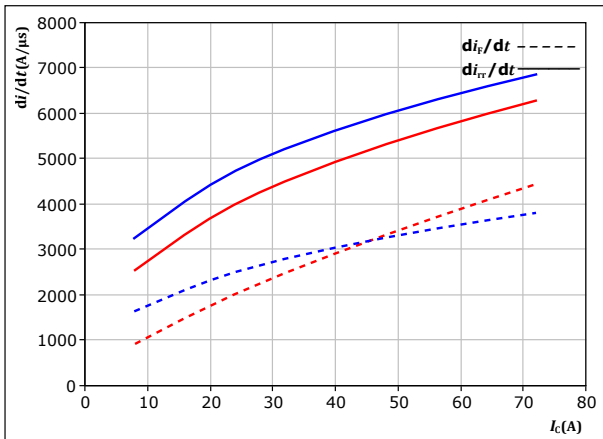
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Boost Switching Characteristics

figure 25. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



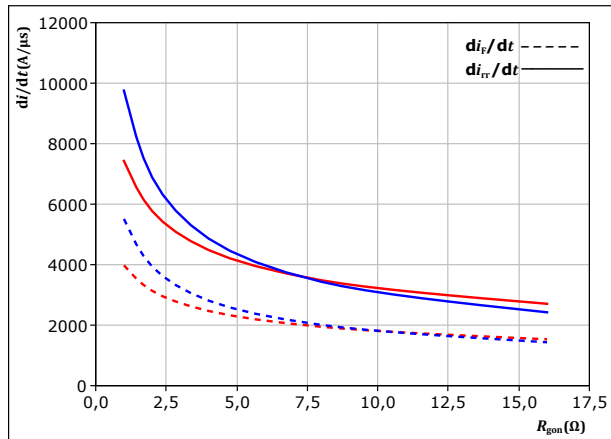
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 4$ Ω

T_j : — 25 °C
— 125 °C

figure 26. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

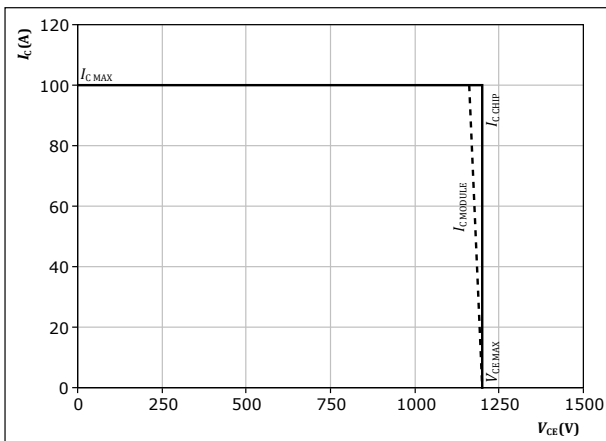
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 40$ A

T_j : — 25 °C
— 125 °C

figure 27. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



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



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Boost Switching Definitions

figure 28. IGBT

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

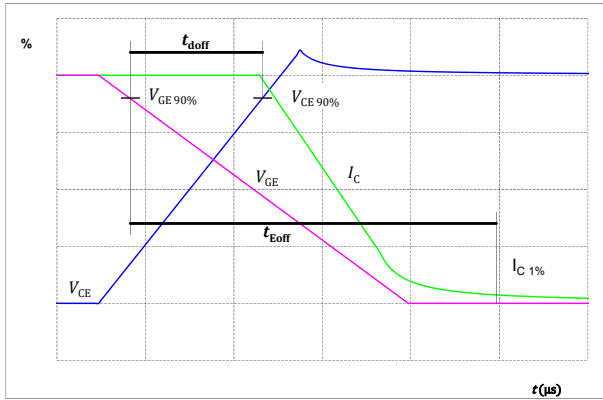


figure 29. IGBT

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

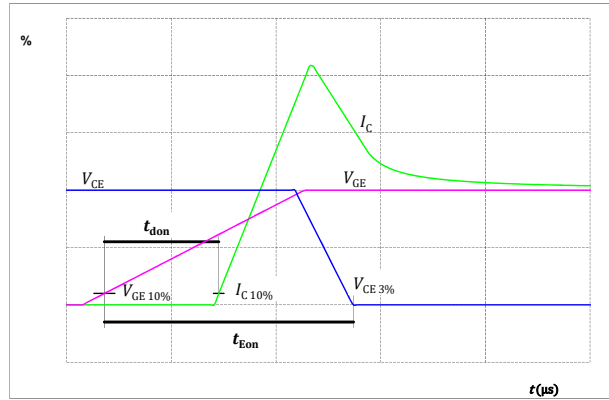


figure 30. IGBT

Turn-off Switching Waveforms & definition of t_f

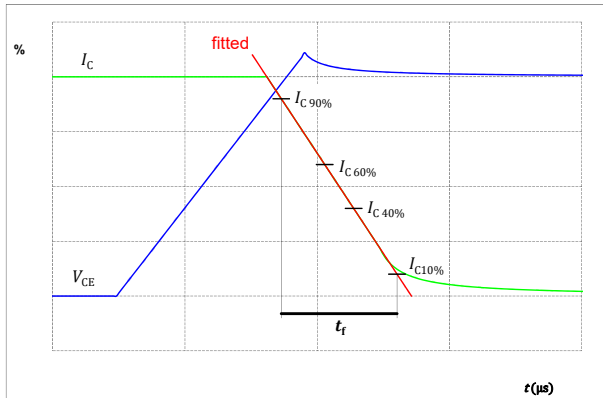
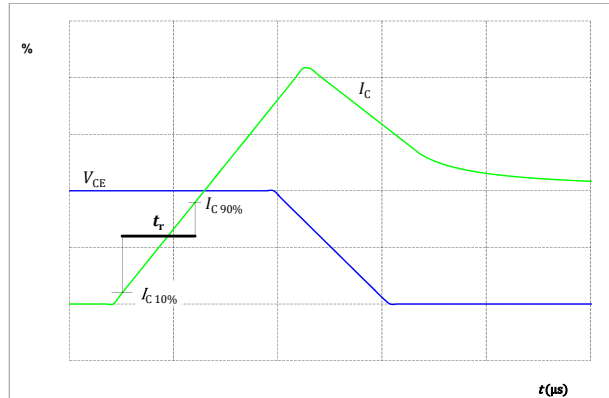


figure 31. IGBT

Turn-on Switching Waveforms & definition of t_r





Boost Switching Definitions

figure 32.

FWD

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

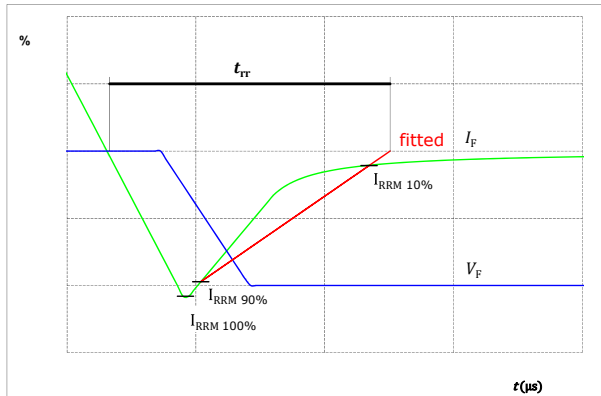
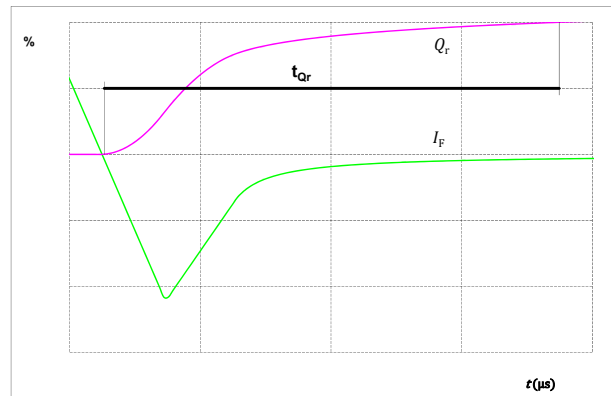


figure 33.

FWD

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





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Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P629-L43
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P629-L43-/7/
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P629-L43-/3/

Marking							
	Text	VIN	Date code	Type&Ver	UL	Lot	Serial
		VIN	WWYY	TTTTTTVV	UL	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTVV	LLLL	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

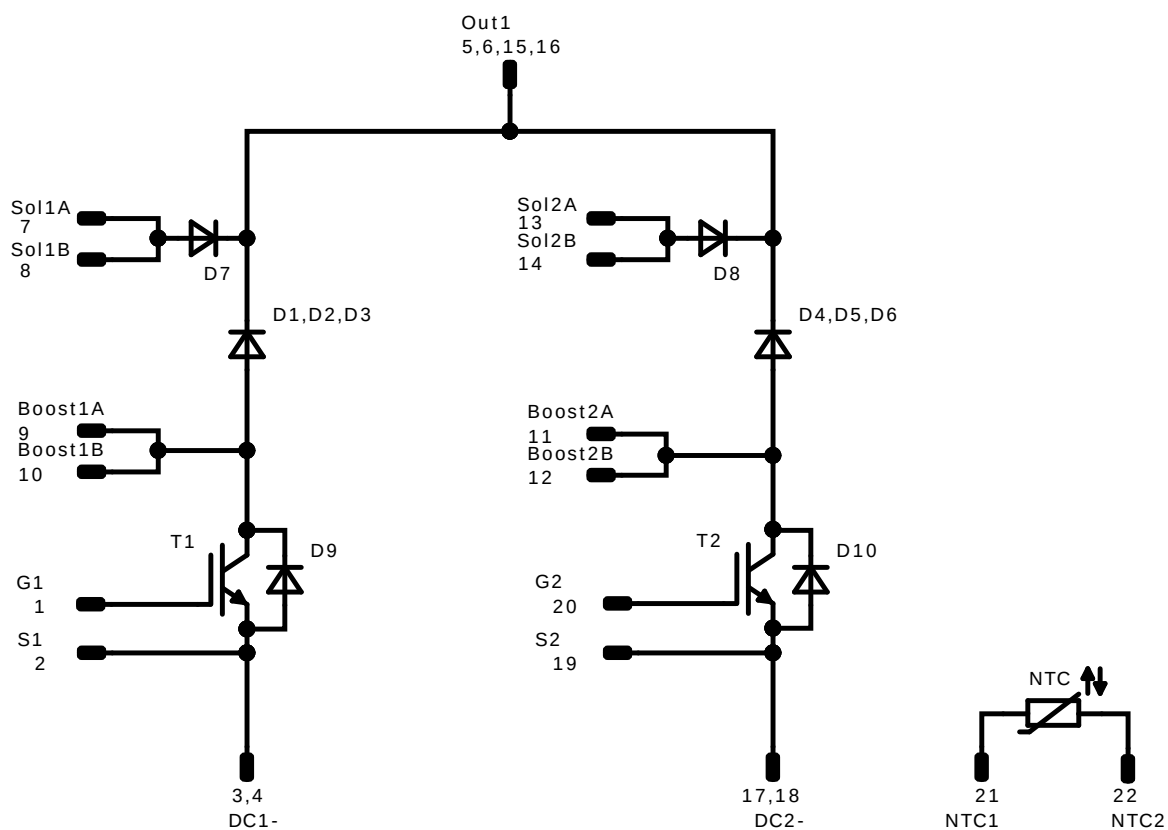
Tolerance of pinpositions: $\pm 0,5\text{mm}$ at the end of pins
Dimension of coordinate axis is only offset without tolerance



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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	
NTC	Thermistor			Thermistor	



Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow 0</i> packages see vincotech.com website.

Package data
Package data for <i>flow 0</i> 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
V23990-P629-L43-D7-14	8 Apr. 2022	New Datasheet format Update of Ir at Protection and Bypass Diode	

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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.