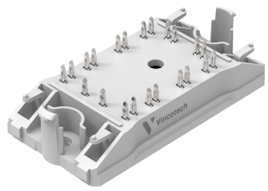
V23990-P629-L58Y-PM
datasheet

***flow*BOOST 0 dual** **1200 V / 40 A**

Features

- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V Si diode

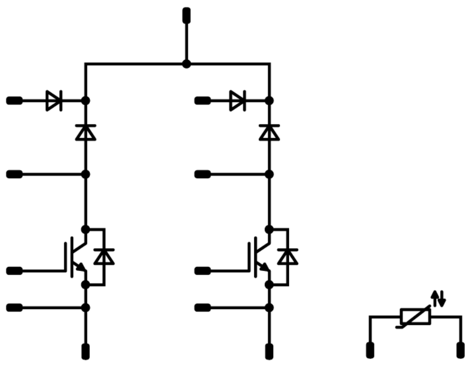
flow 0 12 mm housing



Target applications

- solar inverter

Schematic



Types

- V23990-P629-L58Y-PM

Maximum Ratings

T_j = 25 °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 °C	42	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		120	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	115	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					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	43	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	270	A
Surge current capability	I^2t			365	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	98	W
Maximum junction temperature	T_{jmax}			175	°C
Boost Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	25	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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				9,15	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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125	1,78	2,11 2,48	2,42(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		2330		pF
Output capacitance	C_{oes}							150		pF
Reverse transfer capacitance	C_{res}							130		pF
Gate charge	Q_g	V_{CC} = 960 V	15		40	25		185		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,82		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	700	24	25 125		22,4 20,8		ns
Rise time	t_r					25 125		8,4 10,6		ns
Turn-off delay time	$t_{d(off)}$					25 125		224,6 293		ns
Fall time	t_f					25 125		34,48 67,86		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,24 µC Q_{rFWD}=5,02 µC				25 125		1,09 1,82		mWs
Turn-off energy (per pulse)	E_{off}					25 125		1 1,61		mWs

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				50	25 125 150		2,29 2,37	2,54[(1)] 2,5[(1)]	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 4400	60 8800	µA
Thermal										
Thermal resistance junction to sink [(2)]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,97		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=3264 A/µs d*i*/d*t*=3300 A/µs	0/15	700	24	25 125		62,76 78,31		A
Reverse recovery time	t_{rr}					25 125		82,95 207,96		ns
Recovered charge	Q_r					25 125		2,24 5,02		µC
Reverse recovered energy	E_{rec}					25 125		0,982 2,42		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		5304 3201		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				3	25 125	1,23	1,67 1,58	1,97[1]	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,8		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			50	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,49		K/W
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

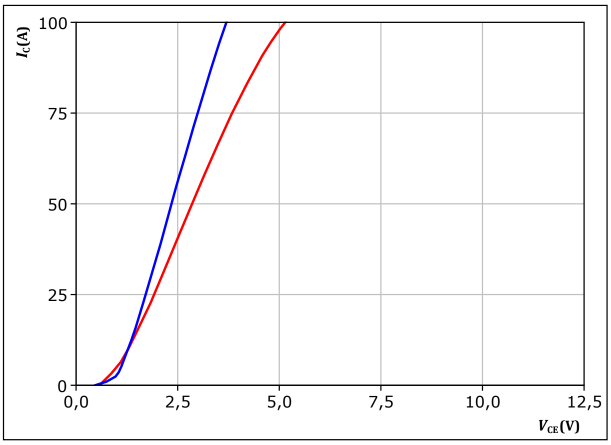
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

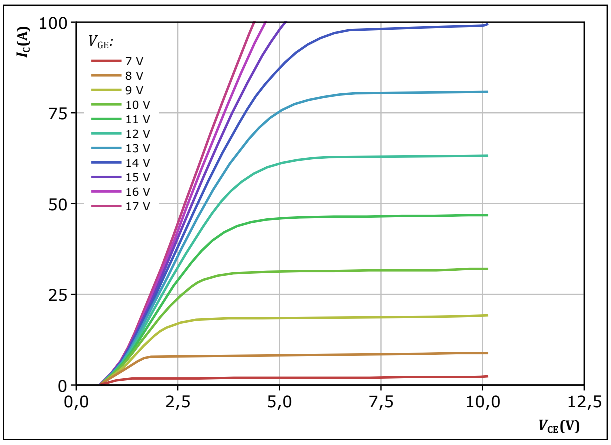


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

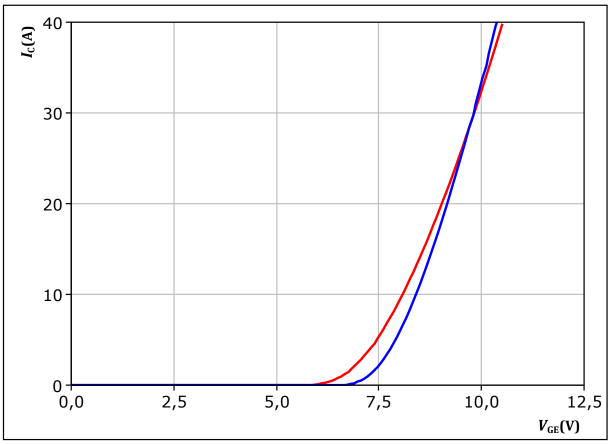


t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

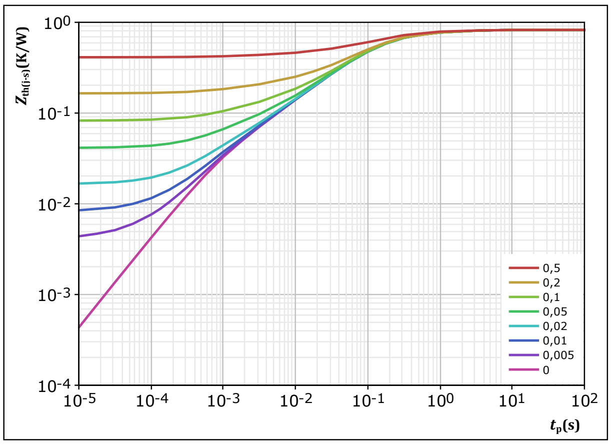


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
$R_{th(j-s)}$ = 0,825 K/W

IGBT thermal model values

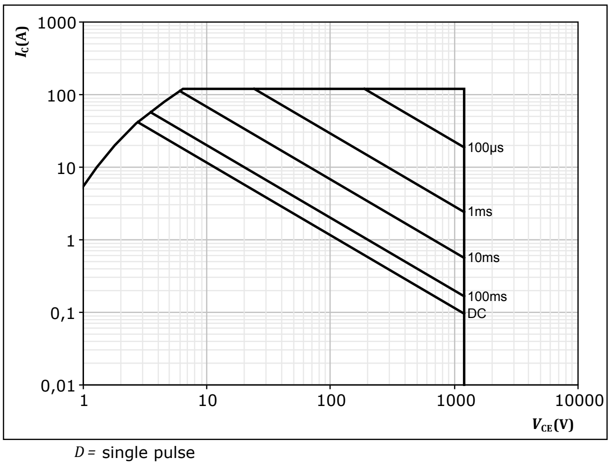
R (K/W)	τ (s)
8,14E-02	1,87E+00
2,77E-01	2,47E-01
3,52E-01	7,24E-02
8,40E-02	1,01E-02
3,10E-02	1,06E-03

Boost Switch Characteristics

figure 5.	IGBT

Safe operating area

$I_C = f(V_{CE})$



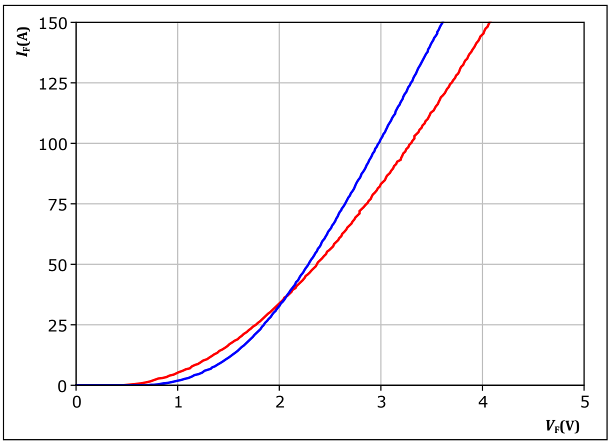
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



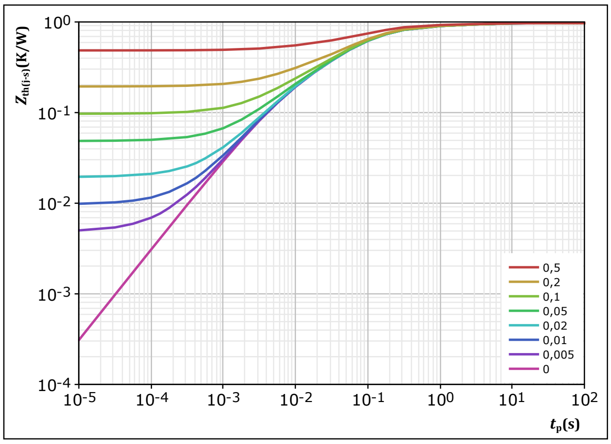
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,971 K/W

FWD thermal model values

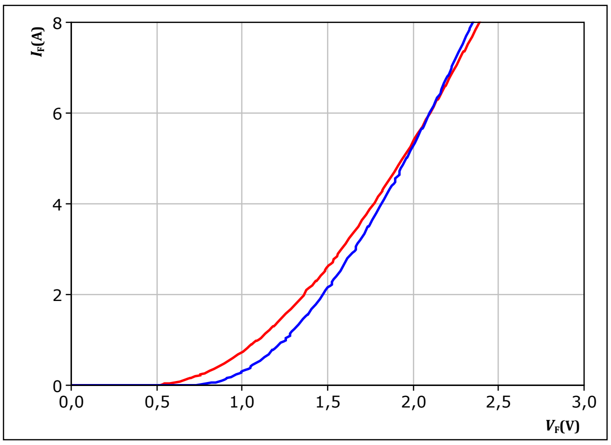
R (K/W)	τ (s)
6,69E-02	3,87E+00
1,47E-01	4,68E-01
4,96E-01	9,12E-02
1,74E-01	2,26E-02
8,75E-02	5,01E-03

Boost Sw. Protection Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

I_F = f(V_F)



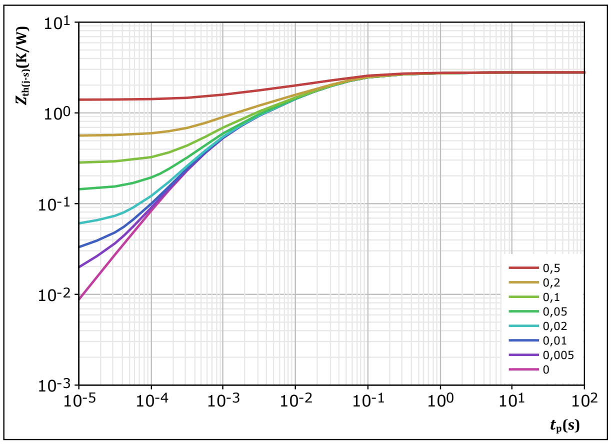
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,796 K/W

FWD thermal model values

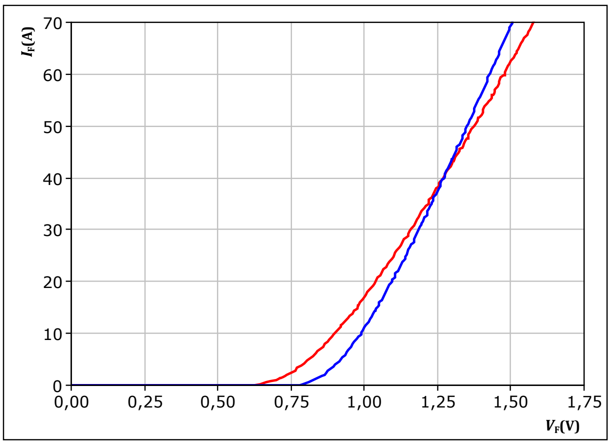
R (K/W)	τ (s)
7,82E-02	2,45E+00
1,95E-01	2,65E-01
9,84E-01	4,77E-02
6,58E-01	1,23E-02
5,09E-01	2,70E-03
3,71E-01	5,98E-04

ByPass Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



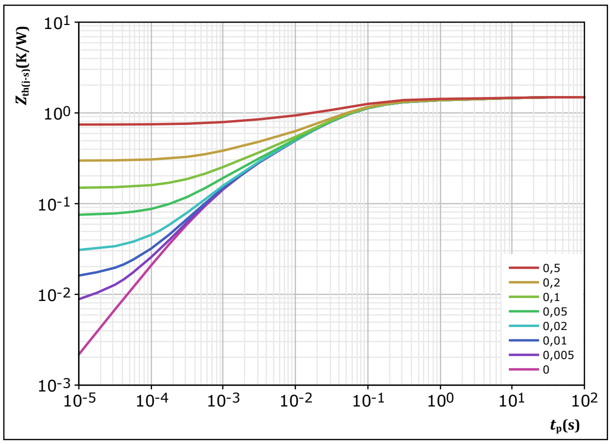
t_p = 250 µs

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

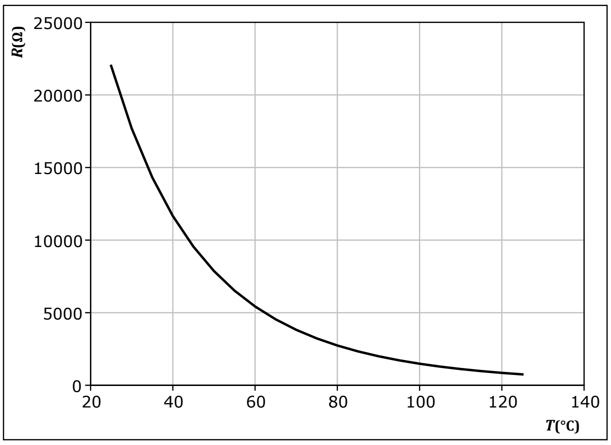
R (K/W)	τ (s)
1,10E-01	7,06E+00
1,38E-01	3,93E-01
6,16E-01	6,84E-02
3,90E-01	1,63E-02
1,63E-01	2,51E-03
7,11E-02	5,88E-04

Thermistor Characteristics

figure 12.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

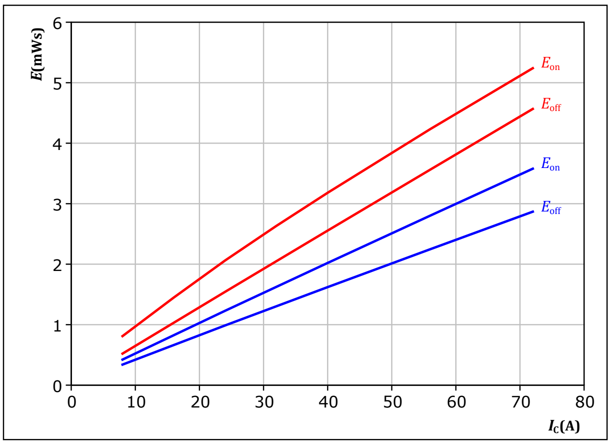


Boost Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

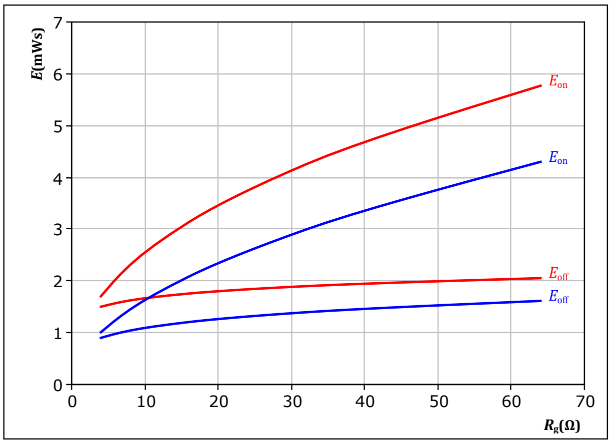
V_{CE} =	700	V	
V_{GE} =	0/15	V	
R_{gon} =	4	Ω	
R_{goff} =	4	Ω	

T_j: 25 °C (blue), 125 °C (red)

figure 14. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



With an inductive load at

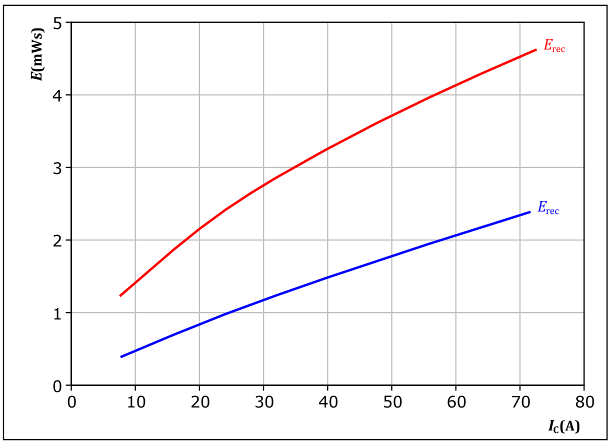
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	24	A

T_j: 25 °C (blue), 125 °C (red)

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

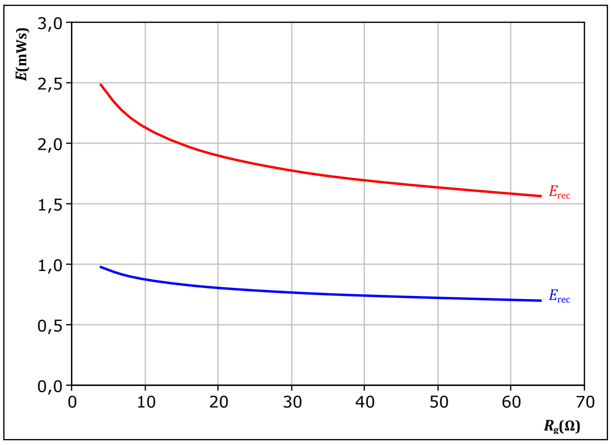
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C (blue), 125 °C (red)

figure 16. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	24	A

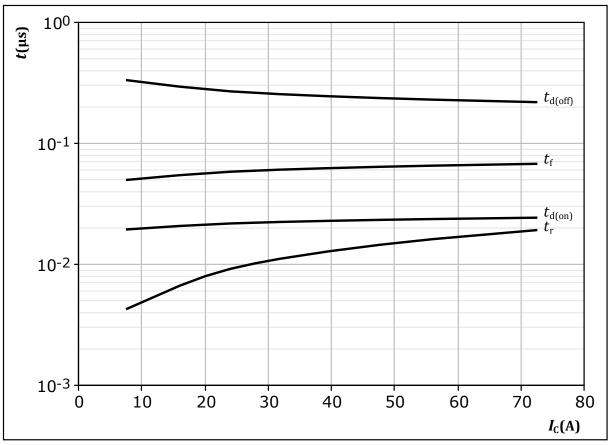
T_j: 25 °C (blue), 125 °C (red)

Boost Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



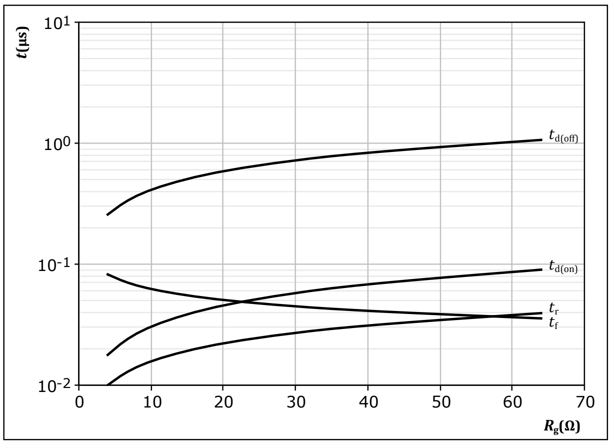
With an inductive load at

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 gate resistor

t = f(R_g)



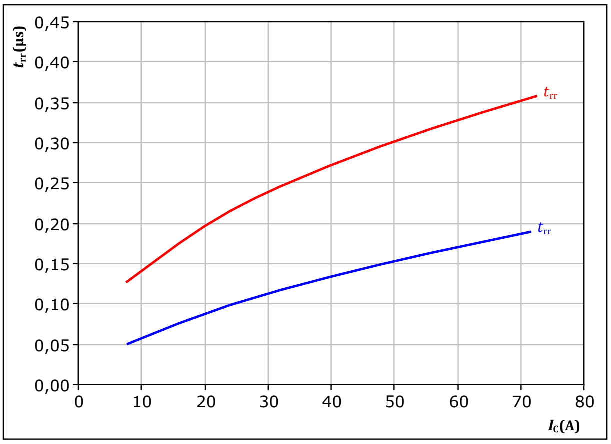
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	24	A

figure 19. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

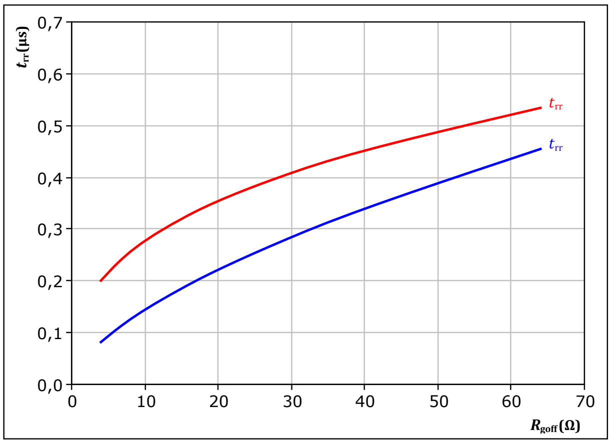
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C

figure 20. **FWD**

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

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



With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	24	A

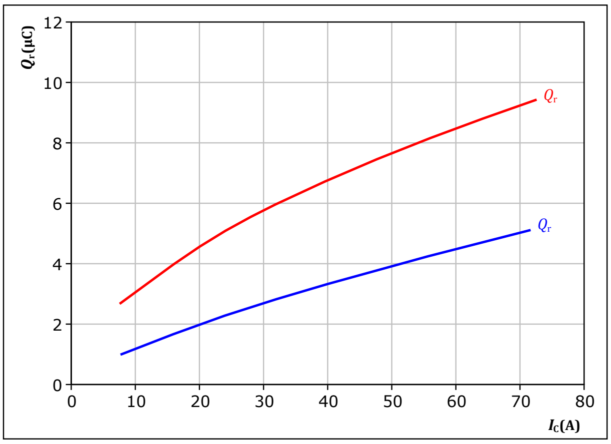
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



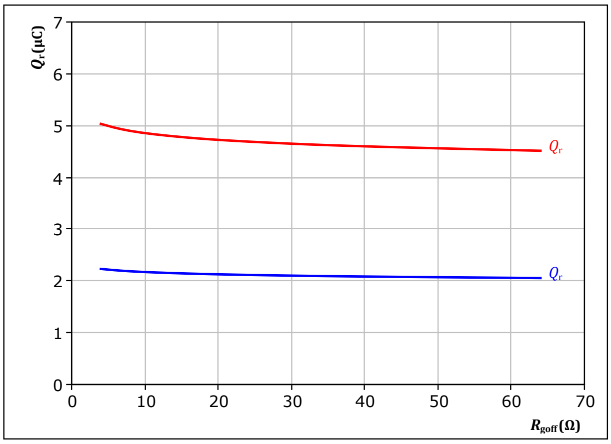
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 22. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



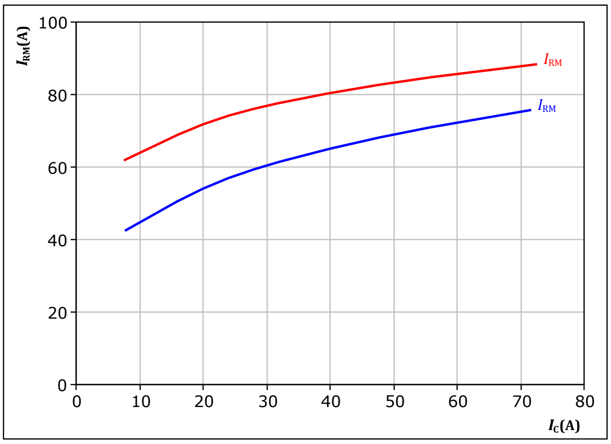
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	24	A		

figure 23. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



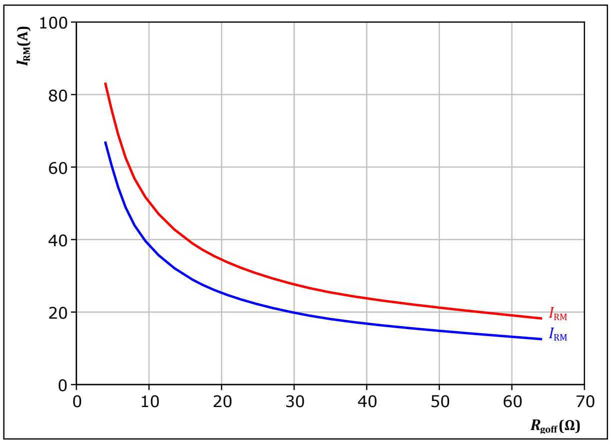
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 24. **FWD**

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

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



With an inductive load at

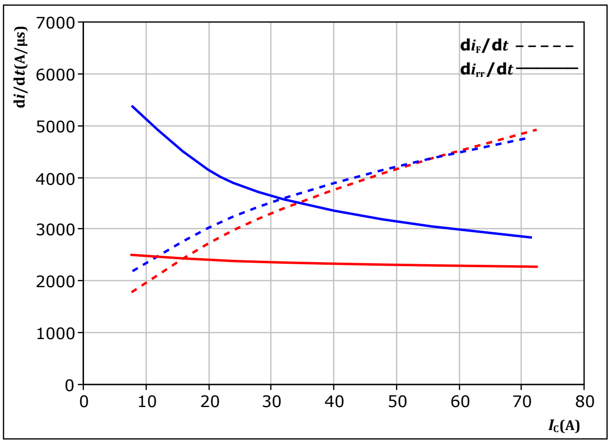
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	24	A		

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)



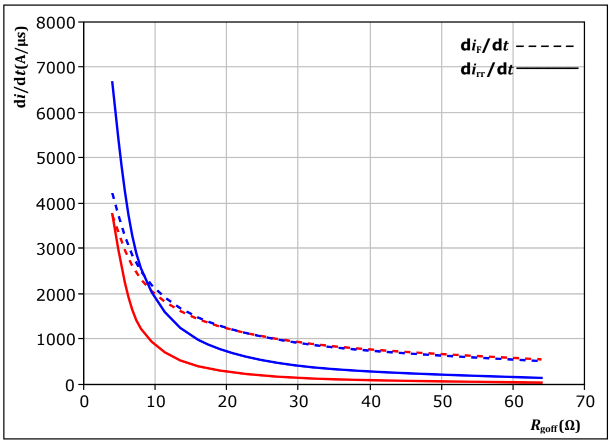
With an inductive load at

V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	4	Ω	

figure 26. **FWD**

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

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



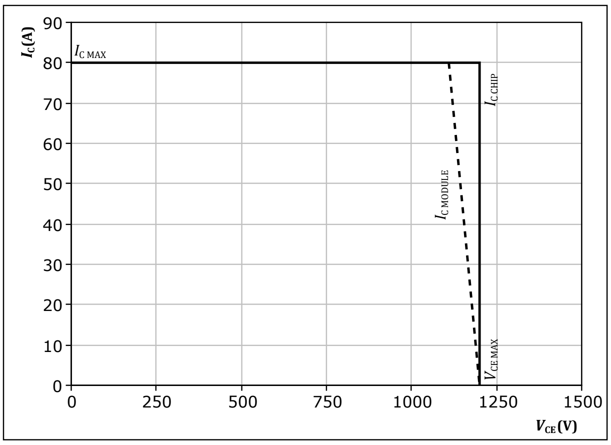
With an inductive load at

V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
I_C =	24	A	

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

Boost Switching Definitions

figure 28. **IGBT**

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

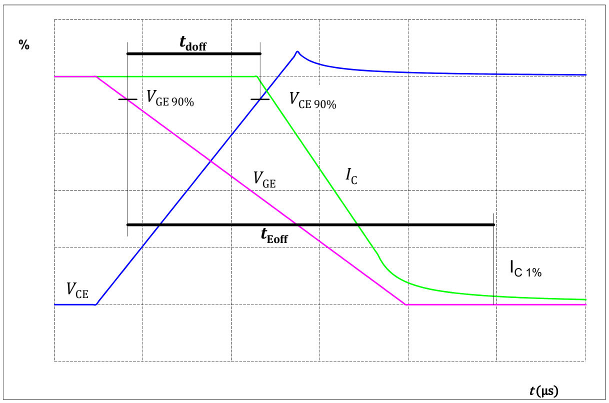


figure 29. **IGBT**

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

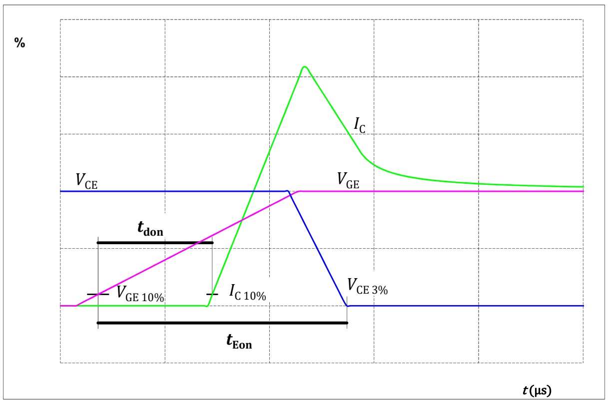


figure 30. **IGBT**

Turn-off Switching Waveforms & definition of t_f

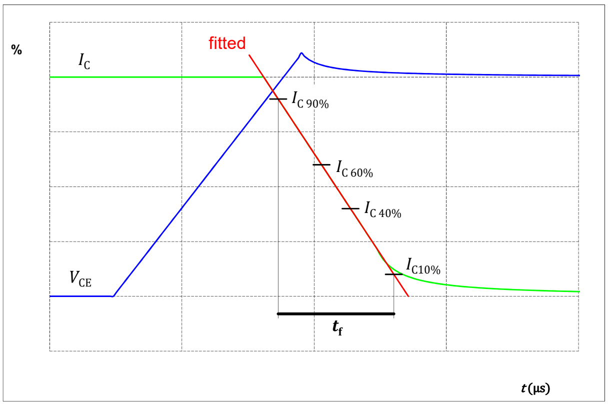
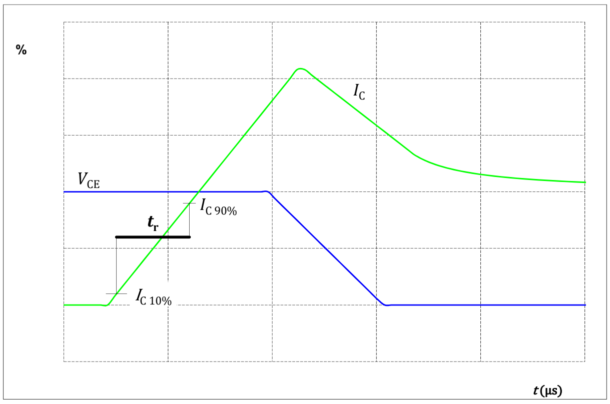


figure 31. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 32.	FWD

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

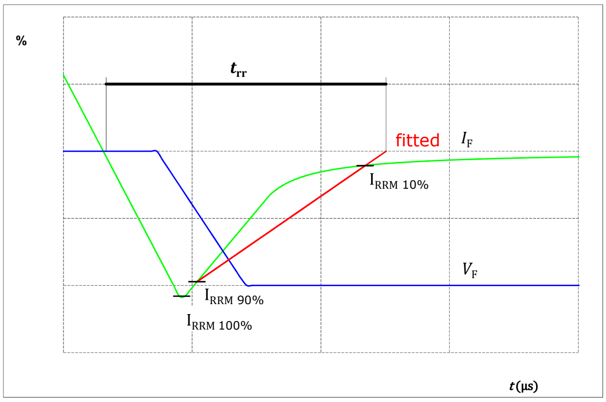
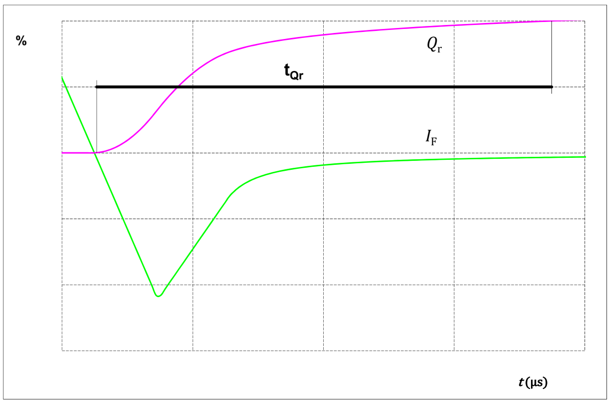


figure 33.	FWD

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



Ordering Code

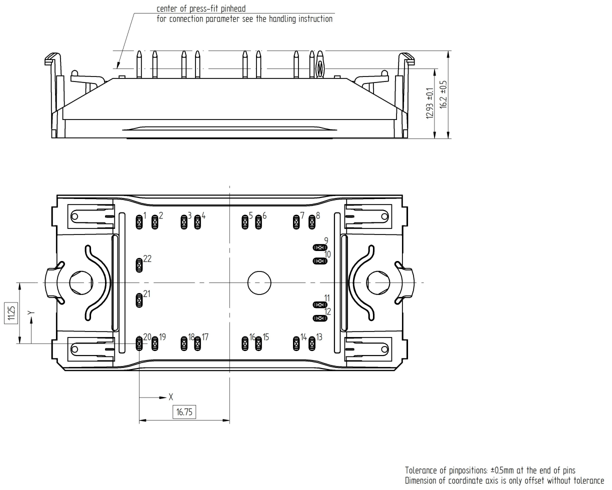
Version	Ordering Code
Without thermal paste	V23990-P629-L58Y-PM
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P629-L58Y-/7/-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P629-L58Y-/3/-PM

Marking

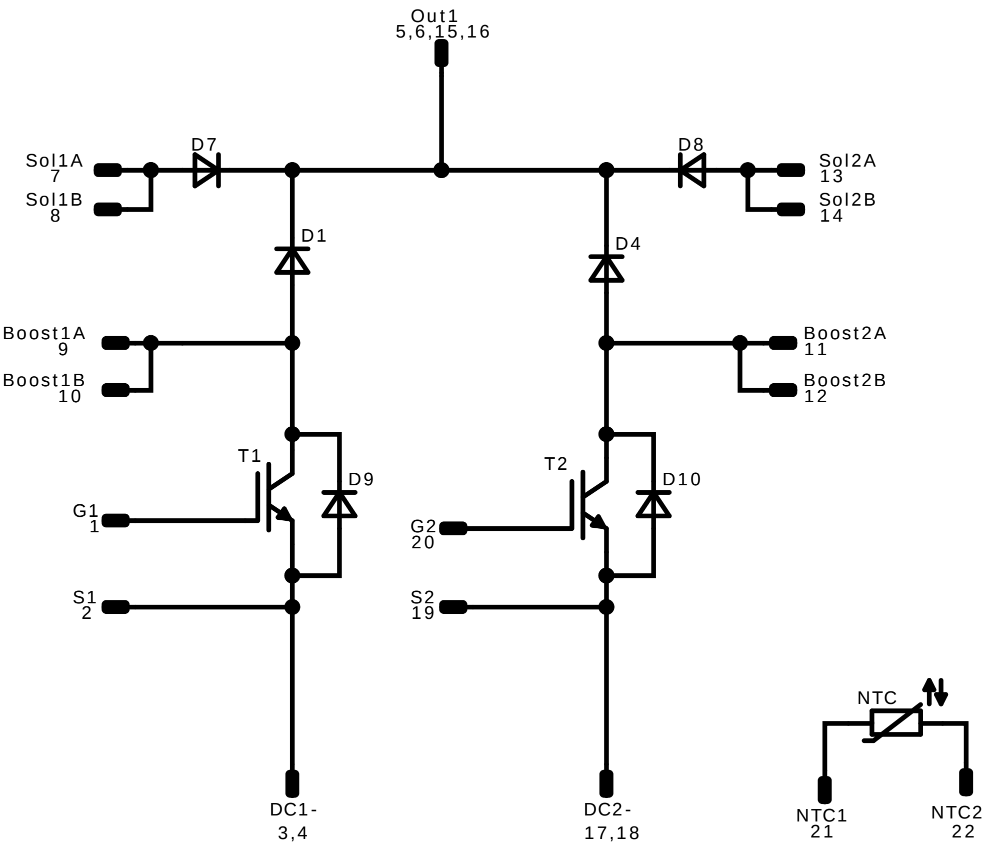
Text	**VIN**	**Date code**	**Type&Ver**	**UL**	**Lot**	**Serial**
	VIN	WWYY	TTTTTTTVV	UL	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

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	Therm1
22	0	14,5	Therm2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2	IGBT	1200 V	40 A	Boost Switch	
D1, D4	FWD	1200 V	50 A	Boost Diode	
D9, D10	FWD	1200 V	3 A	Boost Sw. Protection Diode	
D7, D8	Rectifier	1600 V	25 A	ByPass Diode	
NTC	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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-L58Y-PM-D3-14	11 Sep. 2021	New Datasheet format, module is unchanged Introduce Rth values with PSX-P7 TIM Separate datasheet for pressfit pin version	