



*flow*PACK 2

1200 V / 100 A

Features

- High power *flow2* housing
- Trench Fieldstop Technology IGBT4
- Compact and low inductive design

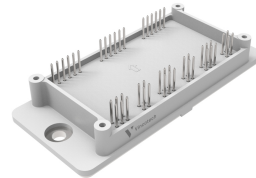
Target applications

- Motor Drive
- Power Generation
- UPS

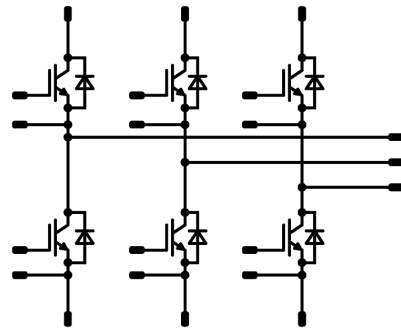
Types

- V23990-P689-F-PM

flow 2 17 mm housing



Schematic





Vincotech

V23990-P689-F-PM
datasheet

Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	115	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	307	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	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	91	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	176	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

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			min. 12,7	mm
Clearance			min. 12,7	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		

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0034	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	25 150	1,58	1,94 2,35	2,07 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2	μA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							2		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		5600		pF
Reverse transfer capacitance	C_{res}							200		pF
Gate charge	Q_g		15		0	25		760		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,31		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	± 15	600	100	25		103,8		ns
Rise time	t_r					150		107,8		ns
Turn-off delay time	$t_{d(off)}$					25		218,6		ns
Fall time	t_f					150		293,2		ns
Turn-on energy (per pulse)	E_{on}					25		71,68		mWs
						150		110,56		mWs
Turn-off energy (per pulse)	E_{off}					25		4,04		mWs
		150		6,73		mWs				
		25		5,25		mWs				
		150		8,77		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		

Inverter Diode

Static

Forward voltage	V_F				100	25 150	1,35	1,99 2,01	2,05 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 1200$ V				25			18	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,54		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=6900$ A/μs $di/dt=5512$ A/μs	±15	600	100	25		163,67		A
						150		186,62		
Reverse recovery time	t_{rr}					25		130,08		ns
						150		294,35		
Recovered charge	Q_r					25		9,32		μC
						150		18,66		
Reverse recovered energy	E_{rec}	25		3,87		mWs				
		150		7,96						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	25		8743		A/μs				
		150		3702						

⁽¹⁾ Value at chip level

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

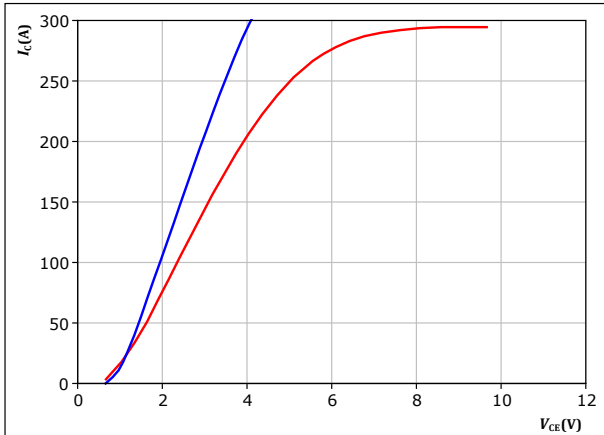


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

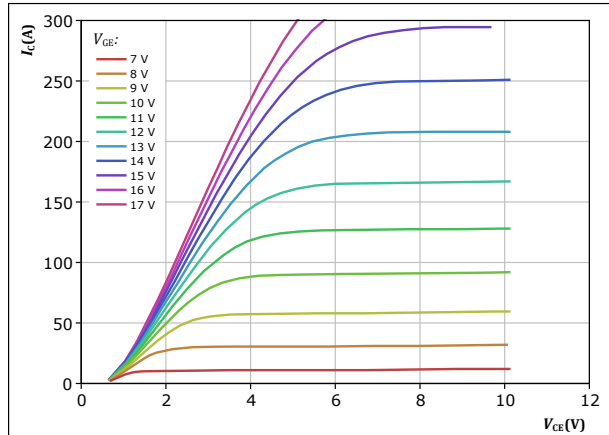


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25^\circ C$ (blue), $150^\circ C$ (red)

figure 2. IGBT

Typical output characteristics

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

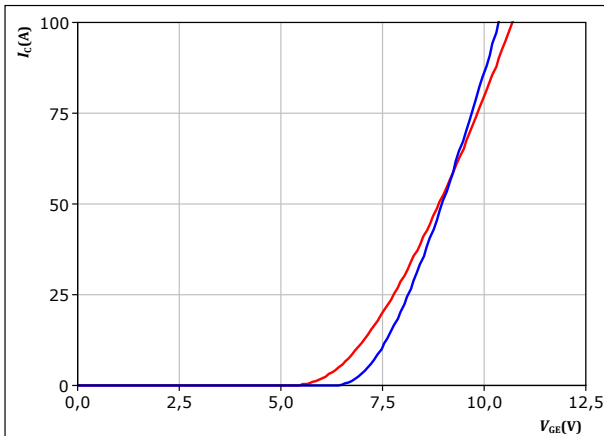


$t_p = 250 \mu s$
 $T_j = 150^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

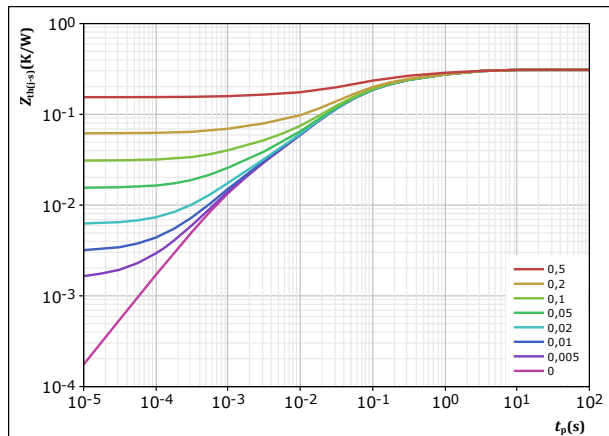


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25^\circ C$ (blue), $150^\circ C$ (red)

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,309 K/W$
IGBT thermal model values

R (K/W)	τ (s)
6,00E-02	1,67E+00
7,30E-02	2,35E-01
1,19E-01	5,35E-02
4,31E-02	1,45E-02
1,45E-02	1,21E-03

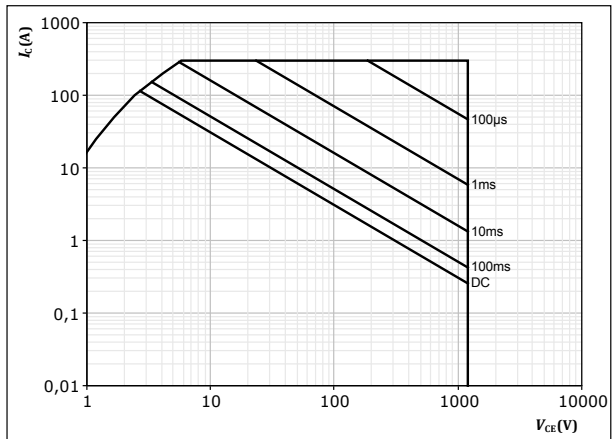


Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



$D =$ single pulse

$T_s = 80 \text{ } ^\circ\text{C}$

$V_{GE} = 15 \text{ V}$

$T_j = T_{jmax}$



Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

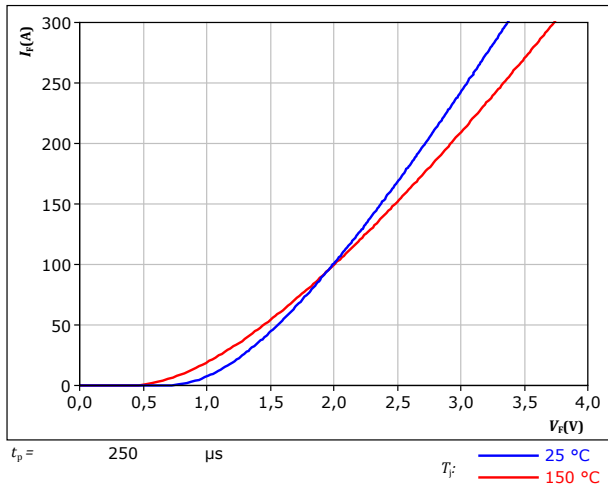
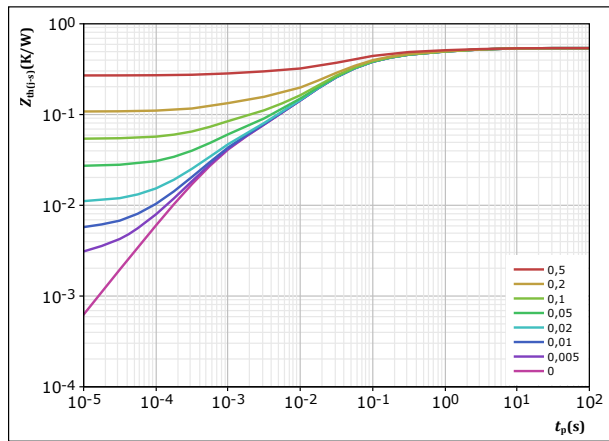


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 0,539 \text{ K/W}$

FWD thermal model values

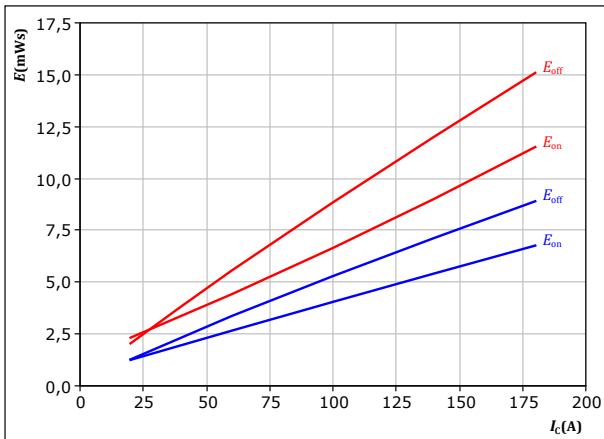
$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,25E-02	4,14E+00
5,01E-02	9,90E-01
1,38E-01	1,45E-01
2,22E-01	3,37E-02
5,69E-02	9,51E-03
3,92E-02	7,97E-04



Inverter Switching Characteristics

figure 8. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$



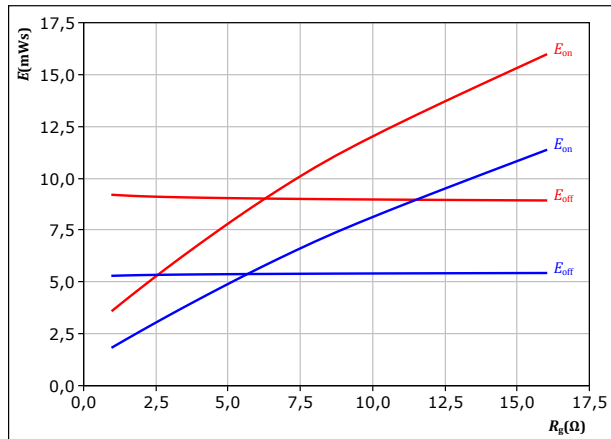
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

T_j : — 25 °C
 — 150 °C

figure 9. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$



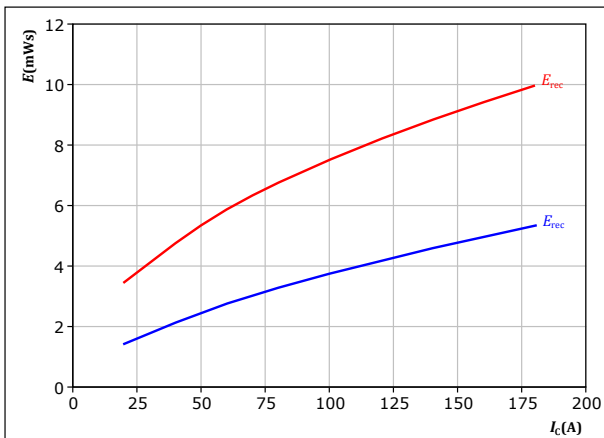
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A

T_j : — 25 °C
 — 150 °C

figure 10. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



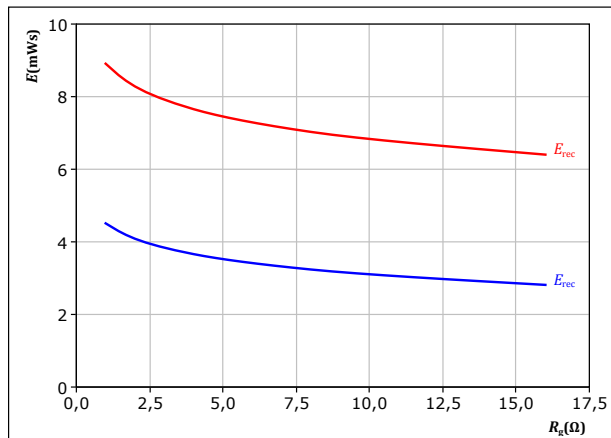
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

T_j : — 25 °C
 — 150 °C

figure 11. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A

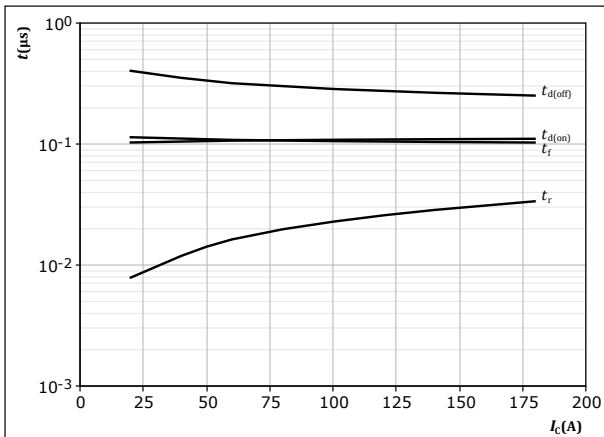
T_j : — 25 °C
 — 150 °C



Inverter Switching Characteristics

figure 12. IGBT

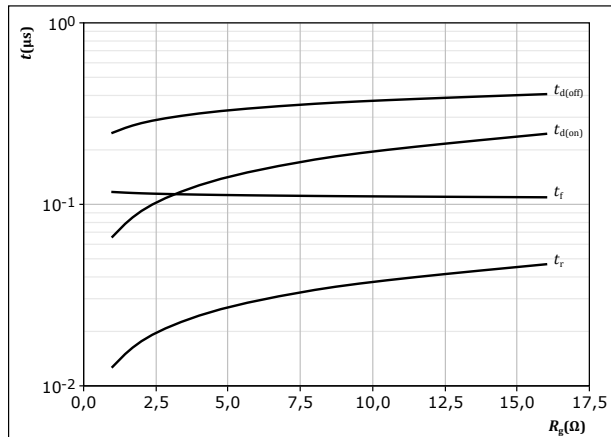
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

figure 13. IGBT

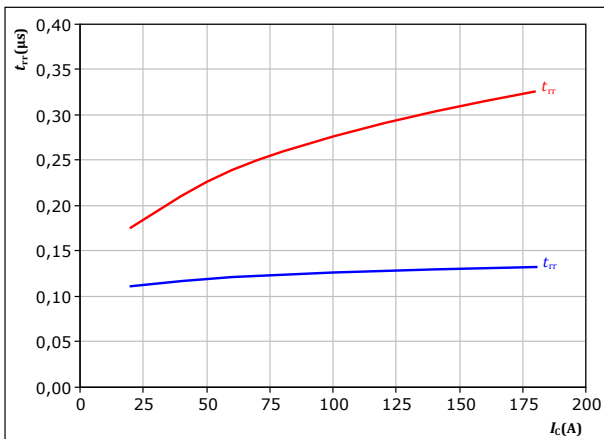
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A

figure 14. FWD

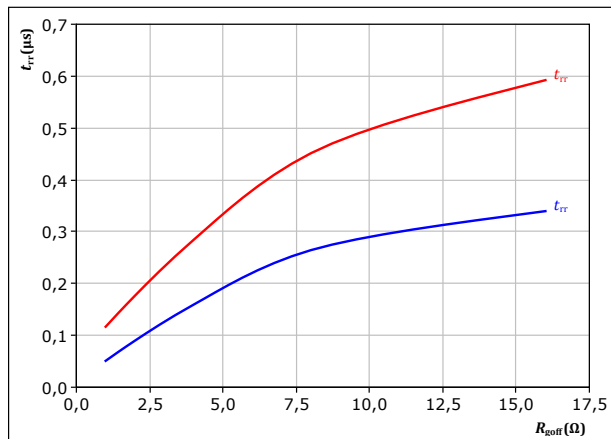
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 T_j : — 25 °C
— 150 °C

figure 15. FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor
 $t_{rr} = f(R_{goff})$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A
 T_j : — 25 °C
— 150 °C

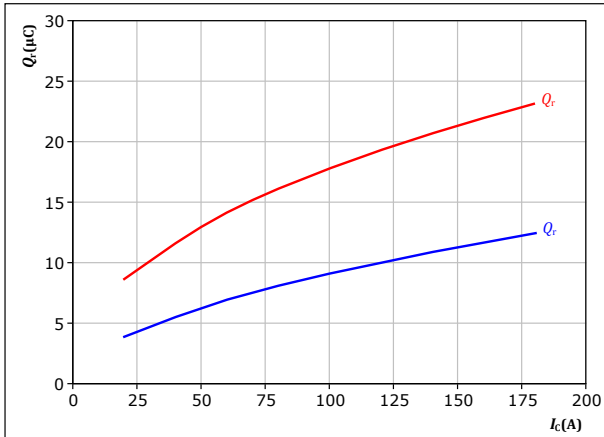


Inverter Switching Characteristics

figure 16. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

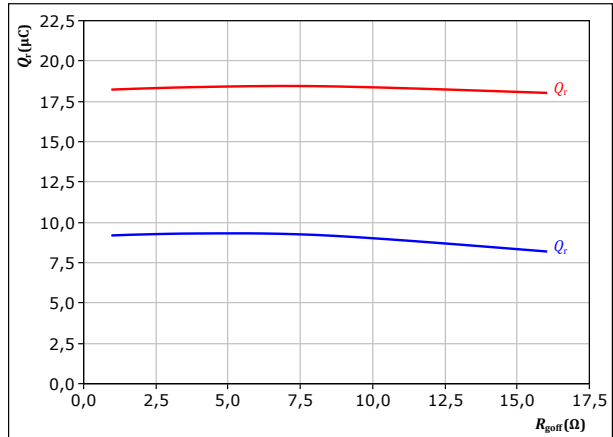
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 4$ Ω

T_j : — 25 °C
— 150 °C

figure 17. FWD

Typical recovered charge as a function of turn off gate resistor

$$Q_r = f(R_{goff})$$



With an inductive load at

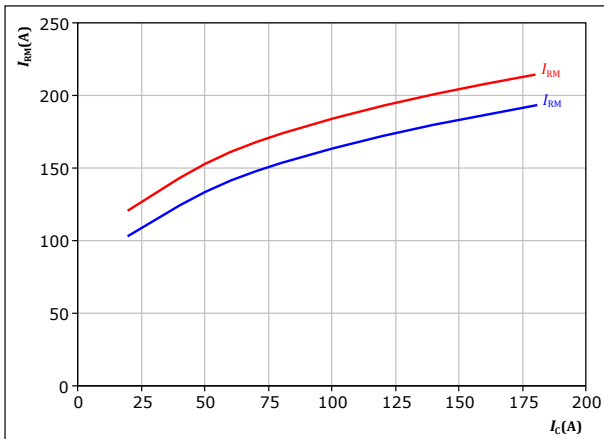
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A

T_j : — 25 °C
— 150 °C

figure 18. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

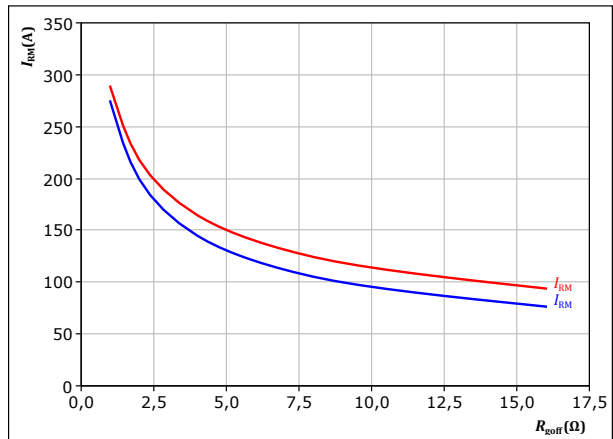
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 4$ Ω

T_j : — 25 °C
— 150 °C

figure 19. FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 100$ A

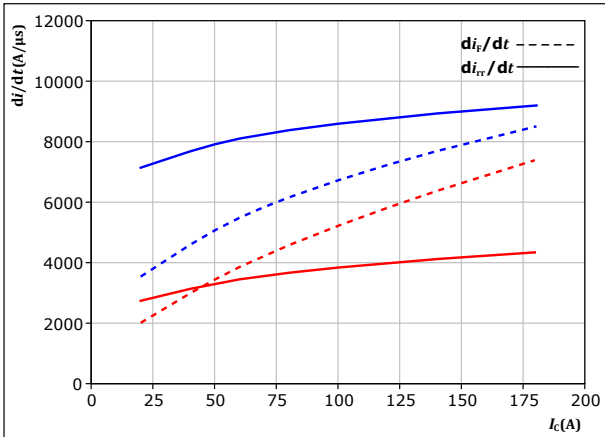
T_j : — 25 °C
— 150 °C



Inverter Switching Characteristics

figure 20. FWD

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



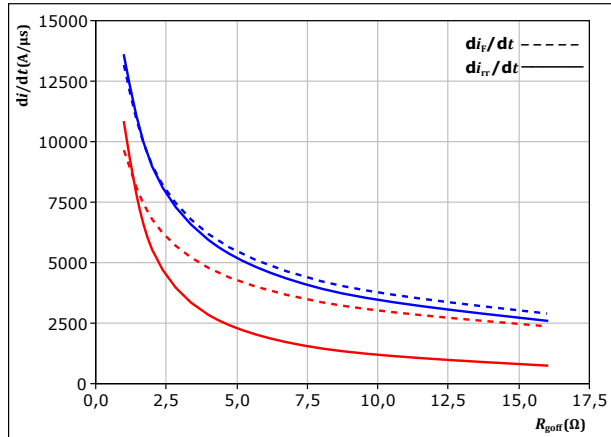
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{goff} = 4 \text{ } \Omega$

T_j : — 25 °C
 — 150 °C

figure 21. FWD

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



With an inductive load at

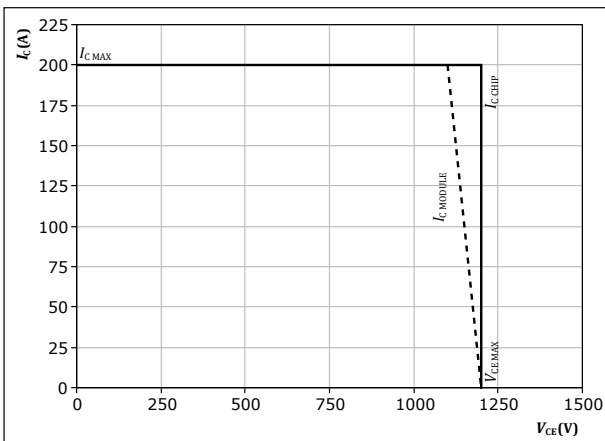
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 100 \text{ A}$

T_j : — 25 °C
 — 150 °C

figure 22. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_j = 150 \text{ } ^\circ\text{C}$
 $R_{goff} = 4 \text{ } \Omega$
 $R_{goff} = 4 \text{ } \Omega$



Inverter Switching Definitions

figure 23. IGBT

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

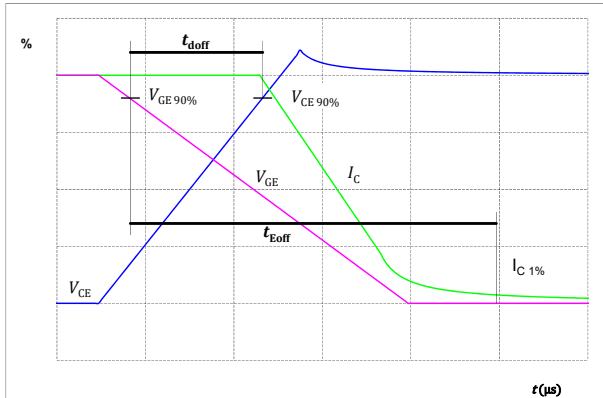


figure 24. IGBT

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

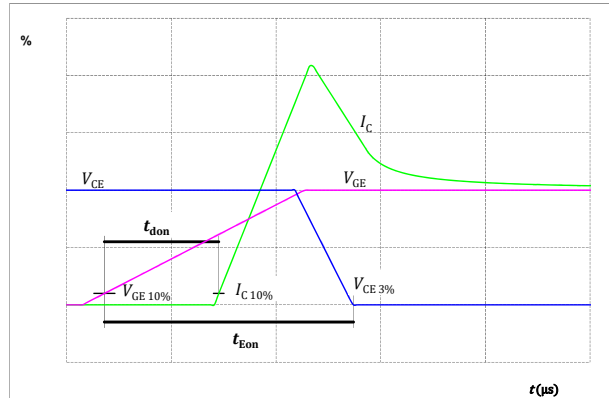


figure 25. IGBT

Turn-off Switching Waveforms & definition of t_f

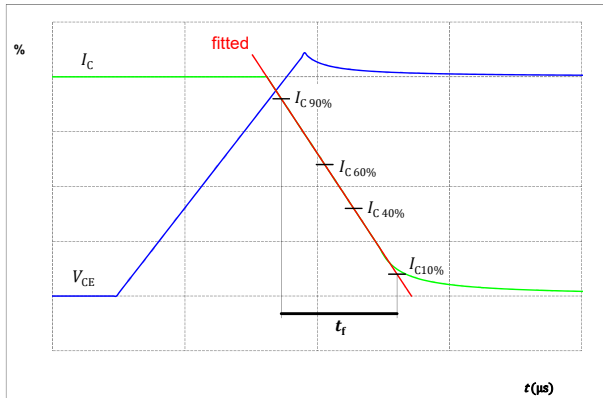
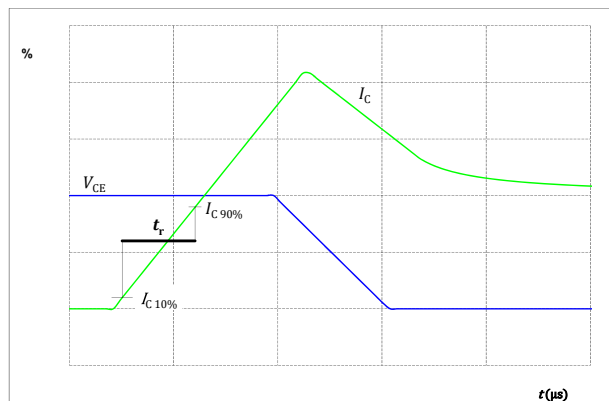


figure 26. IGBT

Turn-on Switching Waveforms & definition of t_r





Inverter Switching Definitions

figure 27. FWD

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

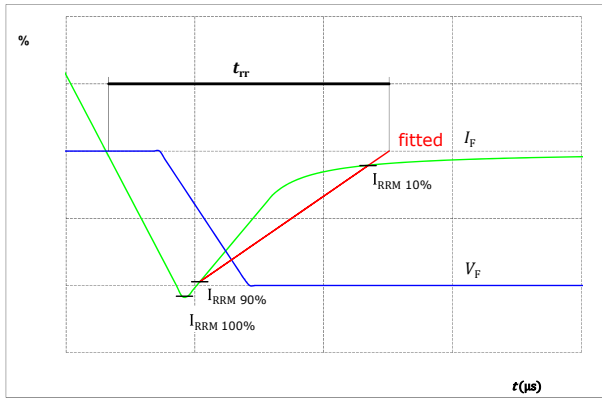
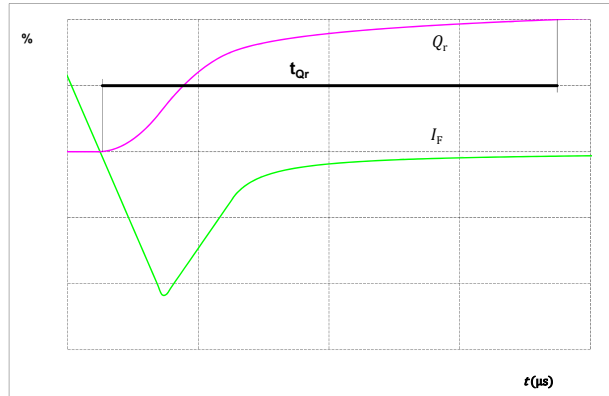


figure 28. FWD

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





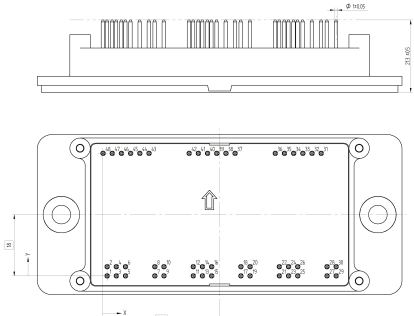
Vincotech

V23990-P689-F-PM
datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P689-F-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P689-F-/3/-PM

Marking							
	Text	VIN VIN	Date code WWYY	Type&Ver TTTTTTV	UL UL	Lot LLLLL	Serial SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTV	LLLLL	SSSS	WWYY		

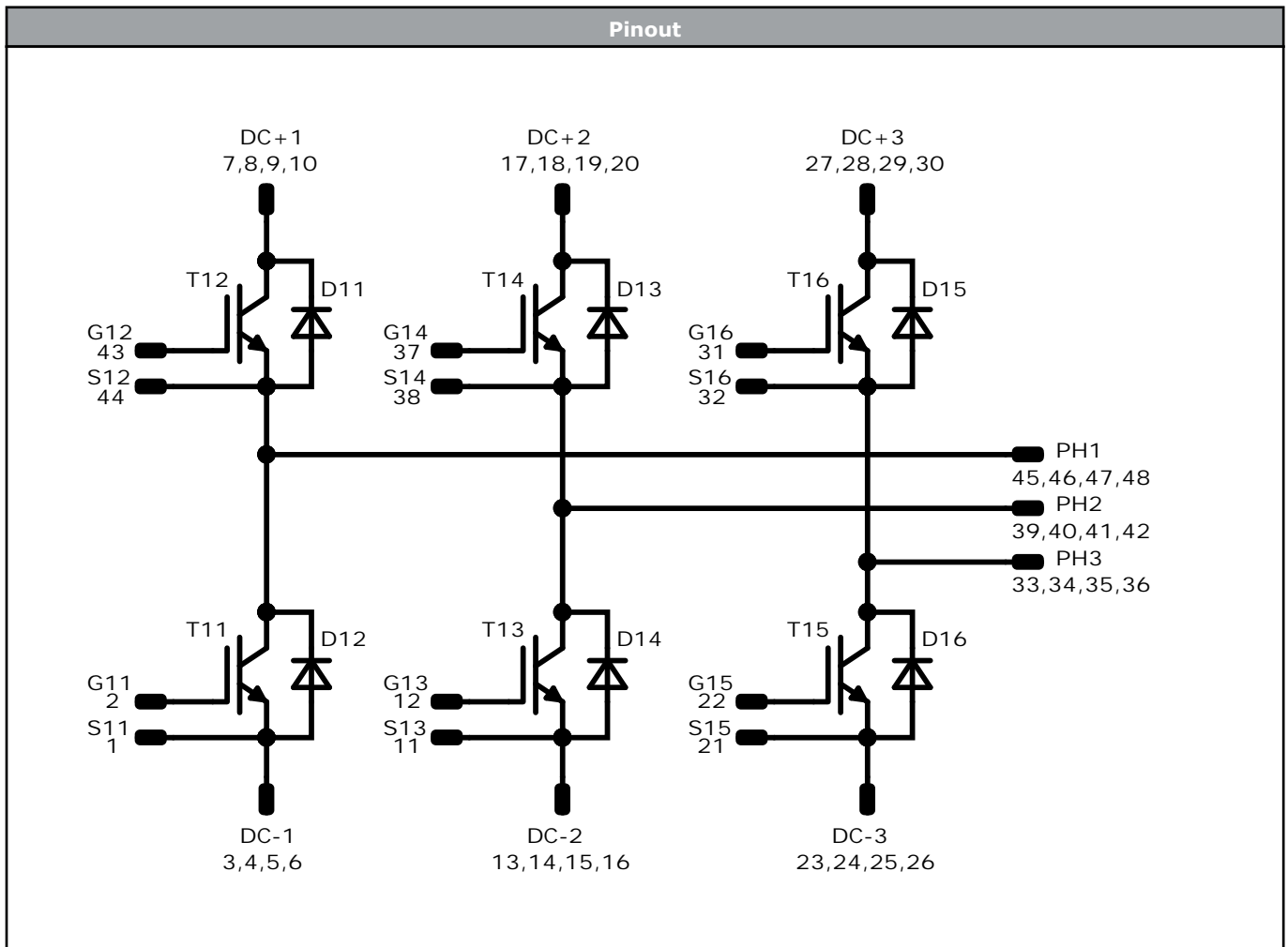
Outline							
Pin table [mm]							
Pin	X	Y	Function	25	57,2	0	DC-3
1	1,2	0	S11	26	57,2	2,7	DC-3
2	1,2	2,7	G11	27	65,8	0	DC+3
3	3,9	0	DC-1	28	65,8	2,7	DC+3
4	3,9	2,7	DC-1	29	68,5	0	DC+3
5	6,6	0	DC-1	30	68,5	2,7	DC+3
6	6,6	2,7	DC-1	31	64,1	36	G16
7	15,2	0	DC+1	32	61,4	36	S16
8	15,2	2,7	DC+1	33	58,7	36	Ph3
9	17,9	0	DC+1	34	56	36	Ph3
10	17,9	2,7	DC+1	35	53,3	36	Ph3
11	26,5	0	S13	36	50,6	36	Ph3
12	26,5	2,7	G13	37	38,8	36	G14
13	29,2	0	DC-2	38	36,1	36	S14
14	29,2	2,7	DC-2	39	33,4	36	Ph2
15	31,9	0	DC-2	40	30,7	36	Ph2
16	31,9	2,7	DC-2	41	28	36	Ph2
17	40,5	0	DC+2	42	25,3	36	Ph2
18	40,5	2,7	DC+2	43	13,5	36	G12
19	43,2	0	DC+2	44	10,8	36	S12
20	43,2	2,7	DC+2	45	8,1	36	Ph1
21	51,8	0	S15	46	5,4	36	Ph1
22	51,8	2,7	G15	47	2,7	36	Ph1
23	54,5	0	DC-3	48	0	36	Ph1
24	54,5	2,7	DC-3				



Tolerance of positions: ±0,05mm at the end of pins.
Dimension of carrier case is only typical tolerance.



Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	100 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	100 A	Inverter Diode	




Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow 2</i> packages see vincotech.com website.

Package data
Package data for <i>flow 2</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-P689-F-PM-D4-14	26 Sep. 2021	New Datasheet format, module is unchanged Introduce Rth values with PSX-P7 TIM	

DISCLAIMER

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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.