Vincotech

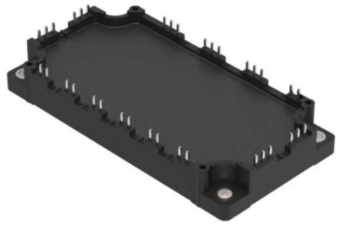
A0-VS126PA200M7-L999F70
A0-VP126PA200M7-L999F70T
datasheet

VINcoPACK E3 **1200 V / 200 A**

Features

- IGBT M7 technology with low V_{CEsat} and improved EMC behavior
- New SoLid Cover Technology for higher reliability
- Industry standard housing
- Press-fit pin and pre-applied phase-change Thermal Interface Material available

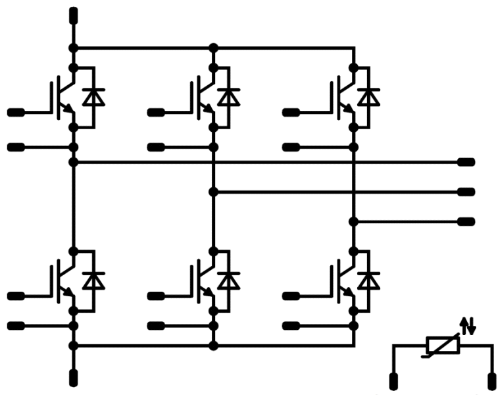
VINco E3



Target applications

- Industrial Drives

Schematic



Types

- A0-VS126PA200M7-L999F70
- A0-VP126PA200M7-L999F70T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	168	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	303	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	141	A
Repetitive peak forward current	I_{FRM}		400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	235	W
Maximum Junction Temperature	T_{jmax}		175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition	Value	Unit
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition	Value	Unit
Isolation voltage	V_{isol}	DC Test Voltage* t_p = 2 s	4000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			9	mm
Clearance			min. 12,7	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	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,02	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125 150		1,68 1,88 1,93	2,15	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			200	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							2		Ω
Input capacitance	C_{ies}		0	10		25		37000		pF
Output capacitance	C_{oes}							1100		
Reverse transfer capacitance	C_{res}							420		
Gate charge	Q_g		15	600	200	25		1200		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,31		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 1 Ω R_{gon} = 1 Ω	±15	600	199	25 125 150		283 300 306		ns
Rise time	t_r					25 125 150		47 59 61		
Turn-off delay time	$t_{d(off)}$					25 125 150		233 263 273		
Fall time	t_f					25 125 150		77 94 96		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 21,4 µC Q_{rFWD} = 32 µC Q_{rFWD} = 36,2 µC				25 125 150		16,282 22,828 25,078		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		13,252 17,540 18,988		

Characteristic Values

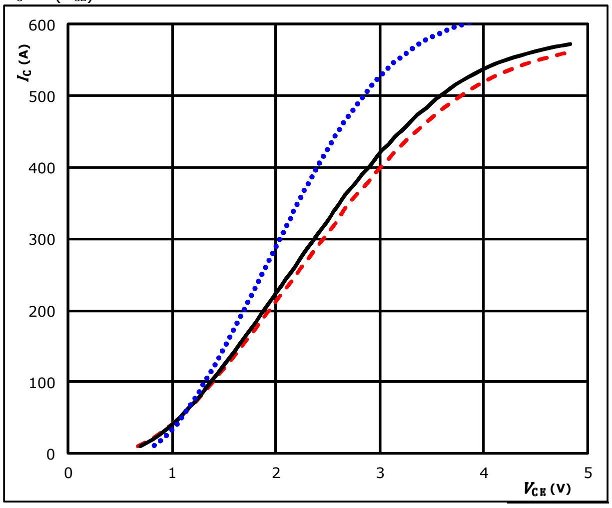
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				200	25 125 150		1,86 1,99 1,98	2,2	V
Reverse leakage current	I_r			1200		25			120	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,40		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 4313 A/µs di/dt = 4301 A/µs di/dt = 3318 A/µs	±15	600	199	25 125 150		167 164 165		A
Reverse recovery time	t_{rr}					25 125 150		310 480 521		ns
Recovered charge	Q_r					25 125 150		21,432 31,958 36,248		µC
Reverse recovered energy	E_{rec}					25 125 150		8,050 12,251 13,915		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1395 924 855		A/µs
Thermistor										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		+5	%
Power dissipation	P					25		245		mW
Power dissipation constant						25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %				25		3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %				25		3437		K
Vincotech NTC Reference									K	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

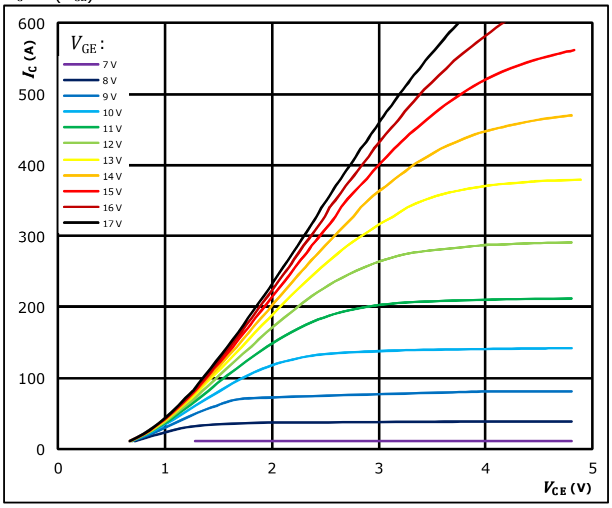


t_p =	250	µs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



t_p = 250 µs

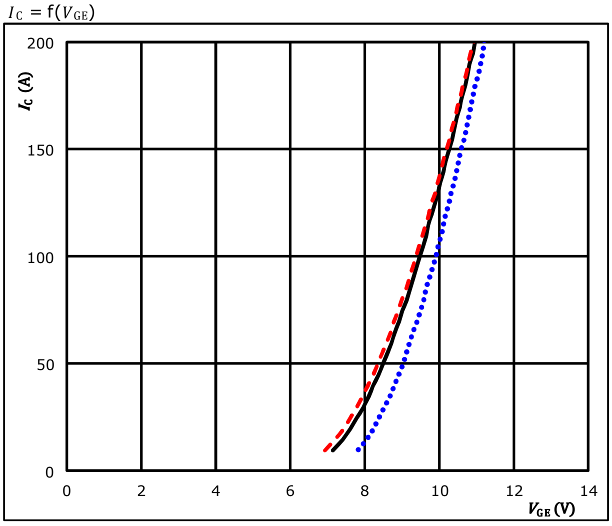
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

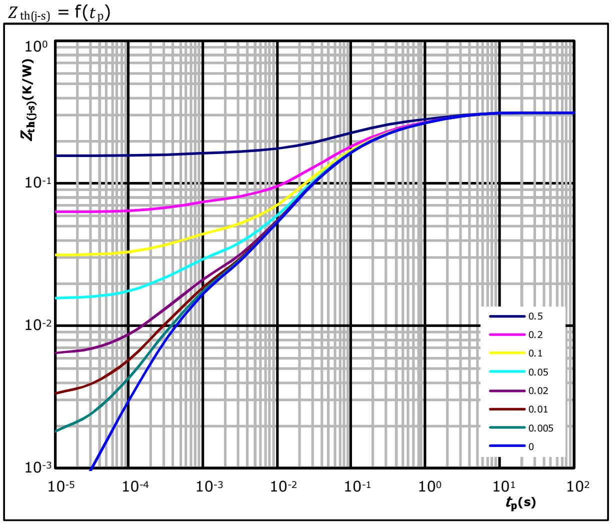


t_p =	100	µs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,31 K/W

IGBT thermal model values

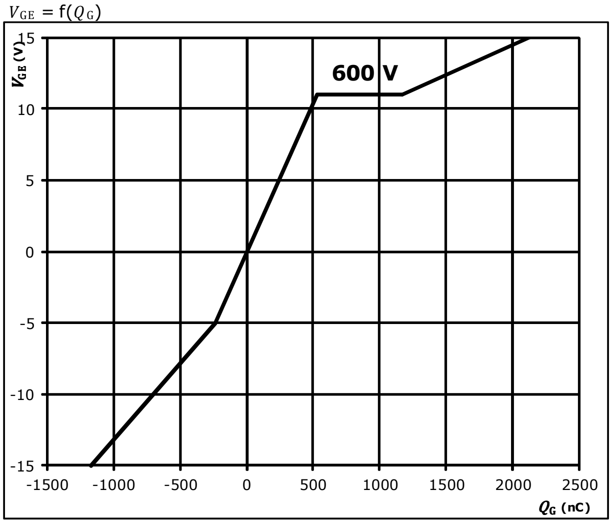
R (K/W)	τ (s)
4,46E-02	2,97E+00
6,58E-02	6,55E-01
1,01E-01	1,27E-01
8,19E-02	2,80E-02
7,90E-03	3,96E-03
1,30E-02	4,73E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

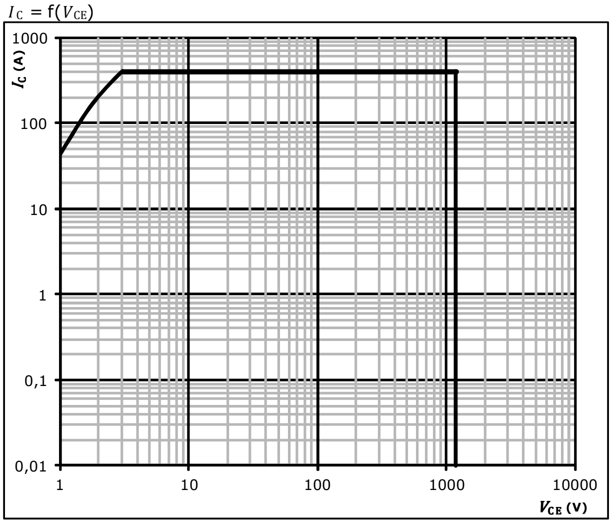


I_C =	690	A
V_{GE} =	±15	V
V_{CC} =	600	V

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



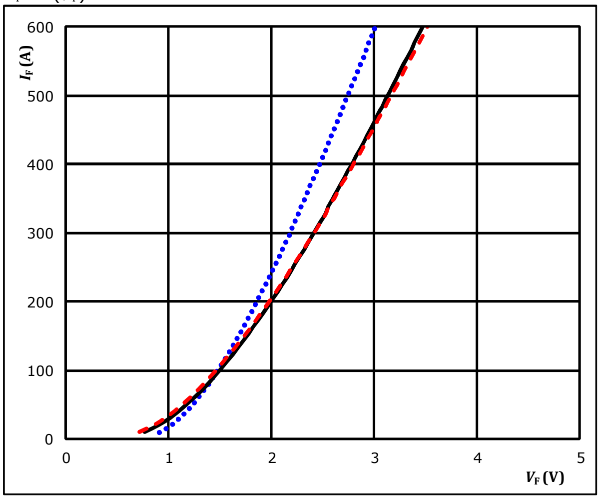
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$I_F = f(V_F)$



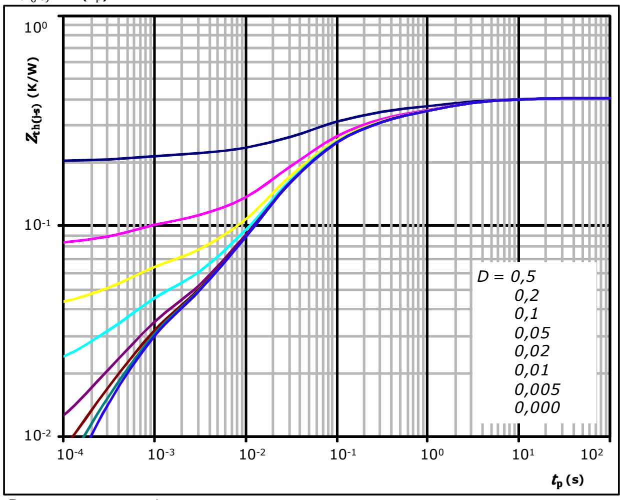
t_p = 250 µs

T_j: 25 °C / 125 °C / 150 °C

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,40 K/W

FWD thermal model values

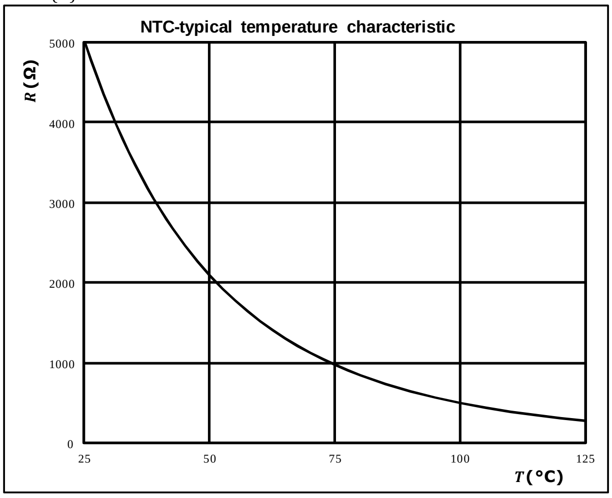
R (K/W)	τ (s)
2,18E-02	6,58E+00
7,39E-02	1,24E+00
1,19E-01	1,47E-01
1,51E-01	3,00E-02
1,42E-02	4,40E-03
2,45E-02	4,95E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$R = f(T)$

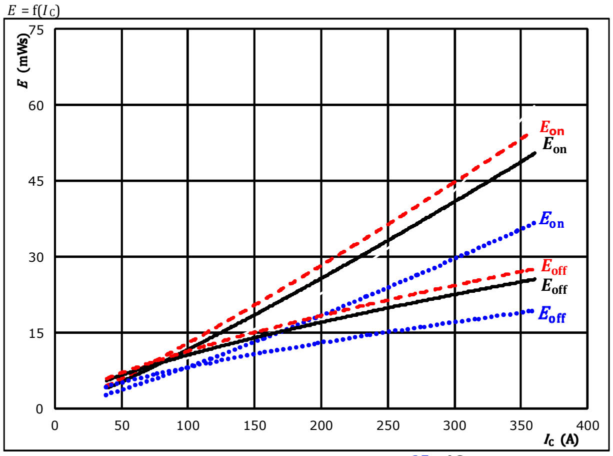


Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



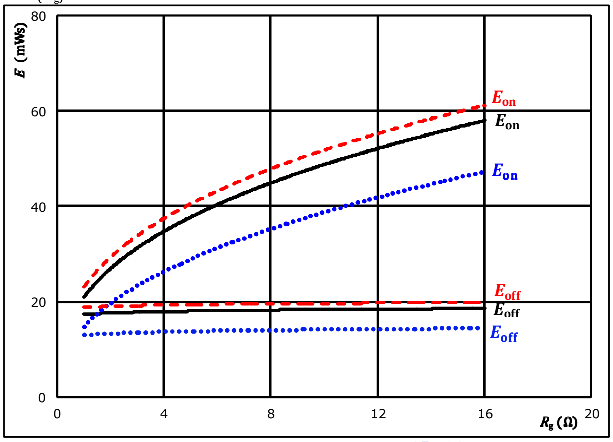
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	1	Ω		150 °C	dashed
R_{goff} =	1	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



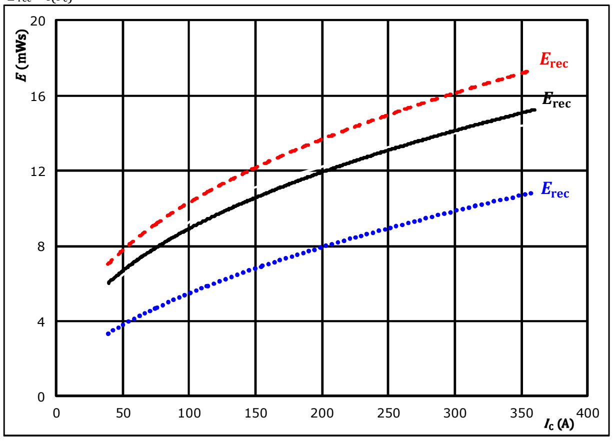
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	199	A		150 °C	dashed

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



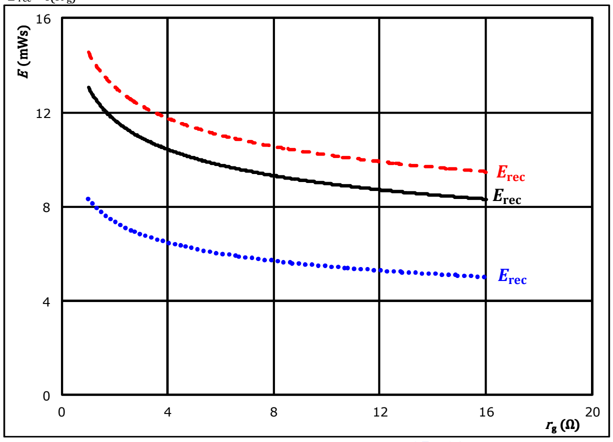
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	1	Ω		150 °C	dashed

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

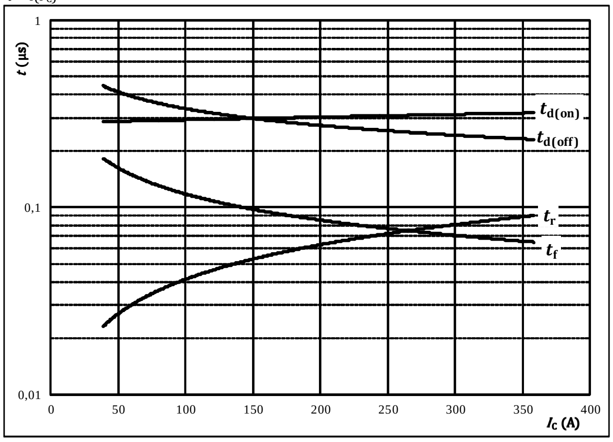
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	199	A		150 °C	dashed

Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



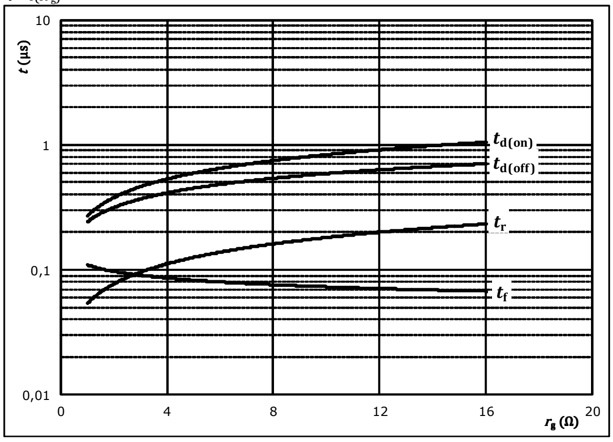
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



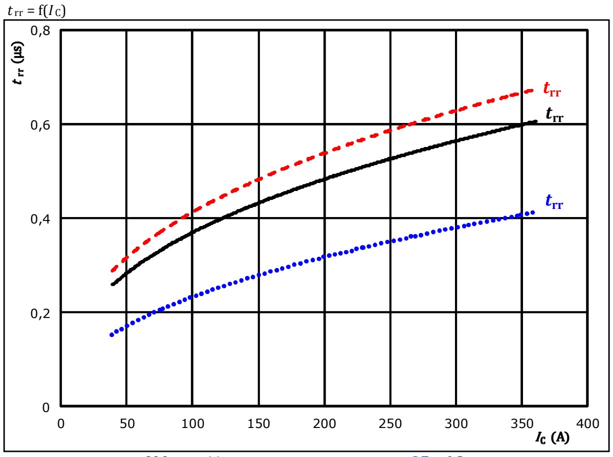
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	199	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

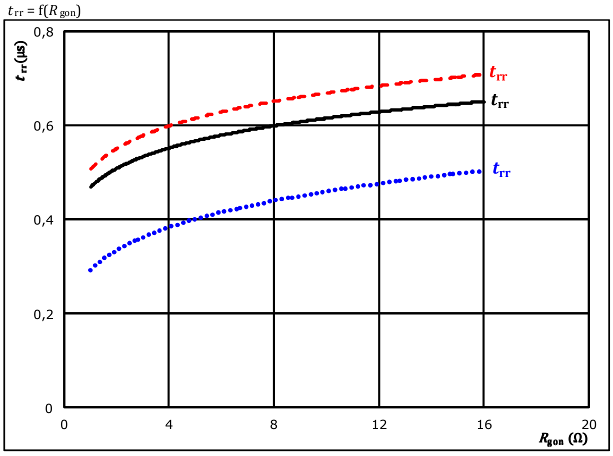


At				T_j:	
V_{CE} =	600	V		25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
R_{gon} =	1	Ω		150 °C	dashed (red)

figure 8. FWD

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

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



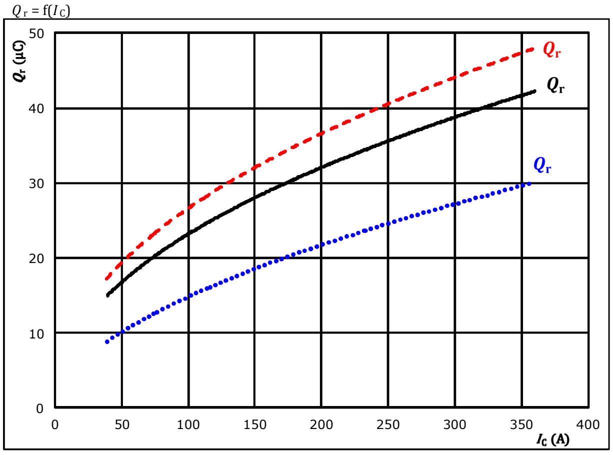
At				T_j:	
V_{CE} =	600	V		25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
I_C =	199	A		150 °C	dashed (red)

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

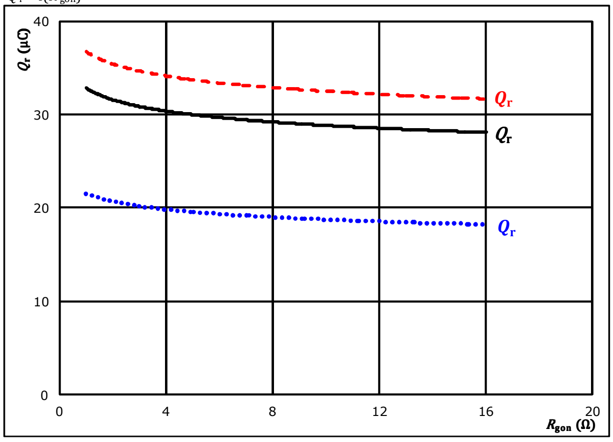


At	V_{CE} =	600	V		
	V_{GE} =	±15	V	T_j:	25 °C / 125 °C / 150 °C
	R_{gon} =	1	Ω		

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

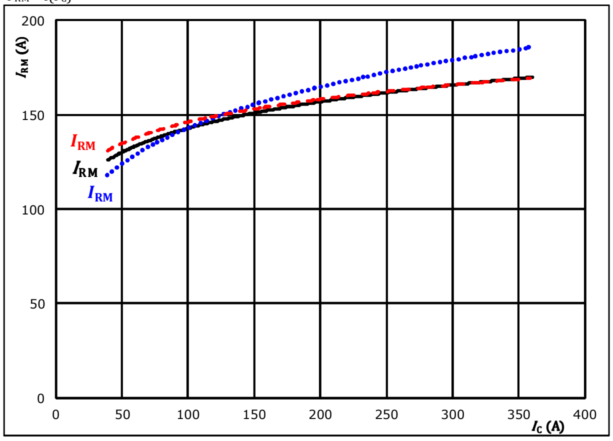


At	V_{CE}=	600	V		
	V_{GE} =	±15	V	T_j:	25 °C / 125 °C / 150 °C
	I_C=	199	A		

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

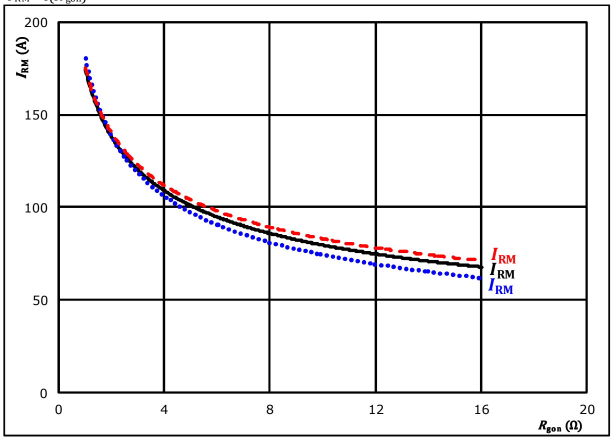


At	V_{CE}:	600	V		
	V_{GE} =	±15	V	T_j:	25 °C / 125 °C / 150 °C
	R_{gon} =	1	Ω		

figure 12. **FWD**

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

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



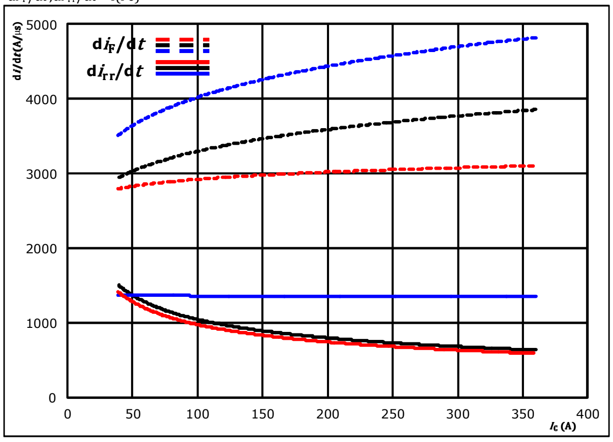
At	V_{CE} =	600	V		
	V_{GE} =	±15	V	T_j:	25 °C / 125 °C / 150 °C
	I_C =	199	A		

Inverter Switching Characteristics

figure 13. **FWD**

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

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

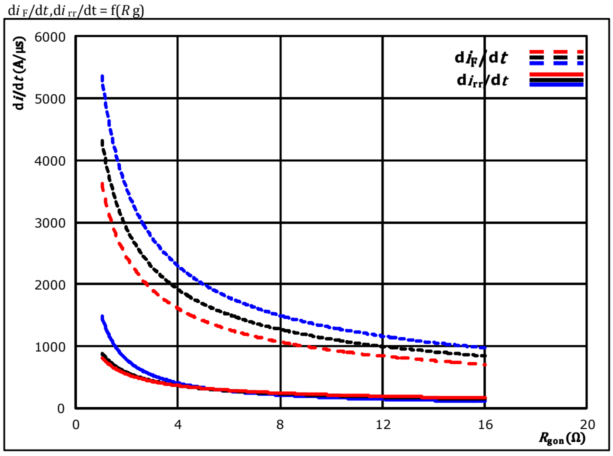


At						
V_{CE} =	600	V	T_j:	25	°C	dotted
V_{GE} =	±15	V		125	°C	solid
R_{gon} =	1	Ω		150	°C	dashed

figure 14. **FWD**

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

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

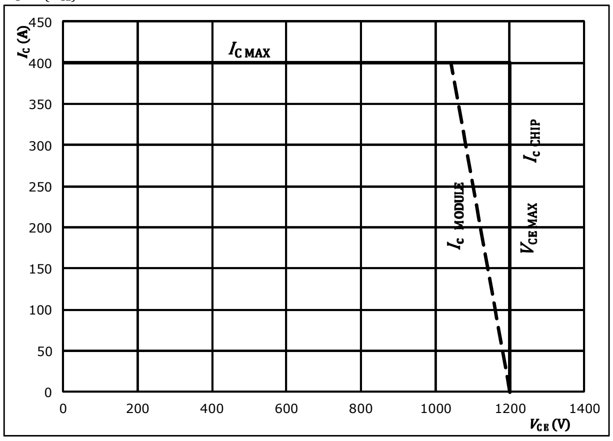


At						
V_{CE} =	600	V	T_j:	25	°C	dotted
V_{GE} =	±15	V		125	°C	solid
I_C =	199	A		150	°C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



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

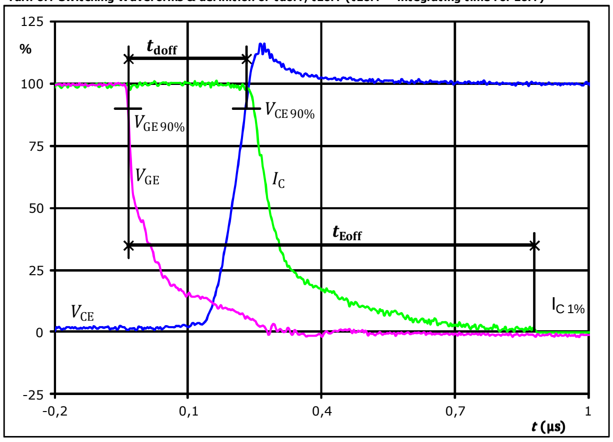
Inverter Switching Definitions

General conditions

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

figure 1. IGBT

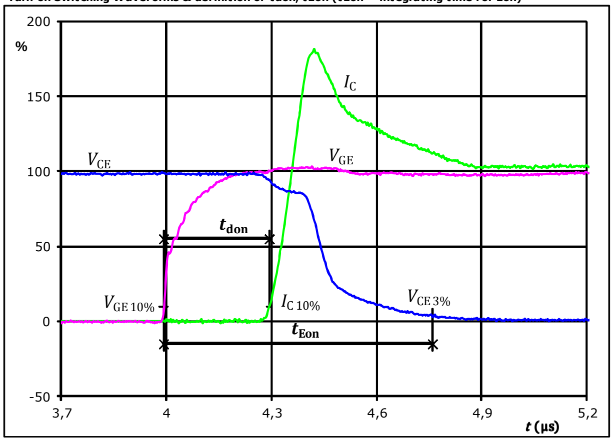
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_{doff} =	0,263	μs
t_{Eoff} =	0,913	μs

figure 2. IGBT

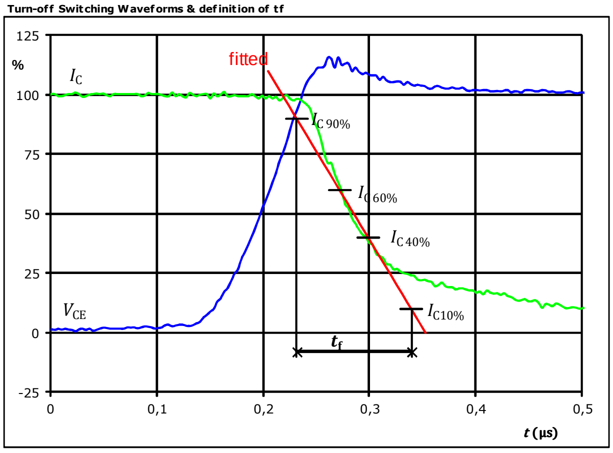
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_{don} =	0,300	μs
t_{Eon} =	0,768	μs

figure 3. IGBT

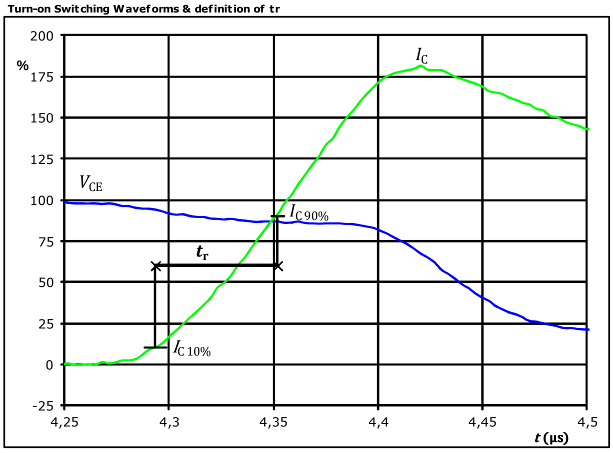
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_f =	0,094	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

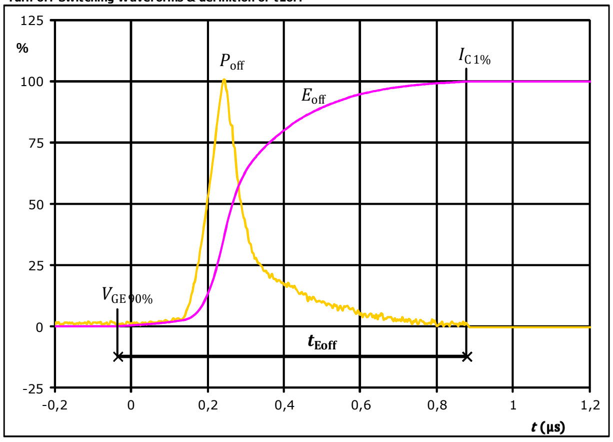


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	200	A
t_r =	0,059	μs

Inverter Switching Characteristics

figure 5.	**IGBT**

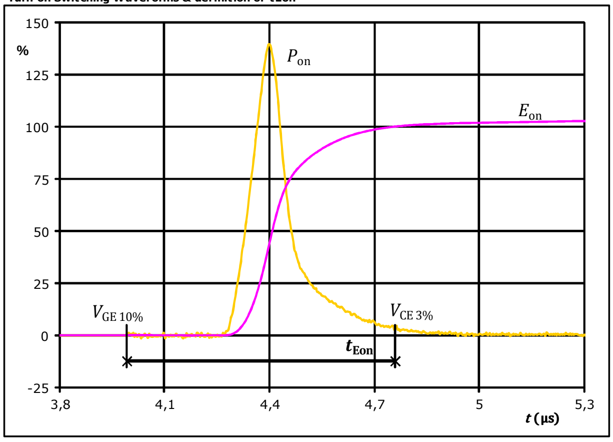
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	120,24	kW
E_{off} (100%) =	17,54	mJ
t_{Eoff} =	0,91	µs

figure 6.	**IGBT**

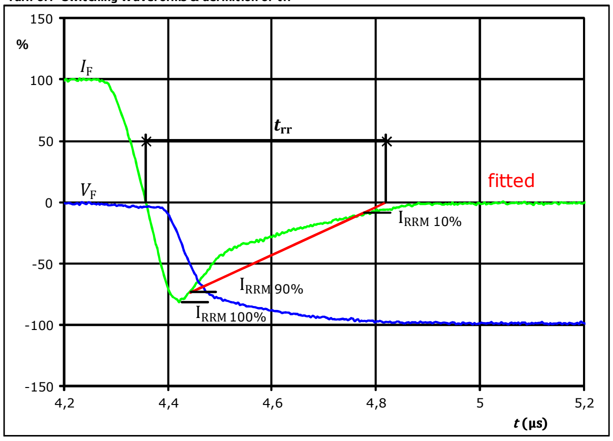
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	120,24	kW
E_{on} (100%) =	22,83	mJ
t_{Eon} =	0,77	µs

figure 7.	**FWD**

Turn-off Switching Waveforms & definition of trr

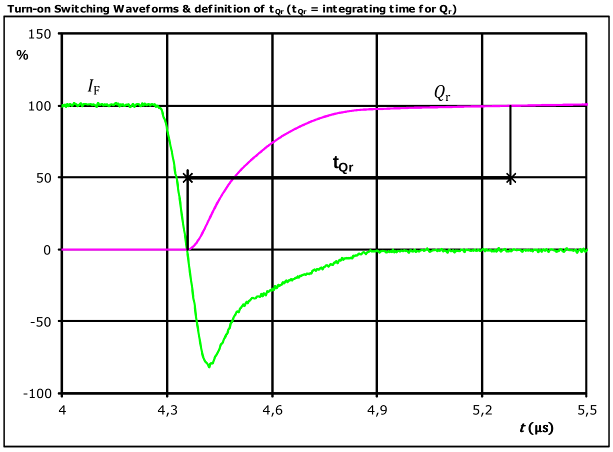


V_F (100%) =	600	V
I_F (100%) =	200	A
I_{RRM} (100%) =	-164	A
t_{rr} =	0,480	µs

Inverter Switching Characteristics

figure 8. **FWD**

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

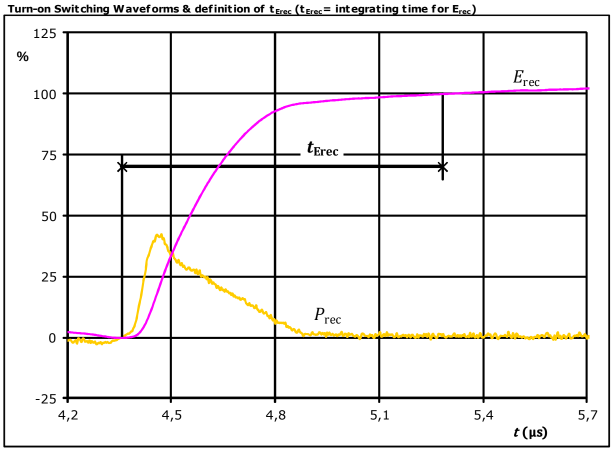


I_F (100%) =	200	A
Q_r (100%) =	31,96	µC
t_{Qr} =	0,93	µs

160

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	120,24	kW
E_{rec} (100%) =	12,25	mJ
t_{Erec} =	0,93	µs

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A0-VP126PA200M7-L999F70T
datasheet

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Ordering Code & Marking

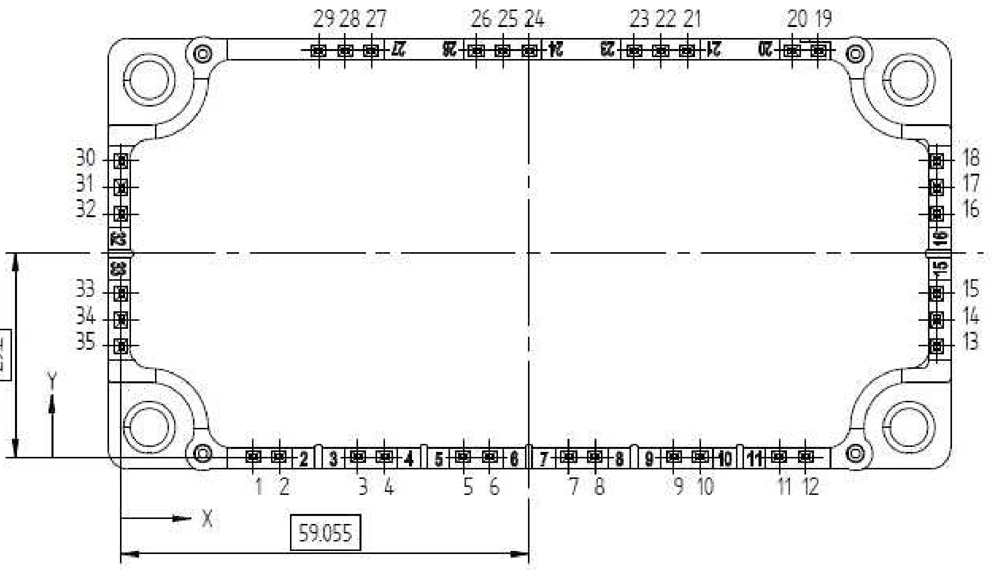
Version	Ordering Code
without thermal paste	A0-VS126PA200M7-L999F70
with thermal paste	A0-VS126PA200M7-L999F70-/3/
without thermal paste and press-fit pins	A0-VP126PA200M7-L999F70T
with thermal paste and press-fit pins	A0-VP126PA200M7-L999F70T-/3/

Text	Name		Date code	UL & VIN	Lot	Serial
	NNNNNNNNNN-T		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

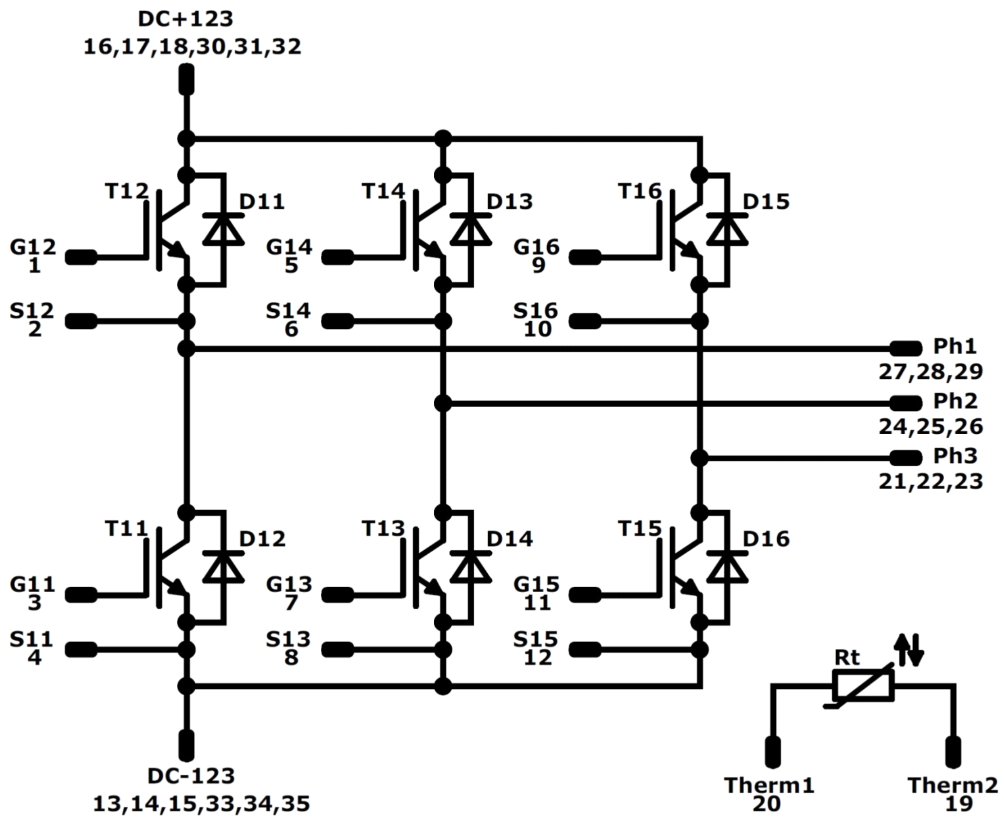
Outline

Pin table [mm]

Pin	X	Y	Function
1	19,05	0	G12
2	22,86	0	S12
3	34,29	0	G11
4	38,1	0	S11
5	49,53	0	G14
6	53,34	0	S14
7	64,77	0	G13
8	68,58	0	S13
9	80,01	0	G16
10	83,82	0	S16
11	95,25	0	G15
12	99,06	0	S15
13	118,11	15,865	DC-123
14	118,11	19,675	DC-123
15	118,11	23,485	DC-123
16	118,11	34,915	DC+123
17	118,11	38,725	DC+123
18	118,11	42,535	DC+123
19	100,97	58,4	Therm1
20	97,155	58,4	Therm2
21	81,915	58,4	Ph3
22	78,105	58,4	Ph3
23	74,295	58,4	Ph3
24	59,055	58,4	Ph2
25	55,245	58,4	Ph2
26	51,435	58,4	Ph2
27	36,195	58,4	Ph1
28	32,385	58,4	Ph1
29	28,575	58,4	Ph1
30	0	42,535	DC+123
31	0	38,725	DC+123
32	0	34,915	DC+123
33	0	23,485	DC-123
34	0	19,675	DC-123
35	0	15,865	DC-123



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11 , T12 , T13 , T14 , T15 , T16	IGBT	1200 V	200 A	Inverter Switch	
D11 , D12 , D13 , D14 , D15 , D16	FWD	1200 V	200 A	Inverter Diode	
Rt	Thermistor			Thermistor	

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datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 24	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for VINco E3 packages see vincotech.com website.

Package data
Package data for VINco E3 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
A0-Vx126PA200M7-L999F70x-D1-14	12 May. 2017		