Vincotech

B0-SP126PA200M7-LR40F78T
datasheet

***flow*PACK S3** **1200 V / 200 A**

Features

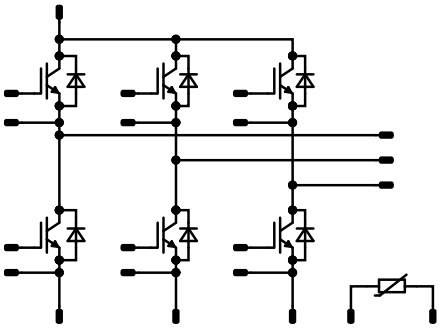
- IGBT M7 with low VCEsat and improved EMC behavior
- New low inductive package
- Enhanced thermal performance

flow S3 12 mm housing

Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- B0-SP126PA200M7-LR40F78T

Maximum Ratings

T_j = 25 °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 °C	154	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	268	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	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	116	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	184	W
Maximum junction temperature	T_{jmax}			175	°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				9,05	mm
Clearance				7,76	mm
Comparative Tracking Index	CTI			≥ 600	

*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	$V_{GE(th)}$			10	0,02	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125 150		1,69 1,88 1,93	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	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		pF
Reverse transfer capacitance	C_{res}							420		pF
Gate charge	Q_g	V_{CC} = 600 V	15		200	25		1200		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,35		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	600	200	25 125 150		461 468 469		ns
Rise time	t_r					25 125 150		107 122 127		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		318 357 367		ns
Fall time	t_f					25 125 150		91,6 125 136		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=15,1 µC Q_{rFWD}=23,7 µC Q_{rFWD}=26,1 µC				25 125 150		29,5 36,6 38,8		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		15,2 21,7 23,4		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				200	25 125 150		1,86 1,99 1,98	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,52		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=1580 A/µs di/dt=1360 A/µs di/dt=1330 A/µs	±15	600	200	25 125 150		75,42 84,36 87,8		A
Reverse recovery time	t_{rr}					25 125 150		371 498 539		ns
Recovered charge	Q_r					25 125 150		15,1 23,7 26,1		µC
Reverse recovered energy	E_{rec}					25 125 150		4,59 7,82 8,65		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		476 298 275		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	
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

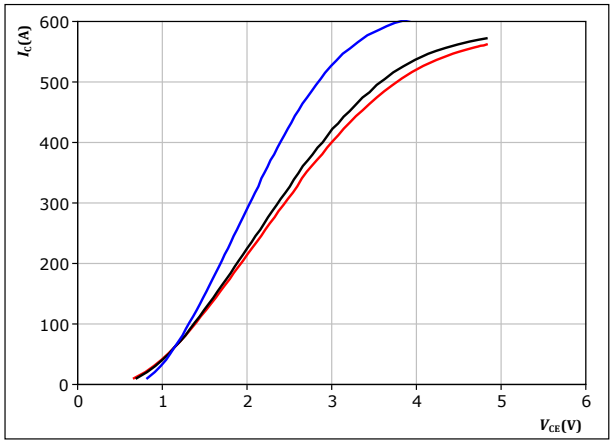
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

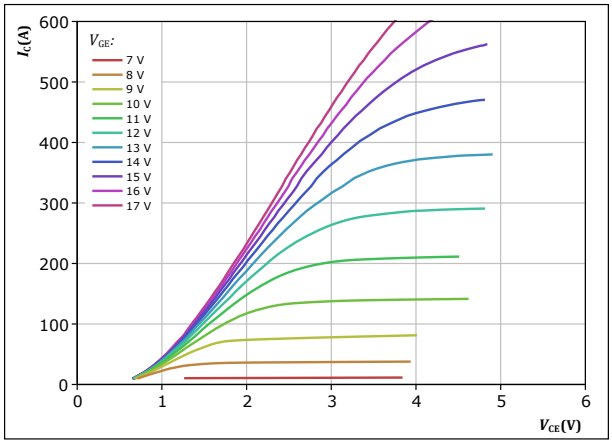


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



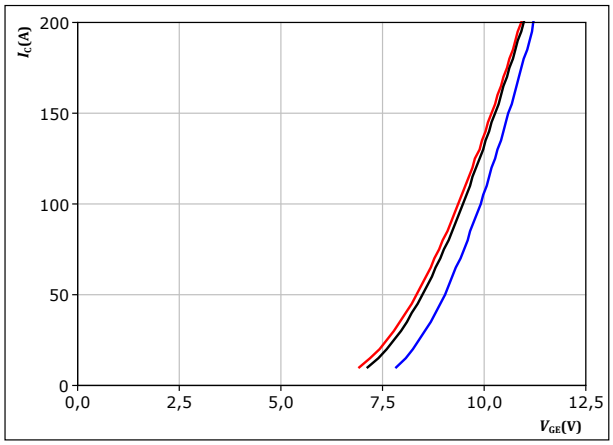
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

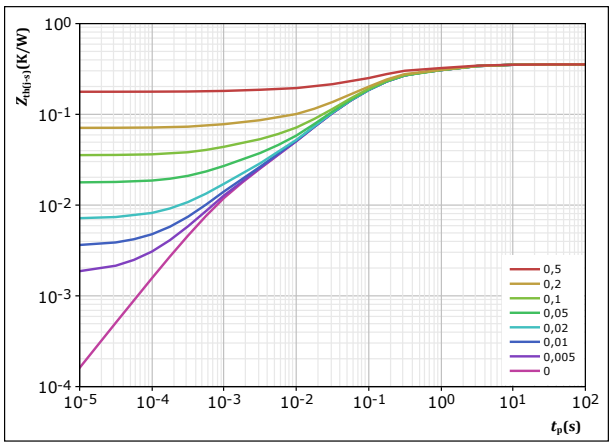


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,355	K/W

IGBT thermal model values

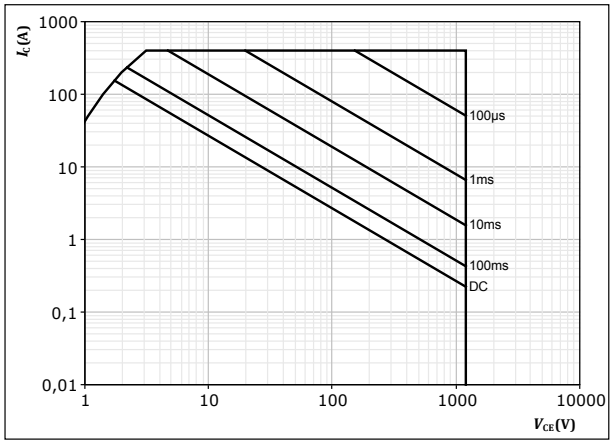
R (K/W)	τ (s)
1,02E-02	7,91E+00
8,22E-02	1,32E+00
2,03E-01	1,11E-01
4,63E-02	1,77E-02
1,25E-02	1,08E-03

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



D = single pulse

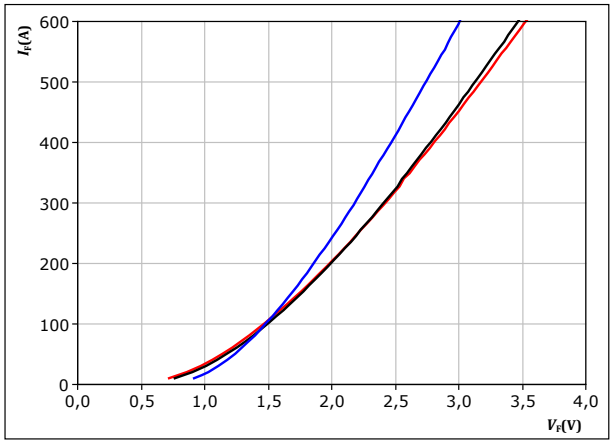
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



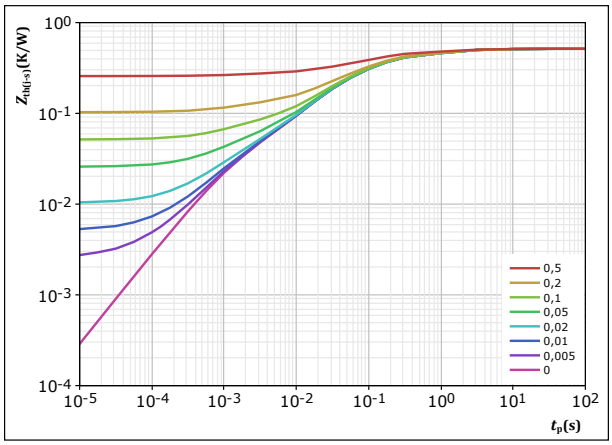
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,515 K/W

FWD thermal model values

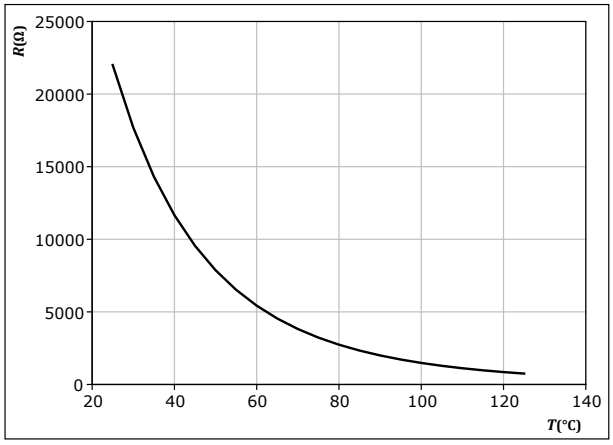
R (K/W)	τ (s)
1,11E-02	9,73E+00
9,80E-02	1,24E+00
2,54E-01	1,11E-01
1,26E-01	2,22E-02
2,60E-02	1,25E-03

Thermistor Characteristics

figure 8. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

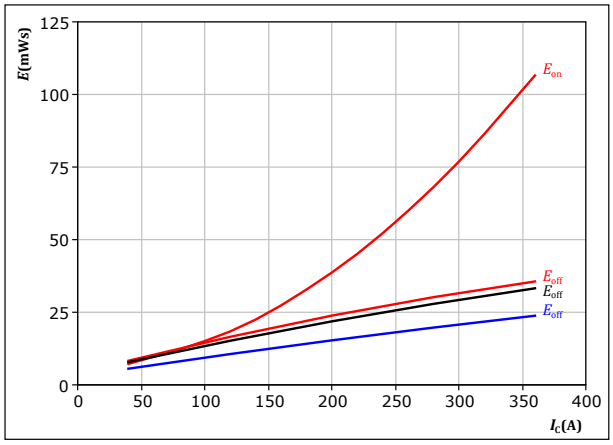


Inverter Switching Characteristics

figure 9. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



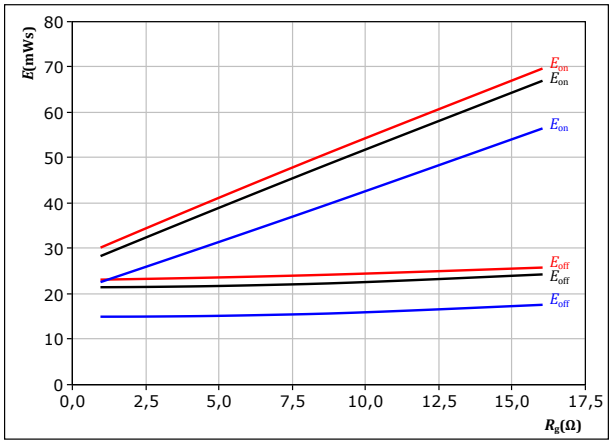
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 10. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



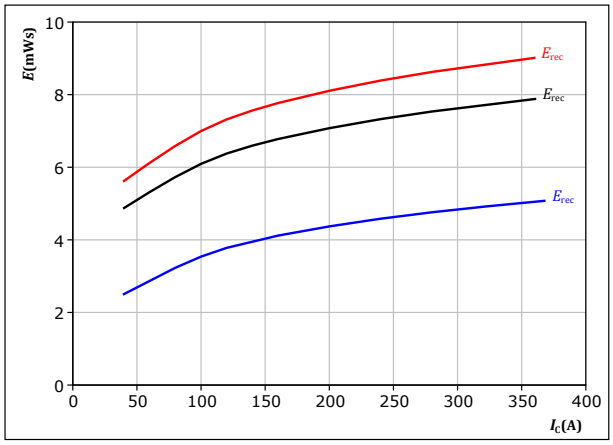
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

figure 11. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



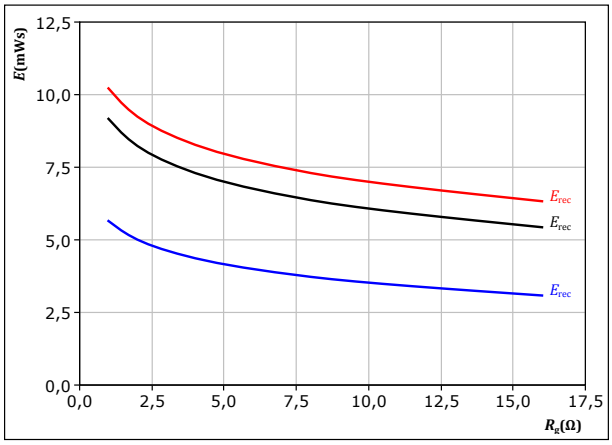
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 12. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

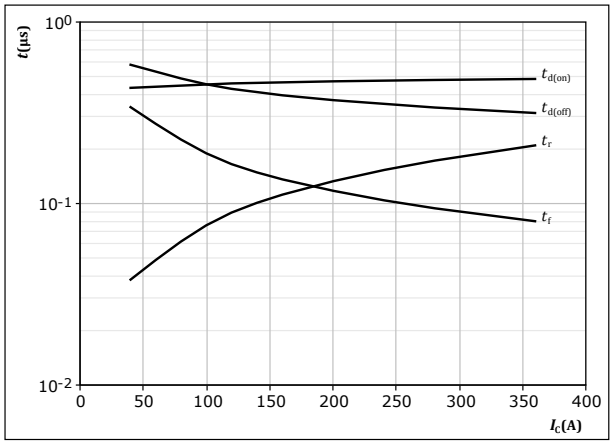
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

Inverter Switching Characteristics

figure 13. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



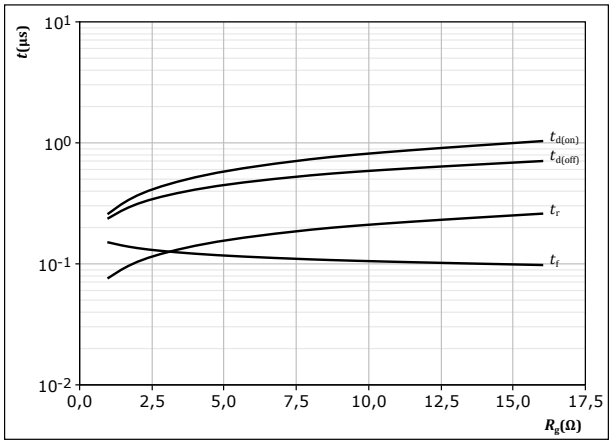
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 14. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



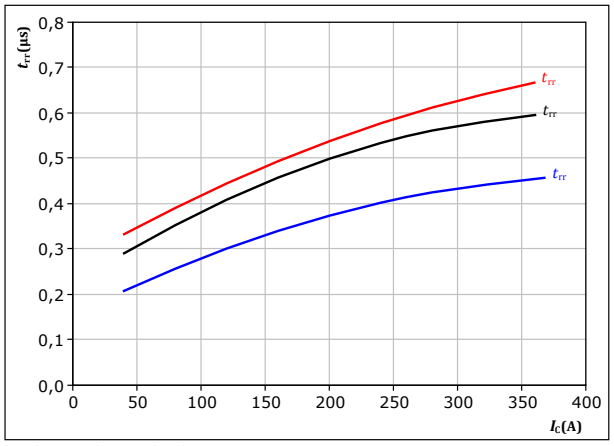
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	200	A

figure 15. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

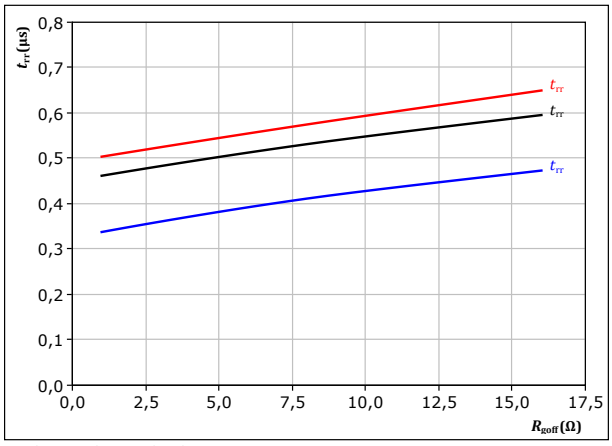
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 16. **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} =	±15	V
I_C =	200	A

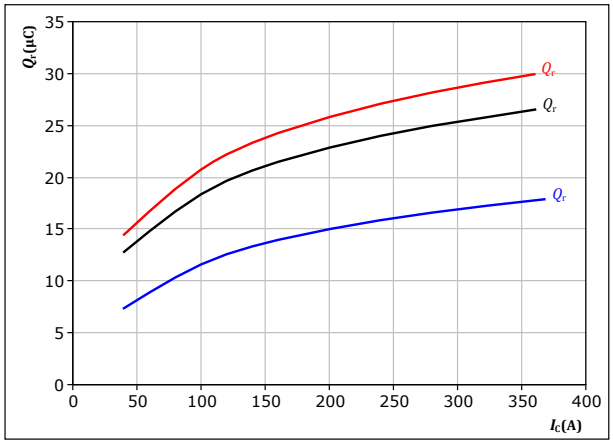
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 17. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



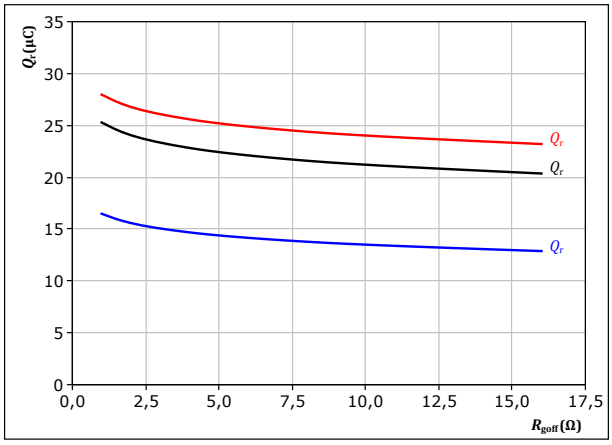
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 18. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$



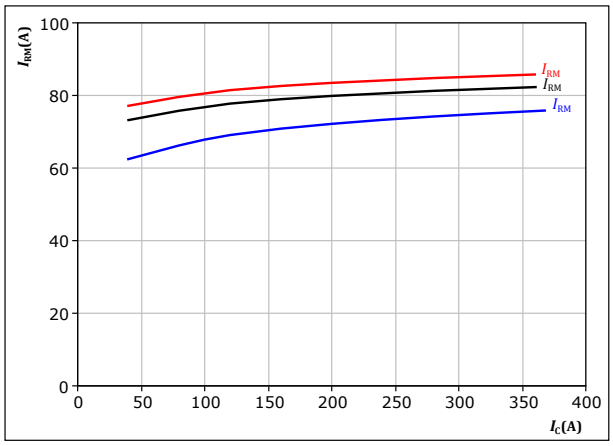
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

figure 19. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



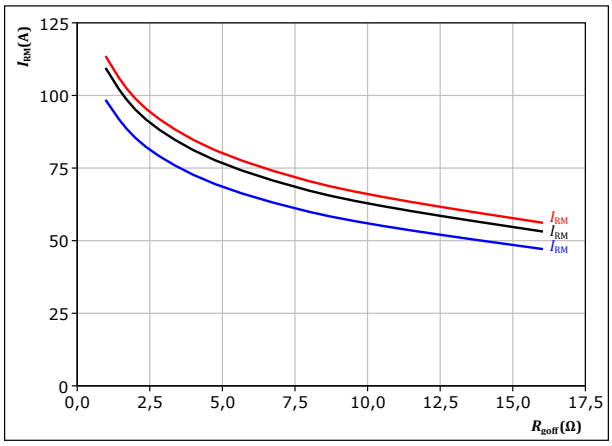
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 20. **FWD**

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

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



With an inductive load at

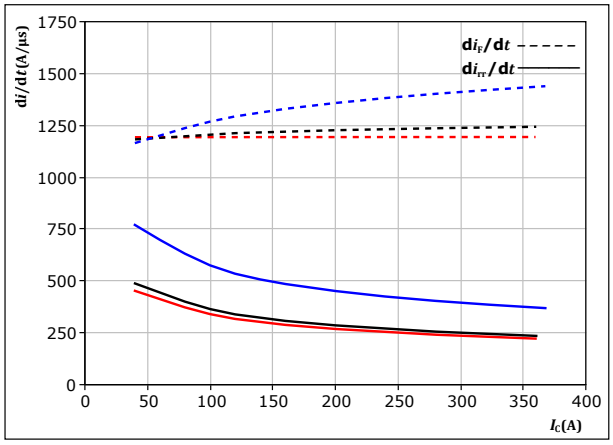
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

Inverter Switching Characteristics

figure 21. **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)



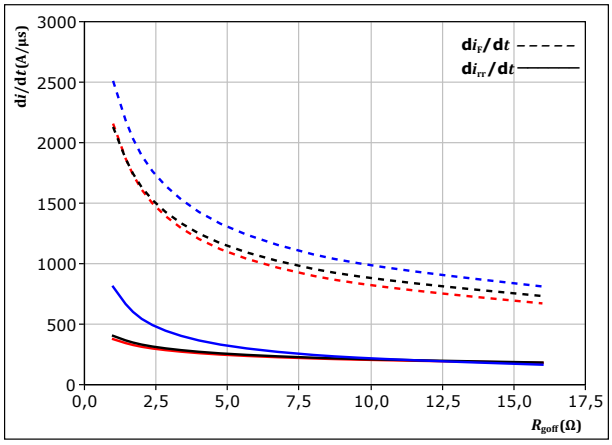
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 22. **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})



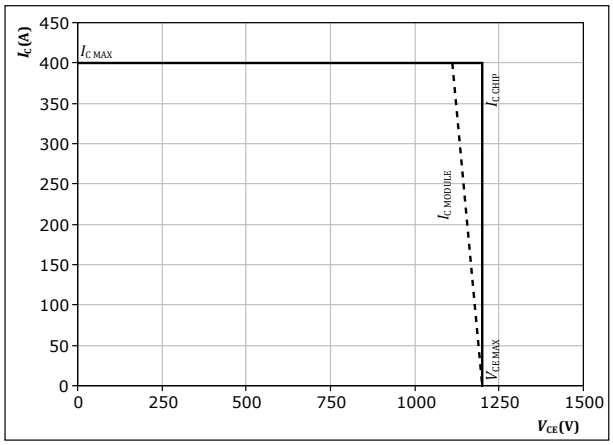
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

figure 23. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

T_j =	150	°C	
R_{gon} =	4	Ω	
R_{goff} =	4	Ω	

Inverter Switching Definitions

figure 24. **IGBT**

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

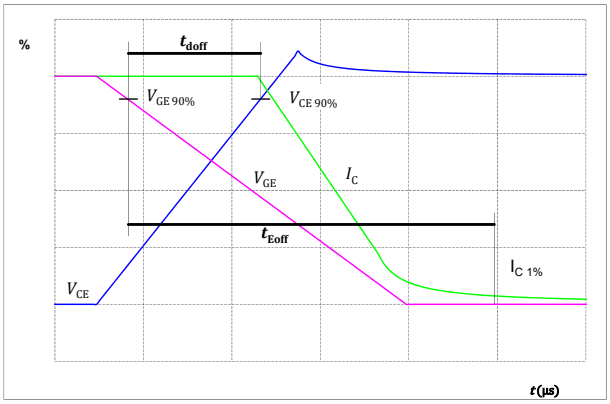


figure 25. **IGBT**

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

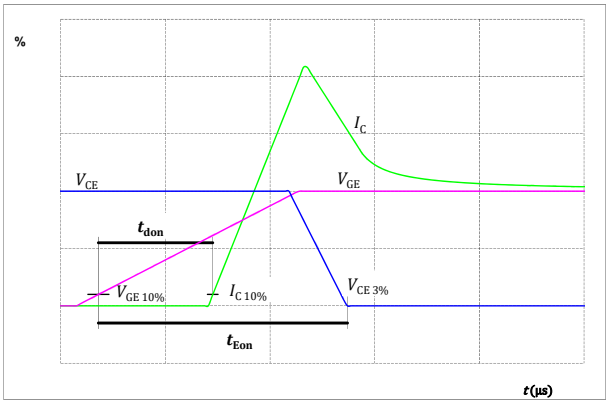


figure 26. **IGBT**

Turn-off Switching Waveforms & definition of t_f

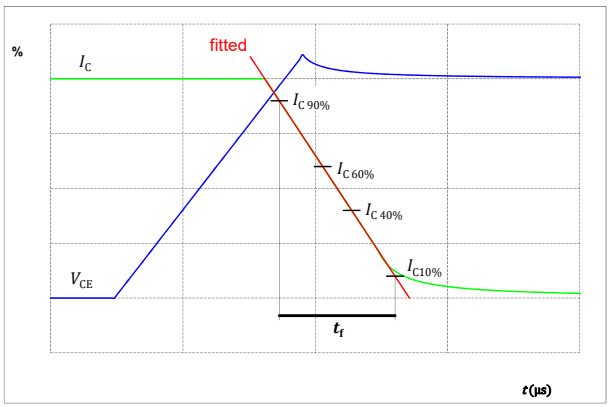
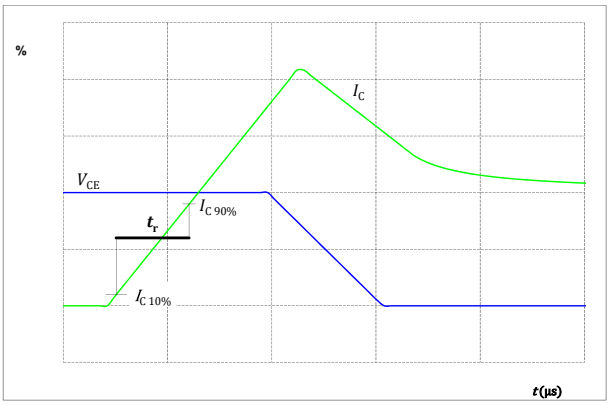


figure 27. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 28. **FWD**

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

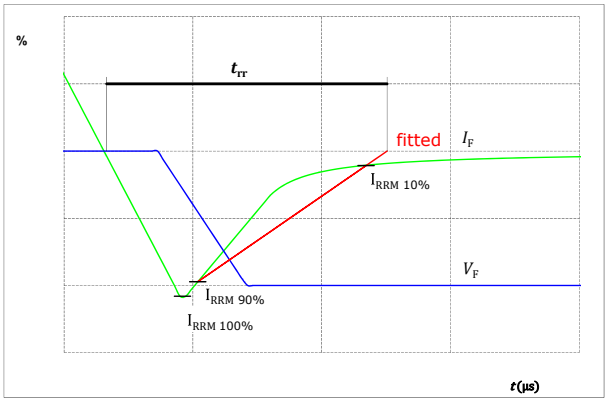
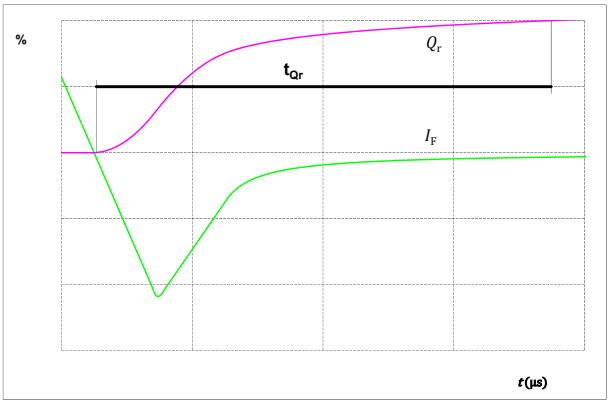


figure 29. **FWD**

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



Ordering Code	
Version	**Ordering Code**
With thermal paste (4,4 W/mK, PTM6000)	B0-SP126PA200M7-LR40F78T-/7/

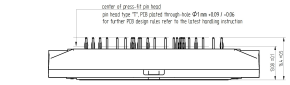
Marking

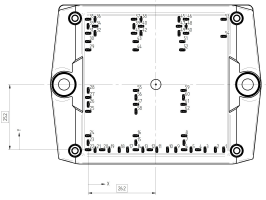
		Name	Date code	UL & VIN	Lot	Serial
Text		NN-NNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

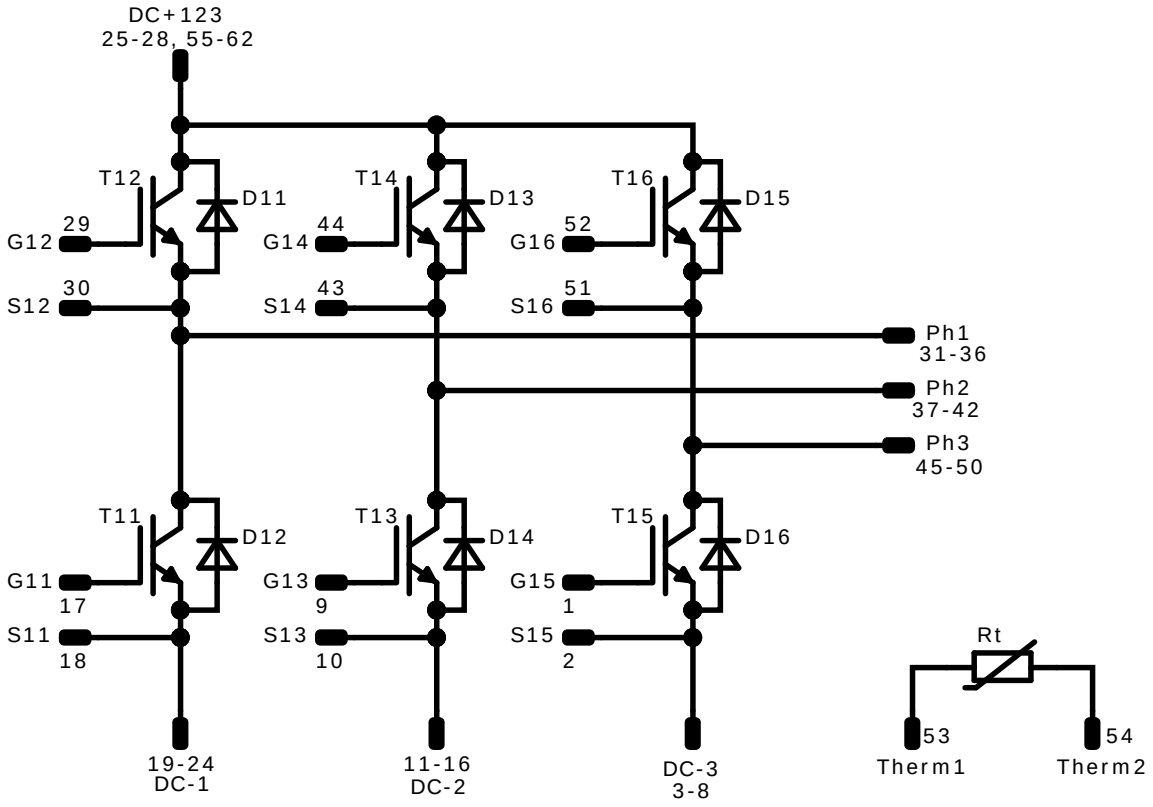
Pin table [mm]

Pin	X	Y	Function	32	2,7	45	Ph1
1	52,4	0	G15	33	0	47,7	Ph1
2	49,2	0	S15	34	2,7	47,7	Ph1
3	45,2	0	DC-3	35	0	50,4	Ph1
4	42,5	0	DC-3	36	2,7	50,4	Ph1
5	39,8	0	DC-3	37	17,75	50,4	Ph2
6	37,1	0	DC-3	38	20,45	50,4	Ph2
7	37,1	2,7	DC-3	39	17,75	47,7	Ph2
8	37,1	5,4	DC-3	40	20,45	47,7	Ph2
9	33,9	0	G13	41	17,75	45	Ph2
10	30,7	0	S13	42	20,45	45	Ph2
11	26,55	0	DC-2	43	18,4	41,8	S14
12	23,85	0	DC-2	44	18,4	38,6	G14
13	21,15	0	DC-2	45	35,15	50,4	Ph3
14	18,45	0	DC-2	46	37,85	50,4	Ph3
15	18,45	2,7	DC-2	47	35,15	47,7	Ph3
16	18,45	5,4	DC-2	48	37,85	47,7	Ph3
17	15,25	0	G11	49	35,15	45	Ph3
18	12,05	0	S11	50	37,85	45	Ph3
19	8,1	0	DC-1	51	36,4	41,8	S16
20	5,4	0	DC-1	52	36,4	38,6	G16
21	2,7	0	DC-1	53	52,4	50,4	Therm1
22	0	0	DC-1	54	52,4	43,8	Therm2
23	0	2,7	DC-1	55	18,5	22,9	DC+
24	0	5,4	DC-1	56	18,5	20,2	DC+
25	0,05	14,8	DC+	57	18,5	17,5	DC+
26	0,05	17,5	DC+	58	18,5	14,8	DC+
27	0,05	20,2	DC+	59	36,9	22,9	DC+
28	0,05	22,9	DC+	60	36,9	20,2	DC+
29	0	38,6	G12	61	36,9	17,5	DC+
30	0	41,8	S12	62	36,9	14,8	DC+
31	0	45	Ph1				





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	

Packaging instruction				
Standard packaging quantity (SPQ) 45	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* S3 packages see vincotech.com website.

Package data
Package data for *flow* S3 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
B0-SP126PA200M7-LR40F78T-D1-14	18 Mar. 2021		
B0-SP126PA200M7-LR40F78T-D2-14	7 Jul. 2021	Module marking is updated with UL logo, product is unchanged	