80-M2126PA035M7-K717F70
datasheet

MiniSKiiP PACK 2 **1200 V / 35 A**

Topology features

- Inverter
- Kelvin Emitter for improved switching performance
- Temperature sensor

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

Housing features

- Base isolation: Al_2O_3
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

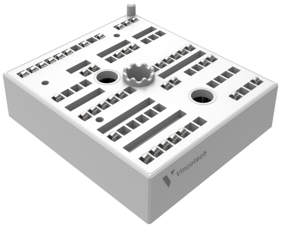
Target applications

- Industrial Drives

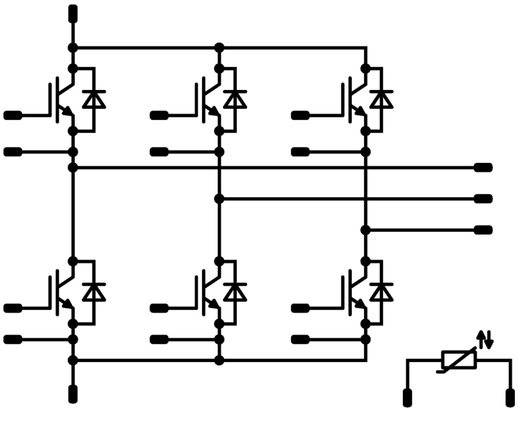
Types

- 80-M2126PA035M7-K717F70

MiniSKiiP® 2 16 mm housing



Schematic



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	70 (1)	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	129	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

(1) limited by I_{CRM}

Parameter	Symbol	Conditions		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	45	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	89	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	5500	V
Creepage distance		With std lid For more informations see handling instructions		6,3	mm
Clearance		With std lid For more informations see handling instructions		6,3	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,47 1,64 1,68	1,85(2)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			80	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		7900		pF
Output capacitance	C_{oes}		0	10		25		270		pF
Reverse transfer capacitance	C_{res}		0	10		25		97		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		35	25		260		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,73		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		124,2 122,4 121,4		ns
Rise time	t_r	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		14,2 17 17,8		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		178,6 202,8 208,2		ns
Fall time	t_f	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		95,14 117,86 118,79		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=4,34 µC Q_{rFWD}=6,18 µC Q_{rFWD}=6,9 µC	±15	600	35	25 125 150		1,45 1,92 2,09		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	35	25 125 150		2,4 3,17 3,42		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				35	25 125 150		1,66 1,76 1,75	2,1[(2)]	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink[(3)]	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,06		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=2681 A/µs d*i*/d*t*=2670 A/µs d*i*/d*t*=2690 A/µs	±15	600	35	25 125 150		77,33 75,64 76,58		A
Reverse recovery time	t_{rr}					25 125 150		157,26 283,67 310,8		ns
Recovered charge	Q_r					25 125 150		4,34 6,18 6,9		µC
Reverse recovered energy	E_{rec}					25 125 150		1,96 2,82 3,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2734 2205 2101		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		1		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		2	%
Maximum Current	I_{max}							3		mA
Power dissipation constant	d					25		0,76		mW/K
A-value	A							$7{,}635 \times 10^{-3}$		1/K
B-value	B							$1{,}73 \times 10^{-5}$		$1/K^2$
Vincotech Thermistor Reference									E	

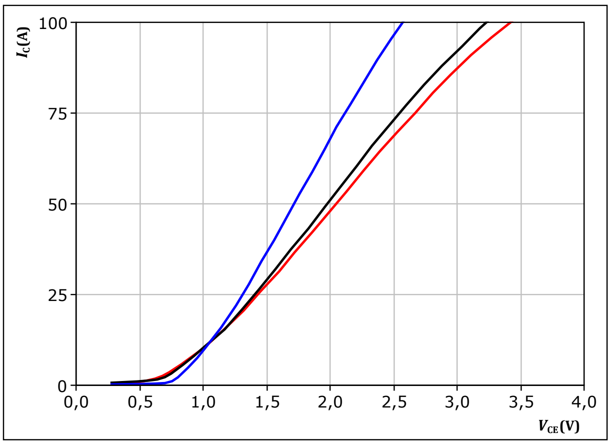
(2) Value at chip level
(3) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



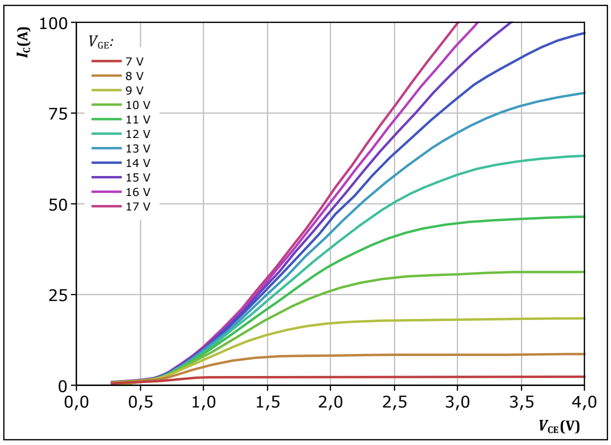
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



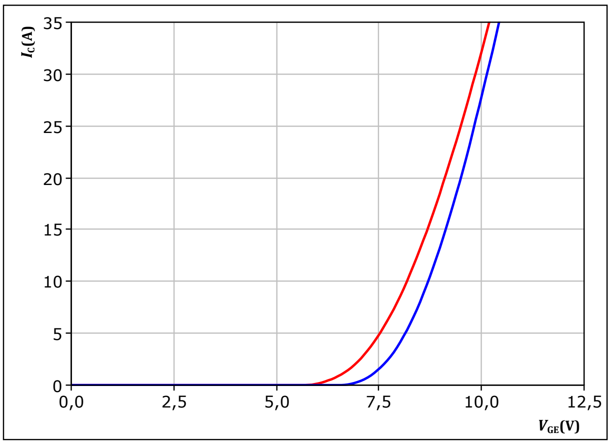
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



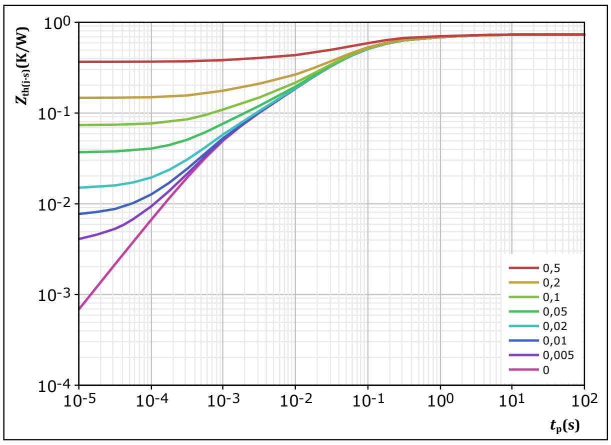
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,734	K/W

IGBT thermal model values

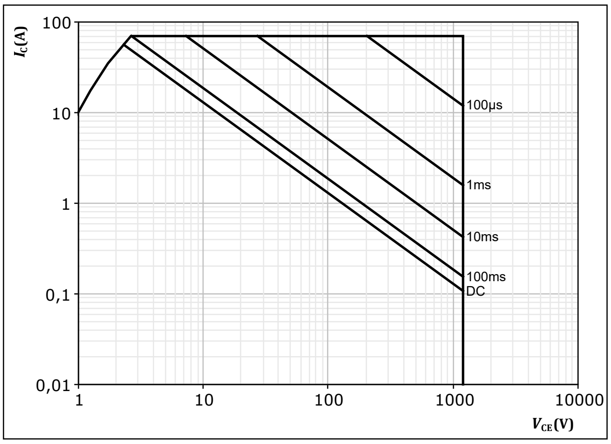
R (K/W)	τ (s)
4,86E-02	2,88E+00
1,00E-01	4,81E-01
3,87E-01	7,10E-02
1,44E-01	1,25E-02
5,43E-02	1,05E-03

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

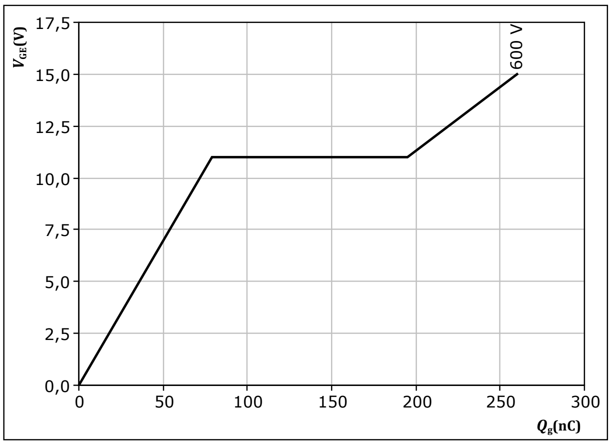


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



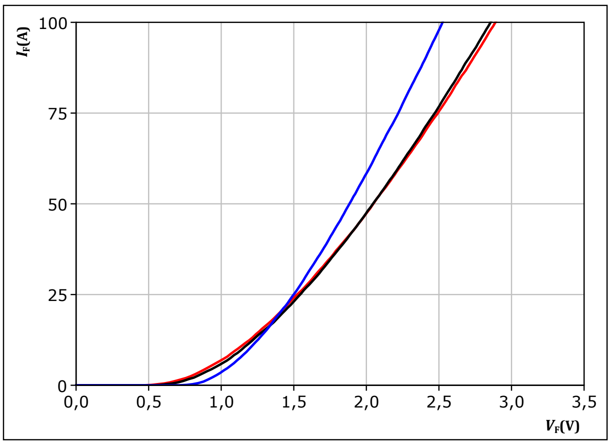
I_C =	35	A
T_j =	25	°C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

I_F = f(V_F)



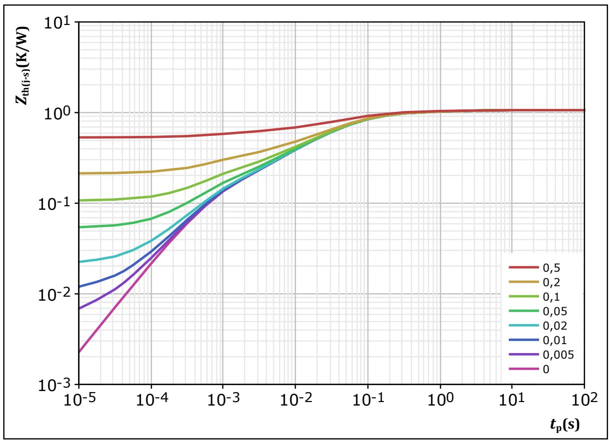
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,064 K/W

FWD thermal model values

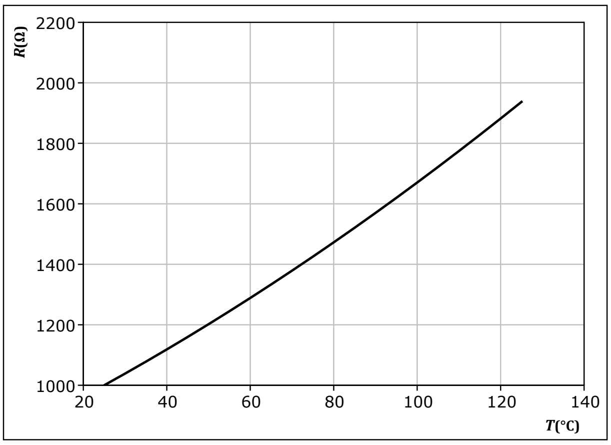
R (K/W)	τ (s)
6,06E-02	1,82E+00
2,37E-01	1,58E-01
4,33E-01	3,97E-02
2,08E-01	7,61E-03
1,26E-01	6,66E-04

Thermistor Characteristics

figure 9.	**Thermistor**

Typical PTC characteristic as function of temperature

R_T = f(T)

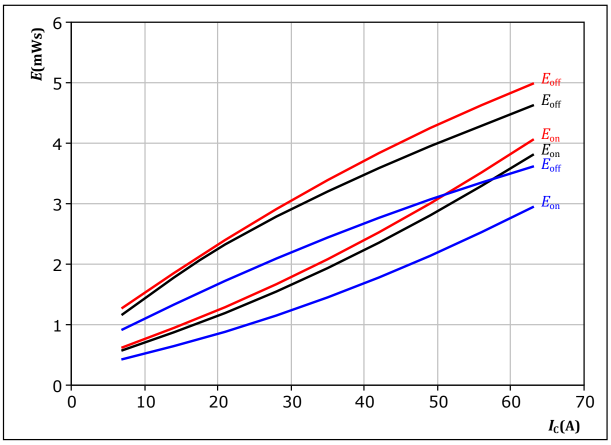


Inverter Switching Characteristics

figure 10. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



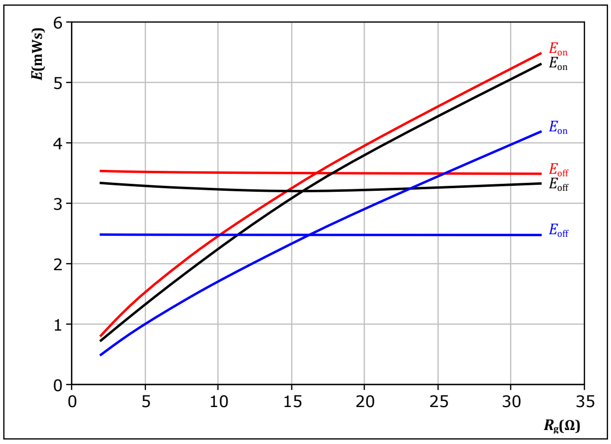
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 11. **IGBT**

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

$E = f(R_g)$



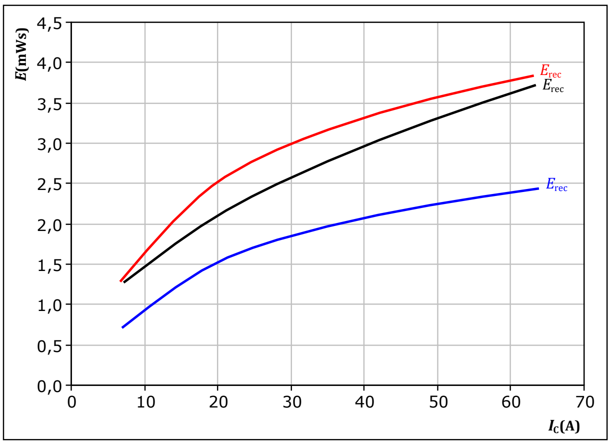
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

figure 12. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



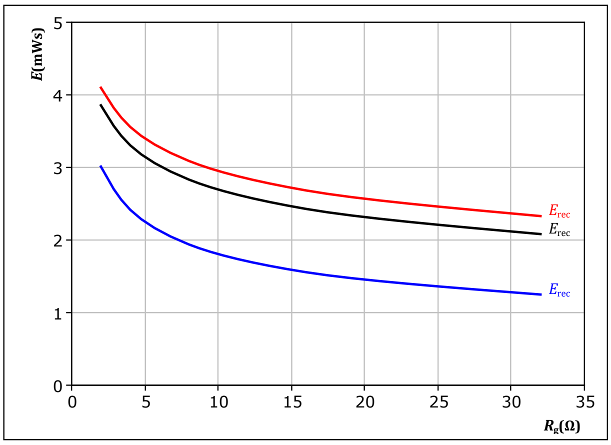
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 13. **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

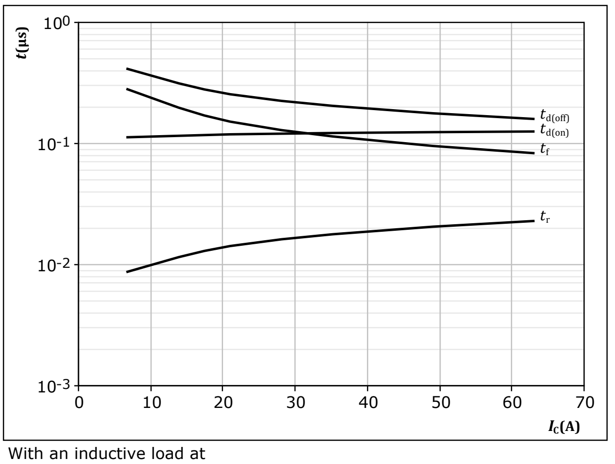
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

Inverter Switching Characteristics

figure 14. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



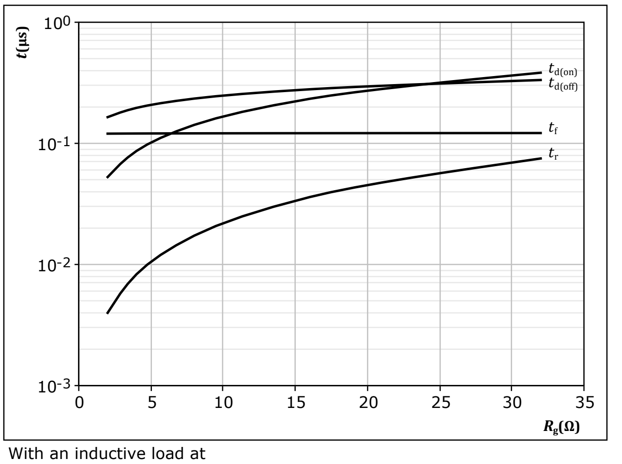
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 15. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

$t = f(R_g)$



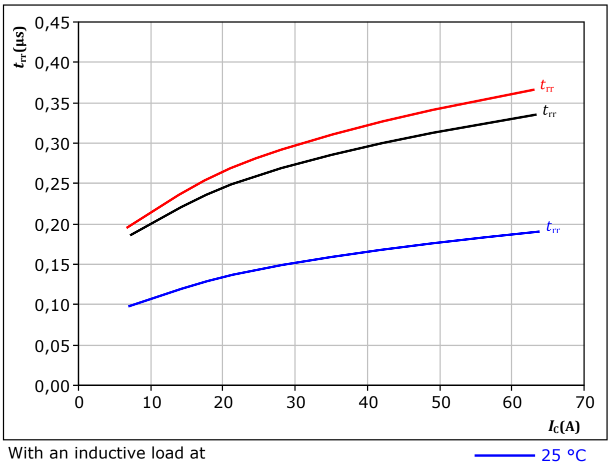
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

figure 16. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

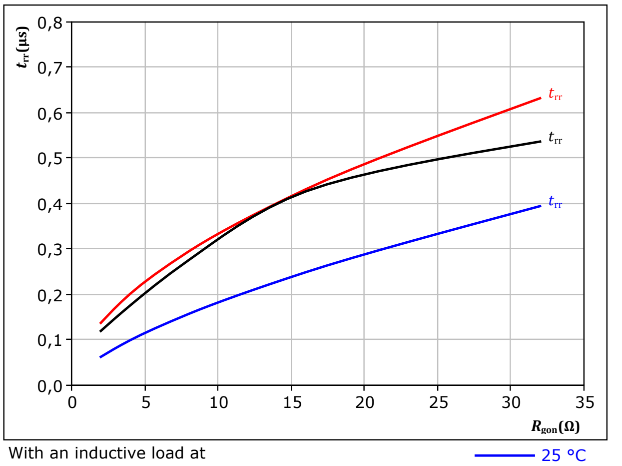
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 17. **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} =	600	V
V_{GE} =	±15	V
I_C =	35	A

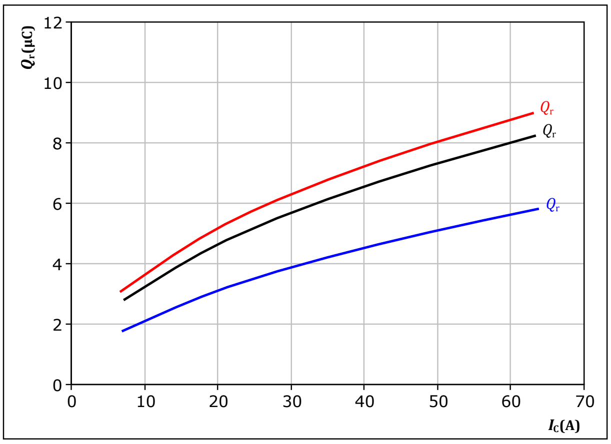
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 18. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



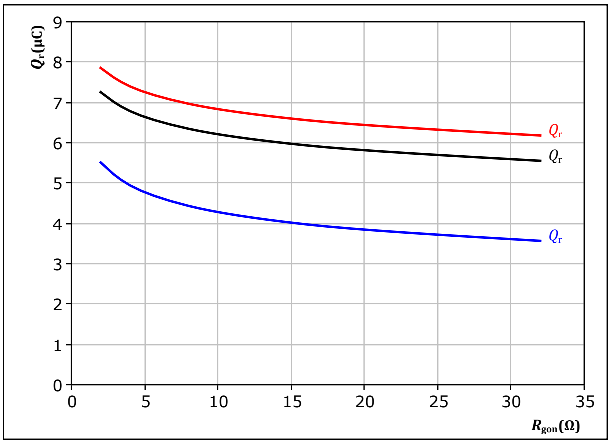
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 19. FWD

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

Q_r = f(R_{gon})



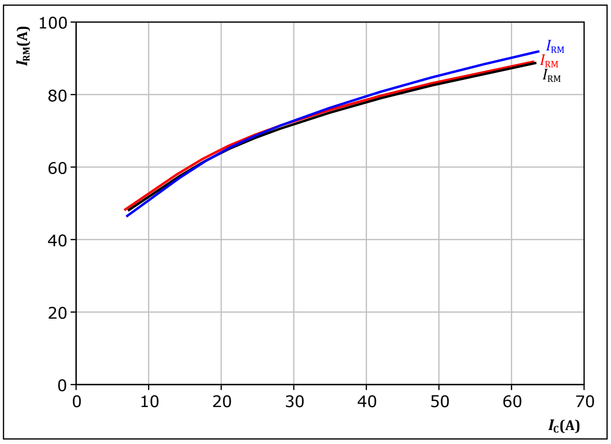
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

figure 20. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



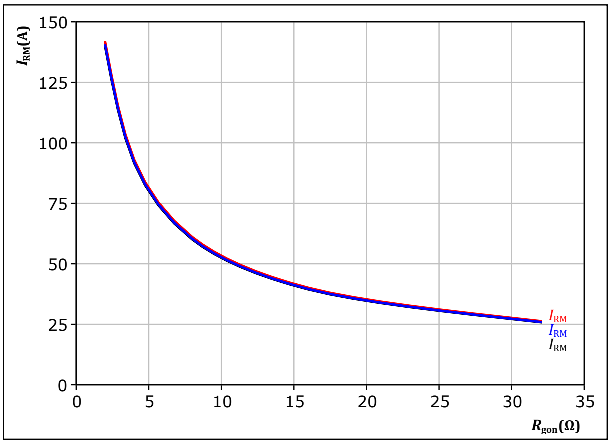
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 21. 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

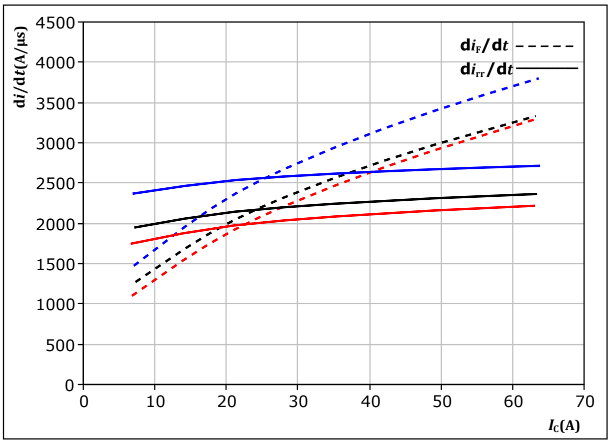
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

Inverter Switching Characteristics

figure 22. 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)



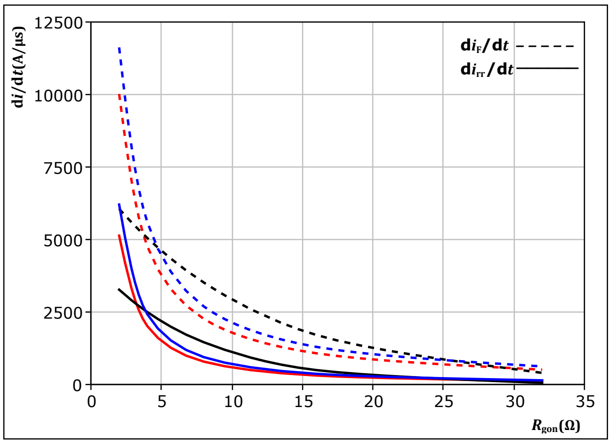
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 23. FWD

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

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



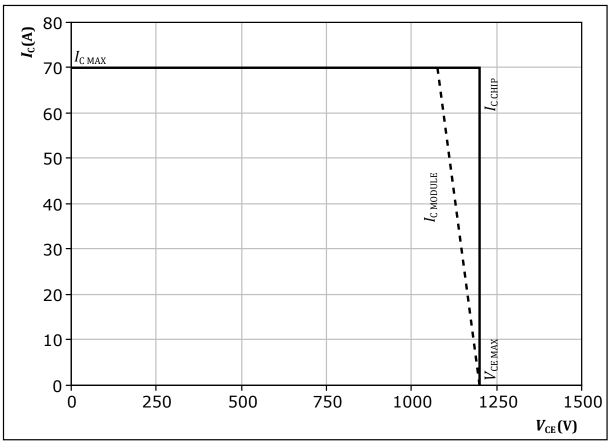
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

figure 24. IGBT

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Inverter Switching Definitions

figure 25.	IGBT

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

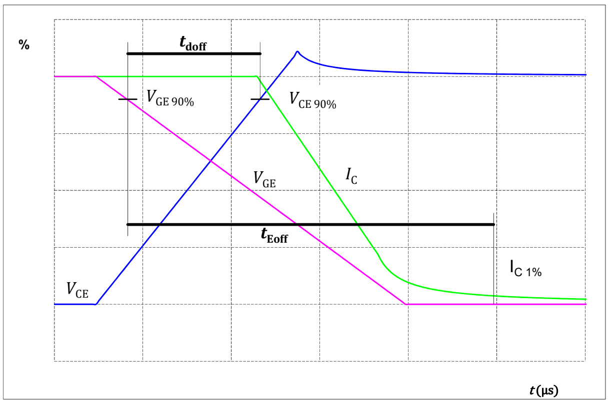


figure 26.	IGBT

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

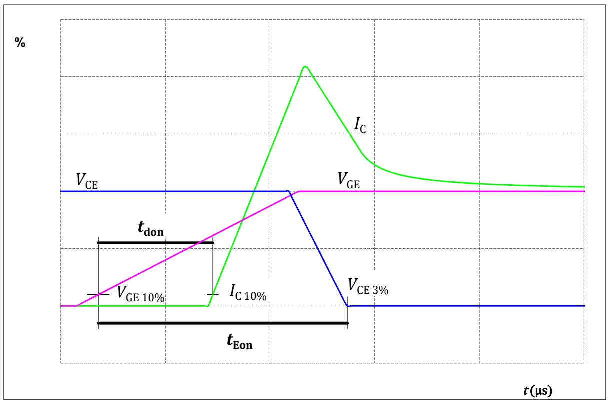


figure 27.	IGBT

Turn-off Switching Waveforms & definition of t_f

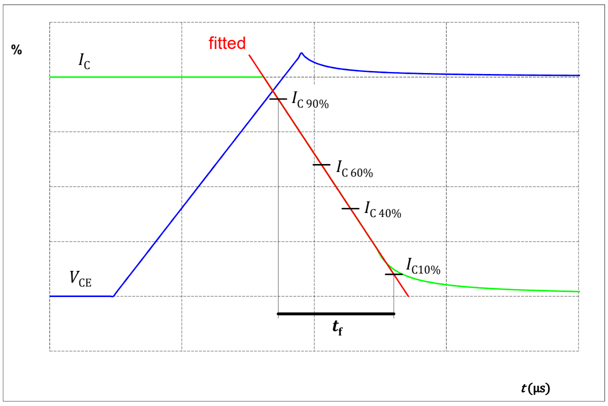
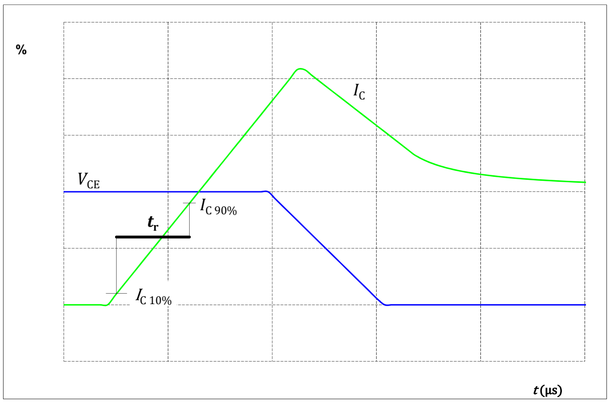


figure 28.	IGBT

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 29. **FWD**

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

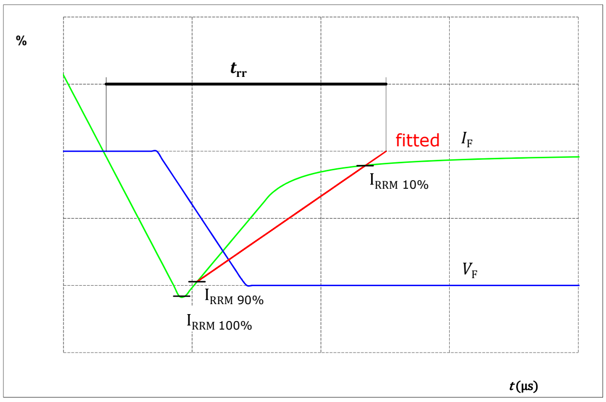
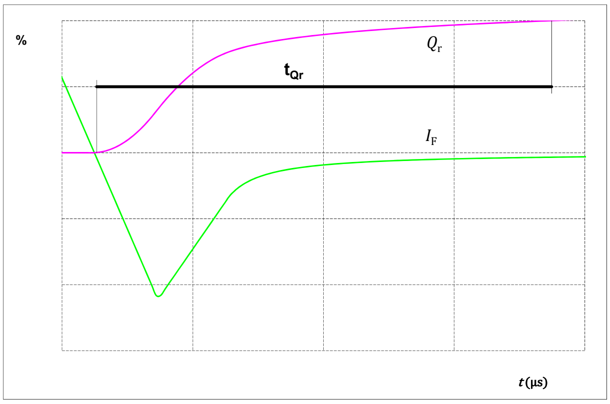


figure 30. **FWD**

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



Ordering Code	
Version	**Ordering Code**
With std lid (6.5mm height) + no thermal grease	80-M2126PA035M7-K717F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M2126PA035M7-K717F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA035M7-K717F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA035M7-K717F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA035M7-K717F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA035M7-K717F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA035M7-K717F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA035M7-K717F70-/5B/

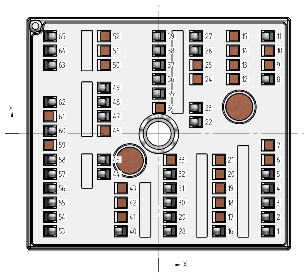
Marking

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

Outline

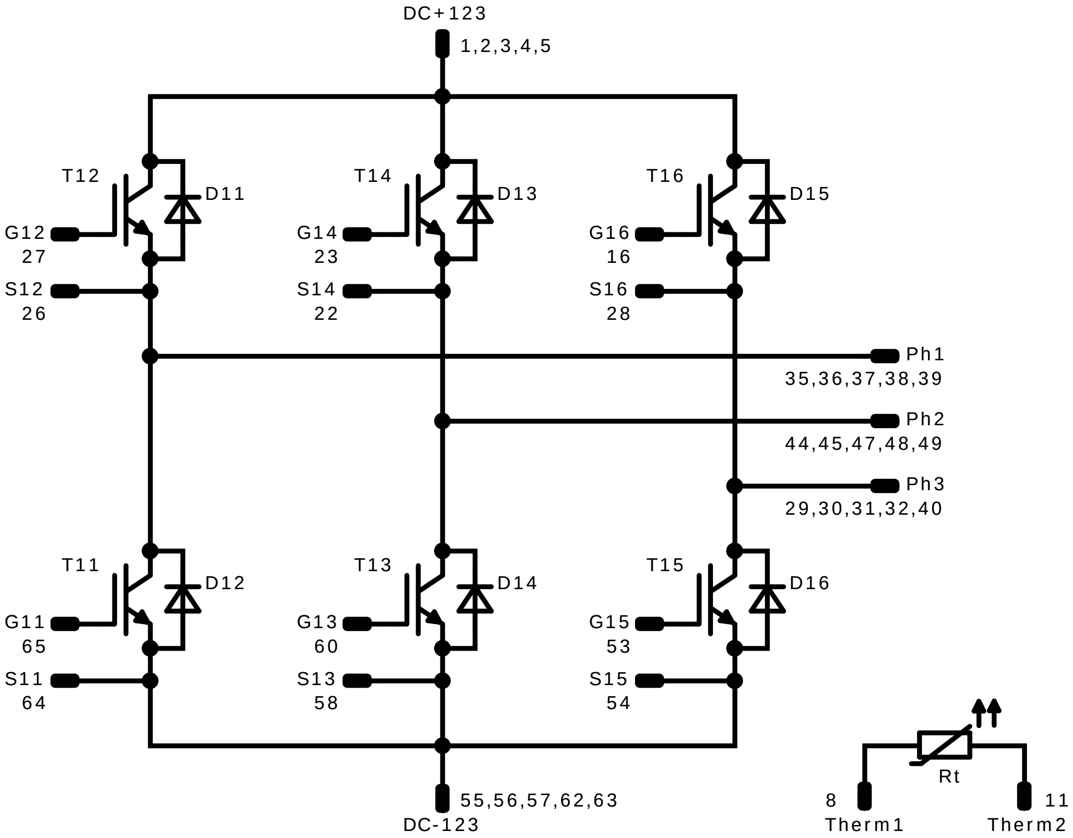
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
				34	not assembled		
1	24,38	-21,8	DC+123	35	0,03	9	Ph1
2	24,38	-18,6	DC+123	36	0,03	12,2	Ph1
3	24,38	-15,4	DC+123	37	0,03	15,4	Ph1
4	24,38	-12,2	DC+123	38	0,03	18,6	Ph1
5	24,38	-9	DC+123	39	0,03	21,8	Ph1
6	not assembled			40	-8,5	-21,8	Ph3
7	not assembled			41	not assembled		
8	24,38	12,2	Therm1	42	not assembled		
9	not assembled			43	not assembled		
10	not assembled			44	-12,22	-9	Ph2
11	24,38	21,8	Therm2	45	-12,22	-5,8	Ph2
12	not assembled			46	not assembled		
13	not assembled			47	-12,22	3,9	Ph2
14	not assembled			48	-12,22	7,1	Ph2
15	not assembled			49	-12,22	10,3	Ph2
16	13,42	-21,8	G16	50	not assembled		
17	not assembled			51	not assembled		
18	not assembled			52	not assembled		
19	not assembled			53	-24,38	-21,8	G15
20	not assembled			54	-24,38	-18,6	S15
21	not assembled			55	-24,38	-15,4	DC-123
22	8,38	2,6	S14	56	-24,38	-12,2	DC-123
23	8,38	5,8	G14	57	-24,38	-9	DC-123
24	not assembled			58	-24,38	-5,8	S13
25	not assembled			59	not assembled		
26	8,38	18,6	S12	60	-24,38	0,7	G13
27	8,38	21,8	G12	61	not assembled		
28	2,46	-21,8	S16	62	-24,38	7,1	DC-123
29	2,46	-18,6	Ph3	63	-24,38	15,4	DC-123
30	2,46	-15,4	Ph3	64	-24,38	18,6	S11
31	2,46	-12,2	Ph3	65	-24,38	21,8	G11
32	2,46	-9	Ph3				
33	not assembled						



Pad positions refers to center point. For more informations on pad design please see package data

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	35 A	Inverter Diode	
Rt	PTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 72	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 2 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 2 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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=150°C and up to 2500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
80-M2126PA035M7-K717F70-D3-14	20 Feb. 2024	Pin table correction	