Vincotech

80-M312WPA050SH-K889F40

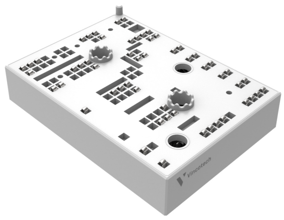
datasheet

MiniSKiiP PACK 3 | **1200 V / 50 A**

Features

- Twin sixpack configuration
- High Speed IGBT4 Technology
- Solderless spring contact mounting system

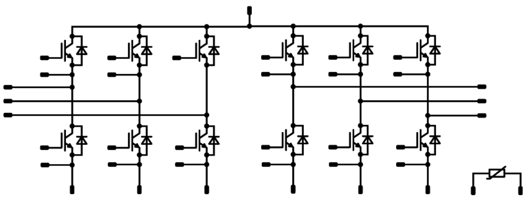
MiniSKiiP® 3 16 mm housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 80-M312WPA050SH-K889F40

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	58	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	163	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
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	53	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	123	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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	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					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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0017	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150	1,78	2,05 2,38 2,46	2,42(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							4		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		2770		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		160		pF
Gate charge	Q_g		15		0	25		380		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,58		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	50	25 125 150		99 103 103		ns
Rise time	t_r	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	50	25 125 150		22 24 25		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	50	25 125 150		185 245 260		ns
Fall time	t_f	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	50	25 125 150		54,75 90,57 105,76		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=3,7 µC Q_{rFWD}=7,15 µC Q_{rFWD}=8,84 µC	±15	600	50	25 125 150		2,78 4,09 4,57		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	50	25 125 150		2,03 3,52 3,92		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				50	25 125 150		2,22 2,31 2,21	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} = 2,5 W/mK (HPTP)						0,77		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2640 A/µs d*i*/d*t*=2128 A/µs d*i*/d*t*=2300 A/µs	±15	600	50	25 125 150		52,81 63,56 68,09		A
Reverse recovery time	t_{rr}					25 125 150		199,74 355,14 413,02		ns
Recovered charge	Q_r					25 125 150		3,7 7,15 8,84		µC
Reverse recovered energy	E_{rec}					25 125 150		1,33 2,72 3,42		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2544 1714 1531		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 R_{100}	$\Delta_{R/R}$	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	

(1) Value at chip level

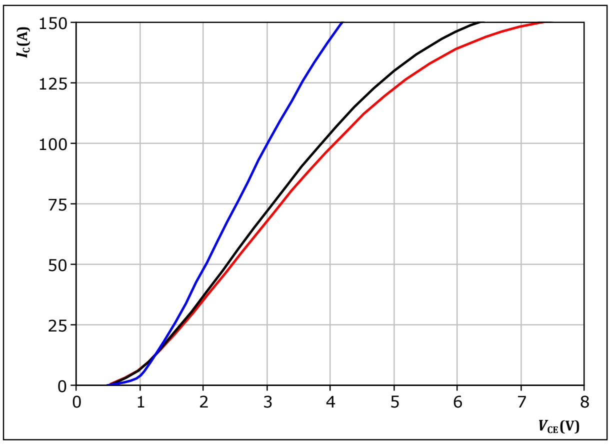
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})

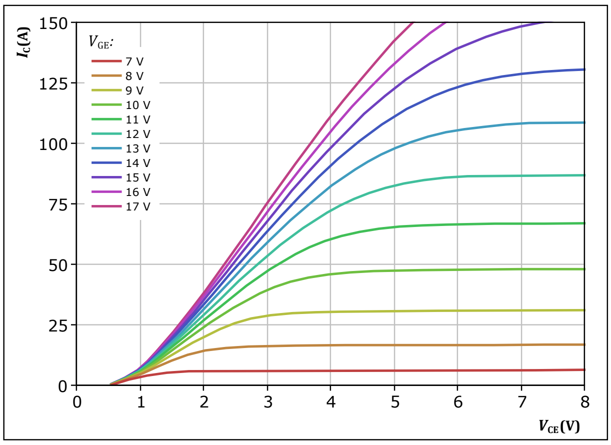


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})

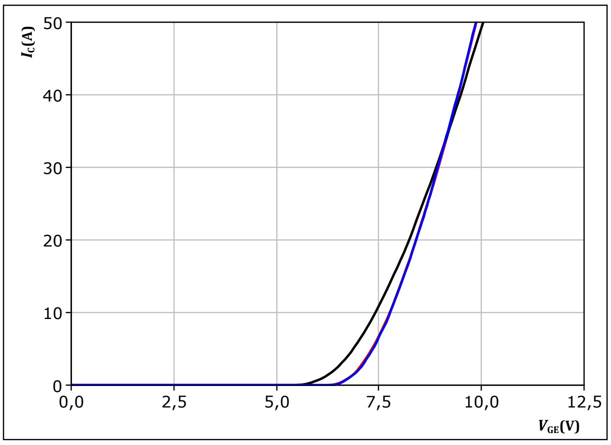


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

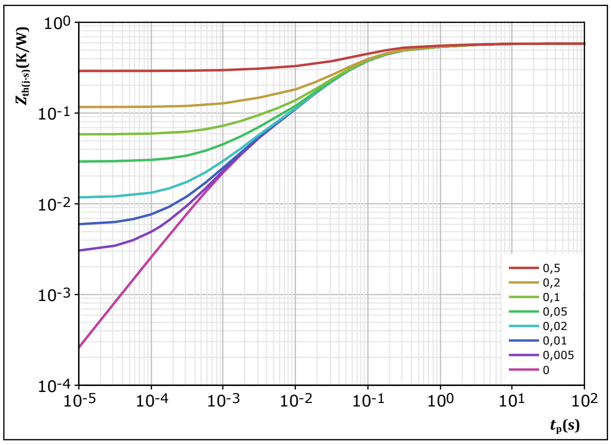


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,582 K/W

IGBT thermal model values

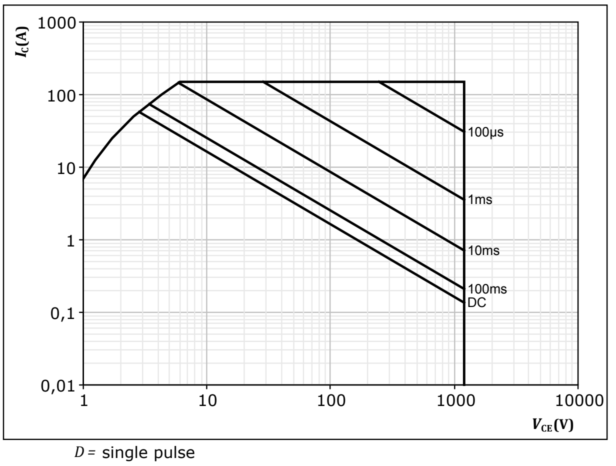
R (K/W)	τ (s)
4,36E-02	3,29E+00
7,77E-02	5,45E-01
3,13E-01	8,58E-02
1,16E-01	2,13E-02
3,15E-02	1,87E-03

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



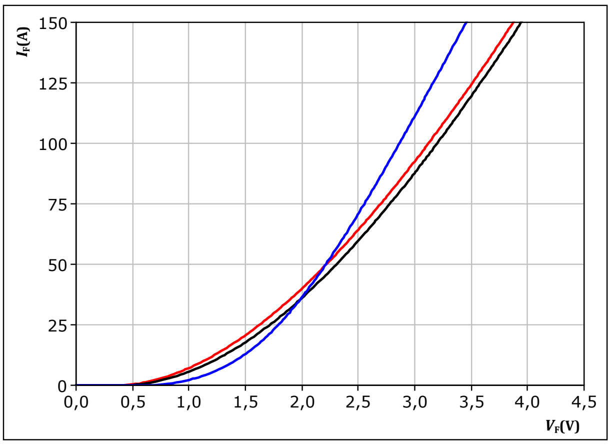
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



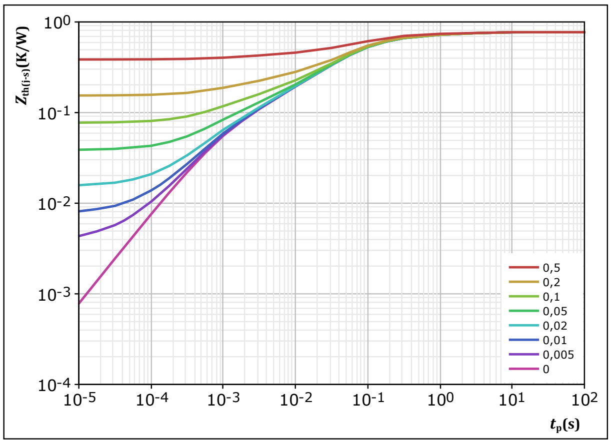
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,77 K/W

FWD thermal model values

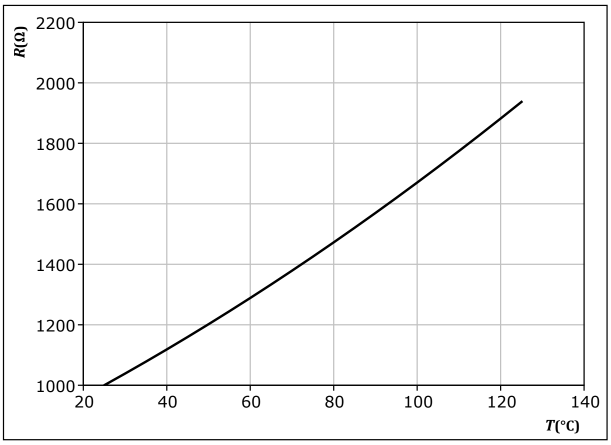
R (K/W)	τ (s)
6,81E-02	2,32E+00
1,41E-01	2,74E-01
4,03E-01	6,14E-02
1,01E-01	8,37E-03
5,84E-02	9,85E-04

Thermistor Characteristics

figure 8. **Thermistor**

Typical PTC characteristic as function of temperature

R_T = f(T)

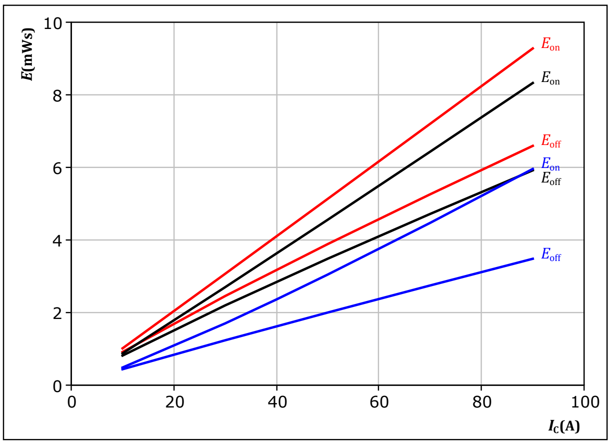


Inverter Switching Characteristics

figure 9. IGBT

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

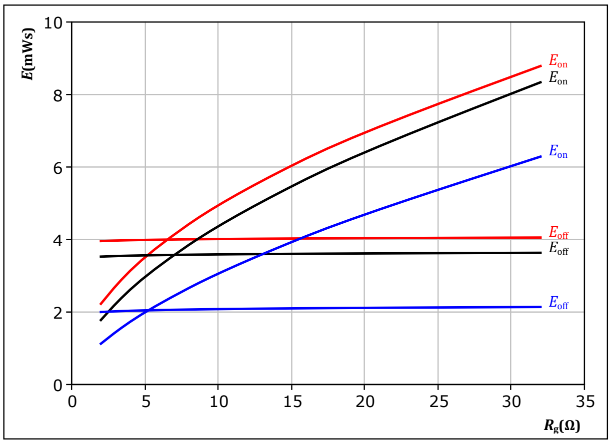
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 8 Ω
R_{goff} = 8 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 10. IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_g)



With an inductive load at

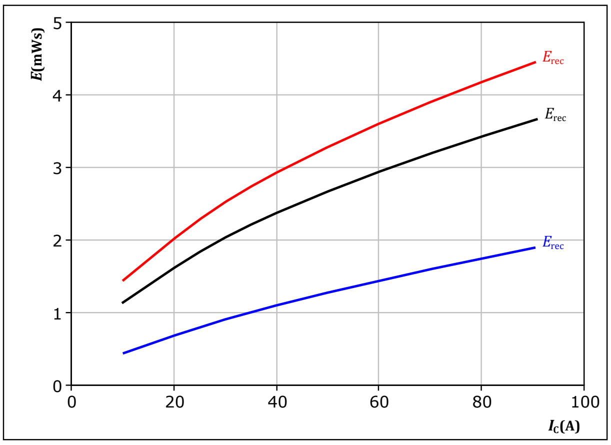
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 50 A

T_j: 25 °C, 125 °C, 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

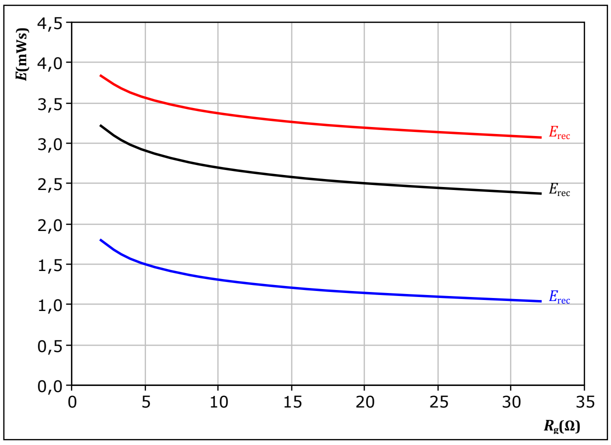
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 8 Ω

T_j: 25 °C, 125 °C, 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
V_{GE} = ±15 V
I_C = 50 A

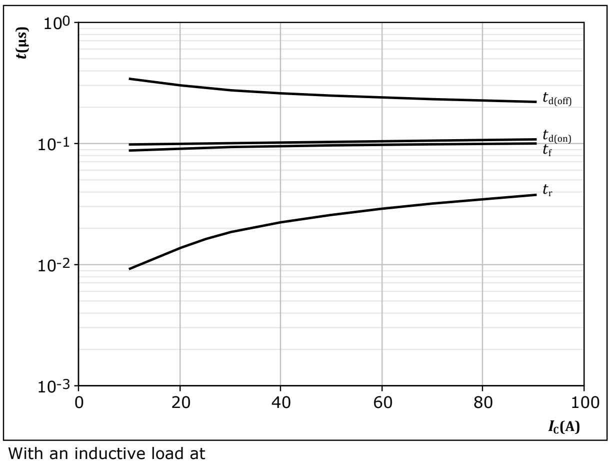
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 13. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



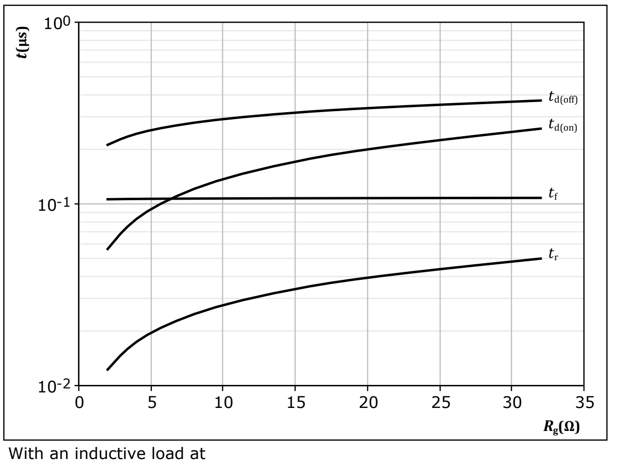
With an inductive load at

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

figure 14. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



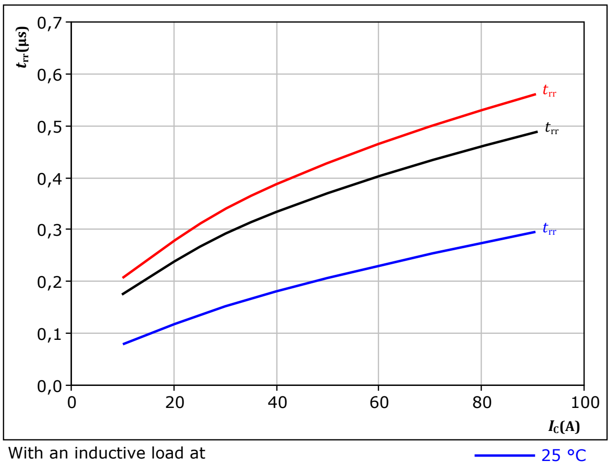
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

figure 15. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

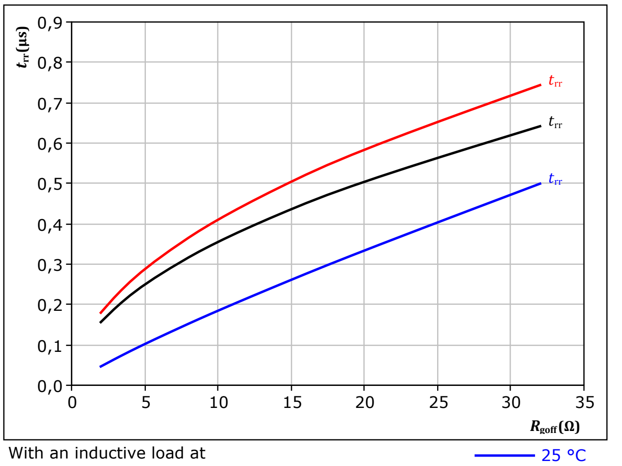
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

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 =	50	A

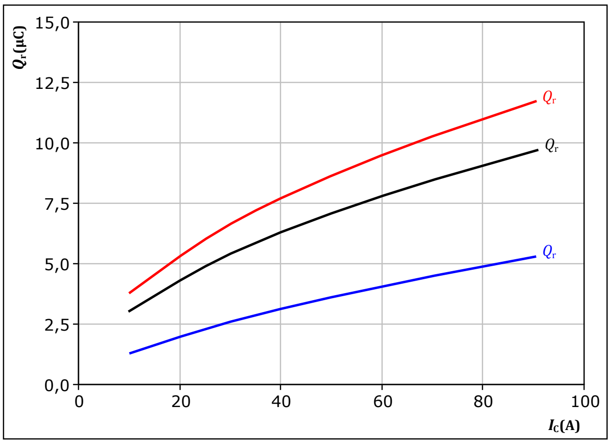
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 17. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



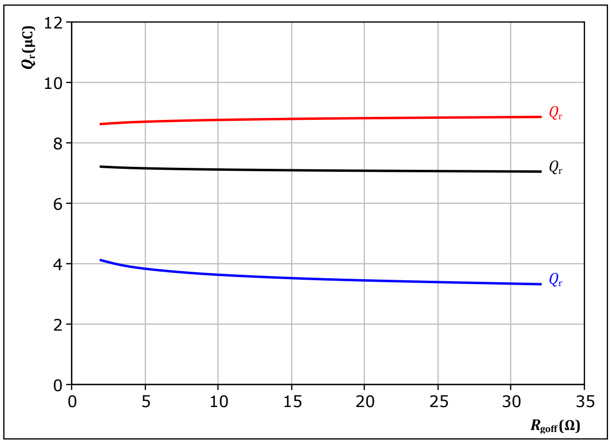
With an inductive load at

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

figure 18. FWD

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



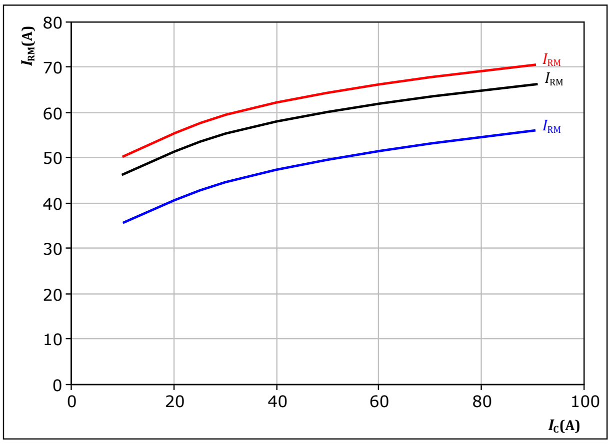
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
I_C =	50	A		

figure 19. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



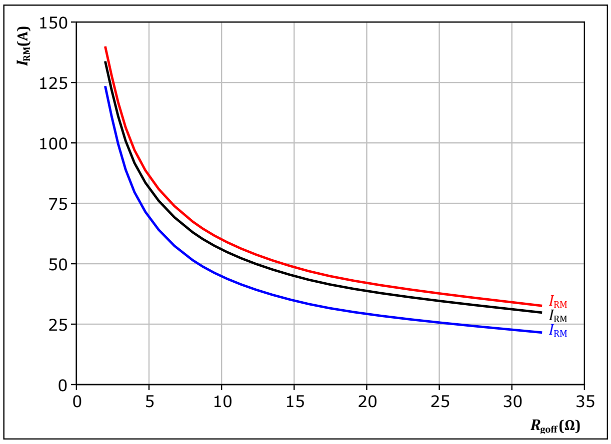
With an inductive load at

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

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

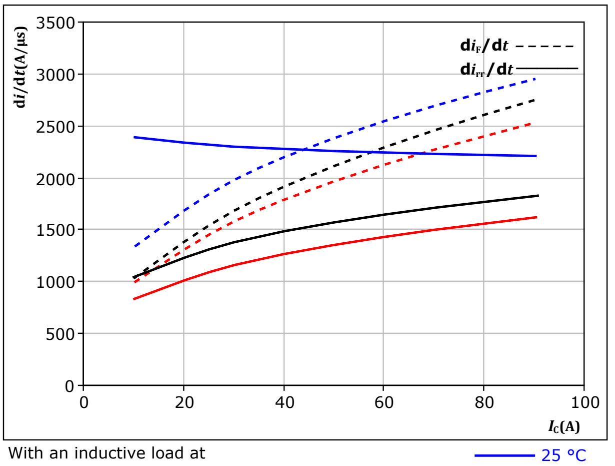
V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
I_C =	50	A		

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)



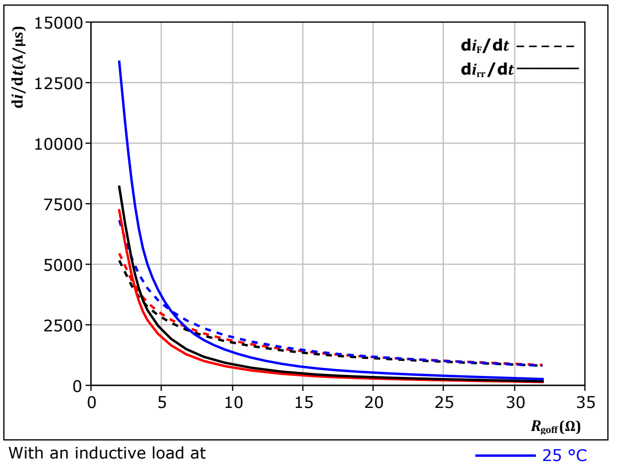
With an inductive load at

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



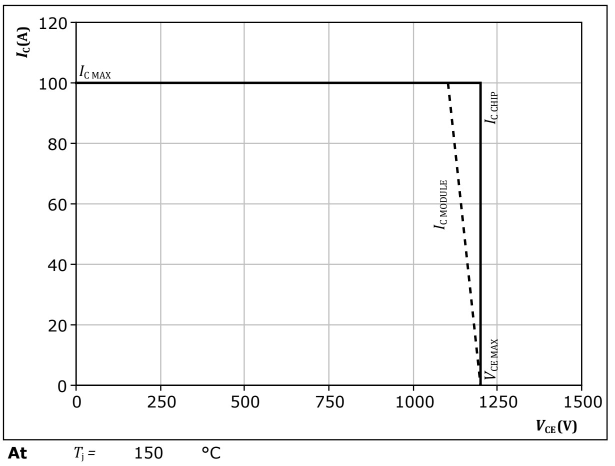
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	50	A		150 °C

figure 23. **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 24. **IGBT**

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

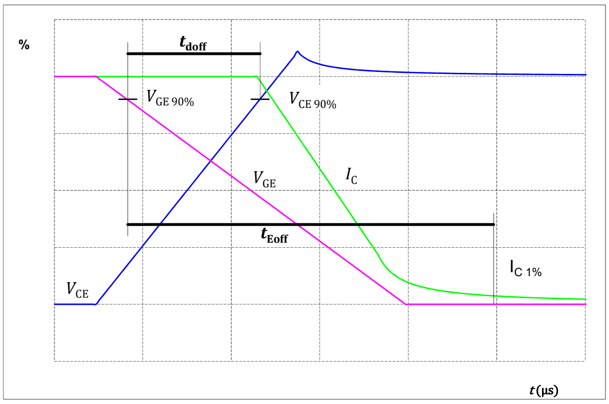


figure 25. **IGBT**

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

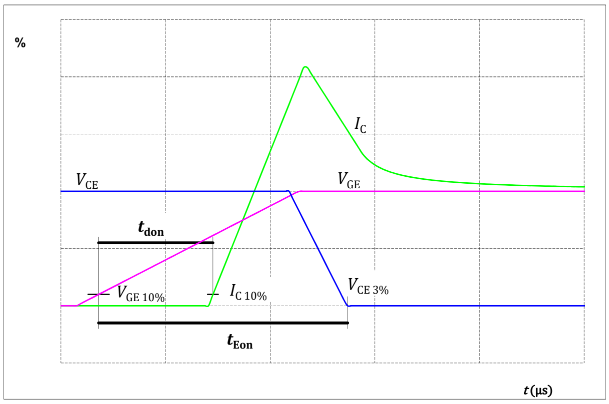


figure 26. **IGBT**

Turn-off Switching Waveforms & definition of t_f

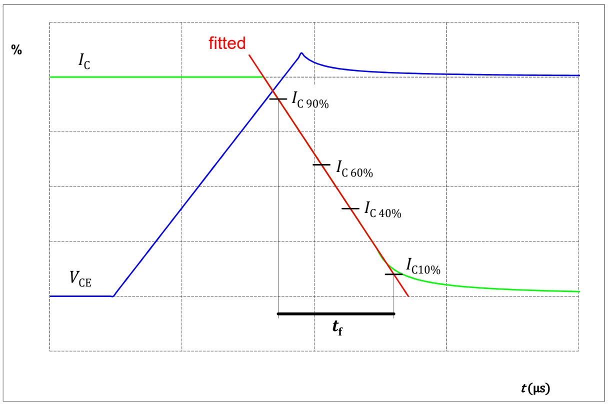
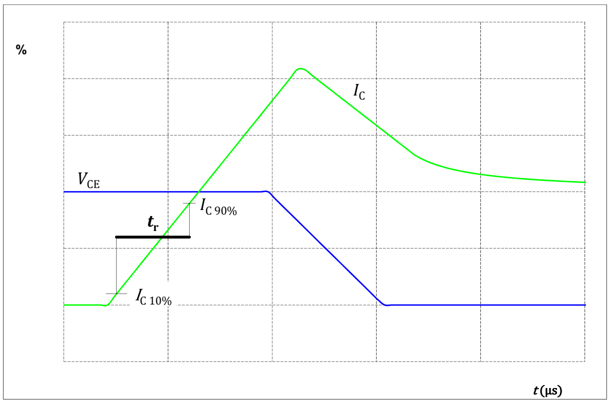


figure 27. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 28. **FWD**

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

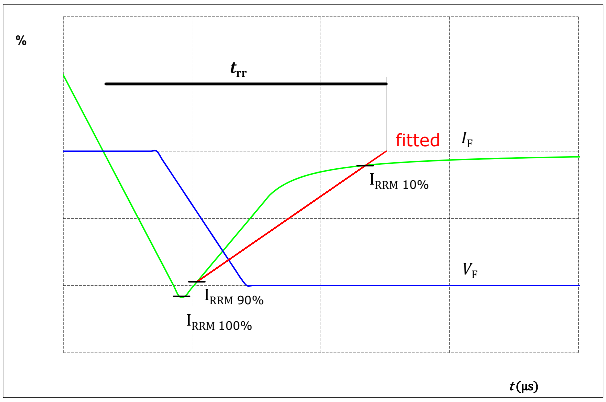
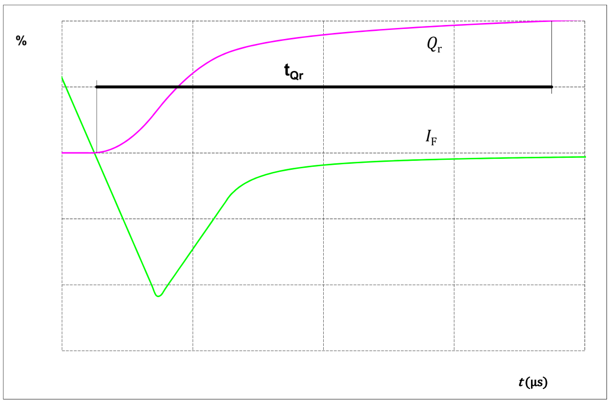


figure 29. **FWD**

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



Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M312WPA050SH-K889F40-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M312WPA050SH-K889F40-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312WPA050SH-K889F40-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312WPA050SH-K889F40-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312WPA050SH-K889F40-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312WPA050SH-K889F40-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312WPA050SH-K889F40-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312WPA050SH-K889F40-/5B/

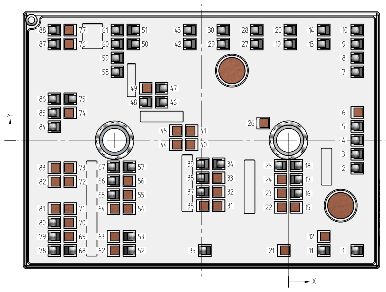
Marking

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

Outline

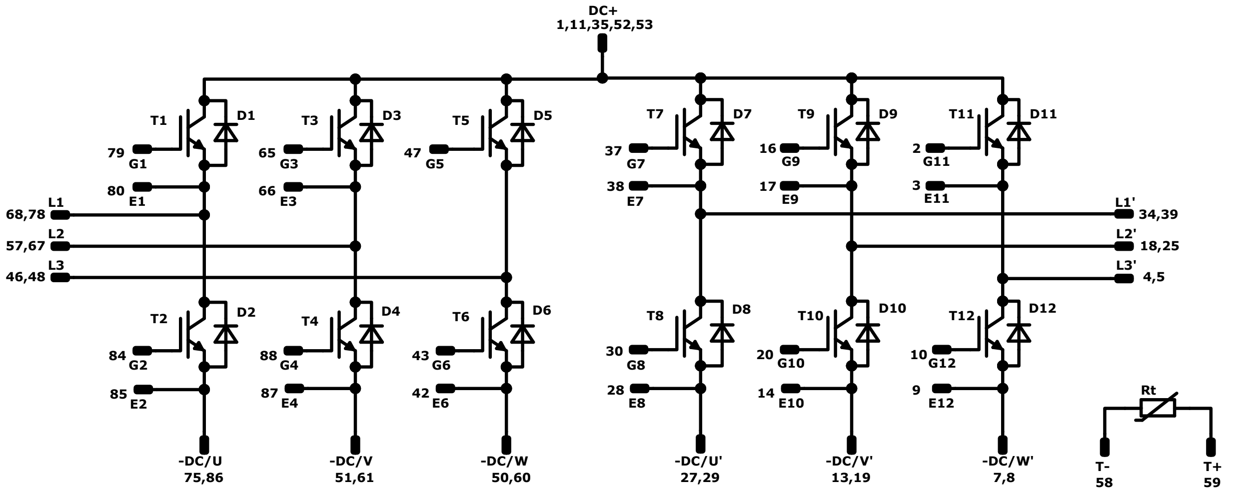
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
				45	not assembled		
1	15,83	-25,3	+DC	46	-29,18	8,74	L3
2	15,83	-6,4	G11	47	-29,18	11,94	G5
3	15,83	-3,2	E11	48	-32,82	8,74	L3
4	15,83	0	L3'	49	not assembled		
5	15,83	3,2	L3'	50	-35,68	22,1	-DC/W
6	not assembled			51	-35,68	25,3	-DC/V
7	15,83	15,7	-DC/W'	52	-36,58	-25,3	+DC
8	15,83	18,9	-DC/W'	53	-36,58	-22,1	+DC
9	15,83	22,1	E12	54	not assembled		
10	15,83	25,3	G12	55	not assembled		
11	8,13	-25,3	+DC	56	not assembled		
12	not assembled			57	-36,58	-6,1	L2
13	8,13	22,1	-DC/V'	58	-39,32	15,7	T-
14	8,13	25,3	E10	59	-39,32	18,9	T+
15	not assembled			60	-39,32	22,1	-DC/W
16	1,82	-12,18	G9	61	-39,32	25,3	-DC/V
17	1,82	-8,98	E9	62	not assembled		
18	1,82	-5,79	L2'	63	not assembled		
19	0,43	22,1	-DC/V'	64	not assembled		
20	0,43	25,3	G10	65	-40,22	-12,5	G3
21	not assembled			66	-40,22	-9,3	E3
22	not assembled			67	-40,22	-6,09	L2
23	not assembled			68	-50,18	-25,3	L1
24	not assembled			69	not assembled		
25	-1,82	-5,79	L2'	70	not assembled		
26	not assembled			71	not assembled		
27	-7,27	22,1	-DC/U'	72	not assembled		
28	-7,27	25,3	E8	73	not assembled		
29	-14,97	22,1	-DC/U'	74	not assembled		
30	-14,97	25,3	G8	75	-50,18	9,5	-DC/U
31	not assembled			76	not assembled		
32	not assembled			77	not assembled		
33	not assembled			78	-53,82	-25,3	L1
34	-16,05	-5,42	L1'	79	-53,82	-22,1	G1
35	-19,22	-25,3	+DC	80	-53,82	-18,9	E1
36	not assembled			81	not assembled		
37	-19,7	-11,82	G7	82	not assembled		
38	-19,7	-8,62	E7	83	not assembled		
39	-19,7	-5,42	L1'	84	-53,82	3,1	G2
40	not assembled			85	-53,82	6,3	E2
41	not assembled			86	-53,82	9,5	-DC/U
42	-22,67	22,1	E6	87	-53,82	22,1	E4
43	-22,67	25,3	G6	88	-53,82	25,3	G4
44	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
T2, T1, T4, T3, T6, T5, T8, T7, T10, T9, T12, T11	IGBT	1200 V	50 A	Inverter Switch	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12	FWD	1200 V	50 A	Inverter Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 48	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 3 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 3 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
80-M312WPA050SH-K889F40-D2-14	30 Sep. 2021	Change of CTI value Change of Inverter Switch and Diode R-Tau values	