80-M1164KA035RW01-K537I10

datasheet

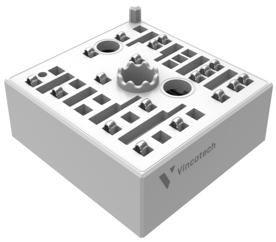
Vincotech

MiniSKiiP® CON 1 **1600 V / 35 A**

Features

- Single phase rectifier
- Brake circuit
- Integrated PTC
- Solder-free spring contact technology

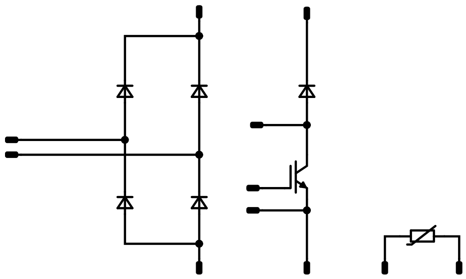
MiniSKiiP® 1 16 mm housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 80-M1164KA035RW01-K537I10

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	52	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	92	W
Gate-emitter voltage	V_{GES}			±30	V
Maximum junction temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	49	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 °C	74	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	40	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			370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	66	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
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					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	
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			5	0,033	25	5	6	7	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150		1,5 1,66 1,7	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			0,01	mA
Gate-emitter leakage current	I_{GES}		30	0		25			0,2	μA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							4200		pF
Output capacitance	C_{oes}	f = 1 Mhz	0	30		25		104		pF
Reverse transfer capacitance	C_{res}							79		pF
Gate charge	Q_g		15	400	50	25		141		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,03		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125 150		62,4 55,8 51,2		ns
Rise time	t_r					25 125 150		22,4 24,6 25,4		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω				25 125 150		185,8 211,2 216,6		ns
Fall time	t_f		0/15	400	50	25 125 150		13,6 18,57 19,23		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,7 μC Q_{rFWD}=2,72 μC Q_{rFWD}=3,14 μC				25 125 150		0,91 1,12 1,19		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,726 0,965 1,04		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	
Brake Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,5 1,57 1,54	1,9(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			10	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,28		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=2596 A/µs di/dt=2820 A/µs di/dt=2555 A/µs	0/15	400	50	25 125 150		51,29 58,76 61,56		A
Reverse recovery time	t_{rr}					25 125 150		66,29 105,04 115,65		ns
Recovered charge	Q_r					25 125 150		1,7 2,72 3,14		µC
Reverse recovered energy	E_{rec}					25 125 150		0,372 0,678 0,799		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1556 1448 1485		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	
Rectifier Diode										
Static										
Forward voltage	V_F				28	25 125		1,15 1,1		V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 1000	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,06		K/W
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	

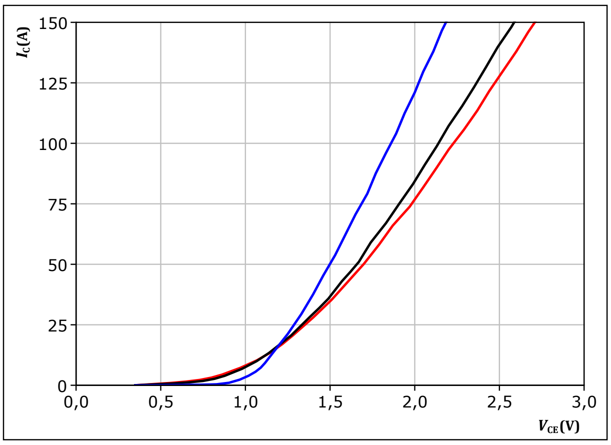
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

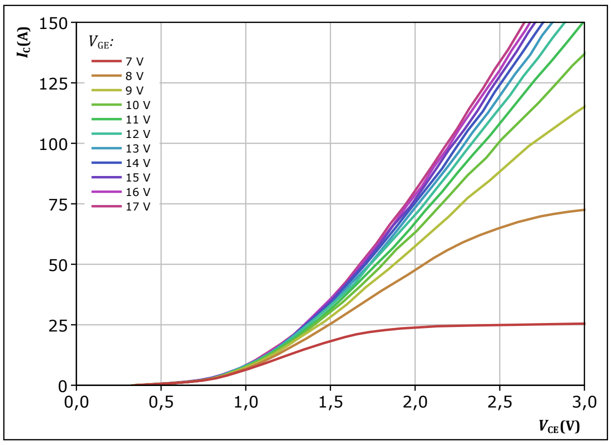


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



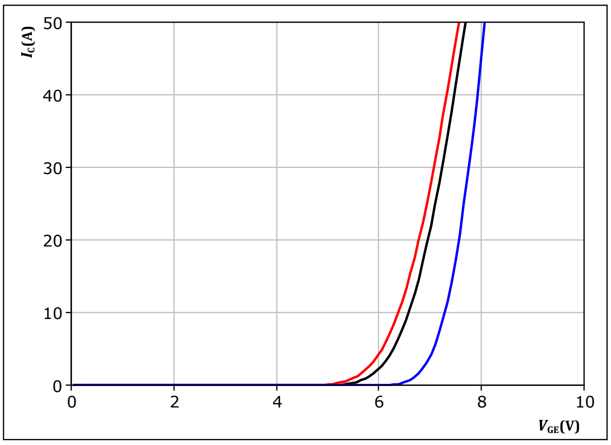
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

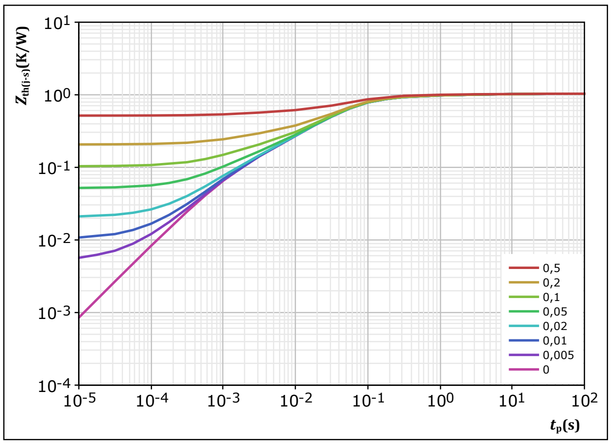


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,035	K/W

IGBT thermal model values

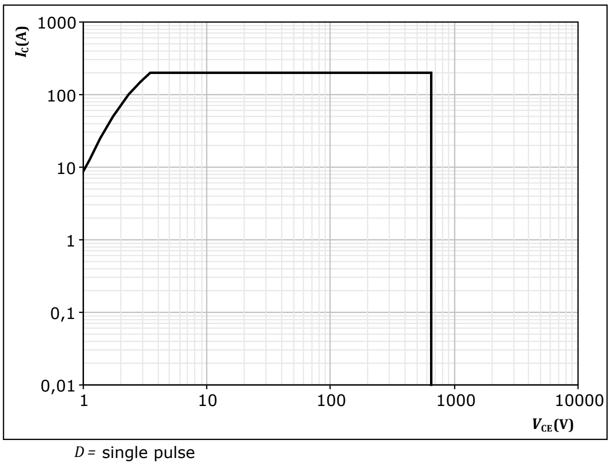
R (K/W)	τ (s)
3,85E-02	8,76E+00
7,22E-02	7,46E-01
1,92E-01	1,33E-01
5,55E-01	4,45E-02
1,03E-01	8,66E-03
6,94E-02	1,33E-03
4,78E-03	6,42E-04

Brake Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



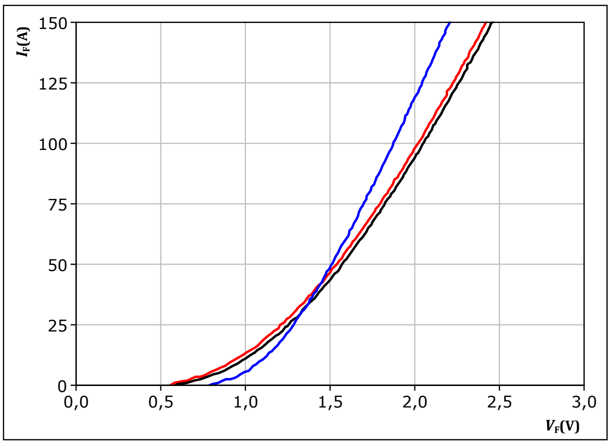
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



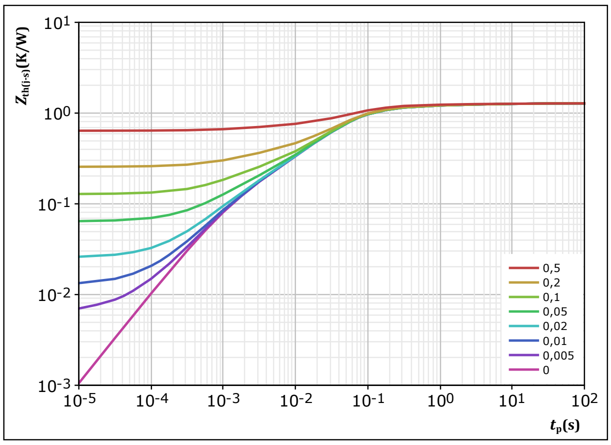
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,279 K/W

FWD thermal model values

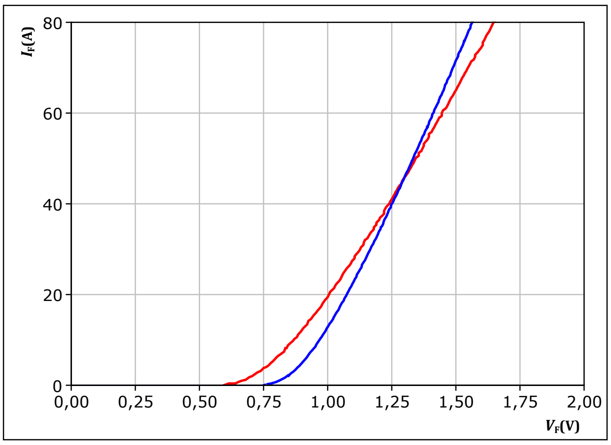
R (K/W)	τ (s)
4,76E-02	8,76E+00
8,93E-02	7,46E-01
2,37E-01	1,33E-01
6,86E-01	4,45E-02
1,28E-01	8,66E-03
8,58E-02	1,33E-03
5,91E-03	6,42E-04

Rectifier Diode Characteristics

figure 8. Rectifier

Typical forward characteristics

$I_F = f(V_F)$



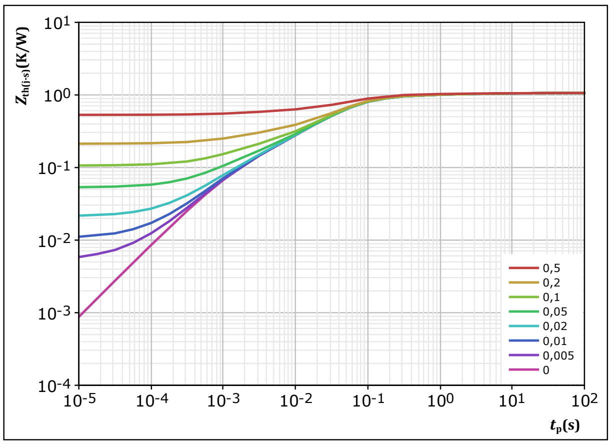
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. Rectifier

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

Rectifier thermal model values

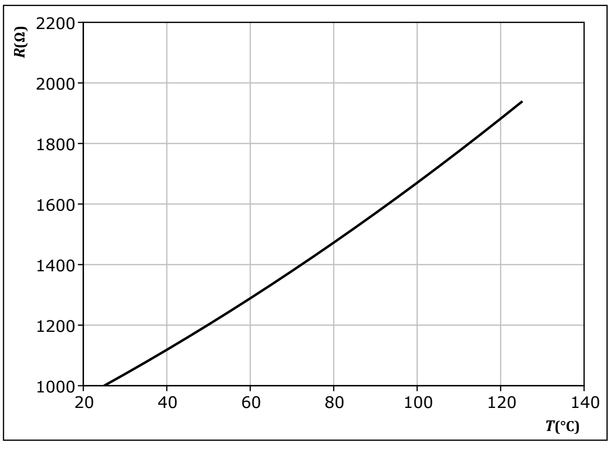
R (K/W)	τ (s)
3,96E-02	8,76E+00
7,42E-02	7,46E-01
1,97E-01	1,33E-01
5,70E-01	4,45E-02
1,06E-01	8,66E-03
7,14E-02	1,33E-03
4,92E-03	6,42E-04

Thermistor Characteristics

figure 10.	Thermistor

Typical PTC characteristic as function of temperature

R_T = f(T)

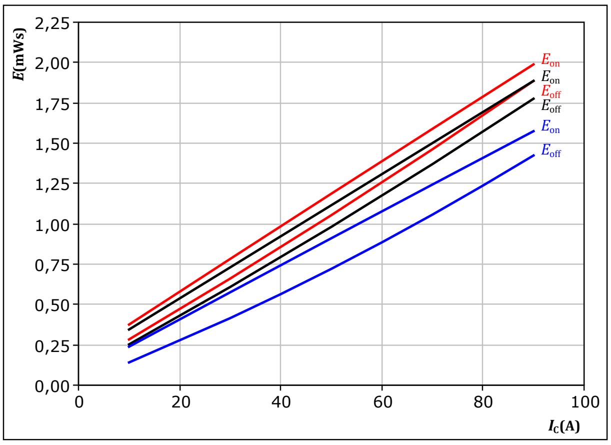


Brake Switching Characteristics

figure 11. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



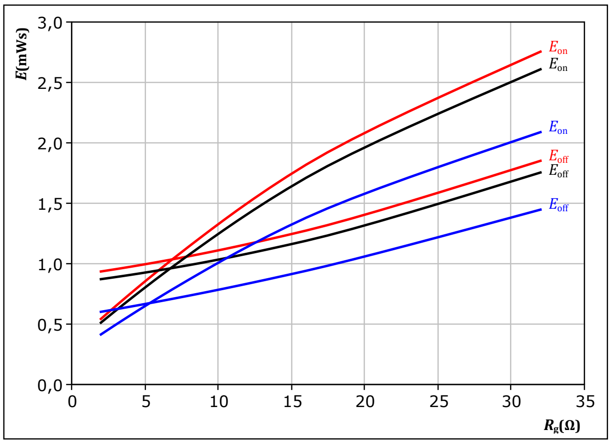
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 12. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



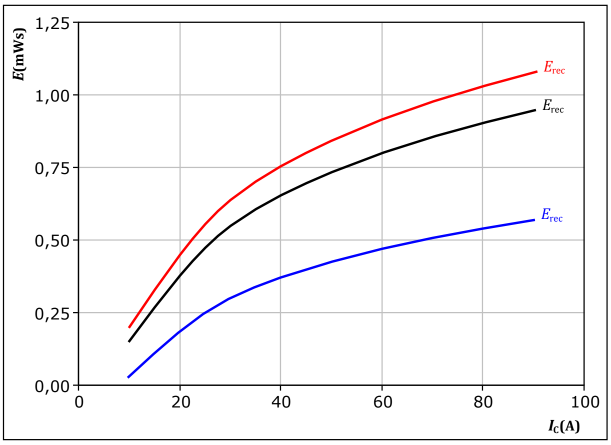
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 13. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



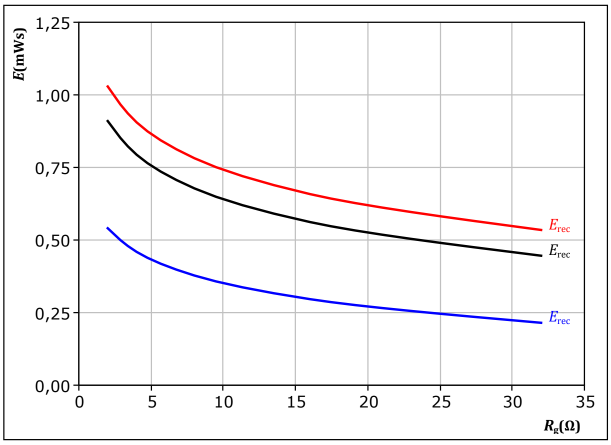
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 14. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

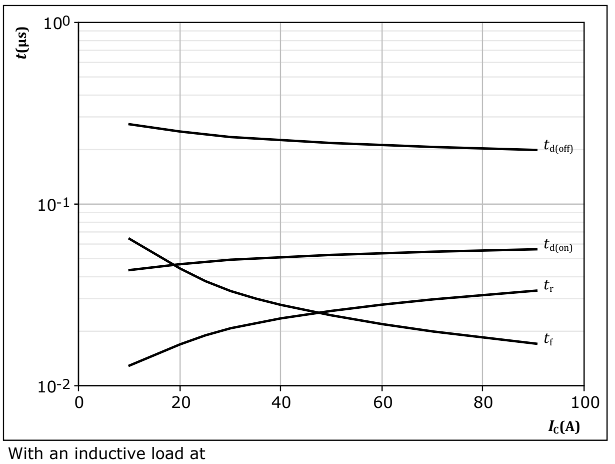
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

Brake Switching Characteristics

figure 15. IGBT

Typical switching times as a function of collector current

t = f(I_C)



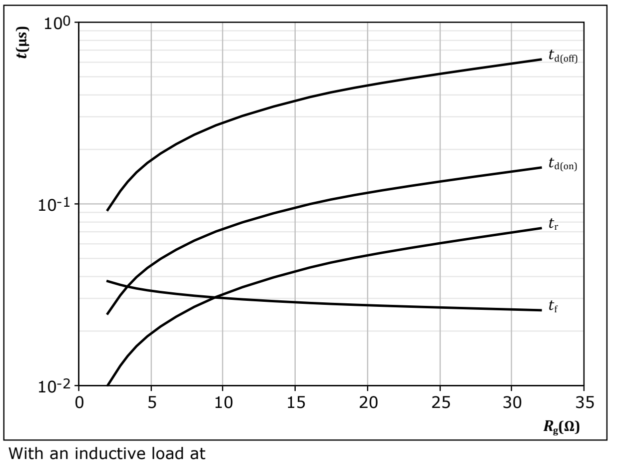
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 16. IGBT

Typical switching times as a function of gate resistor

t = f(R_g)



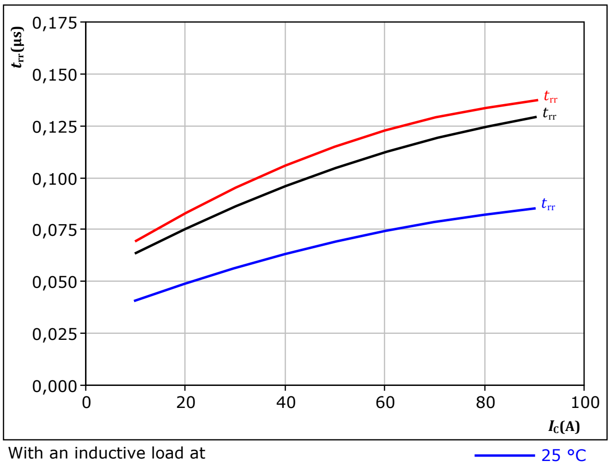
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	50	A

figure 17. FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

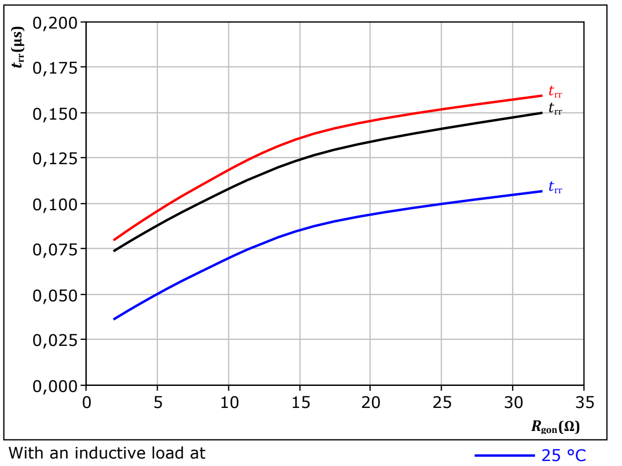
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 18. 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} =	400	V
V_{GE} =	0/15	V
I_C =	50	A

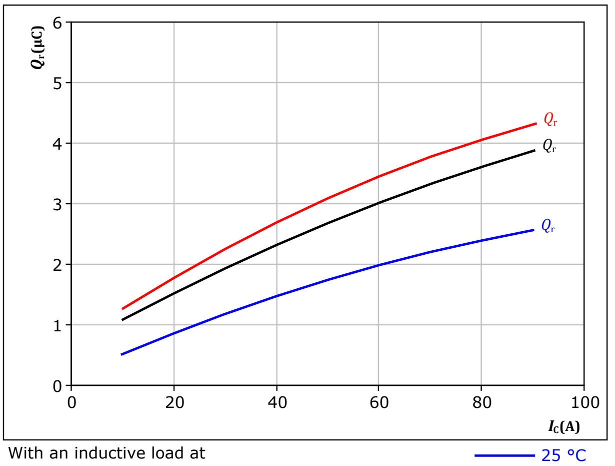
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 19. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



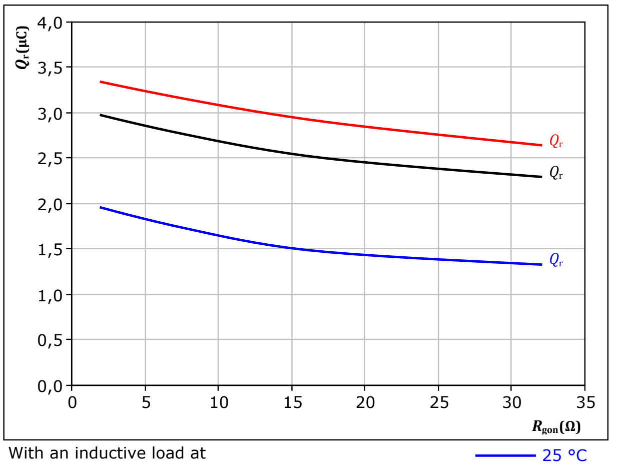
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 20. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



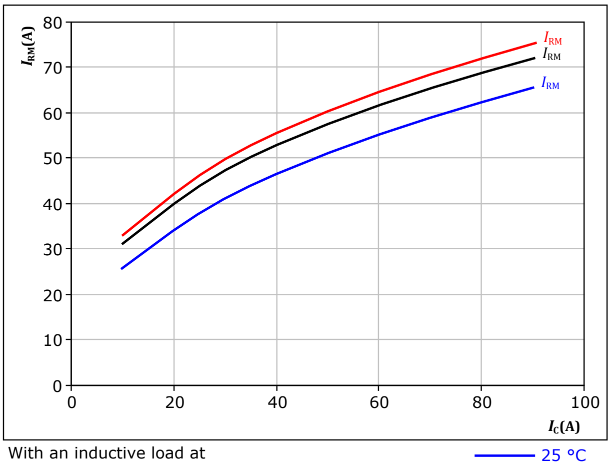
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 21. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



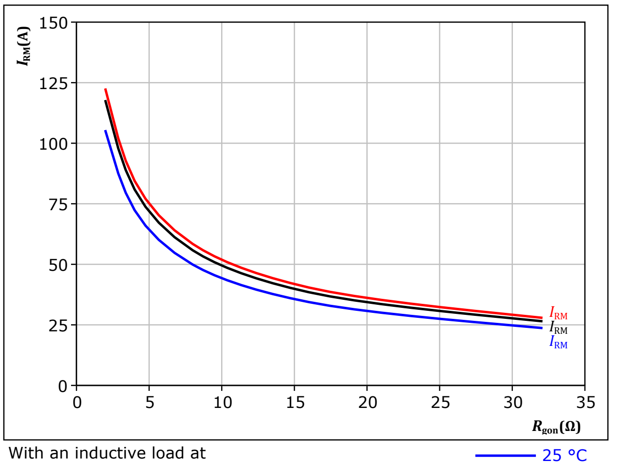
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 22. **FWD**

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

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



With an inductive load at

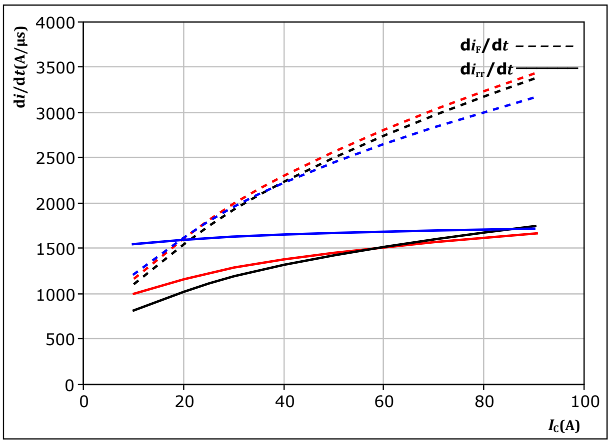
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

Brake Switching Characteristics

figure 23. **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)



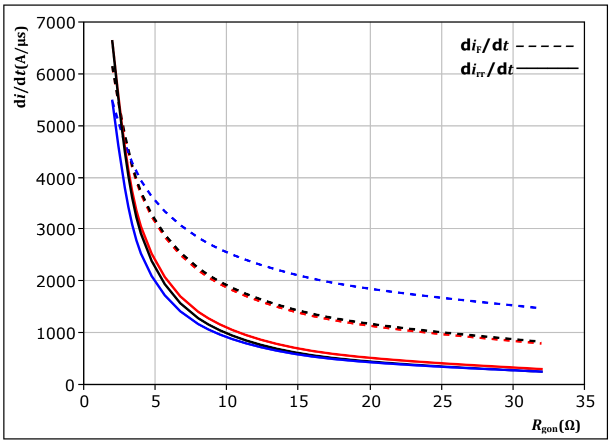
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 24. **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})



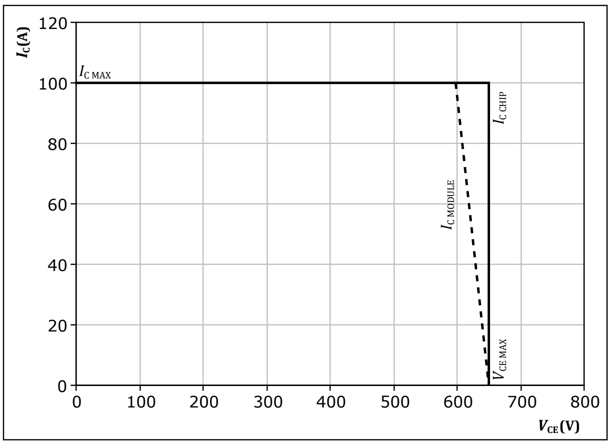
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 25. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Brake Switching Definitions

figure 26. **IGBT**

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

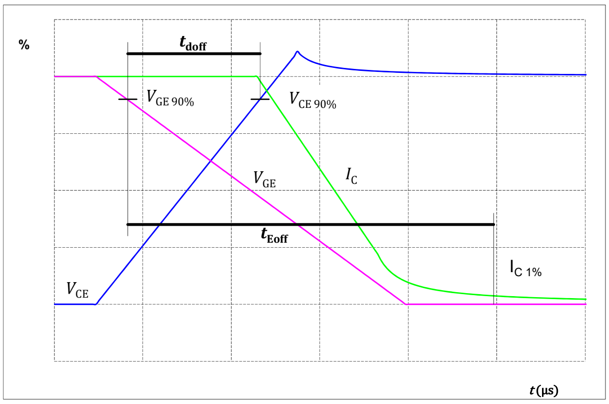


figure 27. **IGBT**

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

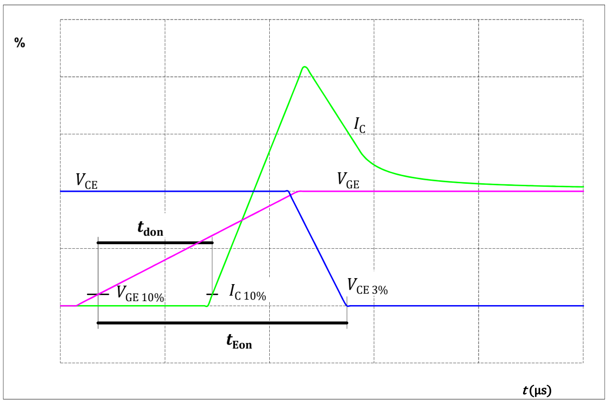


figure 28. **IGBT**

Turn-off Switching Waveforms & definition of t_f

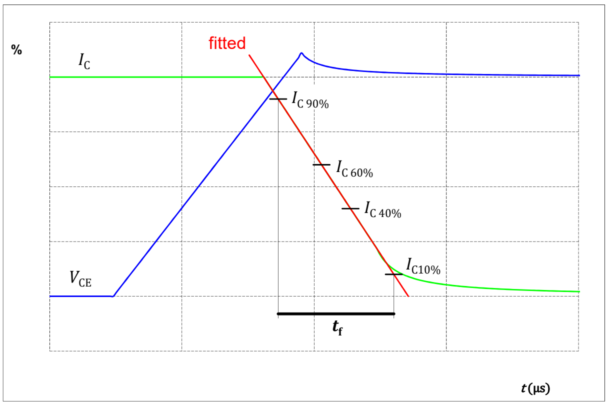
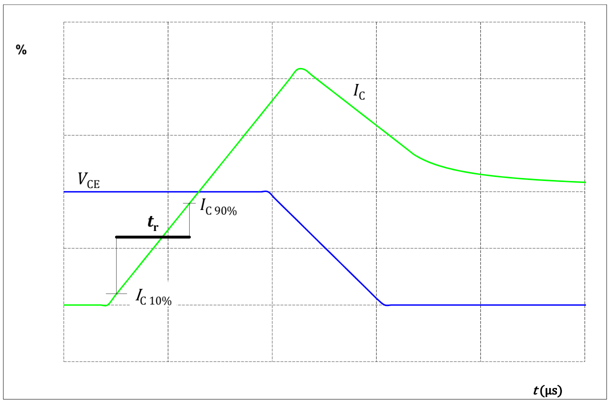


figure 29. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Brake Switching Definitions

figure 30.	FWD

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

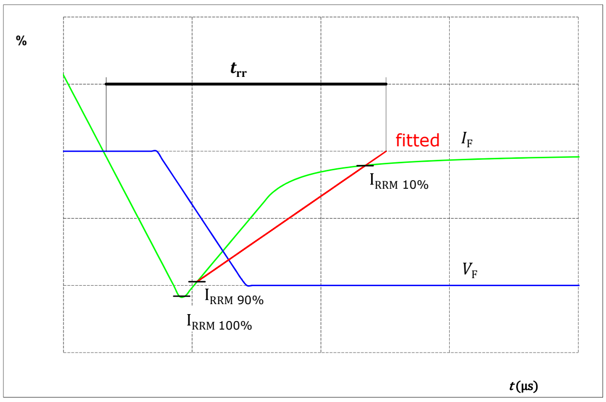
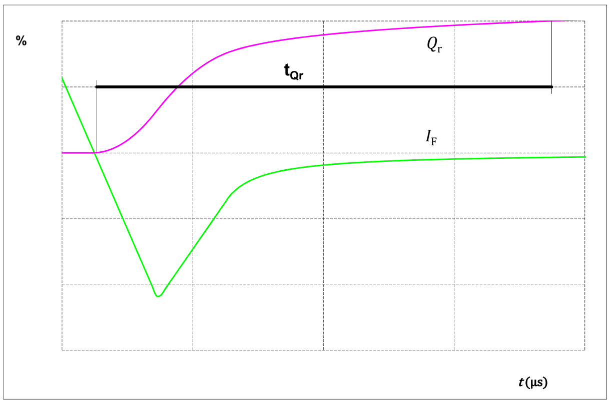


figure 31.	FWD

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-M1164KA035RW01-K537I10-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M1164KA035RW01-K537I10-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M1164KA035RW01-K537I10-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M1164KA035RW01-K537I10-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M1164KA035RW01-K537I10-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M1164KA035RW01-K537I10-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M1164KA035RW01-K537I10-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M1164KA035RW01-K537I10-/5B/

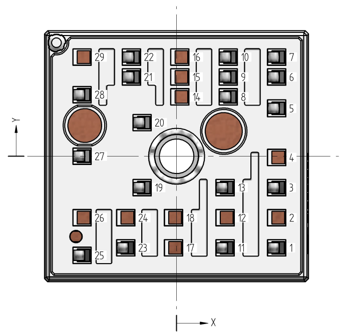
Marking

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

Outline

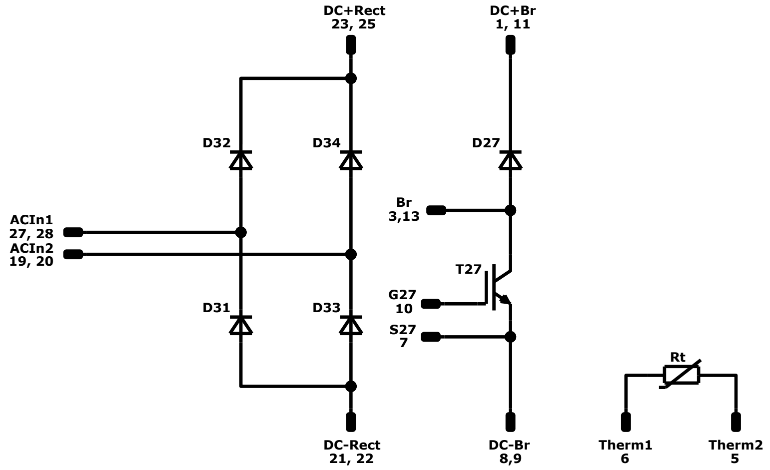
Pin table [mm]

Pin	X	Y	Function
1	15,93	-14,6	DC+Br
2	not assembled		
3	15,93	-5	Br
4	not assembled		
5	15,93	7,62	Therm2
6	15,93	12,62	Therm1
7	15,93	15,8	S27
8	8,23	9,45	DC-Br
9	8,23	12,62	DC-Br
10	8,23	15,8	G27
11	7,73	-14,6	DC+Br
12	not assembled		
13	7,73	-5	Br
14	not assembled		
15	not assembled		
16	not assembled		
17	not assembled		
18	not assembled		
19	-5,47	-5	ACIn2
20	-5,47	5,35	ACIn2
21	-7,17	12,62	DC-Rect
22	-7,17	15,8	DC-Rect
23	-8,07	-14,6	DC+Rect
24	not assembled		
25	-15,02	-15,8	DC+Rect
26	not assembled		
27	-15,02	0	ACIn1
28	-15,02	9,8	ACIn1
29	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
T1	IGBT	650 V	50 A	Brake Switch	
D5	FWD	650 V	50 A	Brake Diode	
D2, D1, D4, D3	Rectifier	1600 V	40 A	Rectifier Diode	
PTC	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 120	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 1 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 1 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-M1164KA035RW01-K537I10-D1-14	24 Jul. 2020		