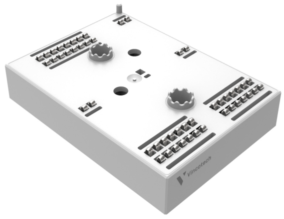
80-M3122PA400M7-K830F70
datasheet

MiniSKiiP® DUAL 3 | **1200 V / 400 A**

Features

- IGBT Mitsubishi gen 7 technology with low VCEsat and improved EMC behavior
- Solder-free spring contact technology
- Standard MiniSKiiP package sizes
- Built-in NTC

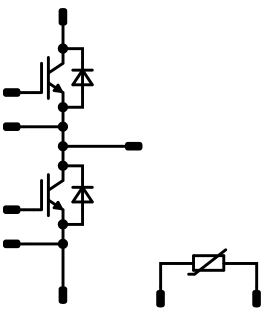
MiniSKiiP® 3 16 mm housing



Target applications

- Industrial Drives
- Power Supply
- Solar Inverters
- UPS

Schematic



Types

- 80-M3122PA400M7-K830F70

Vincotech

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Half-Bridge Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	460	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		800	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	883	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
Half-Bridge Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	303	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		800	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	536	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	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
Half-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,04	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		400	25 125 150		1,53 1,71 1,75	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			400	µA
Gate-emitter leakage current	I_{GES}		20	0		25			2	µA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		84000		pF
Output capacitance	C_{oes}		0	10		25		2800		pF
Reverse transfer capacitance	C_{res}		0	10		25		1120		pF
Gate charge	Q_g	V_{CC} = 600 V	15		400	25		2800		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,11		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		369 366 367		ns
Rise time	t_r	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		41 49 48		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		339 367 373		ns
Fall time	t_f	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		71,54 91,22 96,68		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=41,48 µC Q_{rFWD}=62,92 µC Q_{rFWD}=71,62 µC	±15	600	400	25 125 150		26,33 36,74 39,06		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	400	25 125 150		27,4 35,13 37,85		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	
Half-Bridge Diode										
Static										
Forward voltage	V_F				400	25 125 150		1,82 1,96 1,97	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			160	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,18		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=10059 A/µs d*i*/d*t*=9788 A/µs d*i*/d*t*=8678 A/µs	±15	600	400	25 125 150		377,36 392,8 405,45		A
Reverse recovery time	t_{rr}					25 125 150		273,65 420,45 457,89		ns
Recovered charge	Q_r					25 125 150		41,48 62,92 71,62		µC
Reverse recovered energy	E_{rec}					25 125 150		15,82 24,25 27,87		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5015 3117 3230		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		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		5	%
Power dissipation	P							245		mW
Power dissipation constant	d					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %						3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %						3437		K
Vincotech Thermistor Reference									K	

(1) Value at chip level

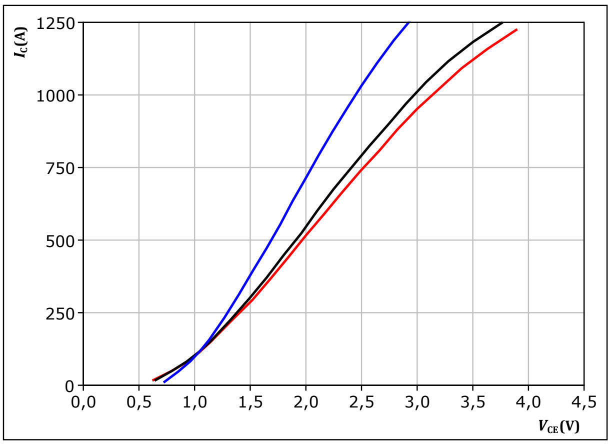
(2) Only valid with pre-applied Vincotech thermal interface material.

Half-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



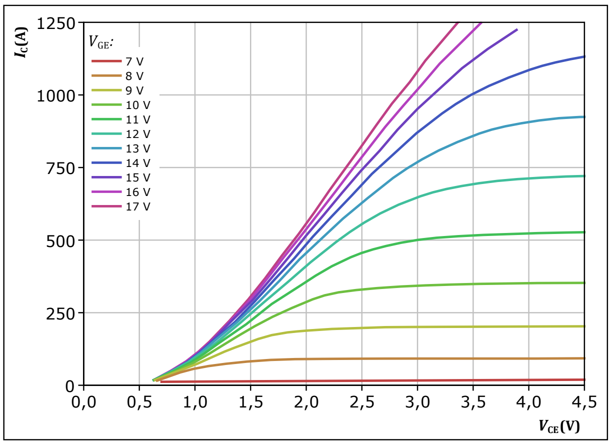
t_p =	250	μs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



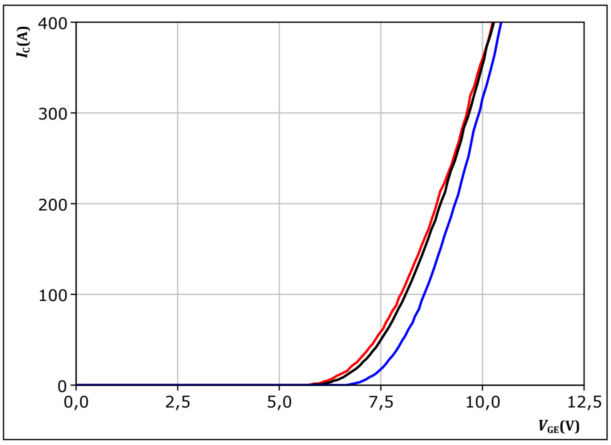
t_p =	250	μs
T_j =	150	°C

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



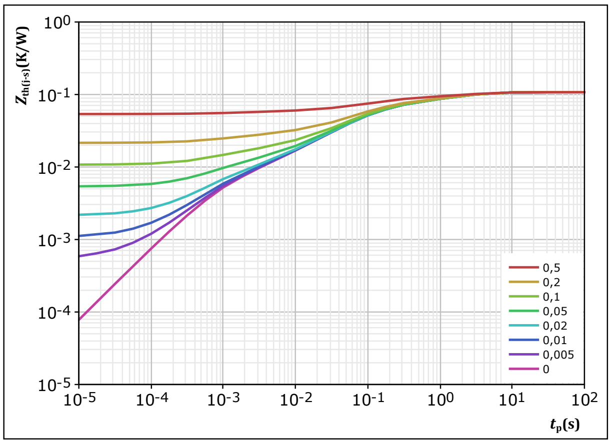
t_p =	250	μs
V_{CE} =	10	V

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	
$R_{th(j-s)}$ =	0,108	K/W

IGBT thermal model values

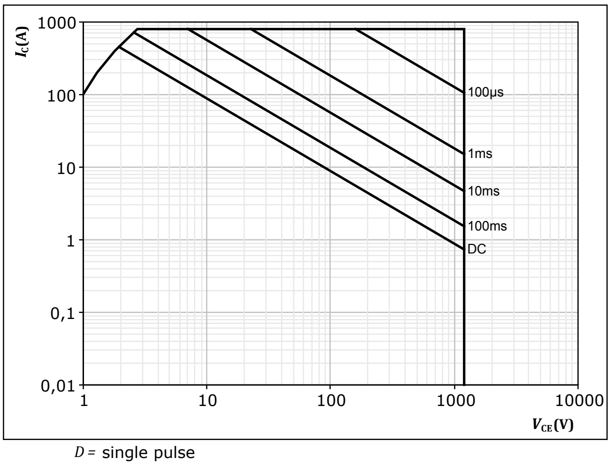
R (K/W)	τ (s)
2,25E-02	2,75E+00
1,79E-02	7,60E-01
3,26E-02	1,38E-01
2,34E-02	4,75E-02
5,79E-03	6,77E-03
5,38E-03	8,68E-04

Half-Bridge Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

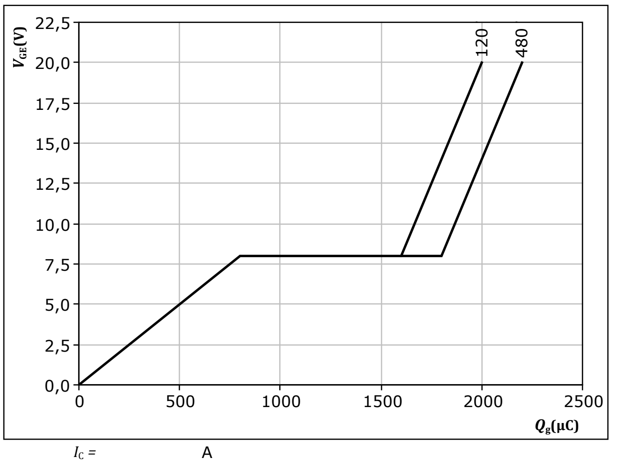


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



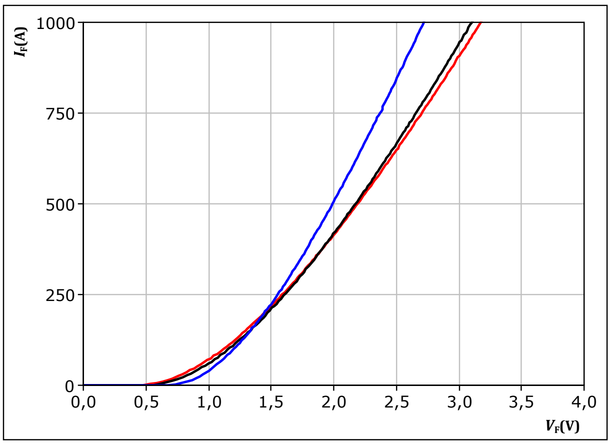
I_C =		A
T_j =	25	°C

Half-Bridge Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



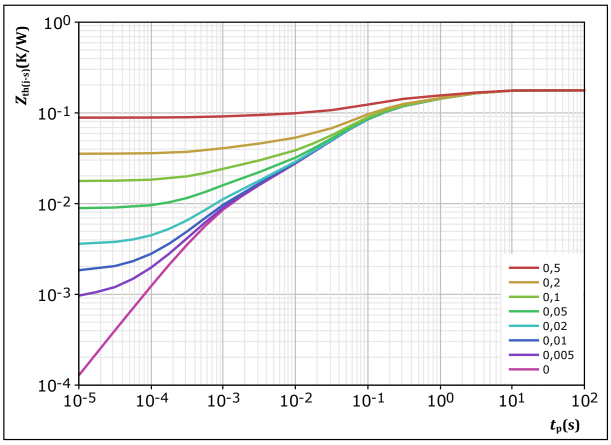
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,177 K/W

FWD thermal model values

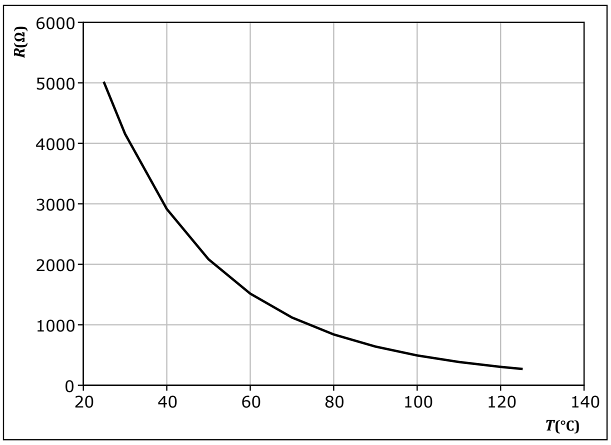
R (K/W)	τ (s)
3,71E-02	2,75E+00
2,94E-02	7,60E-01
5,37E-02	1,38E-01
3,85E-02	4,75E-02
9,53E-03	6,77E-03
8,87E-03	8,68E-04

Thermistor Characteristics

figure 9.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

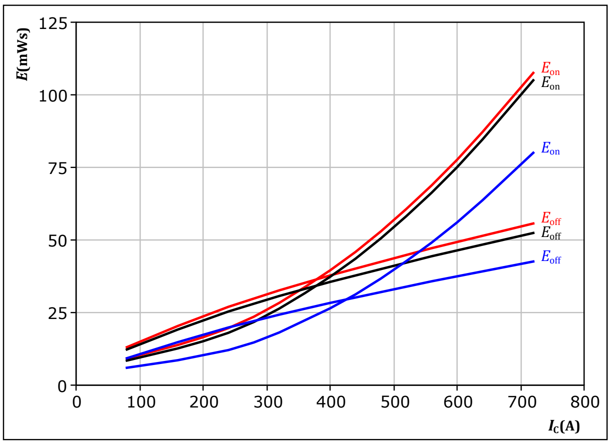


Half-Bridge Switching Characteristics

figure 10. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



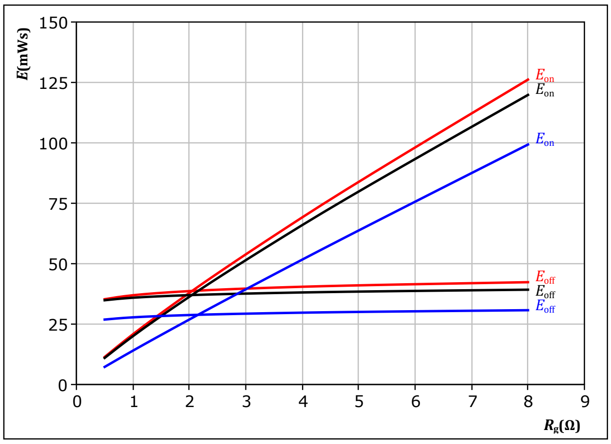
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 11. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



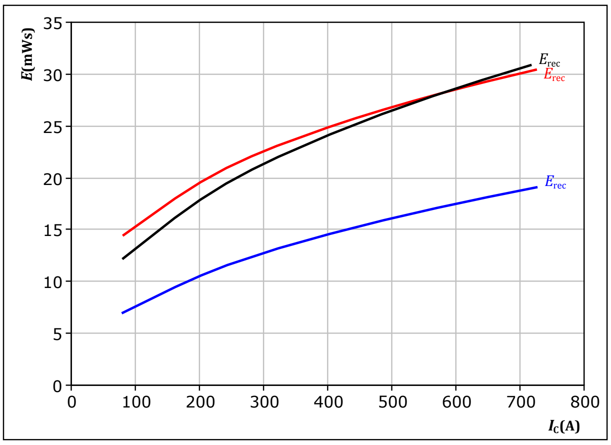
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

figure 12. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



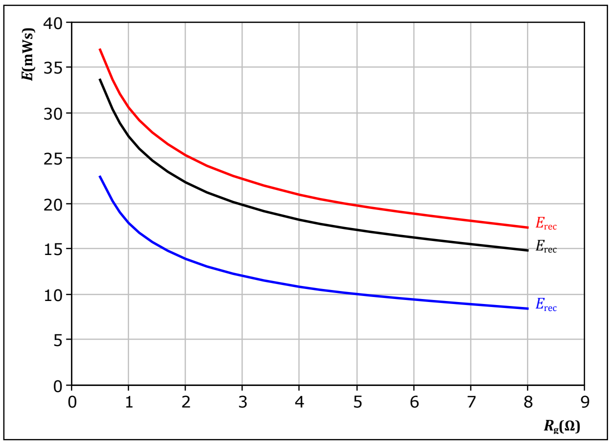
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 13. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

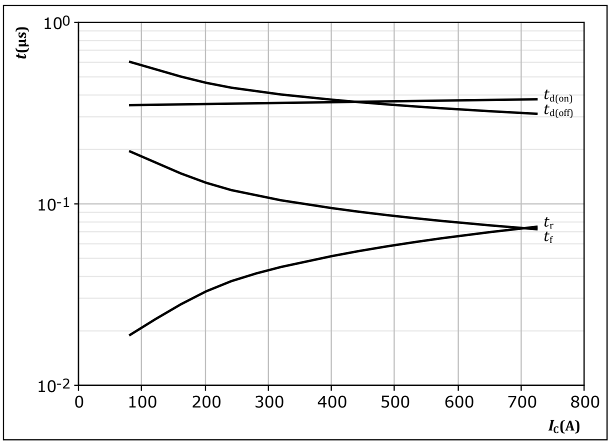
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

Half-Bridge Switching Characteristics

figure 14. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



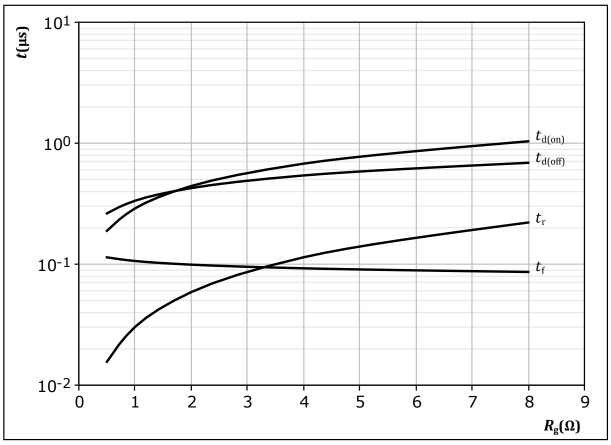
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 15. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



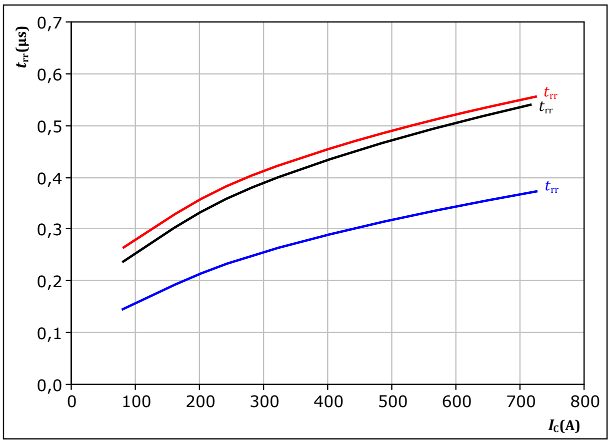
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	400	A

figure 16. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

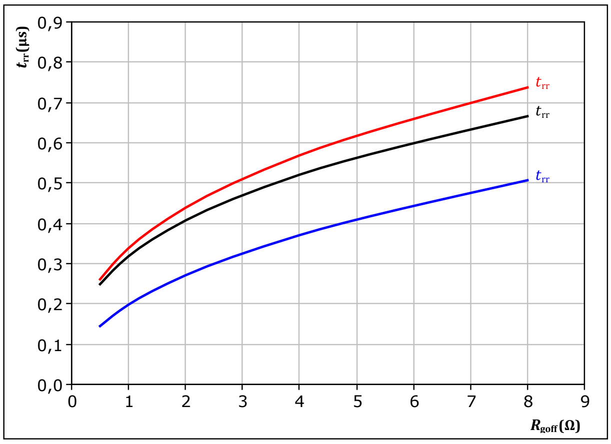
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 17. **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 =	400	A

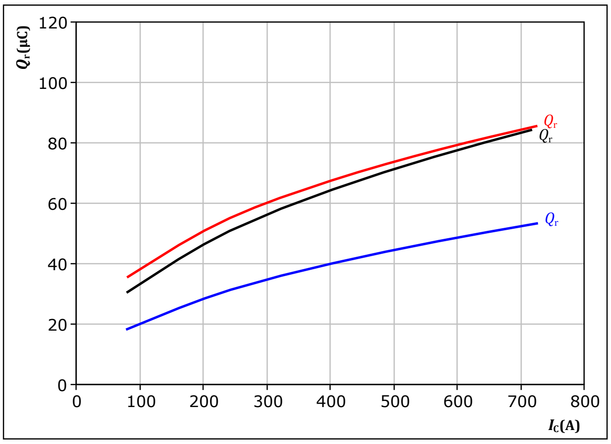
T_j: 25 °C, 125 °C, 150 °C

Half-Bridge Switching Characteristics

figure 18. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



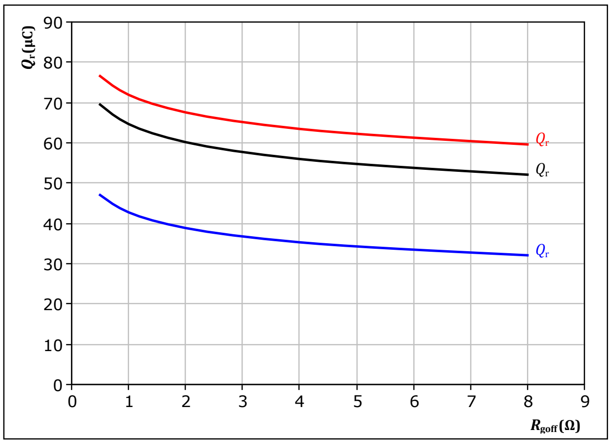
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 19. FWD

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



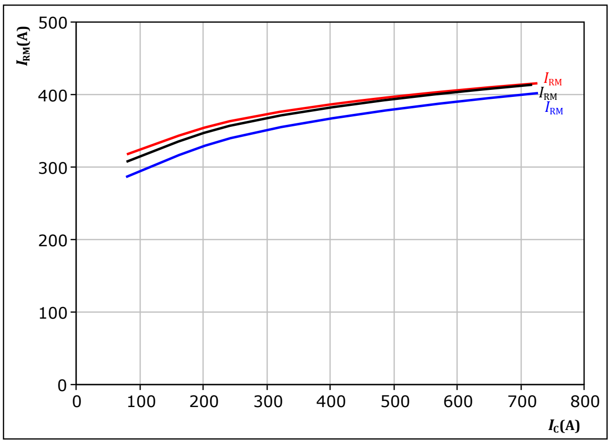
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

figure 20. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



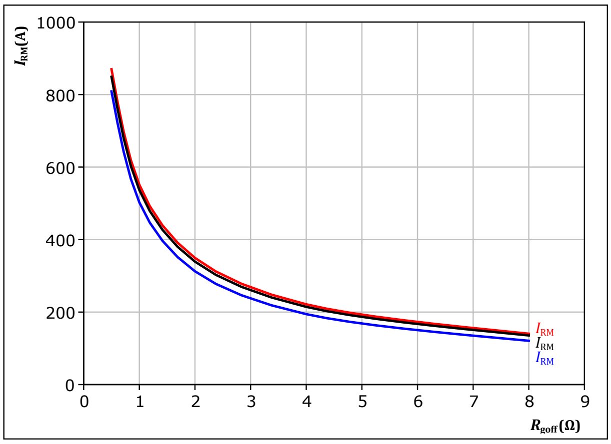
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 21. FWD

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

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



With an inductive load at

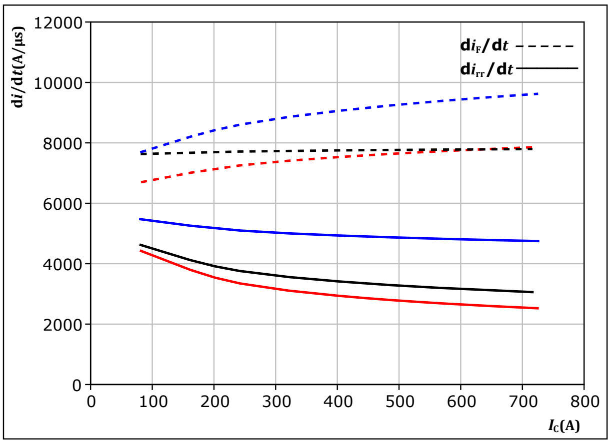
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

Half-Bridge 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)



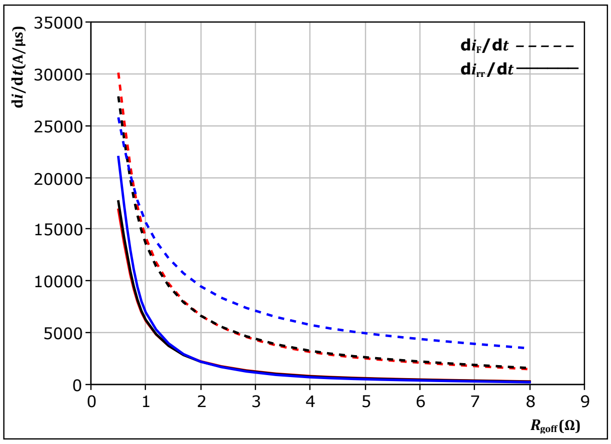
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 23. **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})



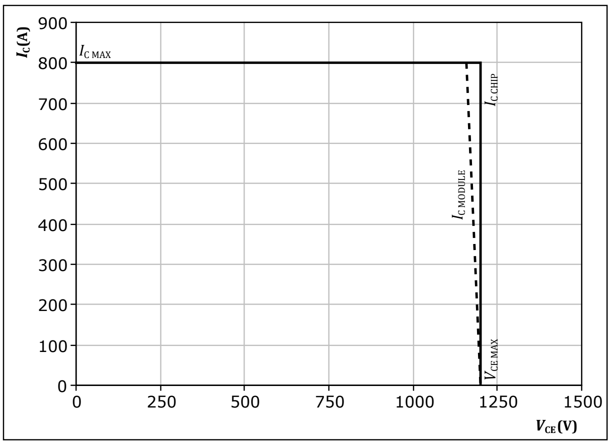
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

figure 24. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

Half-Bridge Switching Definitions

figure 25. **IGBT**

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

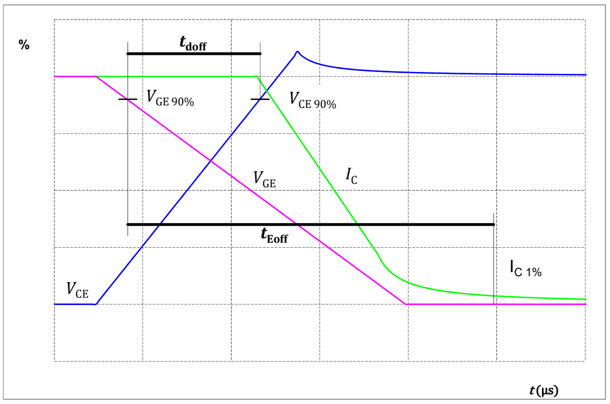


figure 26. **IGBT**

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

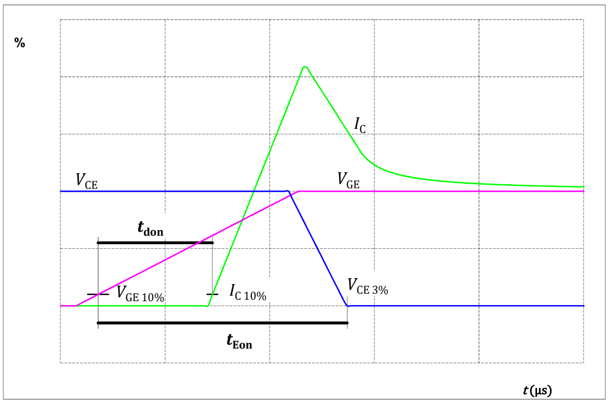


figure 27. **IGBT**

Turn-off Switching Waveforms & definition of t_f

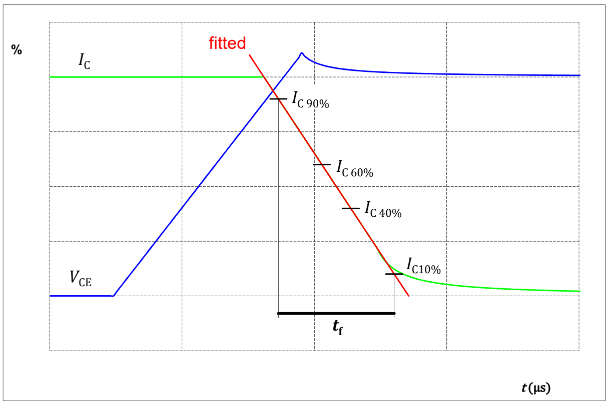
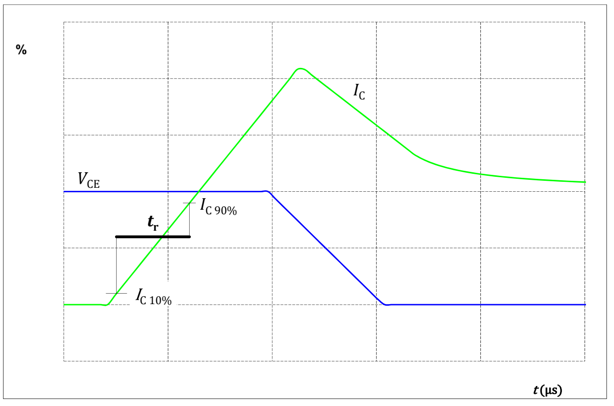


figure 28. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Half-Bridge Switching Definitions

figure 29. **FWD**

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

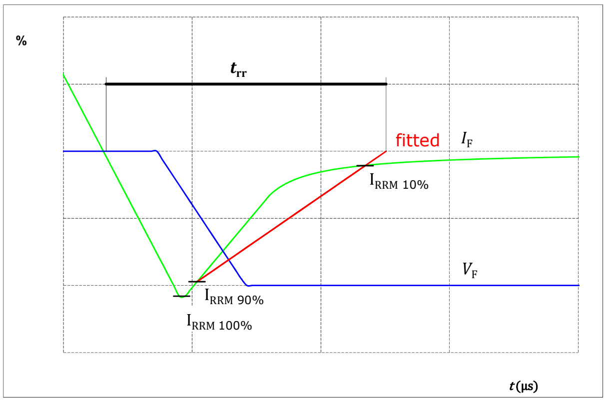
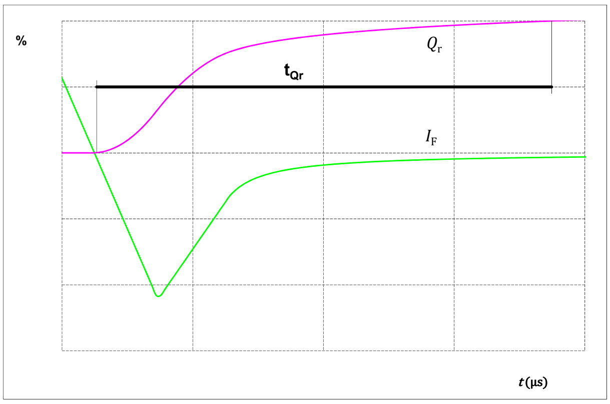


figure 30. **FWD**

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-M3122PA400M7-K830F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3122PA400M7-K830F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400M7-K830F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400M7-K830F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400M7-K830F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400M7-K830F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400M7-K830F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400M7-K830F70-/5B/

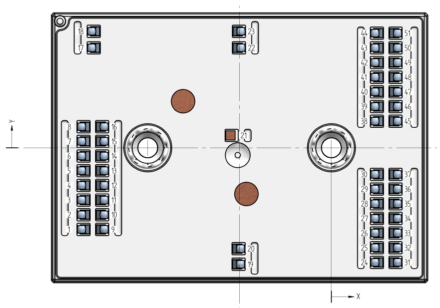
Marking

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

Outline

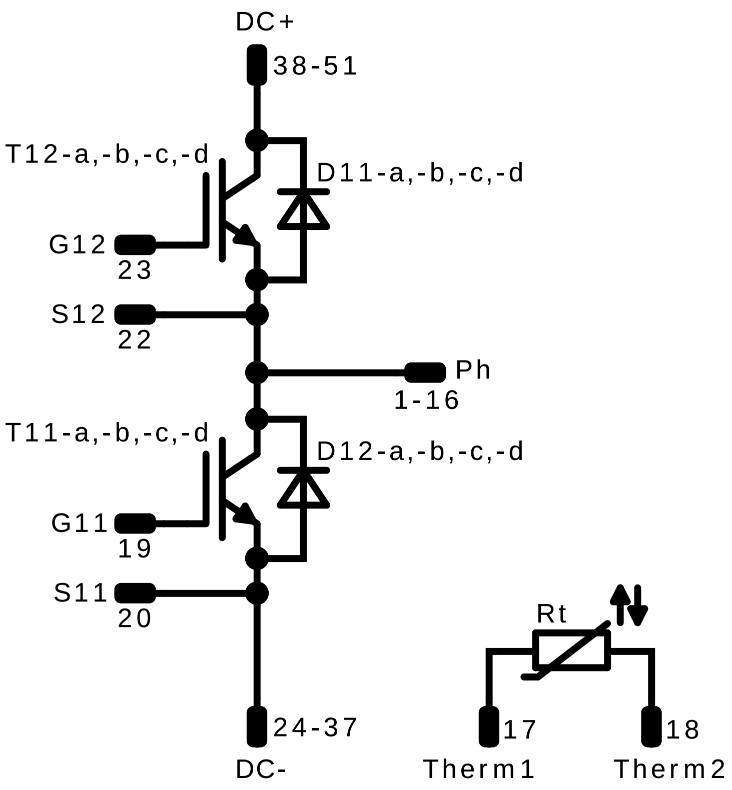
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
1	-53,95	-17,8	Ph	27	9,95	-15,4	-DC
2	-53,95	-14,6	Ph	28	9,95	-12,2	-DC
3	-53,95	-11,4	Ph	29	9,95	-9	-DC
4	-53,95	-8,2	Ph	30	9,95	-5,8	-DC
5	-53,95	-5	Ph	31	13,95	-25	-DC
6	-53,95	-1,8	Ph	32	13,95	-21,8	-DC
7	-53,95	1,4	Ph	33	13,95	-18,6	-DC
8	-53,95	4,6	Ph	34	13,95	-15,4	-DC
9	-49,95	-17,8	Ph	35	13,95	-12,2	-DC
10	-49,95	-14,6	Ph	36	13,95	-9	-DC
11	-49,95	-11,4	Ph	37	13,95	-5,8	-DC
12	-49,95	-8,2	Ph	38	9,95	5,8	+DC
13	-49,95	-5	Ph	39	9,95	9	+DC
14	-49,95	-1,8	Ph	40	9,95	12,2	+DC
15	-49,95	1,4	Ph	41	9,95	15,4	+DC
16	-49,95	4,6	Ph	42	9,95	18,6	+DC
17	-51,75	21,8	Therm1	43	9,95	21,8	+DC
18	-51,75	25,4	Therm2	44	9,95	25	+DC
19	-20,25	-25,4	G11	45	13,95	5,8	+DC
20	-20,25	-22	S11	46	13,95	9	+DC
21	not assembled			47	13,95	12,2	+DC
22	-20,15	21,8	S12	48	13,95	15,4	+DC
23	-20,15	25,4	G12	49	13,95	18,6	+DC
24	9,95	-25	-DC	50	13,95	21,8	+DC
25	9,95	-21,8	-DC	51	13,95	25	+DC
26	9,95	-18,6	-DC				



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	IGBT	1200 V	400 A	Half-Bridge Switch	
D11, D12	FWD	1200 V	400 A	Half-Bridge 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-M3122PA400M7-K830F70-D3-14	30 Sep. 2021	Change of CTI value Change of Inverter Switch and Diode Tau times	