Vincotech

10-FZ166BA050RW-M920G78
datasheet

flowCON 0 | **1600 V / 50 A**

Topology features

- Three-phase Rectifier
- Brake Chopper

Component features

- High inrush current capability

Housing features

- Base isolation: Al_2O_3
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

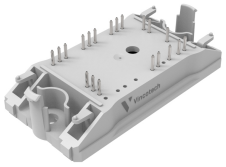
Target applications

- Embedded Drives
- HVAC
- Industrial Drives

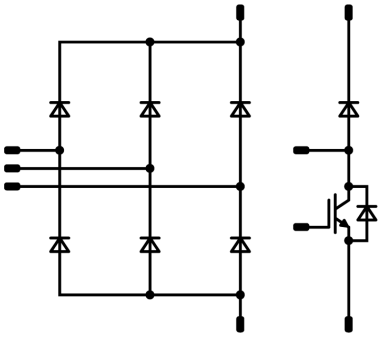
Types

- 10-FZ166BA050RW-M920G78

flow 0 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ T_s = 80 °C	55	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	108	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
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	26	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	44	W
Maximum junction temperature	T_{jmax}		175	°C
Brake Sw. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s <= 80 °C	10 (1)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	10	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	24	W
Maximum junction temperature	T_{jmax}		175	°C

(1) limited by I_{FRM}

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	80	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	600	A
Surge current capability	I^2t			1800	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	105	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
Creepage distance				>12,7	mm
Clearance				9,49	mm
Comparative Tracking Index	CTI			≥ 200	

*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	$V_{GE(th)}$			10	0,005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150		1,55 1,77 1,83	1,9(2)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			0,09	mA
Gate-emitter leakage current	I_{GES}		20	0		25			0,5	µA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		10000		pF
Output capacitance	C_{oes}							350		pF
Reverse transfer capacitance	C_{res}							130		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		50	25		380		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						0,88		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	0/15	700	50	25 125 150		84,1 80,81 79,7		ns
Rise time	t_r					25 125 150		40,49 43,77 45,24		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		287,75 320,31 330		ns
Fall time	t_f					25 125 150		99,85 122,59 132,96		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=3,08 µC Q_{rFWD}=4,48 µC Q_{rFWD}=4,99 µC				25 125 150		4,01 4,81 5,05		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		4,21 5,61 5,99		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				25	25 125 150		1,63 1,7 1,69	2,1[2]	V
Reverse leakage current	I_R	V_r = 1200 V				25			35	µA
Thermal										
Thermal resistance junction to sink[3]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						2,16		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1032 A/µs di/dt=947 A/µs di/dt=941 A/µs	0/15	700	50	25 125 150		26,25 28,19 29,29		A
Reverse recovery time	t_{rr}					25 125 150		243,98 350,95 383,07		ns
Recovered charge	Q_r					25 125 150		3,08 4,48 4,99		µC
Reverse recovered energy	E_{rec}					25 125 150		1,25 1,96 2,22		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		232,52 170,97 176,78		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	
Brake Sw. Protection Diode										
Static										
Forward voltage	V_F				5	25 125 150		1,57 1,66 1,65	2,1[2]	V
Reverse leakage current	I_R	V_r = 1200 V				25			20	µA
Thermal										
Thermal resistance junction to sink[3]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						3,94		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,14 1,11 1,1	1,5[2]	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			50 1500	µA
Thermal										
Thermal resistance junction to sink[3]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						0,91		K/W

[2] Value at chip level

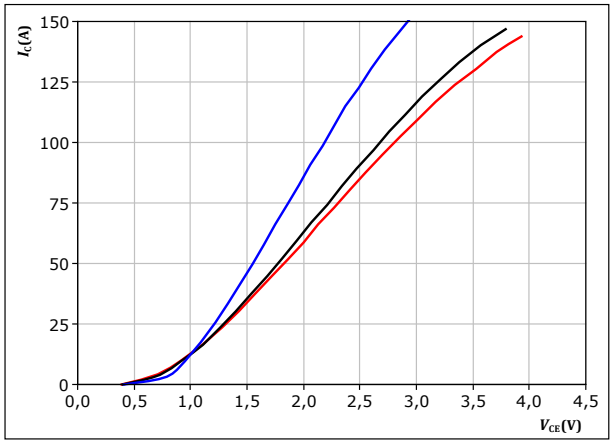
[3] Only valid with pre-applied Vincotech thermal interface material.

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

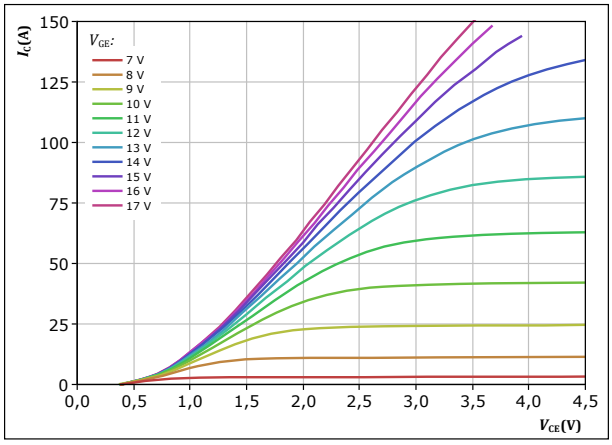


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



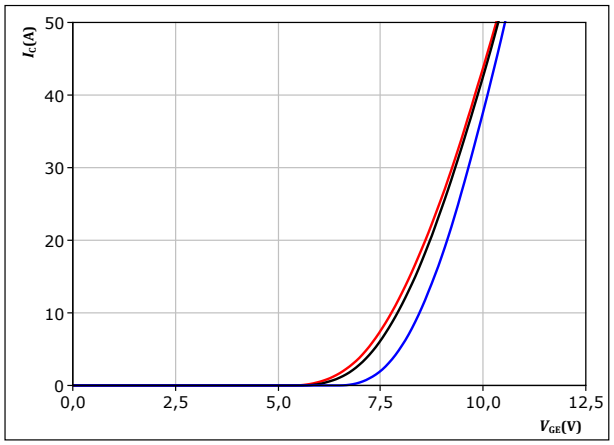
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

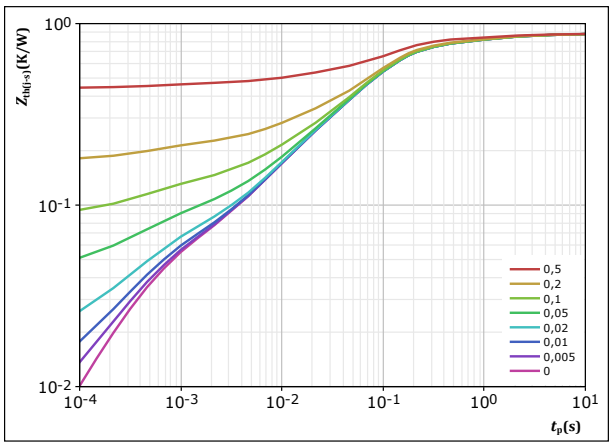


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,877	K/W

IGBT thermal model values

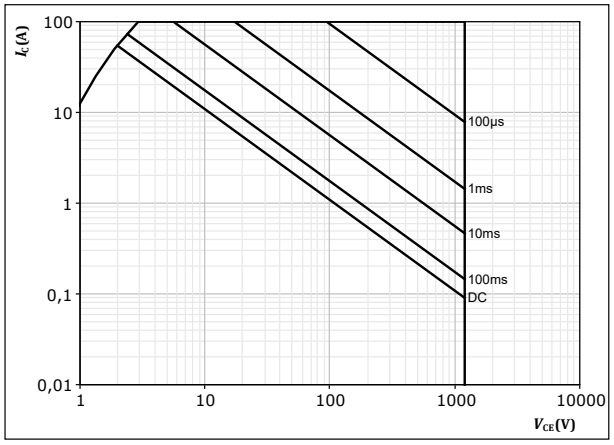
R (K/W)	τ (s)
3,38E-02	5,95E+00
1,25E-01	8,17E-01
5,82E-01	9,10E-02
9,71E-02	9,32E-03
4,41E-02	4,73E-04

Brake Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$

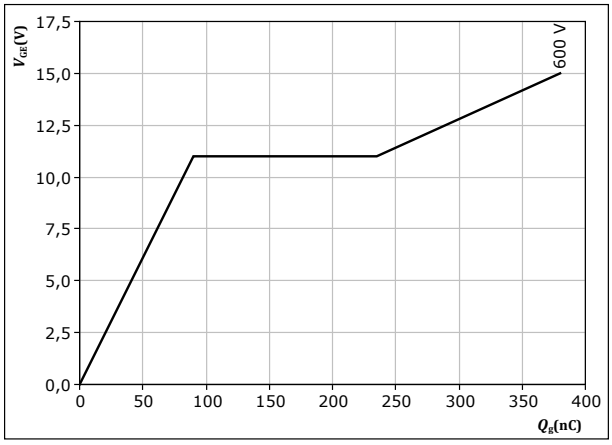


D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

figure 6. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



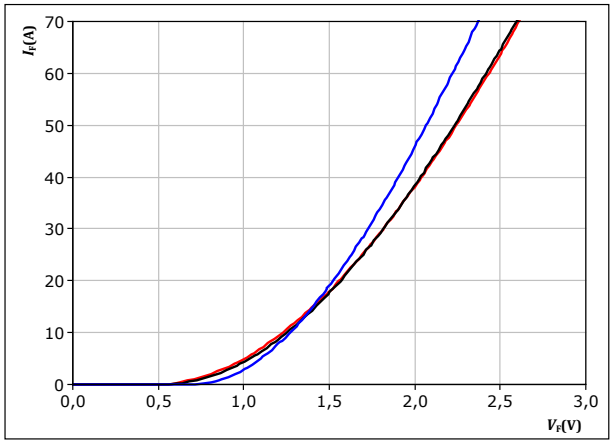
I_C = 50 A
T_j = 25 °C

Brake Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



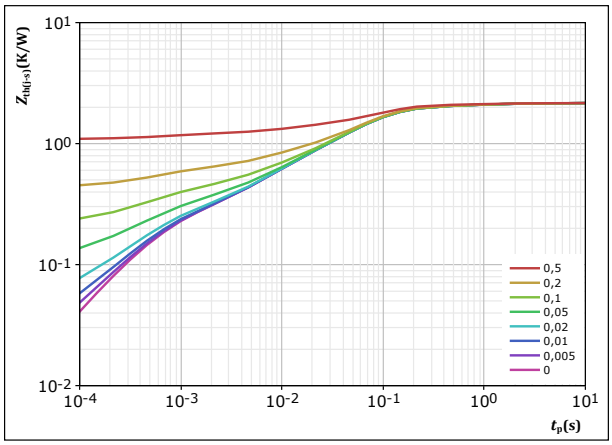
t_p = 250 µs

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

$R_{th(j-s)}$ = 2,163 K/W

FWD thermal model values

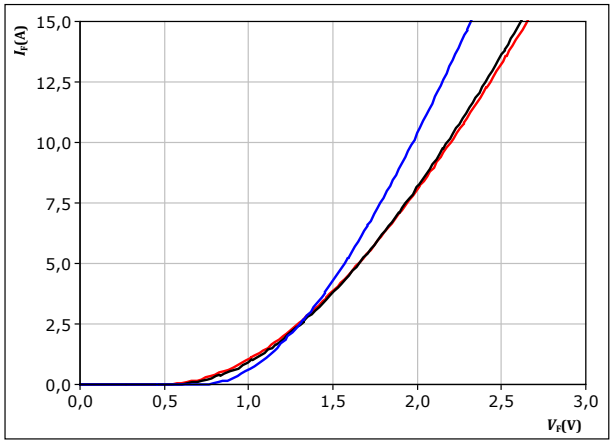
R (K/W)	τ (s)
3,76E-02	5,58E+00
1,79E-01	6,30E-01
1,47E+00	6,61E-02
2,80E-01	7,28E-03
2,01E-01	5,26E-04

Brake Sw. Protection Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



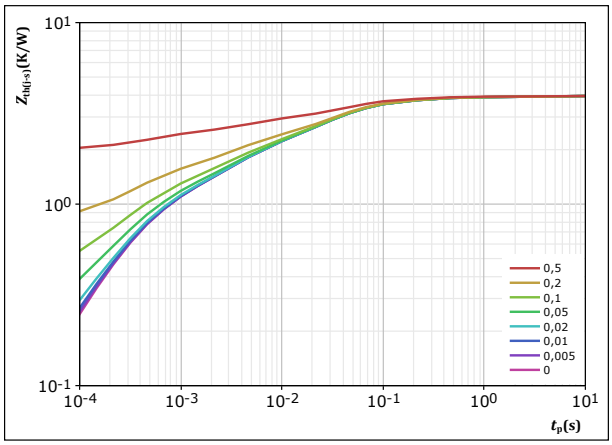
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 3,941 K/W

FWD thermal model values

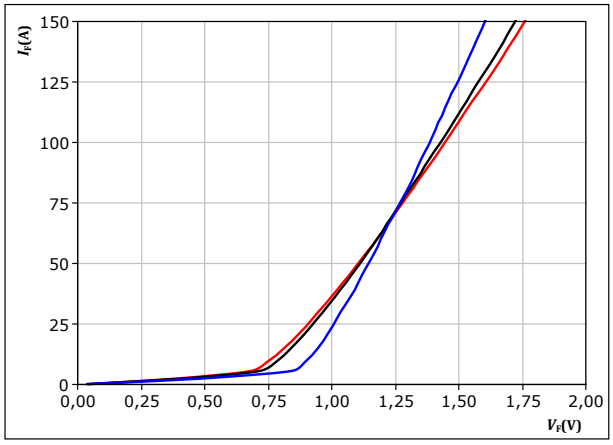
R (K/W)	τ (s)
8,01E-02	3,73E+00
4,45E-01	1,80E-01
1,65E+00	3,02E-02
9,49E-01	3,02E-03
8,18E-01	3,35E-04

Rectifier Diode Characteristics

figure 11. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



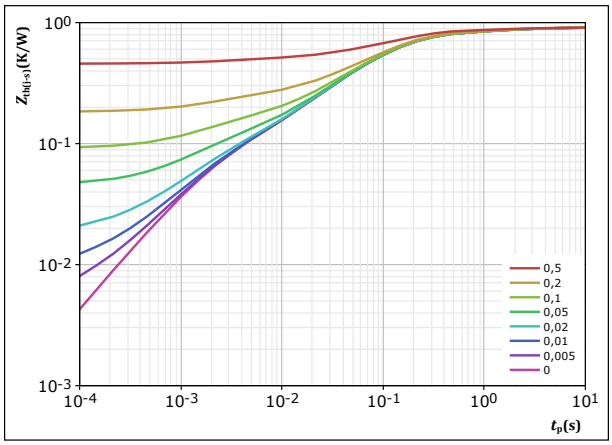
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 12. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,909 K/W

Rectifier thermal model values

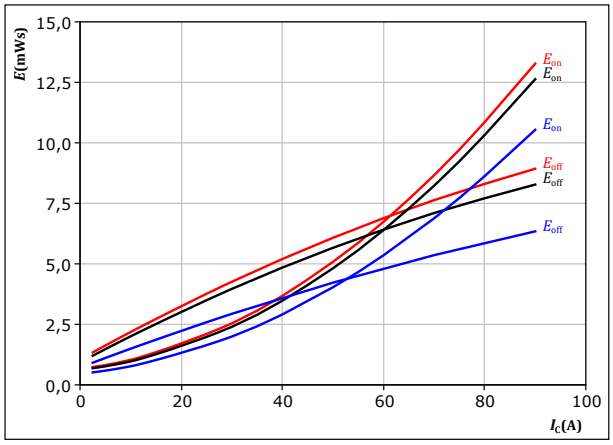
R (K/W)	τ (s)
3,02E-02	6,49E+00
1,10E-01	1,02E+00
5,42E-01	1,22E-01
1,66E-01	2,99E-02
6,56E-02	1,96E-03

Brake Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



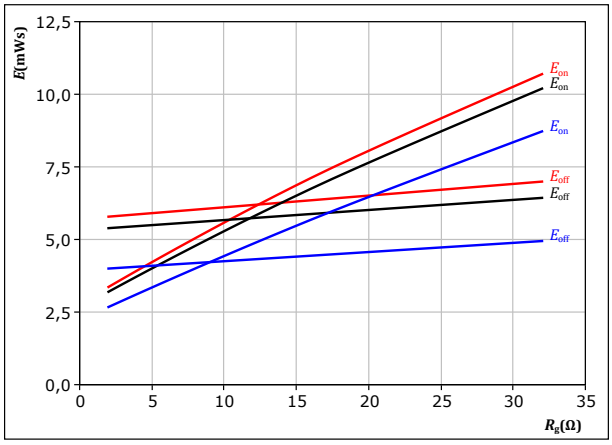
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 14. **IGBT**

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

$E = f(R_g)$



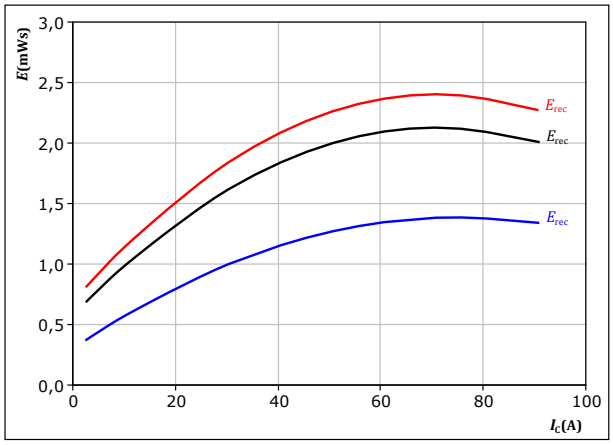
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



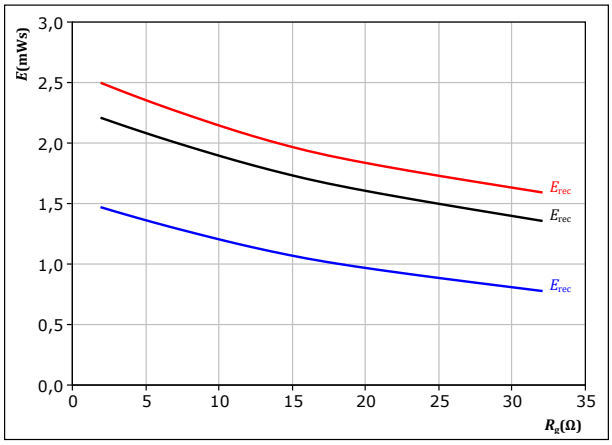
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 16. **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

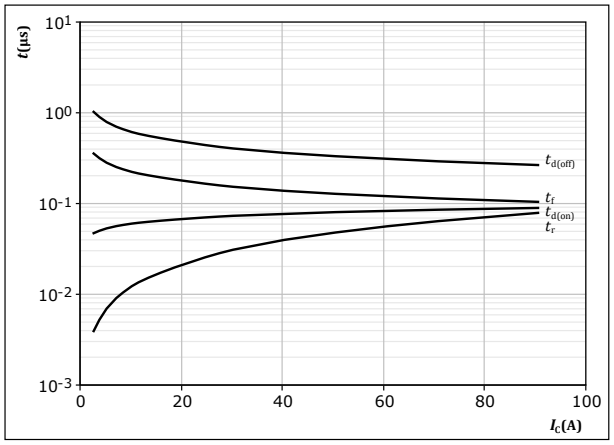
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

Brake Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



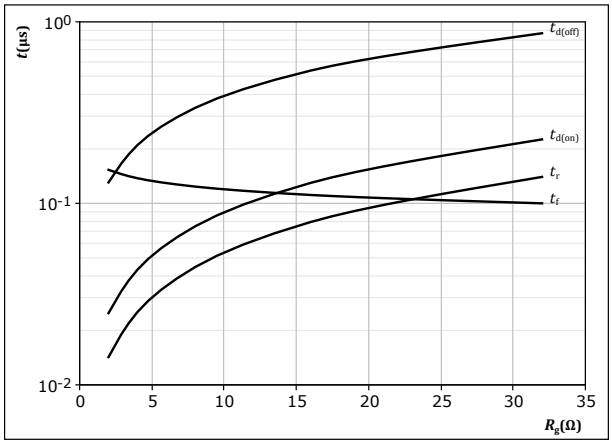
With an inductive load at

T_j =	150	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 18. **IGBT**

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

$t = f(R_g)$



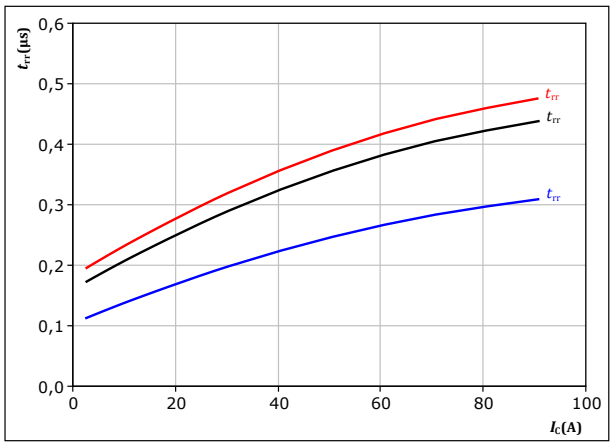
With an inductive load at

T_j =	150	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	50	A

figure 19. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

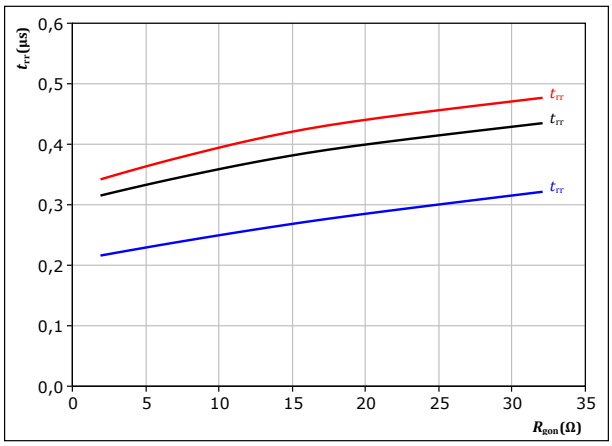
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 20. **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} =	700	V
V_{GE} =	0/15	V
I_C =	50	A

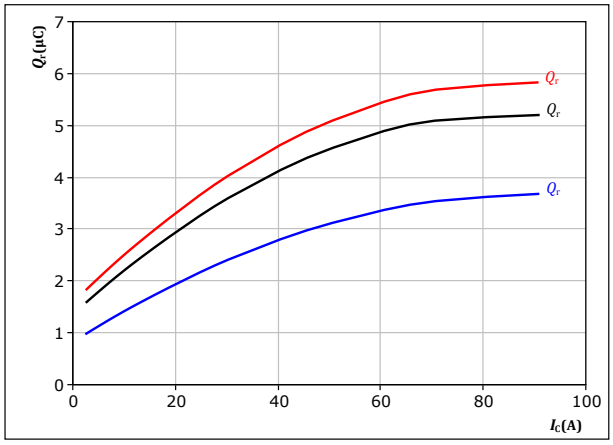
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



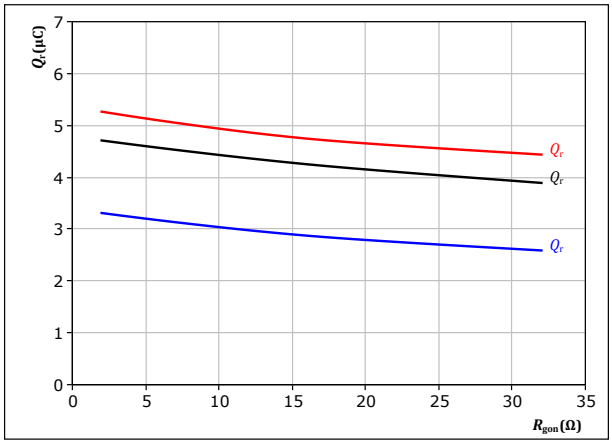
With an inductive load at

V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	8	Ω	150 °C

figure 22. **FWD**

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

$Q_r = f(R_{gon})$



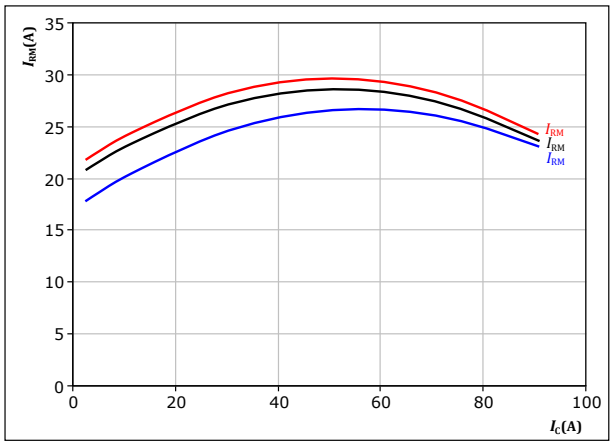
With an inductive load at

V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
I_C =	50	A	150 °C

figure 23. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



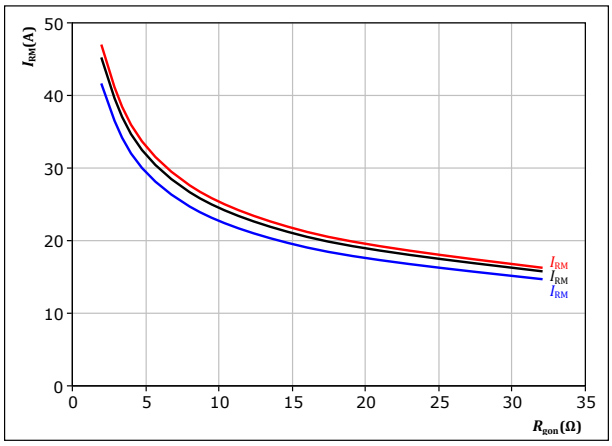
With an inductive load at

V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	8	Ω	150 °C

figure 24. **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

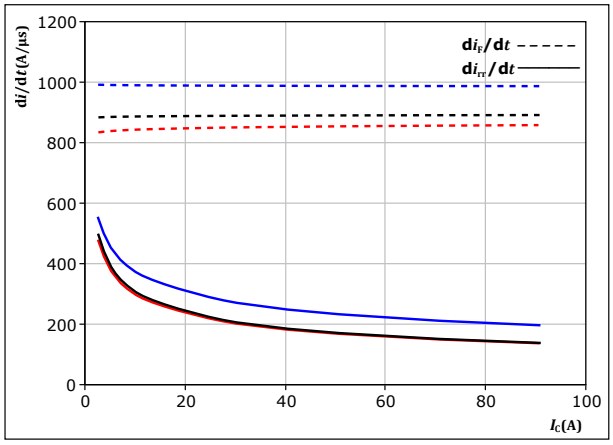
V_{CE} =	700	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
I_C =	50	A	150 °C

Brake Switching Characteristics

figure 25. **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

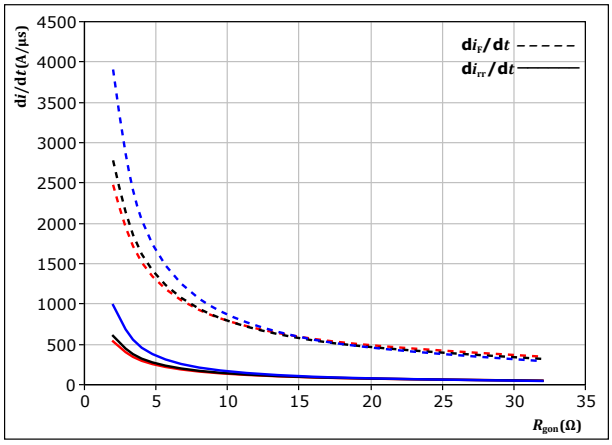
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 26. **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

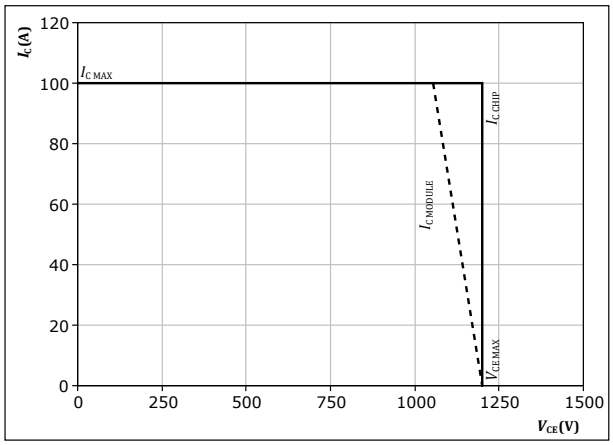
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	50	A

T_j: 25 °C, 125 °C, 150 °C

figure 27. **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 28. **IGBT**

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

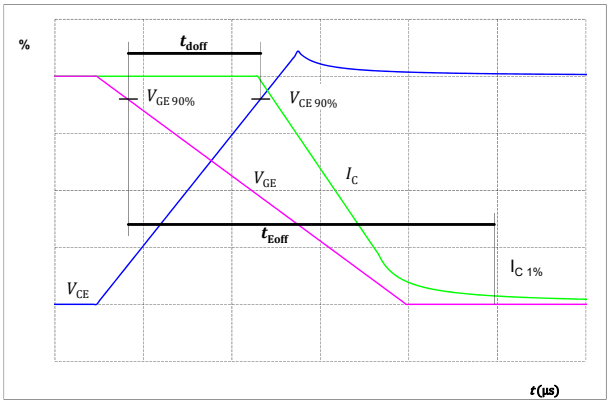


figure 29. **IGBT**

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

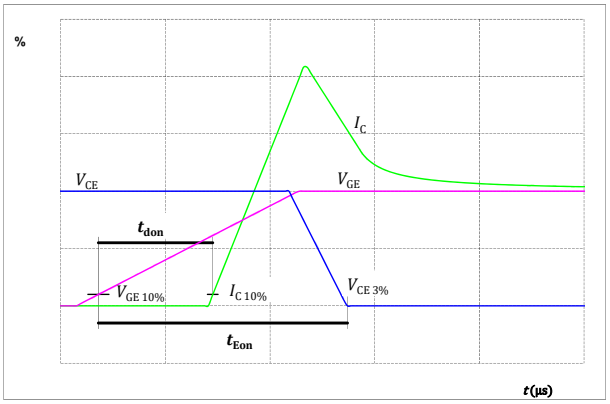


figure 30. **IGBT**

Turn-off Switching Waveforms & definition of t_f

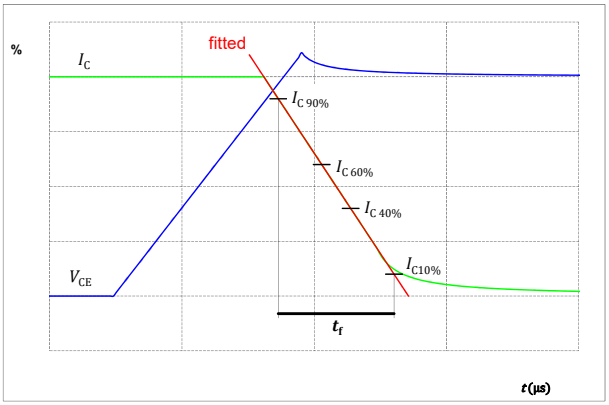
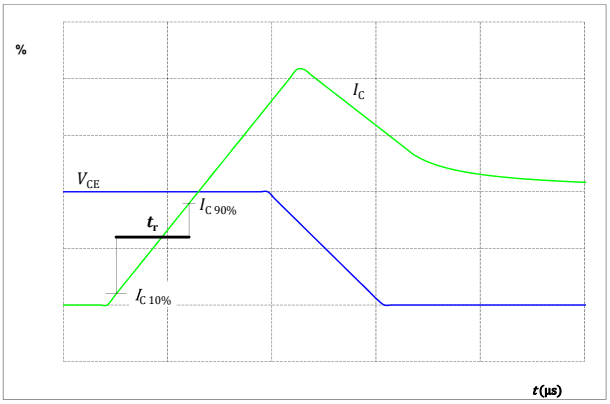


figure 31. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Brake Switching Definitions

figure 32. **FWD**

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

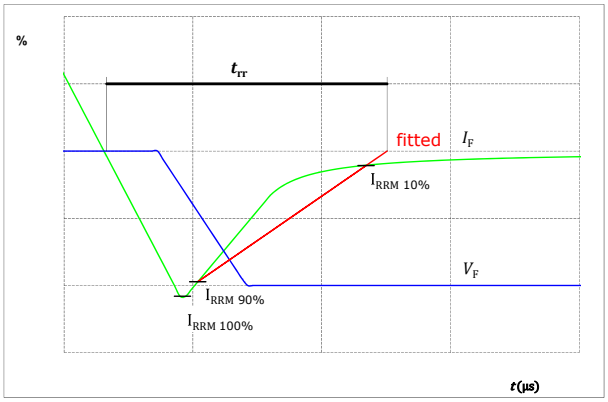
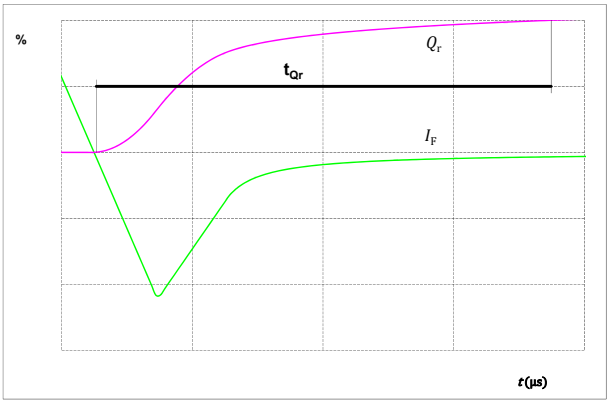


figure 33. **FWD**

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



Ordering Code

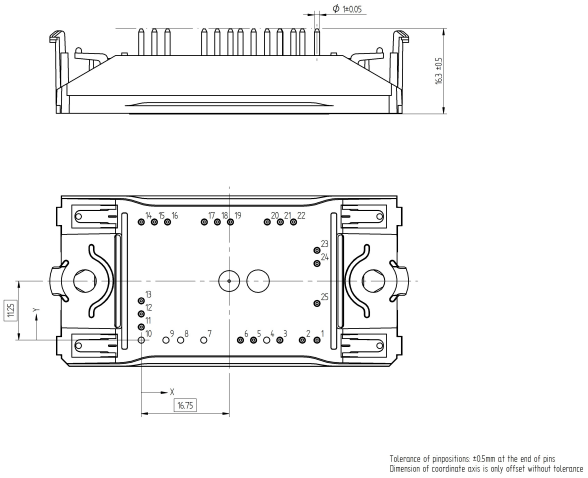
Version	Ordering Code
Without thermal paste	10-FZ166BA050RW-M920G78
With thermal paste (5,2 W/mK, PTM6000HV)	10-FZ166BA050RW-M920G78-/7/

Marking

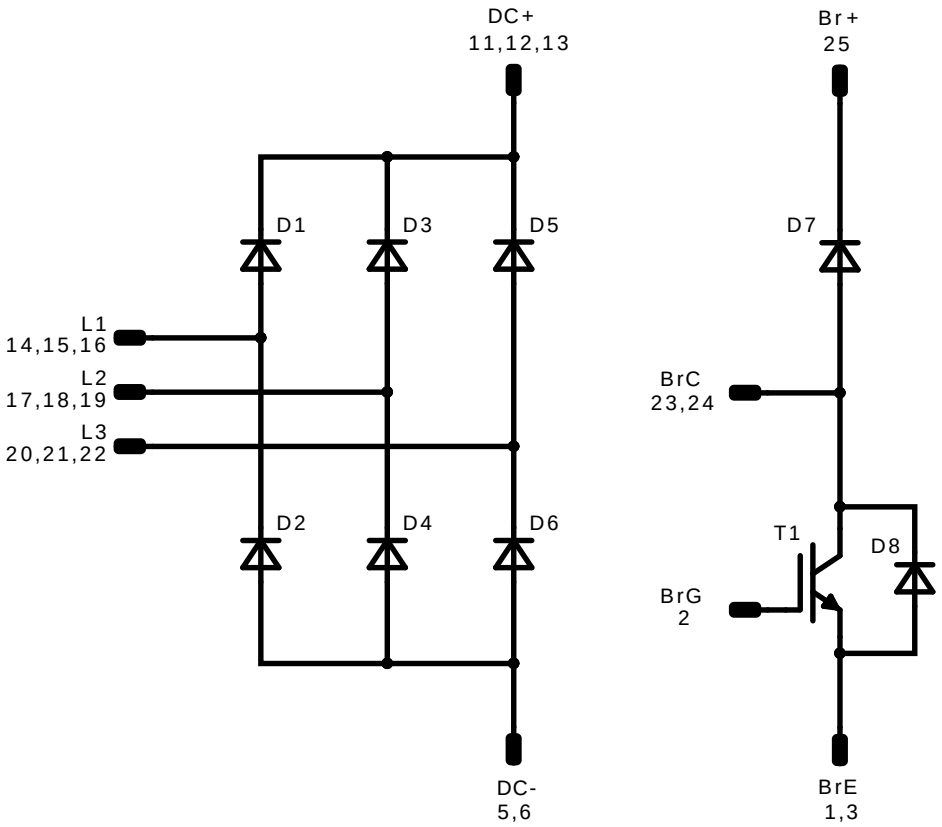
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	BrE
2	30,7	0	BrG
3	26,4	0	BrE
4	not assembled		
5	21,4	0	DC-
6	18,9	0	DC-
7	not assembled		
8	not assembled		
9	not assembled		
10	not assembled		
11	0	2,5	DC+
12	0	5	DC+
13	0	7,5	DC+
14	0	22,5	L1
15	2,5	22,5	L1
16	5	22,5	L1
17	12	22,5	L2
18	14,5	22,5	L2
19	17	22,5	L2
20	24	22,5	L3
21	26,5	22,5	L3
22	29	22,5	L3
23	33,5	17,1	BrC
24	33,5	14,6	BrC
25	33,5	7	Br+



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1	IGBT	1200 V	50 A	Brake Switch	
D7	FWD	1200 V	25 A	Brake Diode	
D8	FWD	1200 V	5 A	Brake Sw. Protection Diode	
D1, D2, D3, D4, D5, D6	Rectifier	1600 V	50 A	Rectifier Diode	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 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 $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-FZ166BA050RW-M920G78-D1-14	6 Feb. 2026	Initial Release	