Vincotech

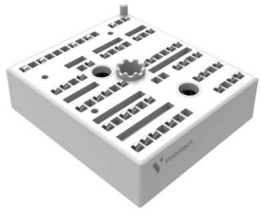
80-M212PMA050M7-K740A
datasheet

MiniSKiiP® PIM 2 — **1200 V / 50 A**

Features

- IGBT M7 with low V_{CEsat} and improved EMC behavior
- Solder-free spring contact technology
- Builtin PTC

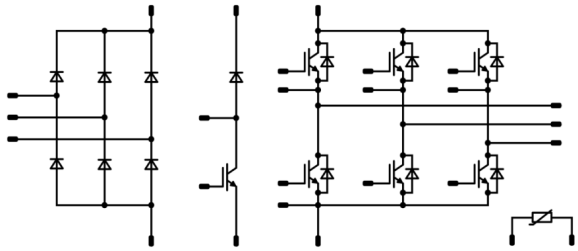
MiniSkiip® 2 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M212PMA050M7-K740A

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	50	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	490	A
Surge current capability	I^2t		1200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	93	W
Maximum Junction Temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	50	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	153	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	50	A
Repetitive peak forward current	I_{FRM}	t_j limited by T_{jmax}	100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	104	W
Maximum junction temperature	T_{jmax}		175	°C
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	50	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	153	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	50	A
Repetitive peak forward current	I_{FRM}	t_j limited by T_{jmax}	100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	104	W
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	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
		AC Voltage t_p = 1 min	2500	V
Creepage distance		with std lid For more information see handling instructions	6,3	mm
Clearance		with std lid For more information see handling instructions	6,3	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			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				50	25 125 150		1,14 1,08 1,07	1,65	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,75		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			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	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			90	µA
Gate-emitter leakage current	I_{GES}		15	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		10000		pF
Output capacitance	C_{oes}							350		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	600	50	25		410		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,62		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	600	48	25 125 150		343 337 349		ns
Rise time	t_r					25 125 150		84 94 96		
Turn-off delay time	$t_{d(off)}$					25 125 150		274 297 308		
Fall time	t_f					25 125 150		97 107 115		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,5 µC Q_{rFWD} = 8 µC Q_{rFWD} = 8,1 µC				25 125 150		5,834 7,881 7,977		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,969 4,124 5,041		

Characteristic Values

Parameter	Symbol	Conditions					Value			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		1,66 1,78 1,79	2,15	V
Reverse leakage current	I_R			1200		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,91		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 488 A/µs di/dt = 364 A/µs di/dt = 416 A/µs	±15	600	48	25 125 150		23 28 28		A
Reverse recovery time	t_{rr}					25 125 150		320 503 543		ns
Recovered charge	Q_r					25 125 150		4,513 7,960 8,097		µC
Reverse recovered energy	E_{rec}					25 125 150		1,483 2,901 3,157		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		150 121 83		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Value			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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			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	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			90	µA
Gate-emitter leakage current	I_{GES}		15	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		10000		pF
Output capacitance	C_{oes}							350		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	600	50	25		410		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,62		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	15/0	600	49	25 125 150		165 157 166		ns
Rise time	t_r					25 125 150		94 102 102		
Turn-off delay time	$t_{d(off)}$					25 125 150		522 536 547		
Fall time	t_f					25 125 150		76 119 109		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,2 µC Q_{rFWD} = 6,5 µC Q_{rFWD} = 7 µC				25 125 150		6,656 8,280 8,625		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		3,503 4,664 4,865		

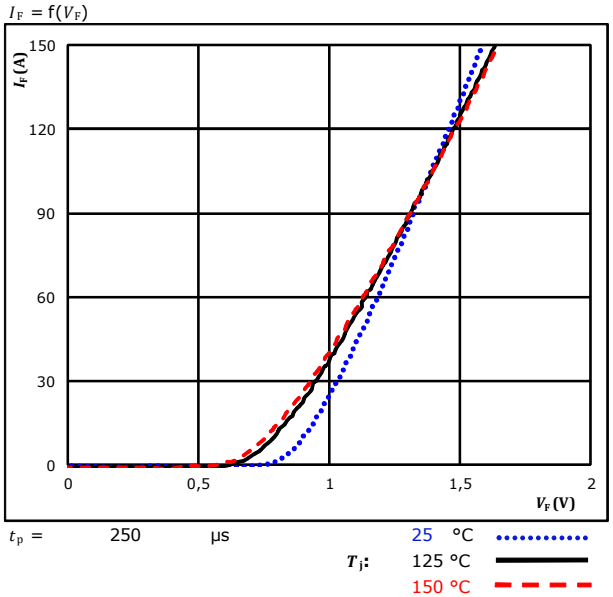
Characteristic Values

Parameter	Symbol	Conditions					Value			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		1,66 1,78 1,79	2,15	V
Reverse leakage current	I_R			1200		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,91		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 425 A/µs di/dt = 481 A/µs di/dt = 395 A/µs	15/0	600	49	25 125 150		21 25 25		A
Reverse recovery time	t_{rr}					25 125 150		364 493 537		ns
Recovered charge	Q_r					25 125 150		4,214 6,525 6,958		µC
Reverse recovered energy	E_{rec}					25 125 150		1,338 2,296 2,456		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		143 104 73		A/µs
Thermistor										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		+2	%
R_{100}	R					100		1670		Ω
Power dissipation constant						25		0,76		mW/K
A-value	$A_{(25/50)}$					25		$7,635*10^{-3}$		1/K
B-value	$B_{(25/100)}$					25		$1,731*10^{-5}$		1/K²
Vincotech PTC Reference									E	

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

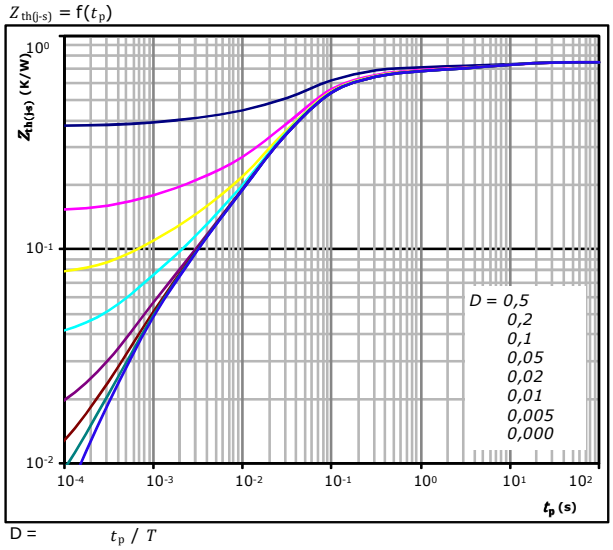


t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width



D = t_p / T

$R_{th(j-s)}$ = 0,75 K/W

Diode thermal model values

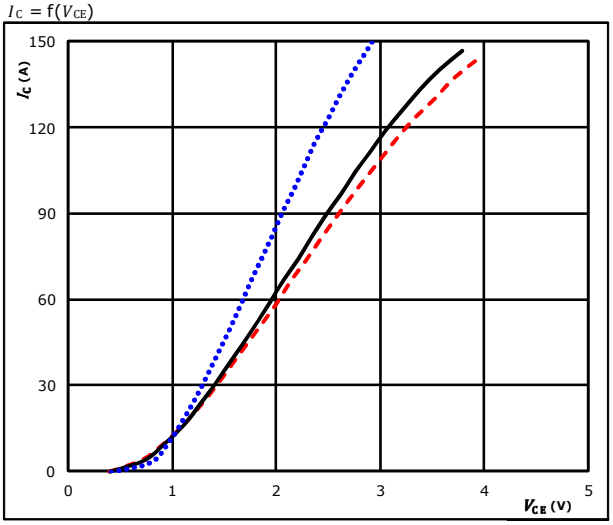
R (K/W)	τ (s)
6,99E-02	7,70E+00
7,97E-02	4,31E-01
3,54E-01	6,42E-02
1,62E-01	2,35E-02
5,21E-02	3,81E-03
3,21E-02	7,57E-04

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

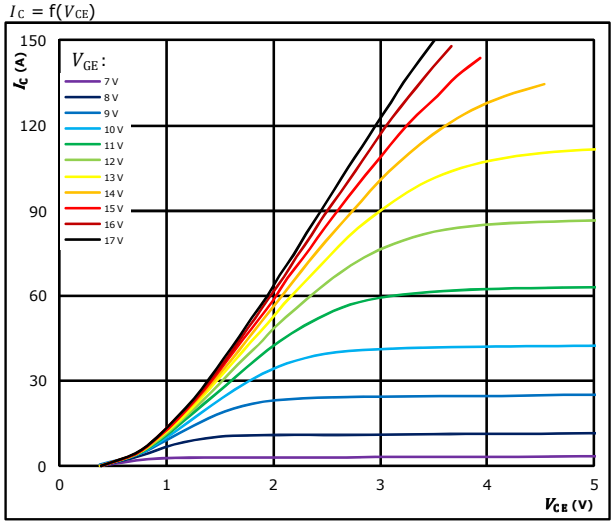


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

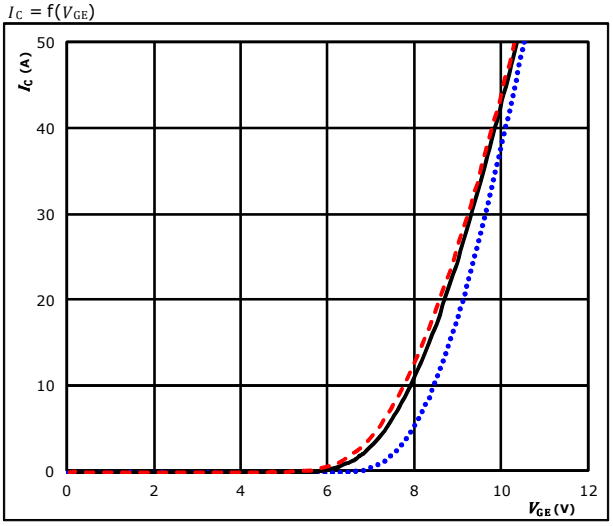


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

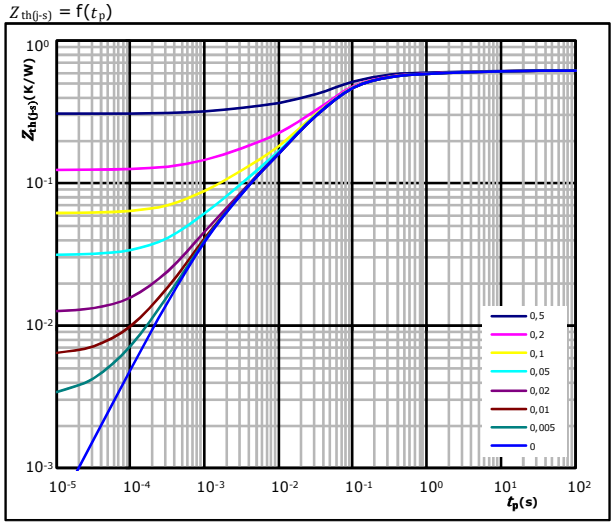


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,62	K/W

IGBT thermal model values

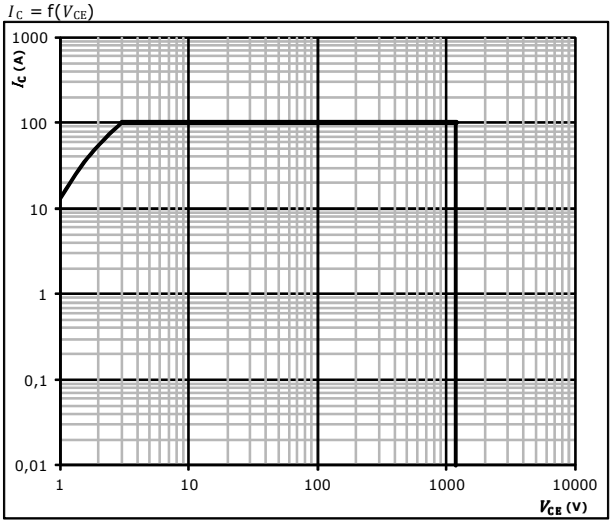
R (K/W)	τ (s)
2,32E-02	4,64E+00
4,34E-02	3,95E-01
1,15E-01	7,05E-02
3,33E-01	2,36E-02
6,22E-02	4,58E-03
4,17E-02	7,04E-04
2,88E-03	3,40E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



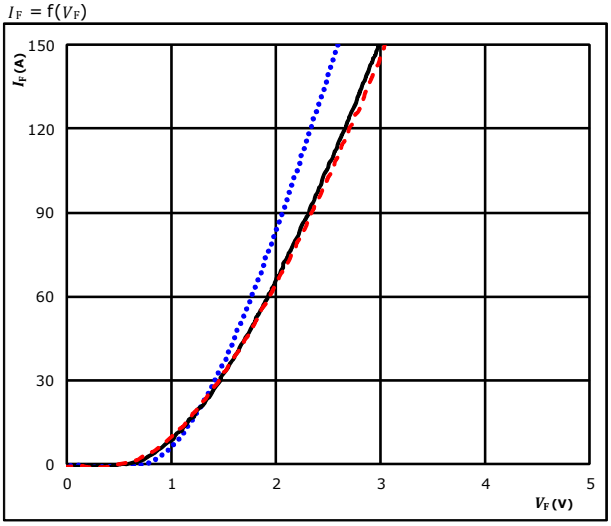
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



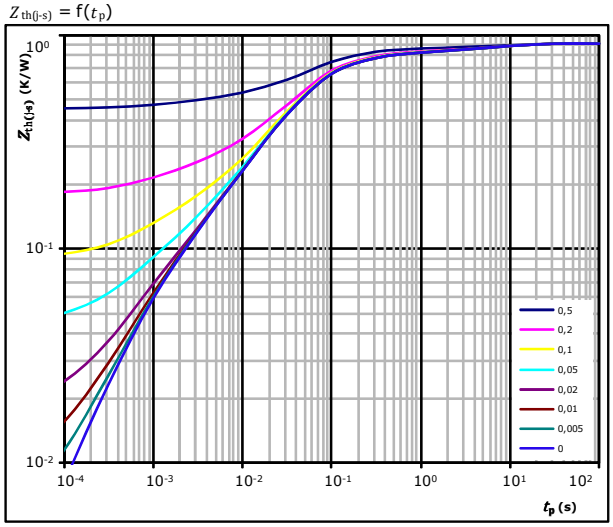
t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,91 K/W

FWD thermal model values

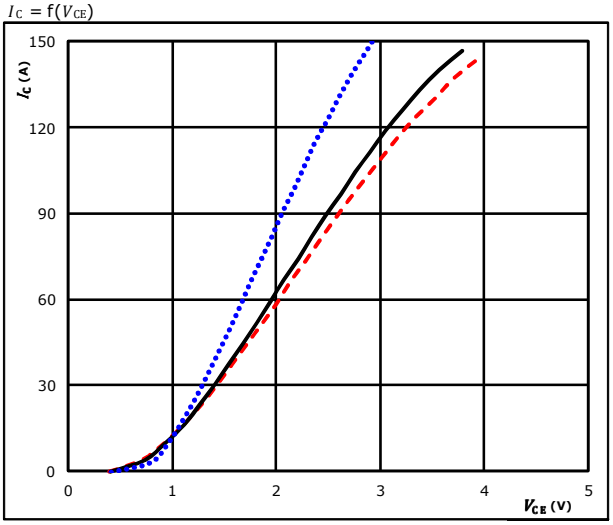
R (K/W)	τ (s)
8,48E-02	5,83E+00
9,67E-02	3,26E-01
4,29E-01	4,85E-02
1,97E-01	1,77E-02
6,32E-02	2,88E-03
3,90E-02	5,73E-04

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

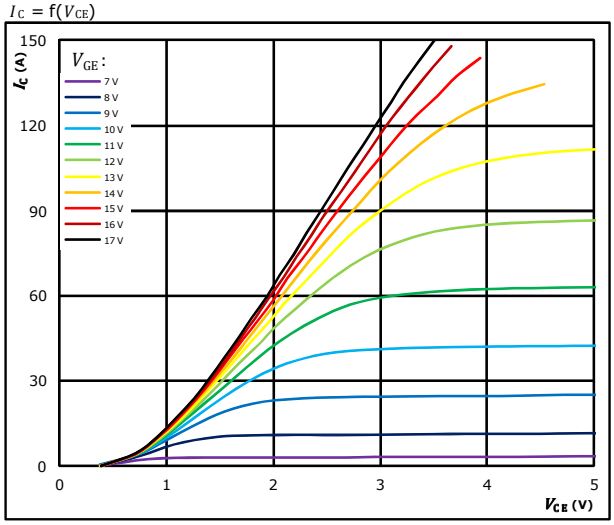


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

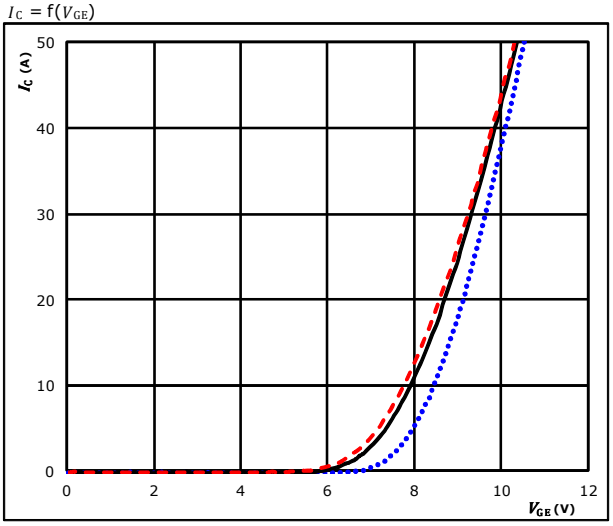


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

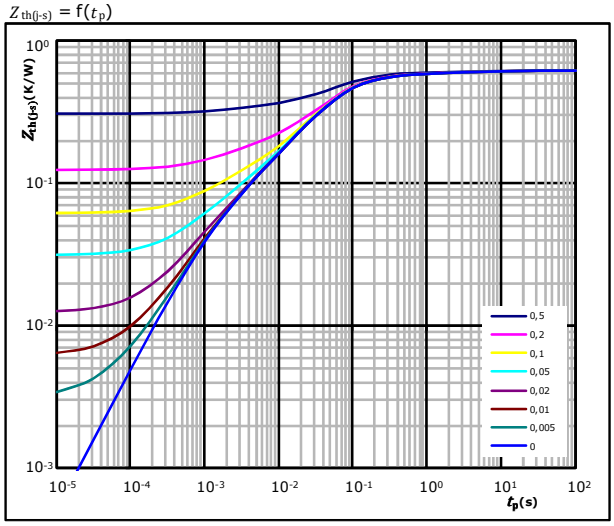


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,62	K/W

IGBT thermal model values

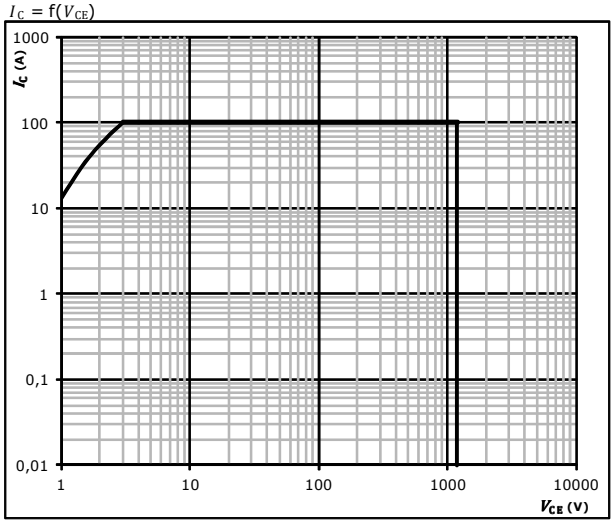
R (K/W)	τ (s)
2,32E-02	4,64E+00
4,34E-02	3,95E-01
1,15E-01	7,05E-02
3,33E-01	2,36E-02
6,22E-02	4,58E-03
4,17E-02	7,04E-04
2,88E-03	3,40E-04

Brake Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



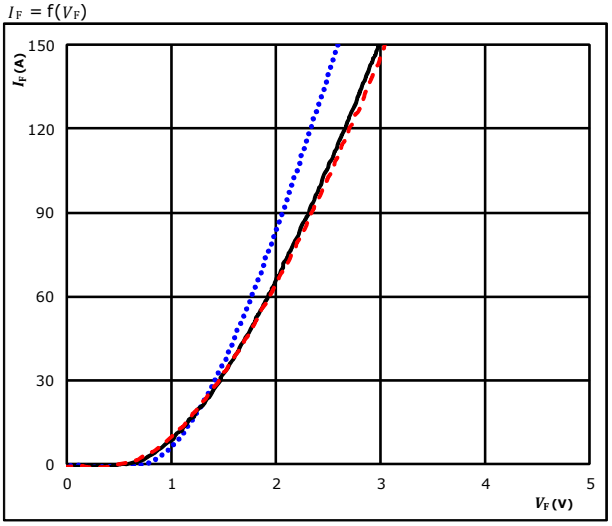
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



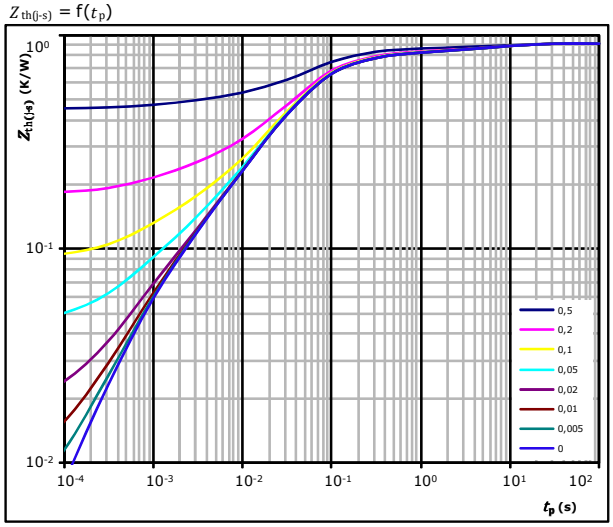
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,91 K/W

FWD thermal model values

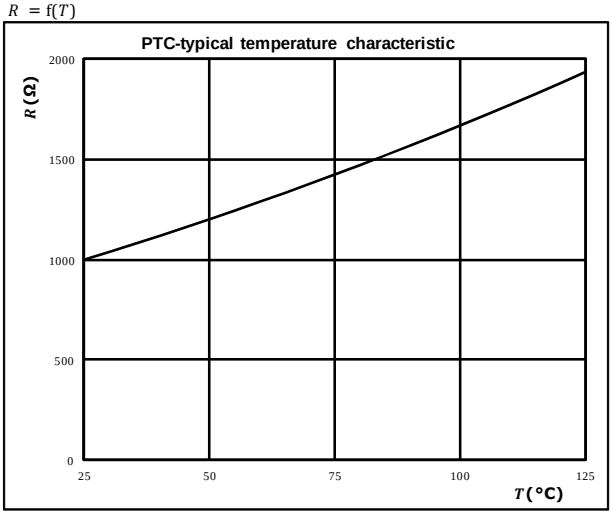
R (K/W)	τ (s)
8,48E-02	5,83E+00
9,67E-02	3,26E-01
4,29E-01	4,85E-02
1,97E-01	1,77E-02
6,32E-02	2,88E-03
3,90E-02	5,73E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

$R = f(T)$

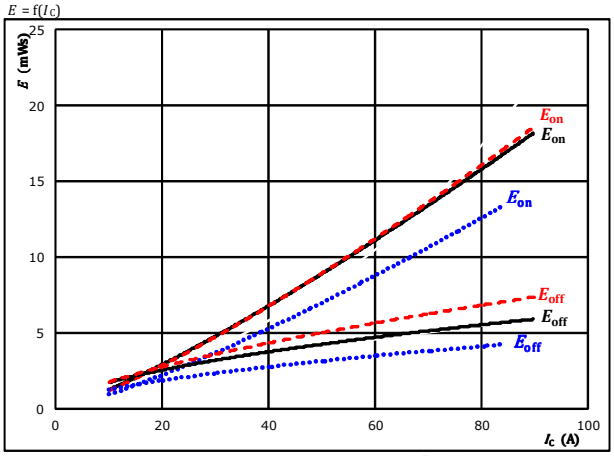


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



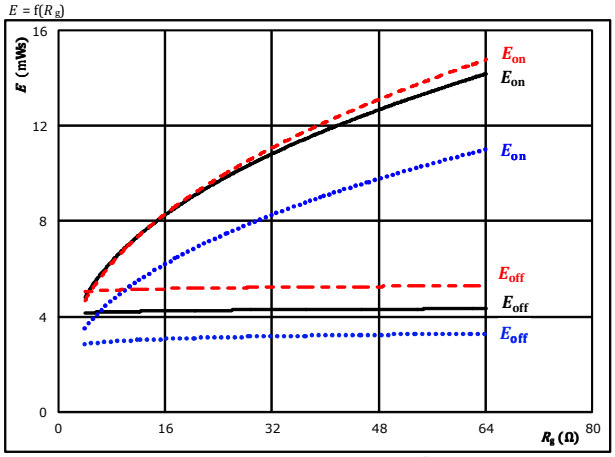
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	16	Ω		150 °C	
R_{goff} =	16	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



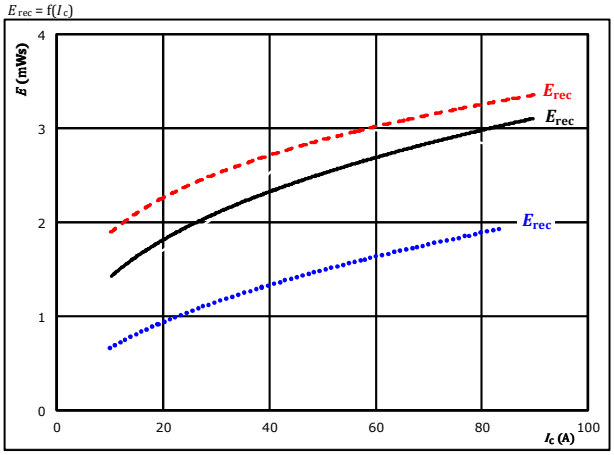
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	48	A		150 °C	

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



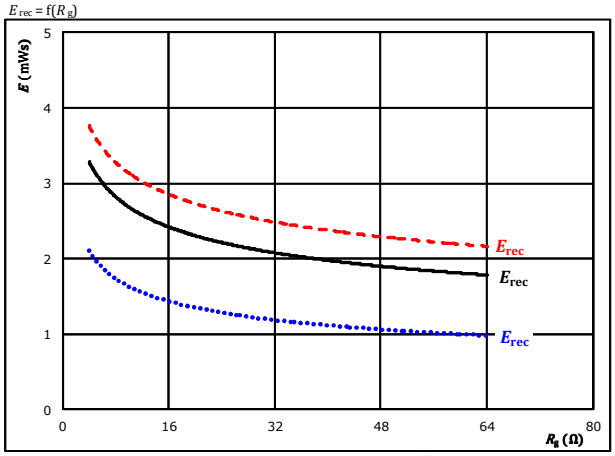
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	16	Ω		150 °C	

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

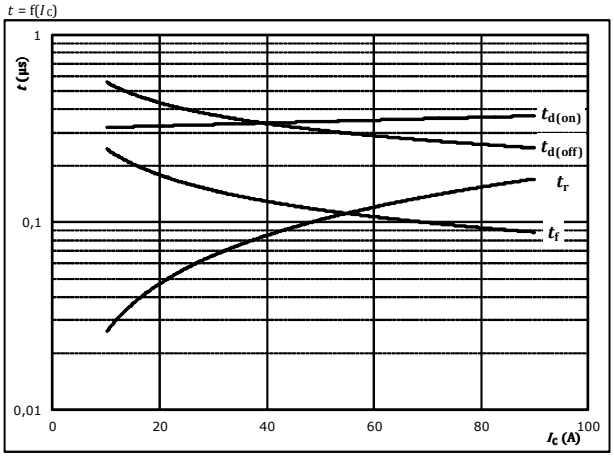
V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	48	A		150 °C	

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



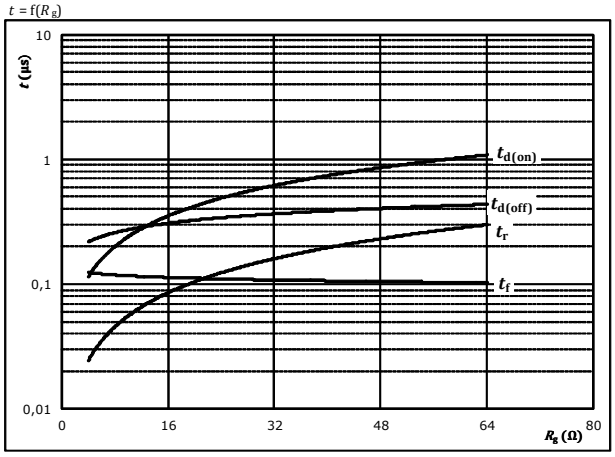
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



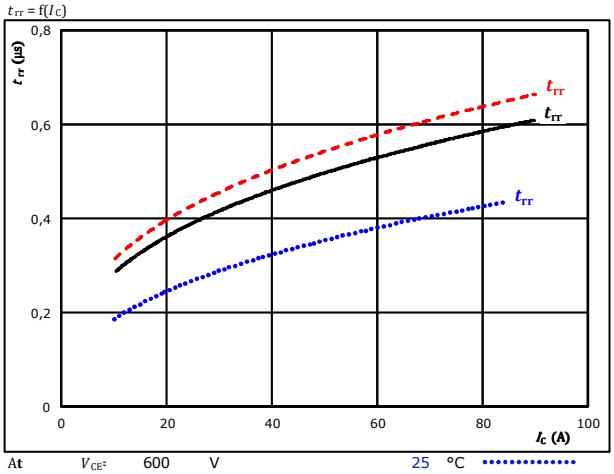
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	48	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

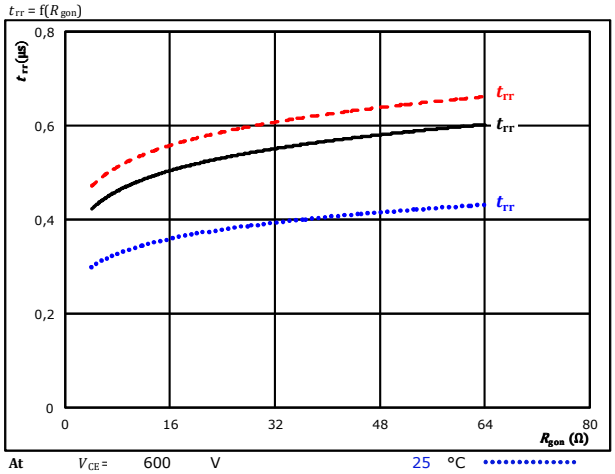


At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	16	Ω		150 °C

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



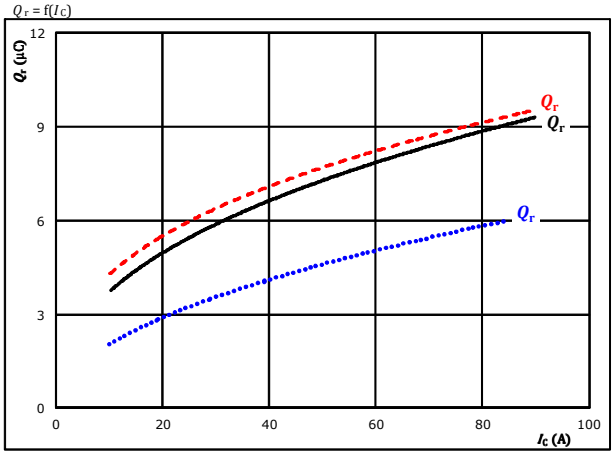
At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	48	A		150 °C

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

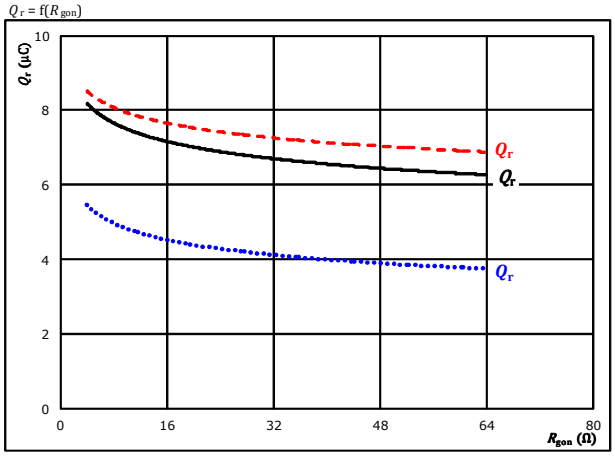


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

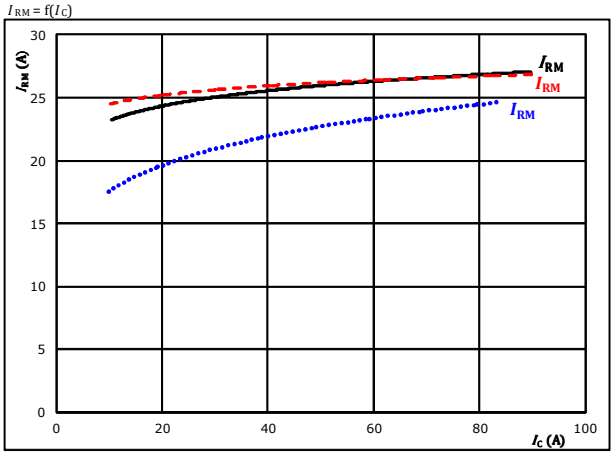


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	48	A		150 °C	

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

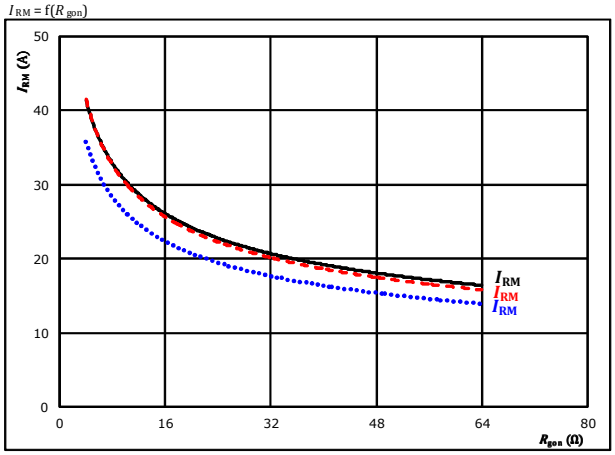


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 12. **FWD**

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

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



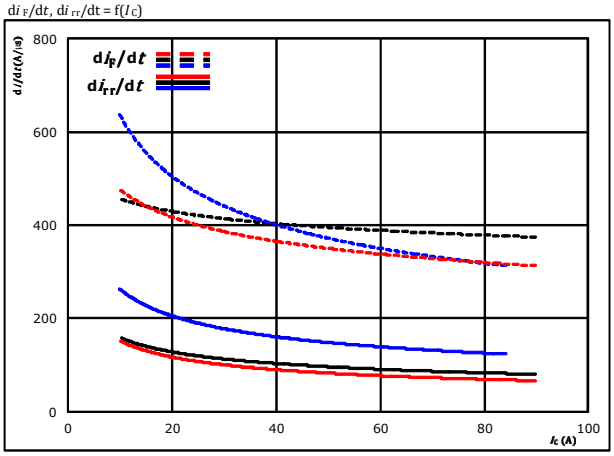
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	48	A		150 °C	

Inverter Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

di_F/dt, $di_{rr}/dt = f(I_C)$

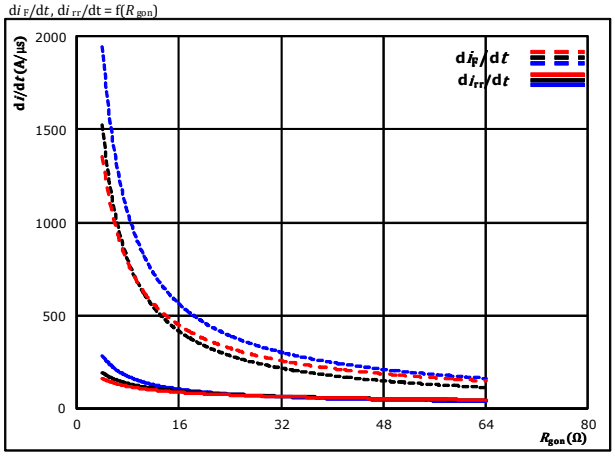


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –

figure 14. **FWD**

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

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

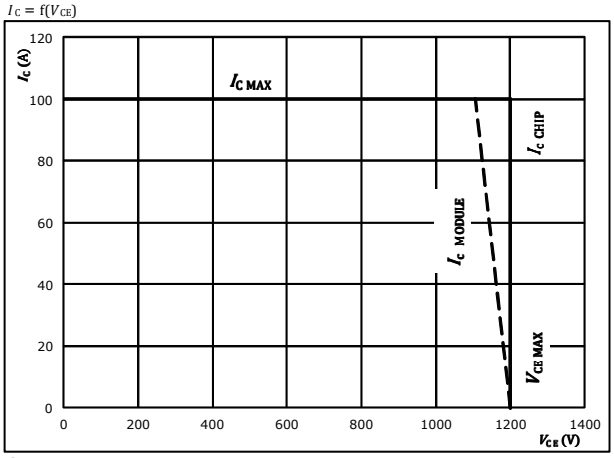


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	48	A		150 °C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

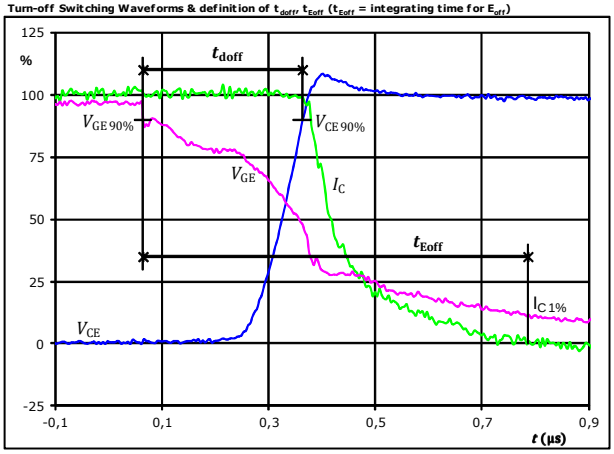
Inverter Switching Definitions

General conditions

T_j	=	**125 °C**
R_{gon}	=	**16 Ω**
R_{goff}	=	**16 Ω**

figure 1. **IGBT**

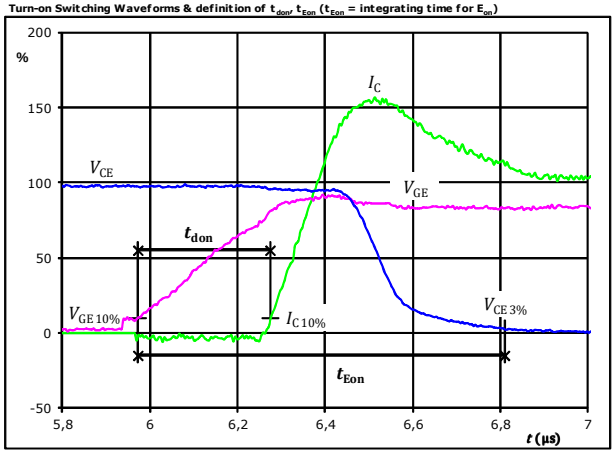
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_{doff} =	0,297	µs
t_{Eoff} =	0,722	µs

figure 2. **IGBT**

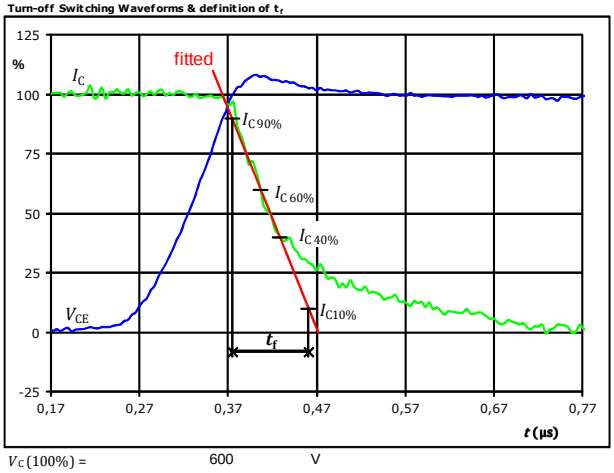
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_{don} =	0,337	µs
t_{Eon} =	0,837	µs

figure 3. **IGBT**

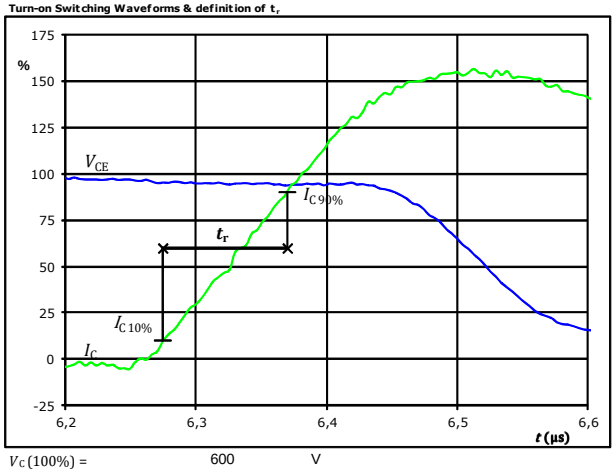
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_f =	0,106	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

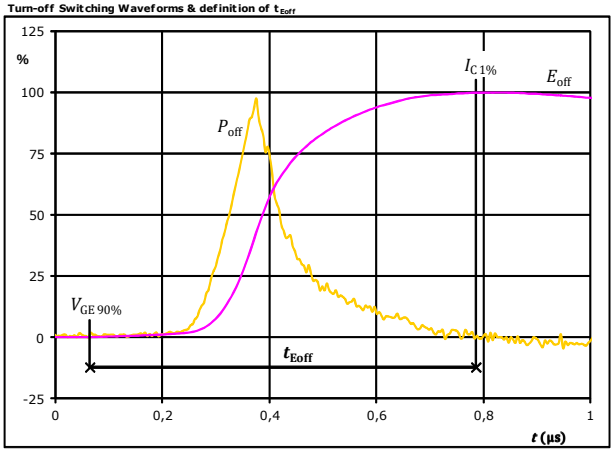


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_r =	0,094	µs

Inverter Switching Characteristics

figure 5. **IGBT**

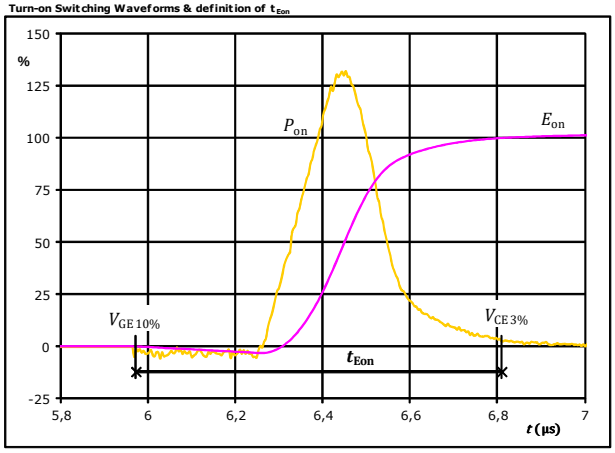
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	29,82	kW
$E_{off}(100\%)$ =	4,12	mJ
t_{Eoff} =	0,72	µs

figure 6. **IGBT**

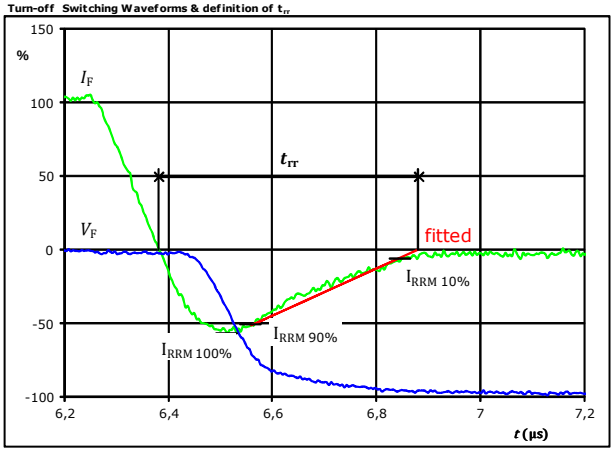
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	29,82	kW
$E_{on}(100\%)$ =	7,88	mJ
t_{Eon} =	0,84	µs

figure 7. **FWD**

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

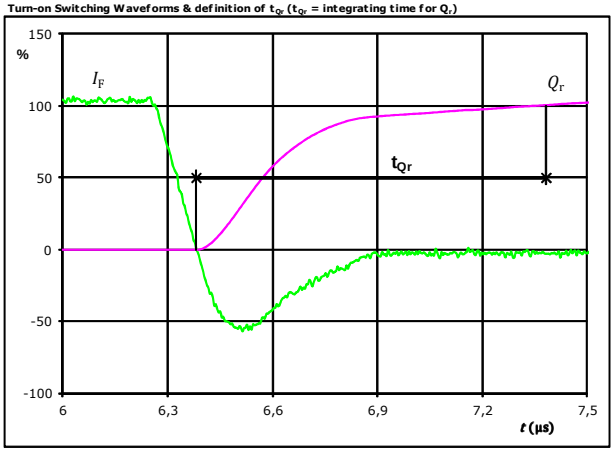


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	50	A
$I_{RRM}(100\%)$ =	-28	A
t_{rr} =	0,502	µs

Inverter Switching Characteristics

figure 8. **FWD**

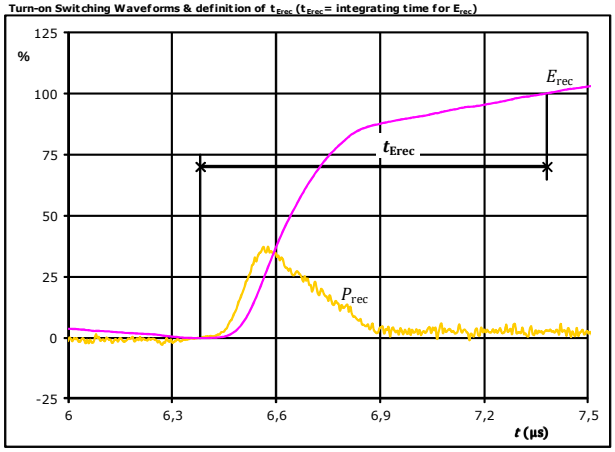
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	50	A
Q_r (100%) =	7,96	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



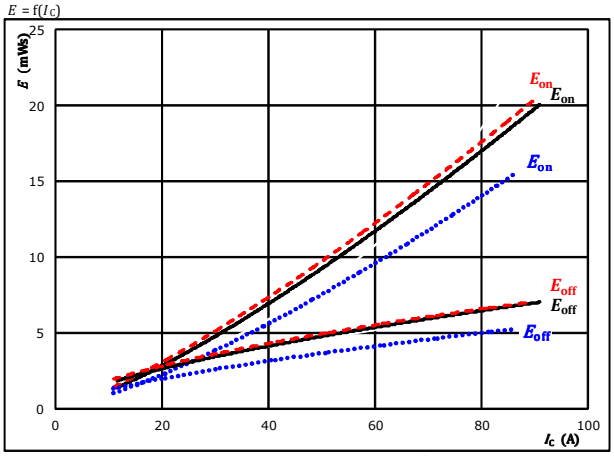
P_{rec} (100%) =	29,82	kW
E_{rec} (100%) =	2,90	mJ
t_{Erec} =	1,00	µs

Brake Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



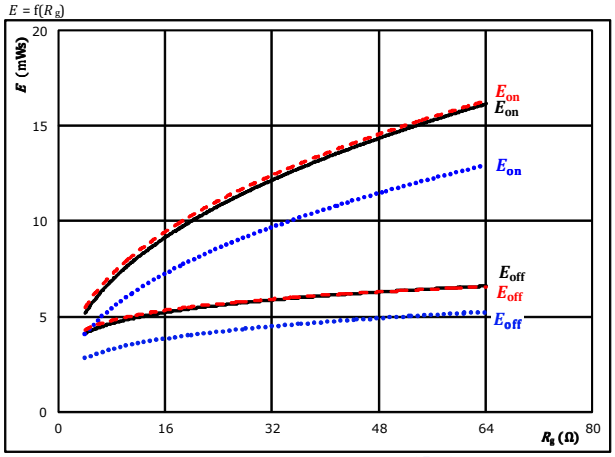
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	15/0	V		125 °C	
R_{gon} =	16	Ω		150 °C	
R_{goff} =	16	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



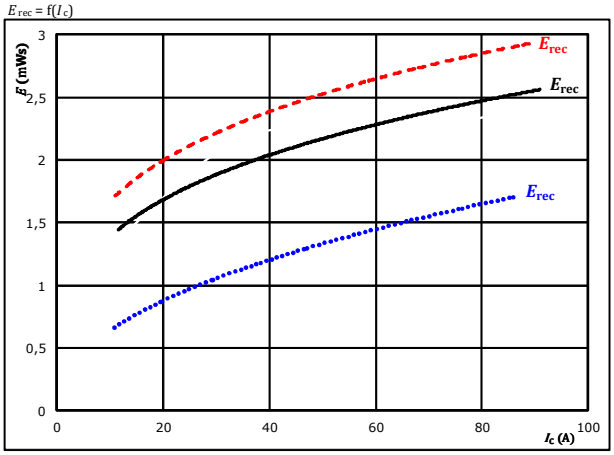
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	15/0	V		125 °C	
I_C =	49	A		150 °C	

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



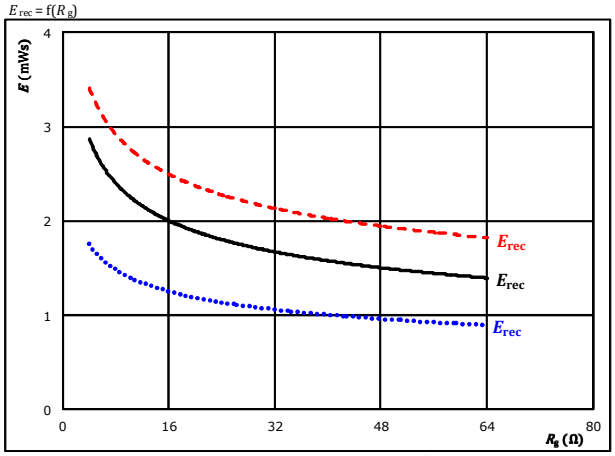
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	15/0	V		125 °C	
R_{gon} =	16	Ω		150 °C	

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

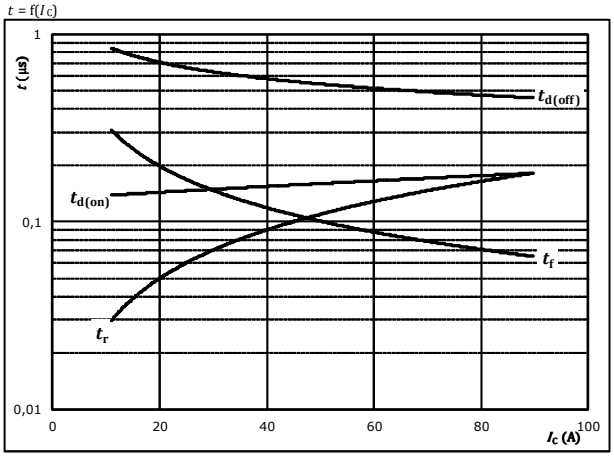
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	15/0	V		125 °C	
I_C =	49	A		150 °C	

Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



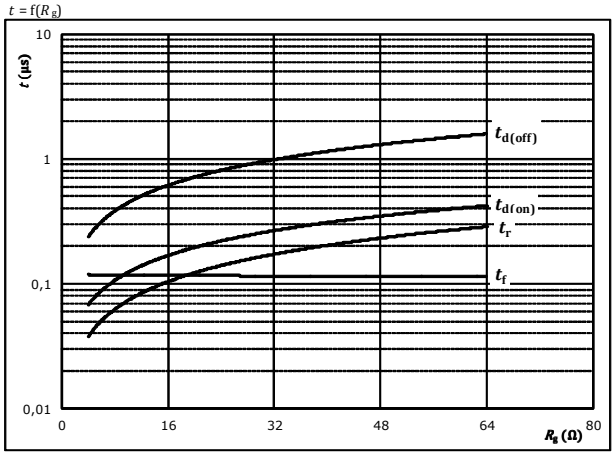
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



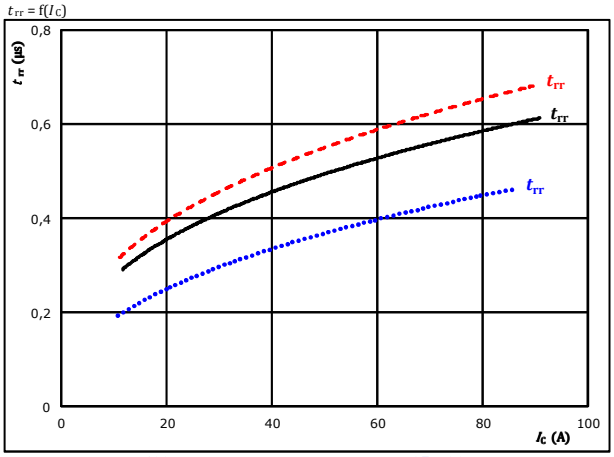
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
I_C =	49	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

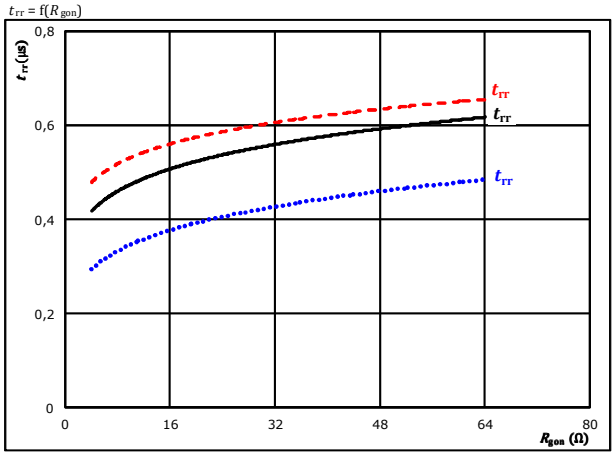


At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	15/0	V		125	°C
R_{gon} =	16	Ω		150	°C

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



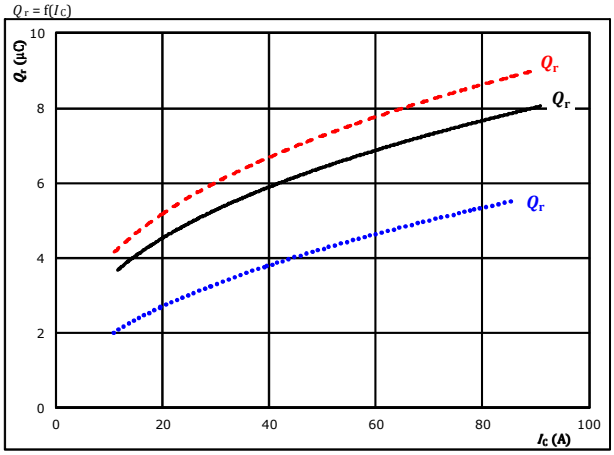
At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	15/0	V		125	°C
I_C =	49	A		150	°C

Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

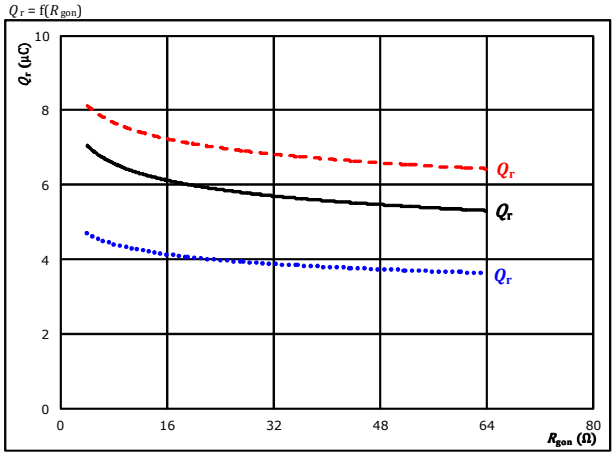


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

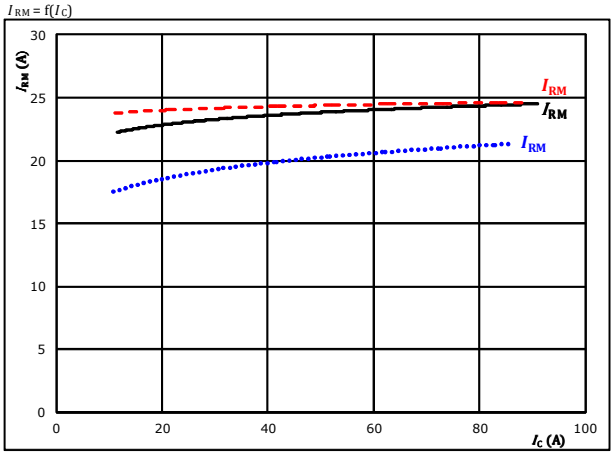


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C=	49	A		150 °C	

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

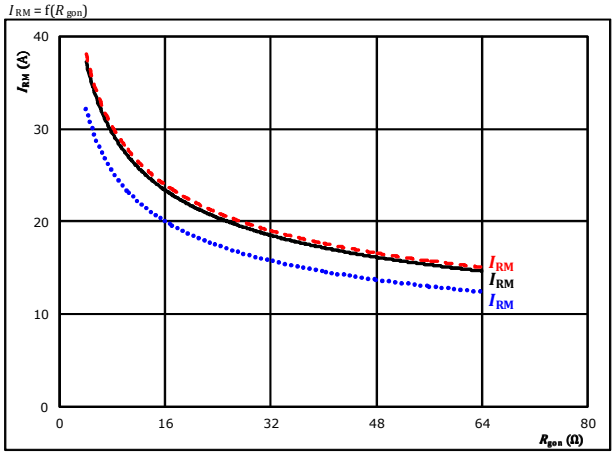


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 12. **FWD**

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

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



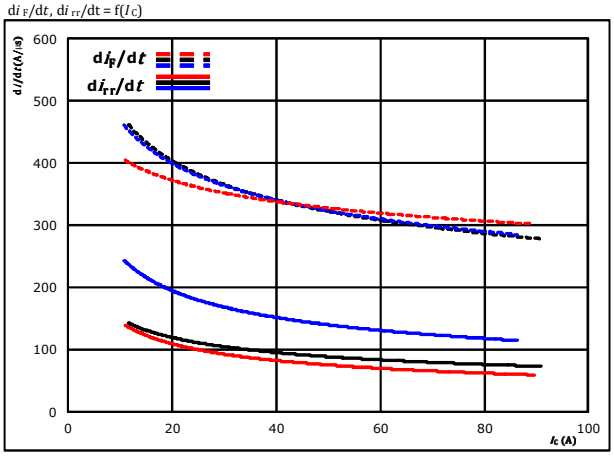
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C =	49	A		150 °C	

Brake Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

di_F/dt, $di_{rr}/dt = f(I_C)$

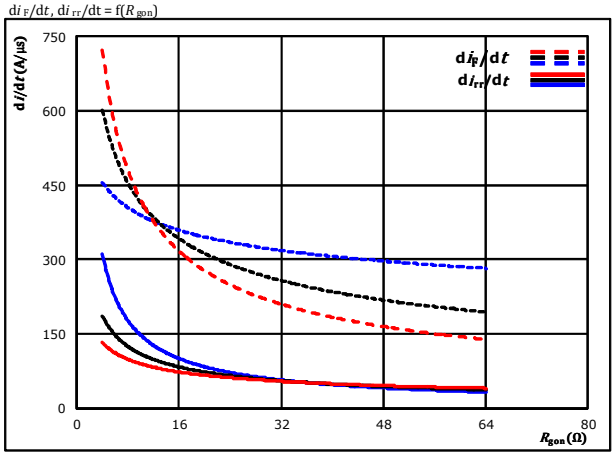


At						
	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	15/0	V		125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 14. **FWD**

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

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

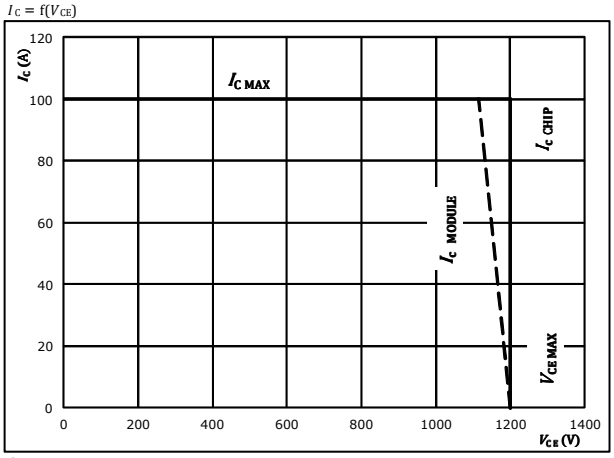


At						
	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	15/0	V		125 °C	
	I_C=	49	A		150 °C	

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

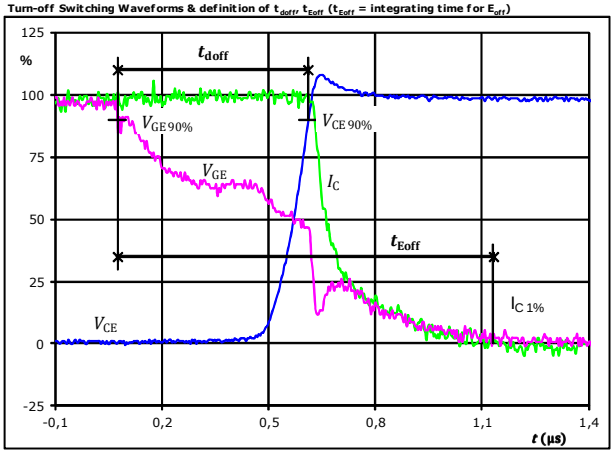
Brake Switching Definitions

General conditions

T_j	=	**125 °C**
R_{gon}	=	**16 Ω**
R_{goff}	=	**16 Ω**

figure 1. **IGBT**

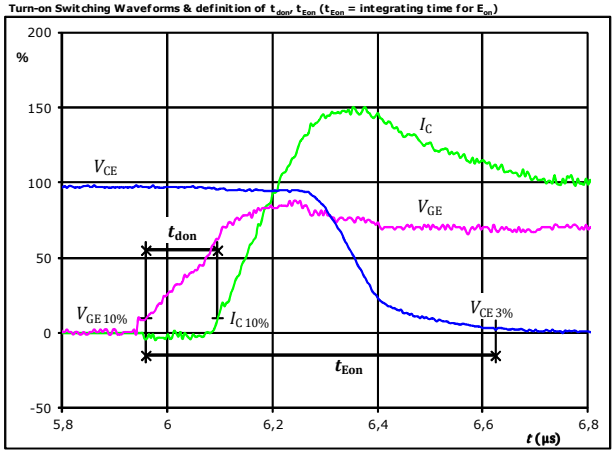
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_{doff} =	0,536	µs
t_{Eoff} =	1,058	µs

figure 2. **IGBT**

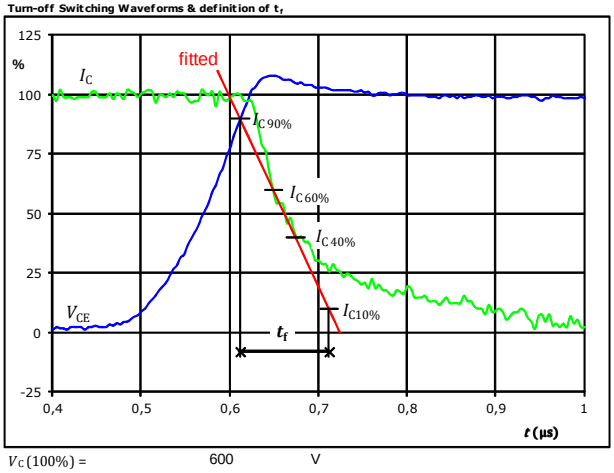
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_{don} =	0,157	µs
t_{Eon} =	0,665	µs

figure 3. **IGBT**

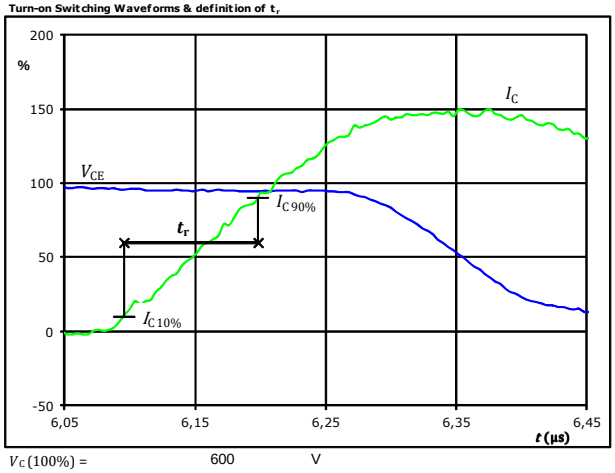
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_f =	0,119	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

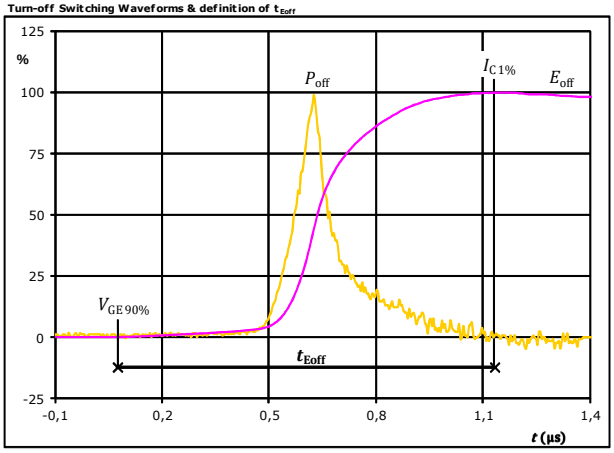


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_r =	0,102	µs

Brake Switching Characteristics

figure 5. **IGBT**

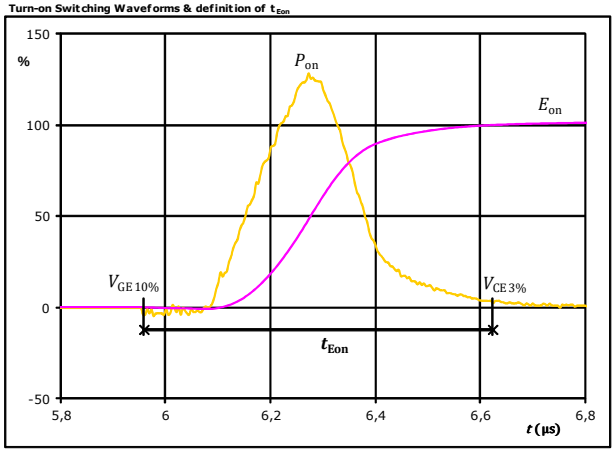
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	30,46	kW
$E_{off}(100\%)$ =	4,66	mJ
t_{Eoff} =	1,06	µs

figure 6. **IGBT**

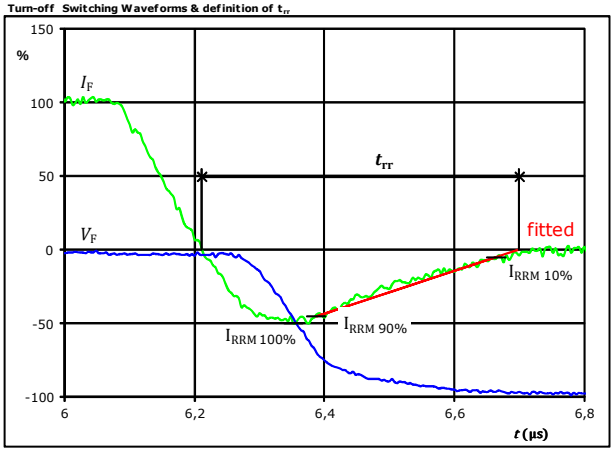
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	30,46	kW
$E_{on}(100\%)$ =	8,28	mJ
t_{Eon} =	0,66	µs

figure 7. **FWD**

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

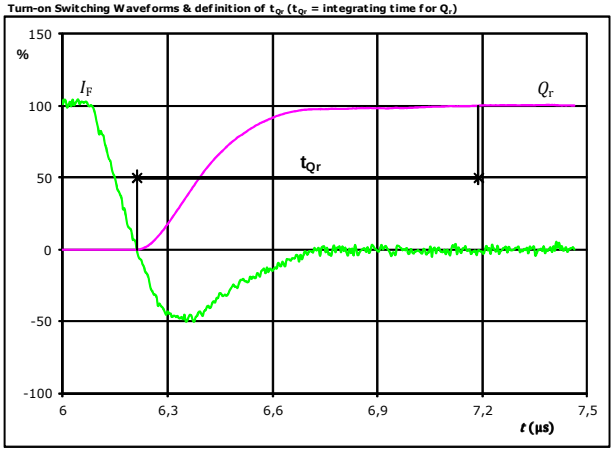


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	51	A
$I_{RRM}(100\%)$ =	-25	A
t_{rr} =	0,493	µs

Brake Switching Characteristics

figure 8. **FWD**

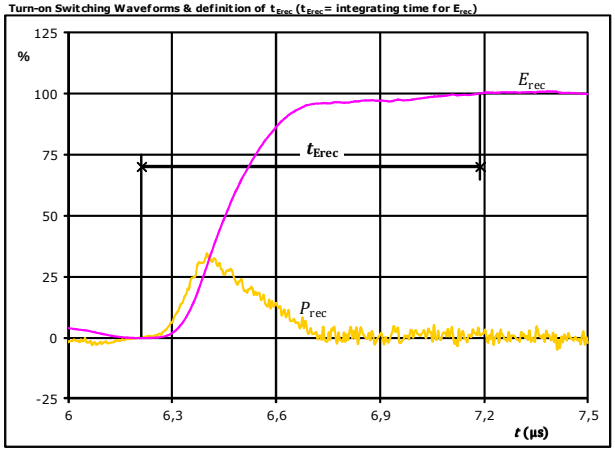
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	51	A
Q_r (100%) =	6,53	µC
t_{Qr} =	0,98	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	30,46	kW
E_{rec} (100%) =	2,30	mJ
t_{Erec} =	0,98	µs

Vincotech

Ordering Code & Marking

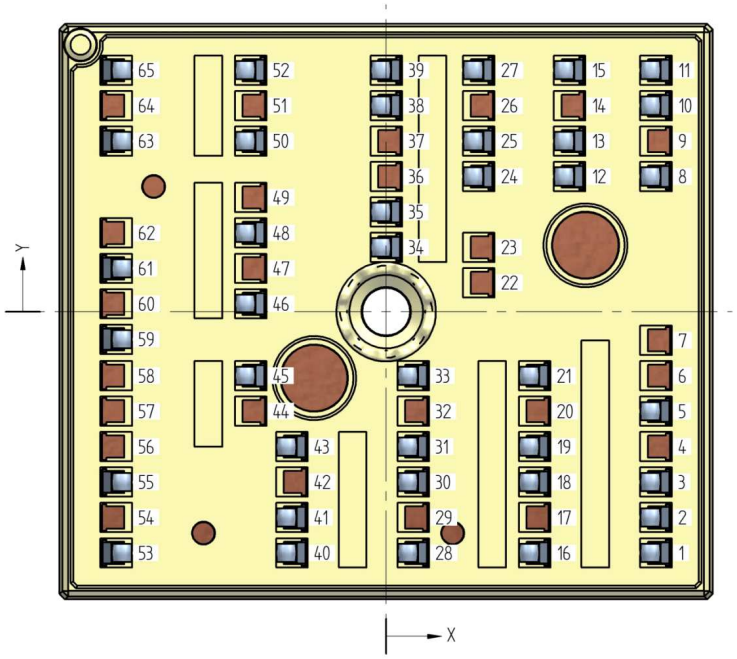
Version	Ordering Code
With std lid (6,5 mm height) + no thermal grease	80-M212PMA050M7-K740A-/0A/
With thin lid (2,8 mm height) + no thermal grease	80-M212PMA050M7-K740A-/0B/
With std lid (6,5 mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMA050M7-K740A-/1A/
With thin lid (2,8 mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMA050M7-K740A-/1B/
With std lid (6,5 mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMA050M7-K740A-/4A/
With thin lid (2,8 mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMA050M7-K740A-/4B/
With std lid (6,5 mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMA050M7-K740A-/5A/
With thin lid (2,8 mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMA050M7-K740A-/5B/

	Name	Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS

	Type&Ver	Lot number	Serial	Date code		
Datamatrix	TTTTTTVV	LLLLL	SSSS	WWYY		

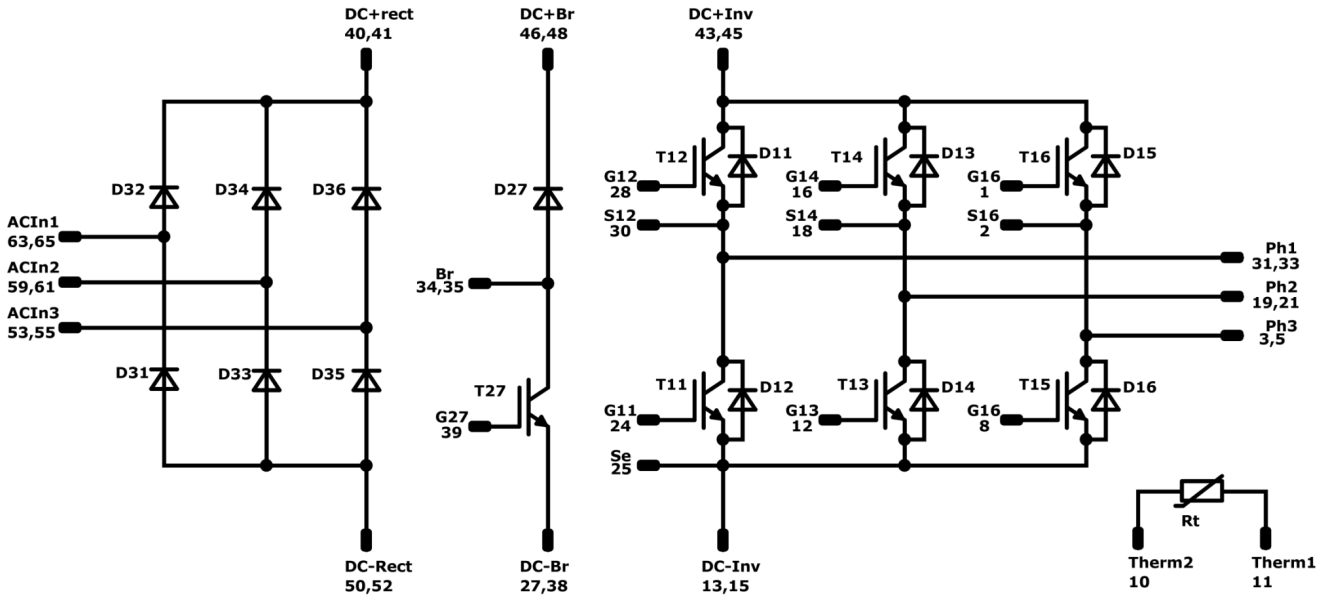
Outline

PCB pad table				PCB pad table			
Pin	X	Y	Function	Pin	X	Y	Function
1	24,38	-21,8	G16	34	0,03	5,8	Br
2	24,38	-18,6	S16	35	0,03	9	Br
3	24,38	-15,4	Ph3	36	Not assembled		
4	Not assembled			37	Not assembled		
5	24,38	-9	Ph3	38	0,03	18,6	DC-Br
6	Not assembled			39	0,03	21,8	G27
7	Not assembled			40	-8,5	-21,8	DC+Rect
8	24,38	12,2	G15	41	-8,5	-18,6	DC+Rect
9	Not assembled			42	Not assembled		
10	24,38	18,6	Therm2	43	-8,5	-12,2	DC+Inv
11	24,38	21,8	Therm1	44	Not assembled		
12	16,58	12,2	G13	45	-12,22	-5,8	DC+Inv
13	16,58	15,4	DC-Inv	46	-12,22	0,7	DC+Br
14	Not assembled			47	Not assembled		
15	16,58	21,8	DC-Inv	48	-12,22	7,1	DC+Br
16	13,42	-21,8	G14	49	Not assembled		
17	Not assembled			50	-12,22	15,4	DC-Rect
18	13,42	-15,4	S14	51	Not assembled		
19	13,42	-12,2	Ph2	52	-12,22	21,8	DC-Rect
20	Not assembled			53	-24,38	-21,8	ACIn3
21	13,42	-5,8	Ph2	54	Not assembled		
22	Not assembled			55	-24,38	-15,4	ACIn3
23	Not assembled			56	Not assembled		
24	8,38	12,2	G11	57	Not assembled		
25	8,38	15,4	Se	58	Not assembled		
26	Not assembled			59	-24,38	-2,5	ACIn2
27	8,38	21,8	DC-Br	60	Not assembled		
28	2,46	-21,8	G12	61	-24,38	3,9	ACIn2
29	Not assembled			62	assembled		
30	2,46	-15,4	S12	63	-24,38	15,4	ACIn1
31	2,46	-12,2	Ph1	64	Not assembled		
32	Not assembled			65	-24,38	21,8	ACIn1
33	2,46	-5,8	Ph1				



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31-D36	Rectifier	1600 V	50 A	Rectifier Diode	
T11-T16	IGBT	1200 V	50 A	Inverter Switch	
D11-D16	FWD	1200 V	50 A	Inverter Diode	
T27	IGBT	1200 V	50 A	Brake Switch	
D27	FWD	1200 V	50 A	Brake 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.

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-M212PMA050M7-K740A-D1-14	16 Nov. 2017		