Vincotech

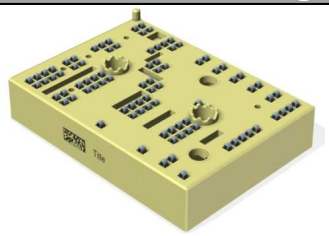
80-M3126BA140SC02-K489G40
datasheet

MiniSkiiP®CON 3 **1200 V / 140 A**

Features

- 3 phase input rectifier with Brake
- Solderless interconnection
- Trench Fieldstop IGBT 4 technology

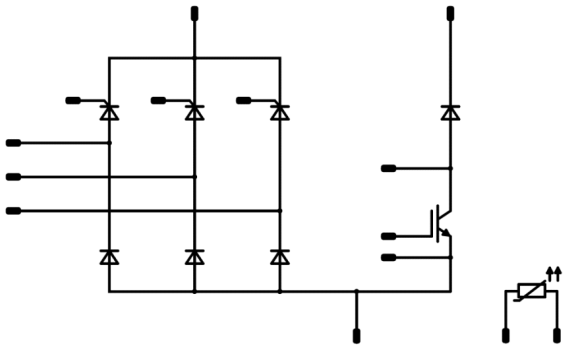
MiniSkiiP® 3 housing



Target applications

- Motor Drives
- Servo Drives
- UPS

Schematic



Types

- 80-M3126BA140SC02-K489G40

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	177	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	450	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	495	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V	10 800	µs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Brake FWD				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	175	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	101	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	1380	A
Surge current capability	I^2t		9520	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	129	W
Maximum Junction Temperature	T_{jmax}		150	°C
Rectifier Thyristor				
Repetitive peak reverse voltage	V_{RRM}		1600	V
Forward average current	I_{FAV}	sine, d = 0,5 $T_j = T_{jmax}$ T_s = 80 °C	106	A
Surge forward current	I_{FSM}	t_p = 10 ms T_j = 130 °C	1250	A
I^2t value	I^2t		7810	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	107	W
Maximum Junction Temperature	$T_j$max		130	°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	6000	V
		Equivalent AC Voltage t_p = 60 s	2500	V
Creepage distance			min. 12,7	mm
Clearance			min. 12,7	mm
Comparative Tracking Index	CTI		> 200	

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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0052	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 150	1,58	1,93 2,39	2,07	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							5		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		8600		pF
Reverse transfer capacitance	C_{res}							320		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						0,19		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	600	151	25 150		175 193		ns
Rise time	t_r					25 150		46 53		
Turn-off delay time	$t_{d(off)}$					25 150		288 375		
Fall time	t_f					25 150		58 100		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 8 µC Q_{rFWD} = 24,3 µC				25 150		15 23		mWs
Turn-off energy (per pulse)	E_{off}					25 150		8,3 14,1		

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 FWD										
Static										
Forward voltage	V_F				150	25 150		2,50 2,53	2,7	V
Reverse leakage current	I_{rm}			1200		25 150			180 28000	µA
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,54		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 2520 A/µs di/dt = 2365 A/µs	±15	600	151	25 150		77 107		A
Reverse recovery time	t_{rr}					25 150		125 492		ns
Recovered charge	Q_r					25 150		8 24,3		µC
Reverse recovered energy	E_{rec}					25 150		2,1 8,2		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		990 1268		A/µs
Rectifier Diode										
Static										
Forward voltage	V_F				77	25 125		1,03 1,12	1,21	V
Reverse leakage current	I_r			1600		25 150			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						0,54		K/W

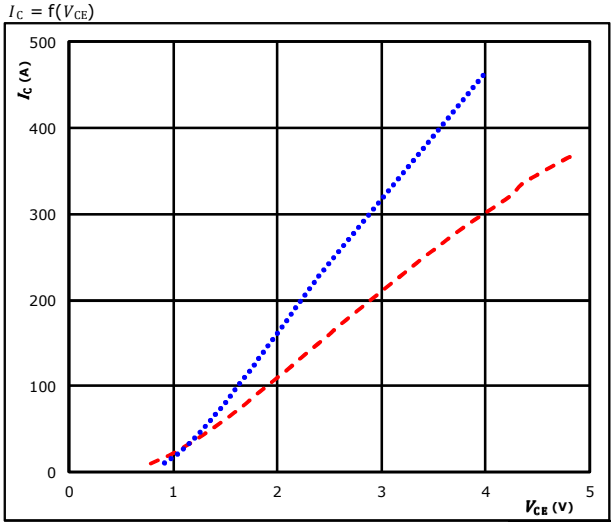
Characteristic Values

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	
Rectifier Thyristor										
Static										
Forward voltage	V_F				110	25 125		1,09 1,02	1,2	V
Threshold voltage (for power loss calc. only)	V_{to}					130			0,85	V
Slope resistance (for power loss calc. only)	r_t					130			3,2	mΩ
Reverse current	I_r			1600		25			0,2	mA
Gate controlled delay time	t_{GD}	Tvj = 25 °C I_G = 1 A dig/dt = 1 A/µs V_D = 0,67 * V_{DRM}		1072		25		1		µs
Gate controlled rise time	t_{GR}			1072		25		2		µs
Critical rate of rise of off-state voltage	(dv/dt)cr					130			1000	V/µs
Critical rate of rise of on-state current	(di/dt)cr					130			100	A/µs
Circuit commutated turn-off time	t_q					130		150		µs
Holding current	I_H					25			220	mA
Latching current	I_L					25			550	mA
Gate trigger voltage	V_{GT}					25			1,98	V
Gate trigger current	I_{GT}					25			100	mA
Gate non-trigger voltage	V_{GD}					130	0,25			V
Gate non-trigger current	I_{GD}					115	6			mA
Thermal										
Thermal resistance chip to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,47		K/W
Thermistor										
Rated resistance	R					25		1		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1670 Ω				100	-2		+2	%
R100	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	

Brake Switch Charateristics

Typical output characteristics **IGBT**

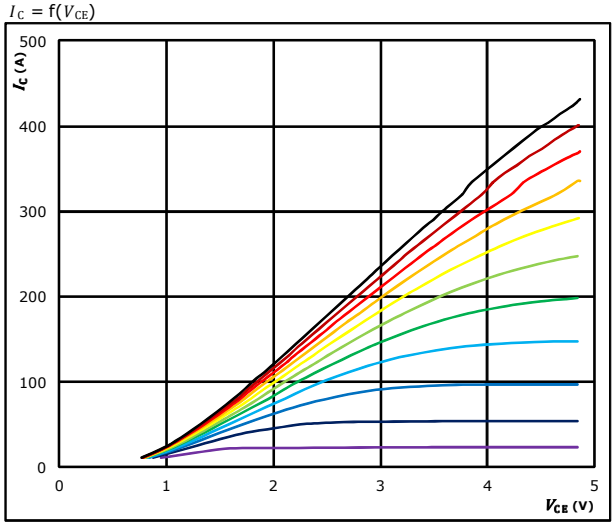
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

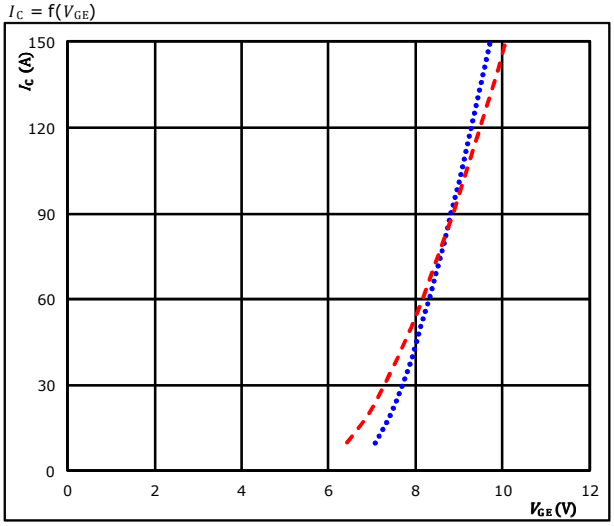
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

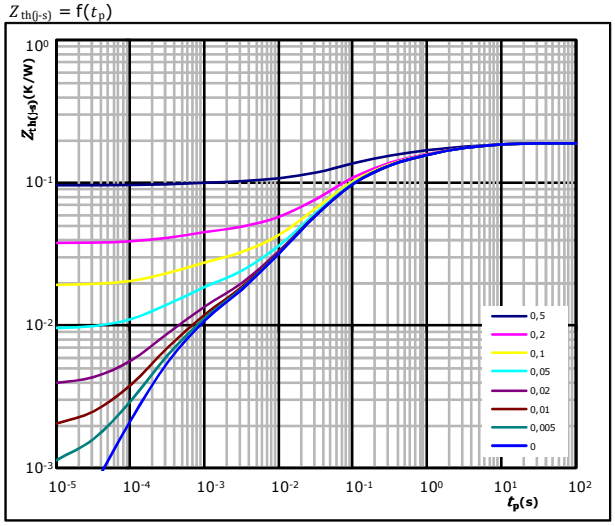
$I_C = f(V_{GE})$



t_p =	100	µs		25 °C	
V_{CE} =	0	V	T_j:	150 °C	

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,19	K/W

IGBT thermal model values

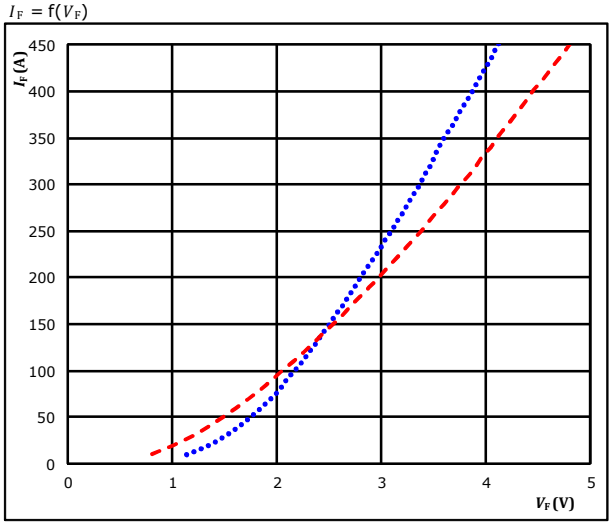
R (K/W)	τ (s)
2,15E-02	4,78E+00
3,49E-02	1,11E+00
6,06E-02	1,81E-01
5,94E-02	3,74E-02
7,73E-03	3,83E-03
7,92E-03	3,88E-04

Brake FWD Charateristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

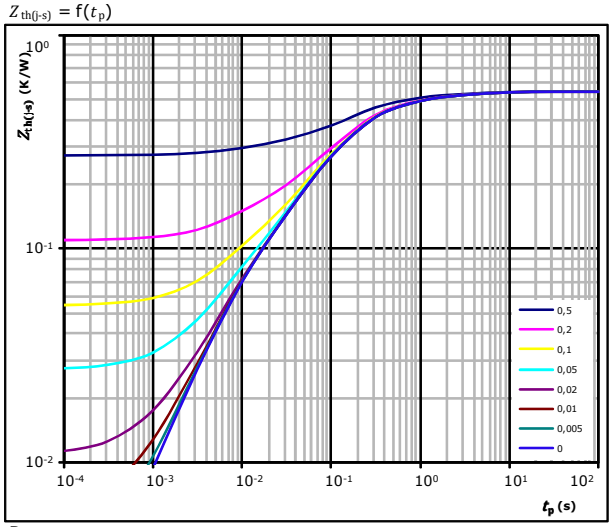
T_j: 25 °C

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

$R_{th(j-s)}$ = 0,54 K/W

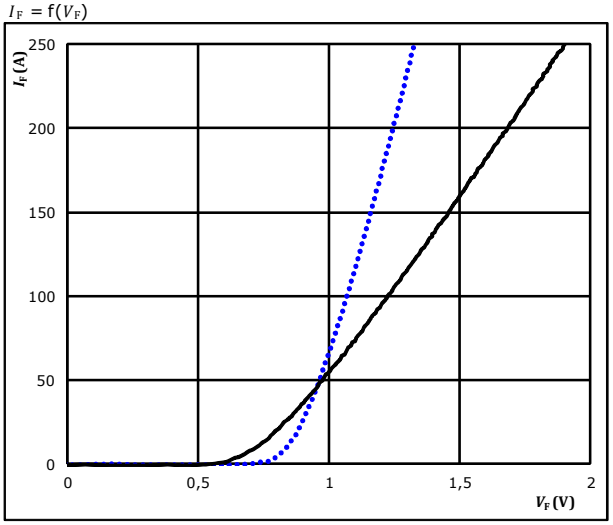
FWD thermal model values

R (K/W)	τ (s)
2,64E-02	5,18E+00
6,98E-02	1,11E+00
1,90E-01	2,33E-01
2,02E-01	8,34E-02
5,60E-02	8,82E-03

Rectifier Diode Charateristics

Typical forward characteristics **Rectifier Diode**

$I_F = f(V_F)$

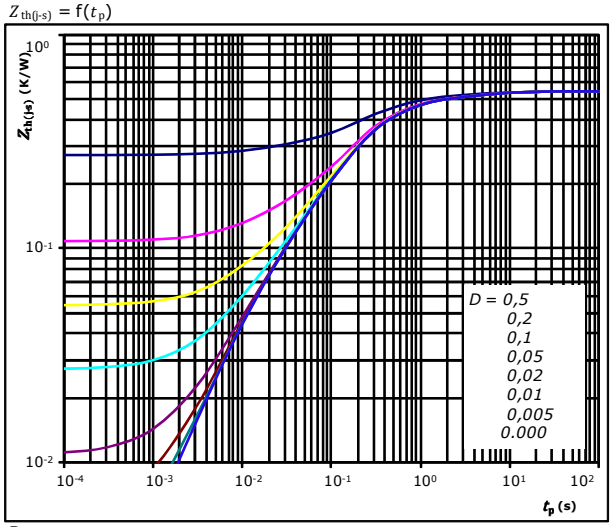


t_p = 250 µs — 25 °C

T_j: 125 °C

Transient thermal impedance as a function of pulse width **Rectifier Diode**

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



D = t_p / T

$R_{th(j-s)}$ = 0,54 K/W

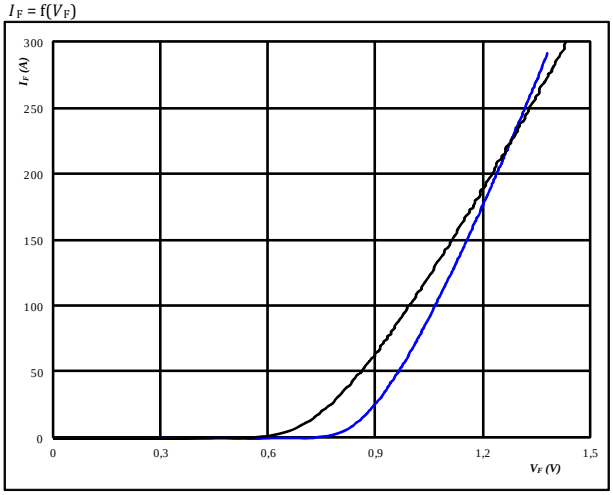
Diode thermal model values

R (K/W)	τ (s)
5,6020E-02	5,1610E+00
1,7740E-01	5,4320E-01
2,6540E-01	1,4390E-01
4,2870E-02	1,3360E-02

Rectifier Thyristor Charateristics

Typical forward characteristics — Thyristor

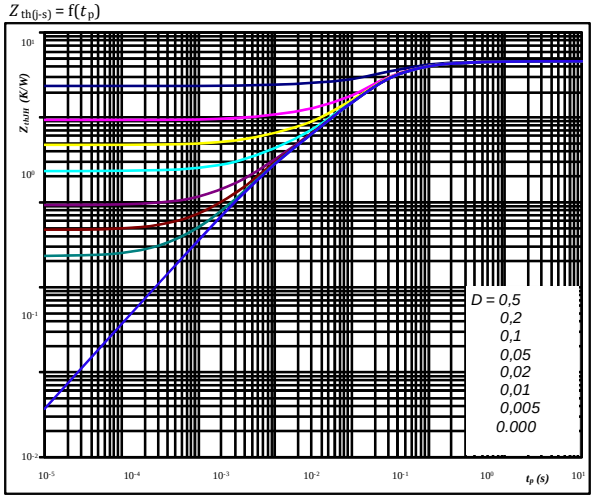
$I_F = f(V_F)$



t_p =	250	µs
T_j=	25, 125	°C

Transient thermal impedance as a function of pulse width — Thyristor

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

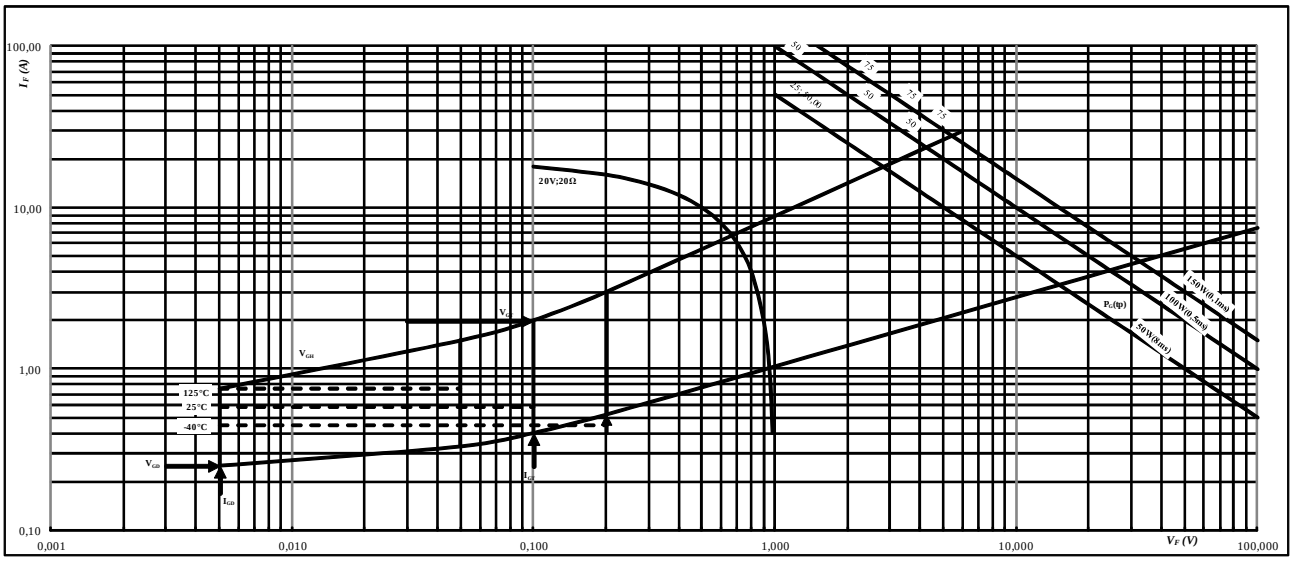


D =	t_p / T	
$R_{th(j-s)}$ =	0,47	K/W

FWD thermal model values

R (K/W)	Tau (s)
2,20E-02	7,32E+00
1,02E-01	9,91E-01
3,04E-01	2,25E-01
2,14E-02	1,04E-01
1,91E-02	9,42E-03

Gate trigger characteristics — Thyristor

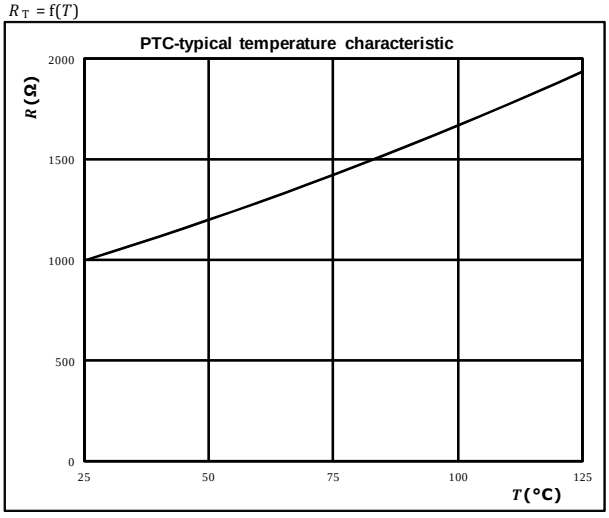


Thermistor Charateristics

Thermistor typical temperature characteristic

Typical PTC characteristic
as a function of temperature

$R_T = f(T)$

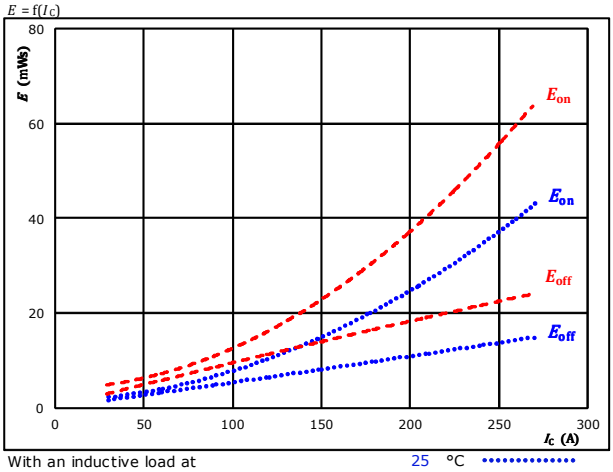


Brake Switching Charateristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



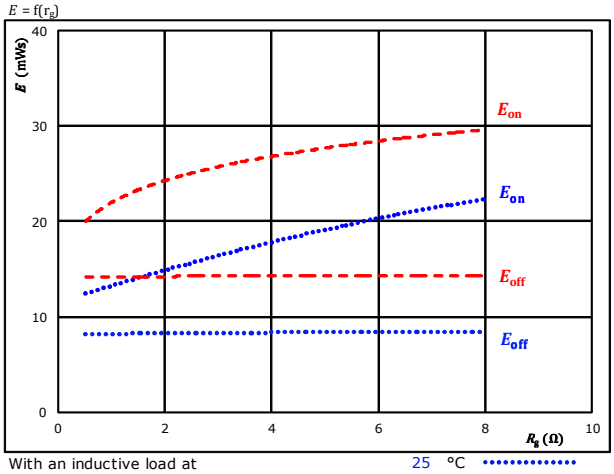
With an inductive load at

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

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



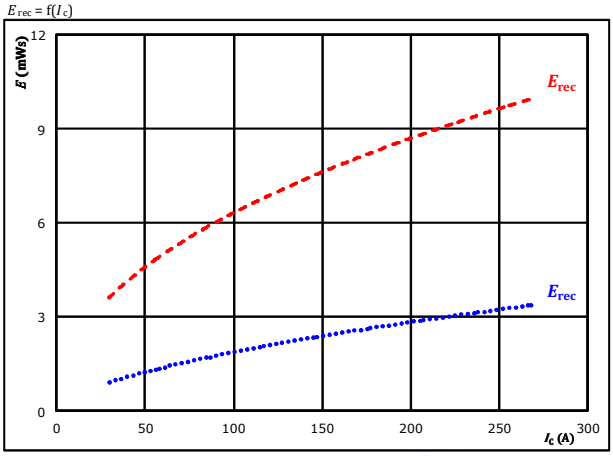
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		150 °C	
I_C =	151	A			

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



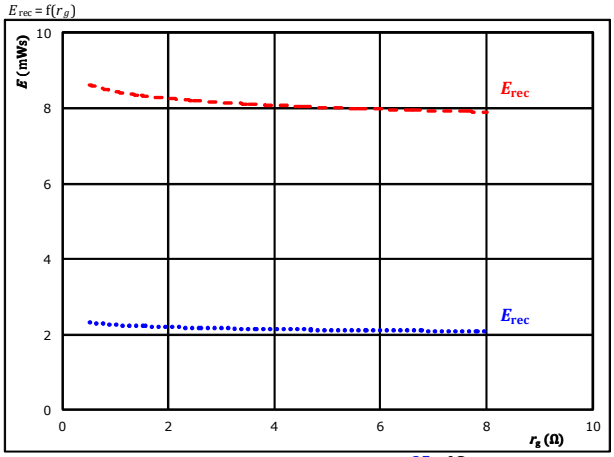
With an inductive load at

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

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

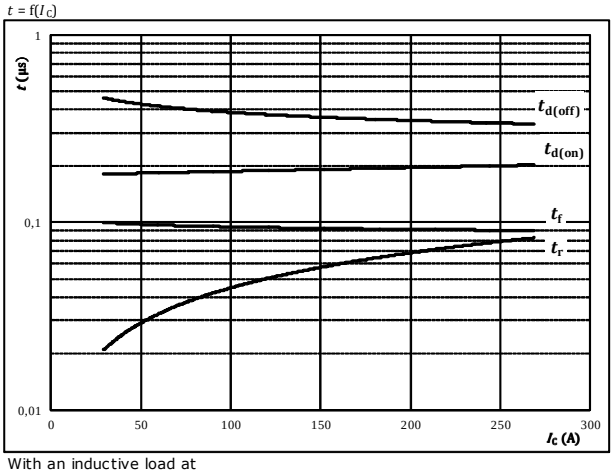
V_{CE} =	600	V	T_J:	25 °C	
V_{GE} =	±15	V		150 °C	
I_C =	151	A			

Brake Switching Charateristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



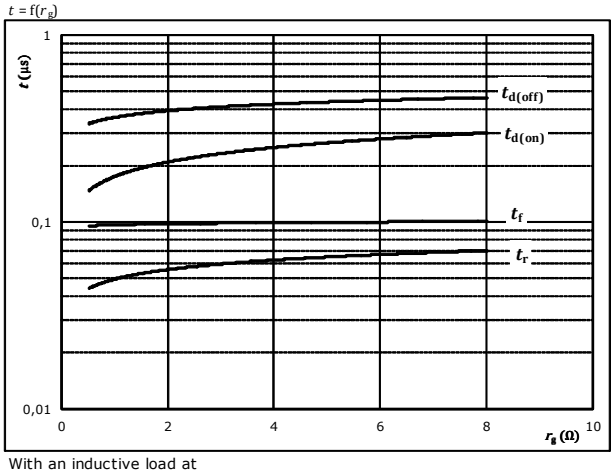
With an inductive load at

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

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



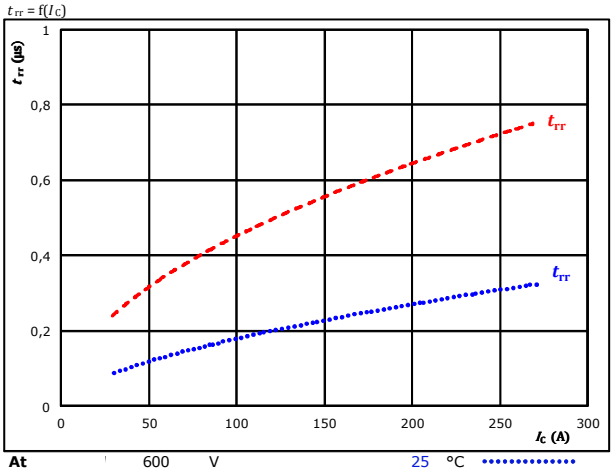
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	151	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

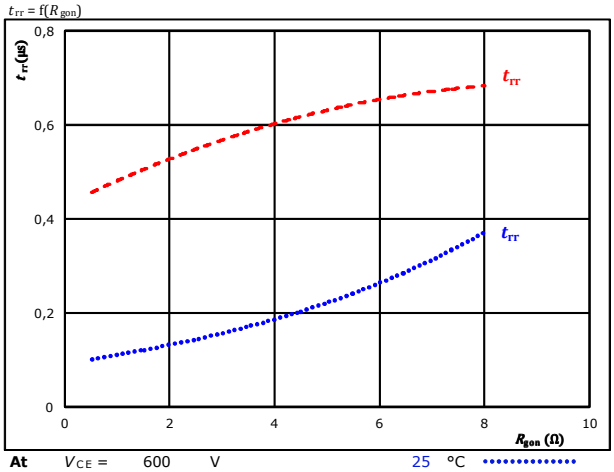


At		600	V		25 °C
	V_{GE} =	±15	V	T_j:	150 °C
	R_{gon} =	2	Ω		

Figure 8. **FWD**

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

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



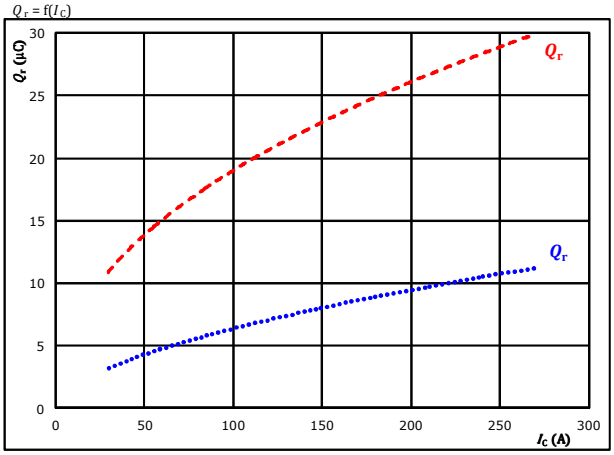
At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	150 °C
	I_C =	151	A		

Brake Switching Charateristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

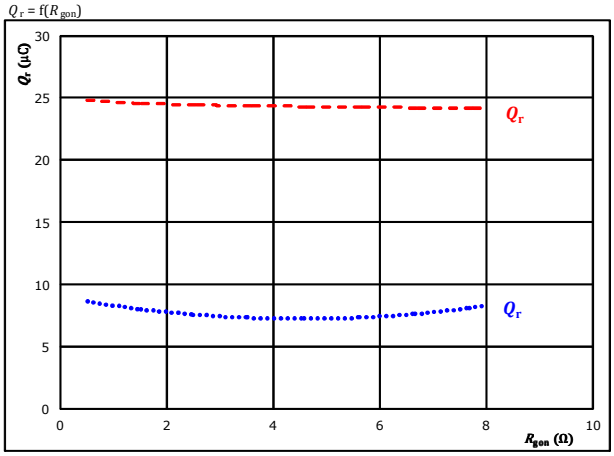


At						
	V_{GE} =	600	V		25 °C	
	R_{gon} =	±15	V	T_j:	150 °C	
		2	Ω			

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

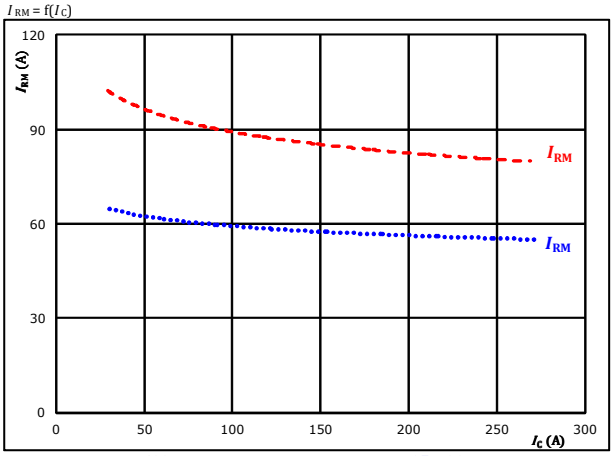


At						
	V_{GE} =	600	V		25 °C	
	I_C =	±15	V	T_j:	150 °C	
		151	A			

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

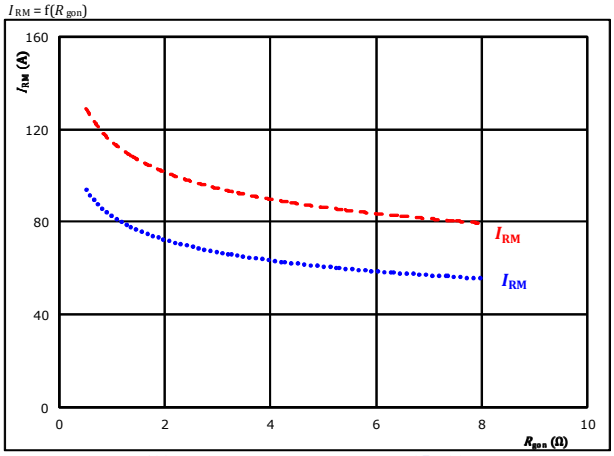


At						
	V_{GE} =	600	V		25 °C	
	R_{gon} =	±15	V	T_j:	150 °C	
		2	Ω			

Figure 12. **FWD**

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

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



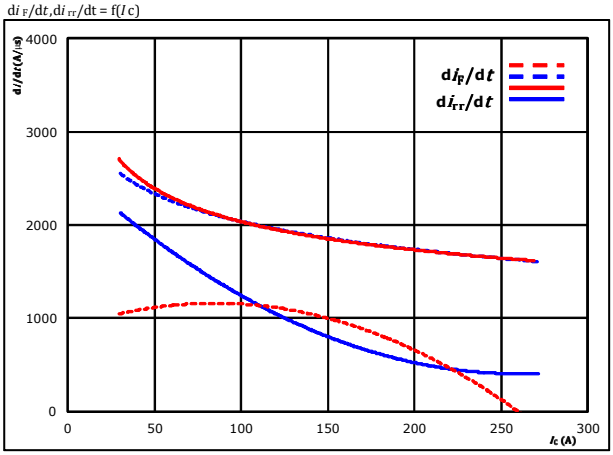
At						
	V_{GE} =	600	V		25 °C	
	I_C =	±15	V	T_j:	150 °C	
		151	A			

Brake Switching Charateristics

Figure 13. **FWD**

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

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

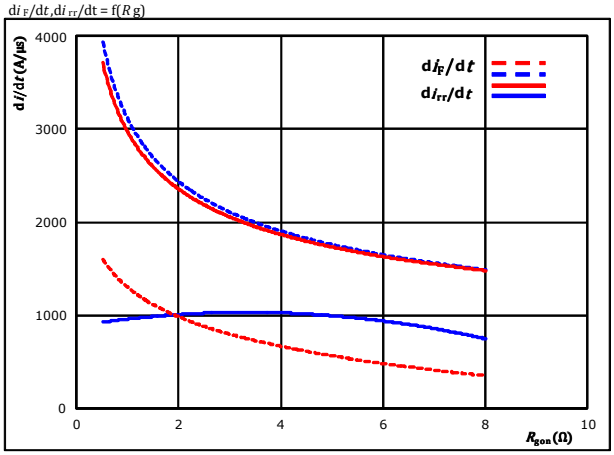


At					
	600	V		25	°C
V_{GE} =	±15	V	T_j:	150	°C
R_{gon} =	2	Ω			

Figure 14. **FWD**

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

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

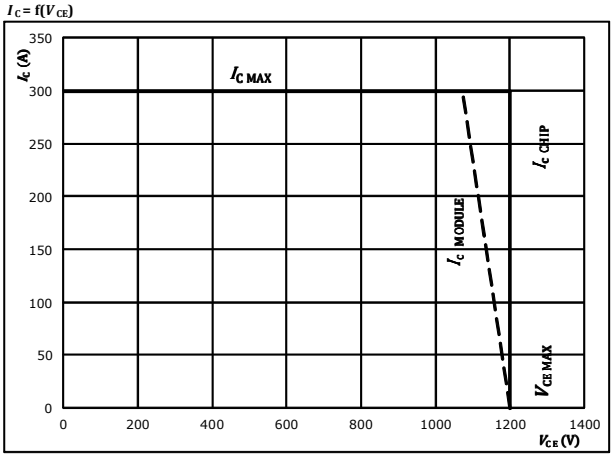


At					
	600	V		25	°C
V_{GE} =	±15	V		150	°C
I_C=	151	A			

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

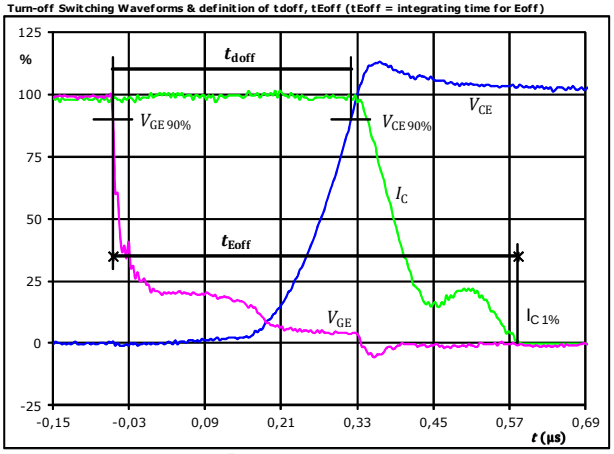
Brake Switching Charaterisitcs

General conditions

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

Figure 1. IGBT

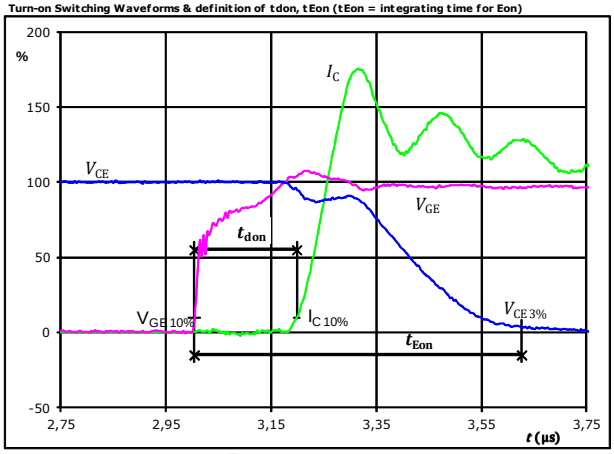
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	151	A
t_{doff} =	0,375	µs
t_{Eoff} =	0,638	µs

Figure 2. IGBT

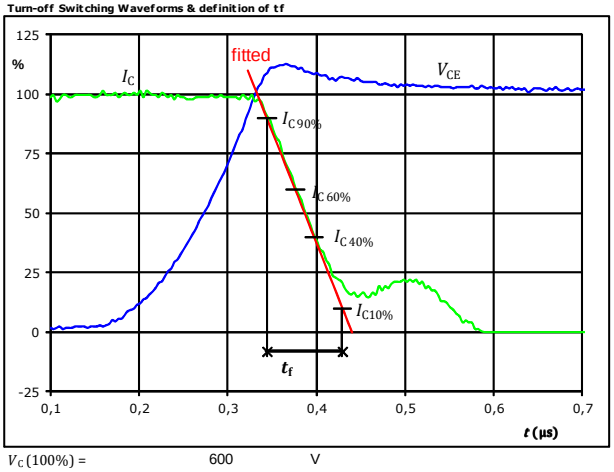
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	151	A
t_{don} =	0,194	µs
t_{Eon} =	0,623	µs

Figure 3. IGBT

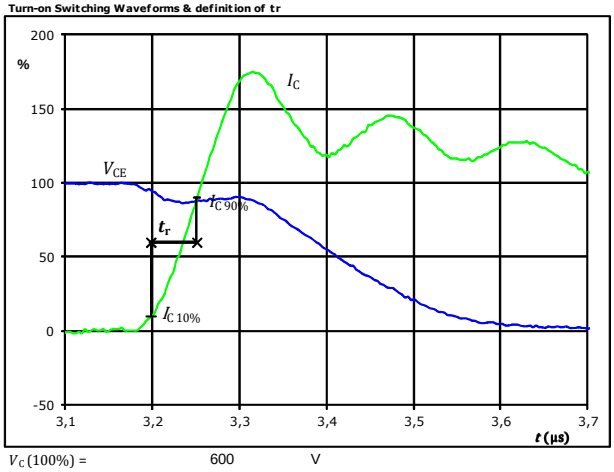
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	151	A
t_f =	0,085	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

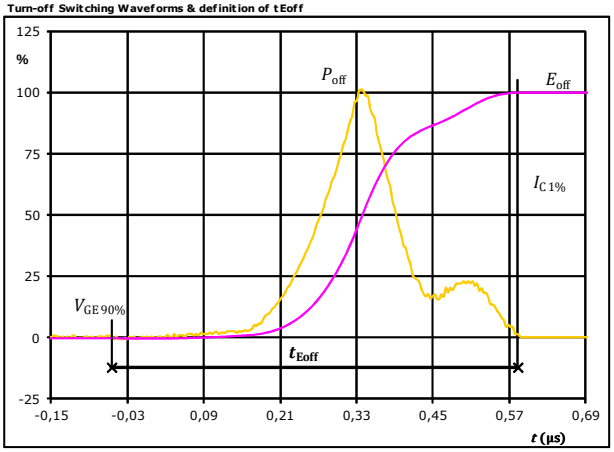


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	151	A
t_r =	0,053	µs

Brake Switching Charaterisitcs

Figure 5. **IGBT**

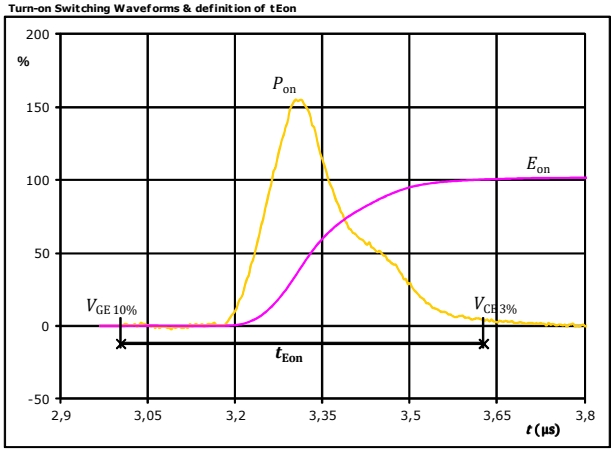
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	90,54	kW
$E_{off}(100\%)$ =	13,82	mJ
t_{Eoff} =	0,638	µs

Figure 6. **IGBT**

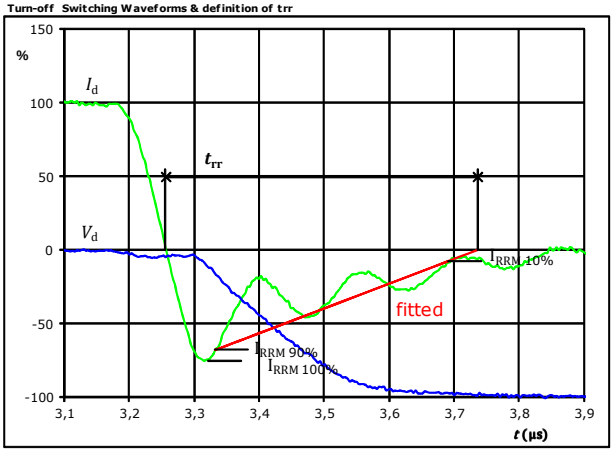
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	90,54	kW
$E_{on}(100\%)$ =	23,22	mJ
t_{Eon} =	0,623	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

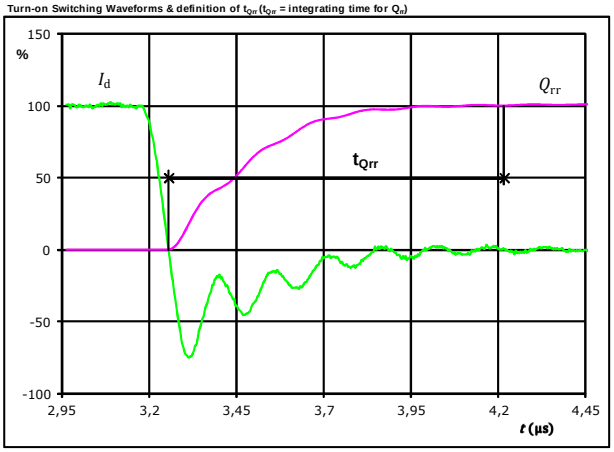


$V_d(100\%)$ =	600	V
$I_d(100\%)$ =	151	A
$I_{RRM}(100\%)$ =	-115	A
t_{rr} =	0,480	µs

Brake Switching Charaterisitcs

Figure 8. **FWD**

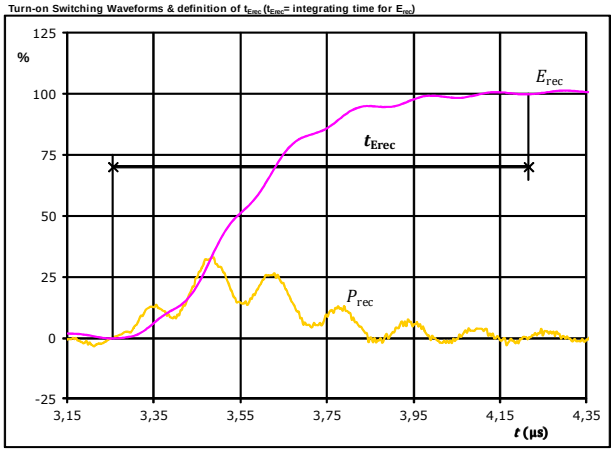
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	151	A
Q_{rr} (100%) =	24,43	µC

Figure 9. **FWD**

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

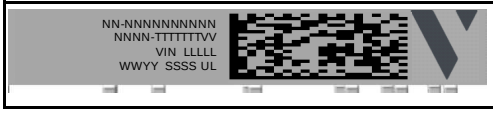


P_{rec} (100%) =	90,54	kW
E_{rec} (100%) =	8,10	mJ

Vincotech

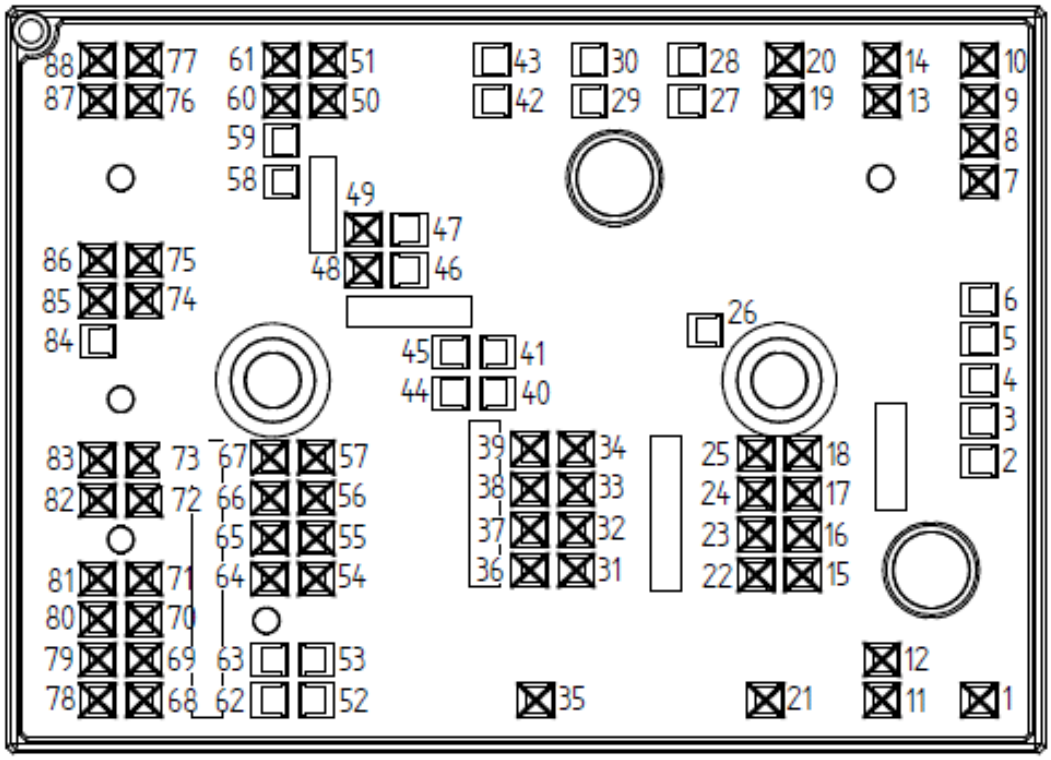
Ordering Code & Marking

Version	Ordering Code
with std lid (black V23990-K32-T-2-PM)	80-M3126BA140SC02-K489G40-/0A/-PM

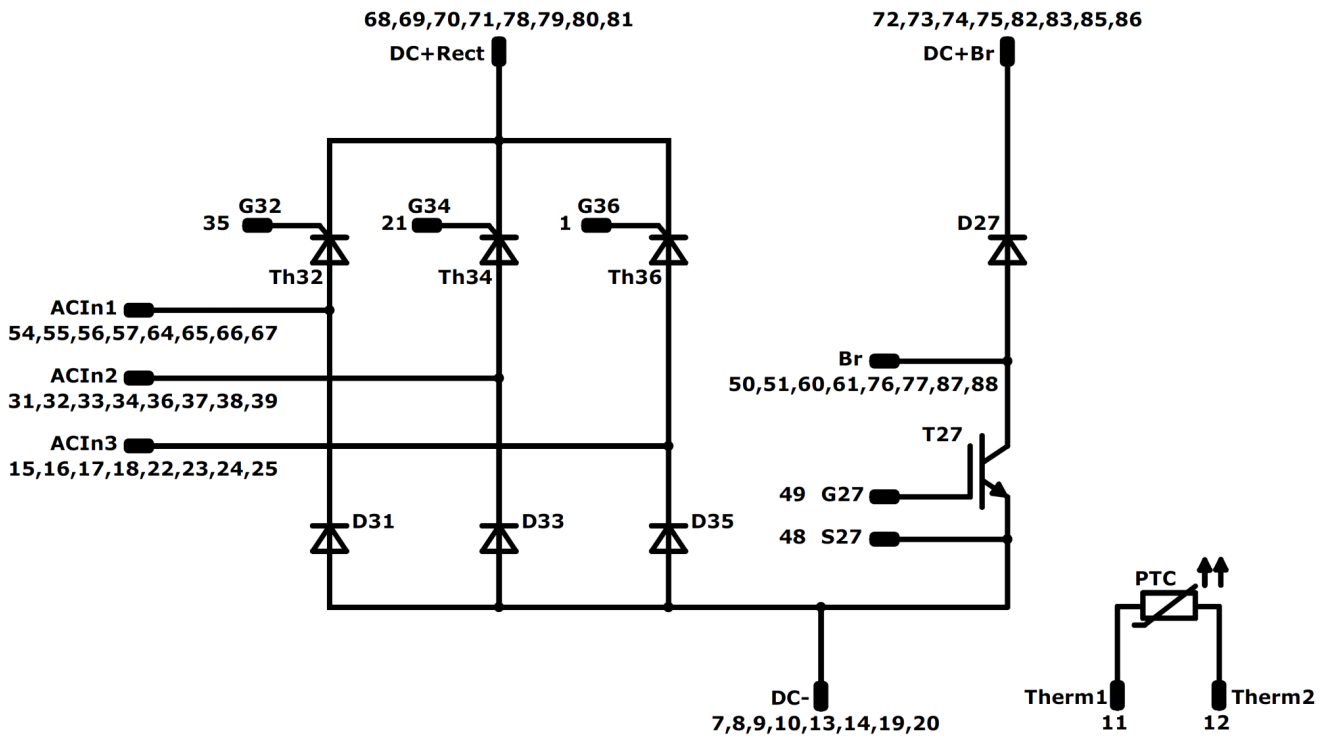


Text	**Name**		**Type&Ver**	**Date code**	**VIN & Lot**	**Serial&UL**
	NN-NNNNNNNNNNNNN		TTTTTTTVV	WWYY	VIN LLLLL	SSSS UL
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31, D33, D35	Diode	1600 V	140 A	Rectifier Diode	
T27	IGBT	1200 V	140 A	Brake Switch	
D27	Diode	1200 V	150 A	Brake Diode	
Th32, Th34, Th36	Thyristor	1600 V	125 A	Rectifier Thyristor	
PTC	PTC			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.

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-M3126BA140SC02-K489G40-D1-14	12 Apr. 2016		