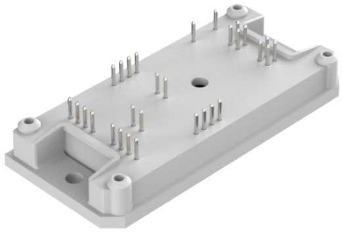
10-FY07NBA150S5-M506L98
datasheet

flow BOOST 1 symmetric	650 V / 150 A

Features

- High efficient and compact symmetric booster
- High switching frequency and low inductive design
- Low losses with TRENCHSTOP™ 5 IGBT
- Integrated temperature sensor

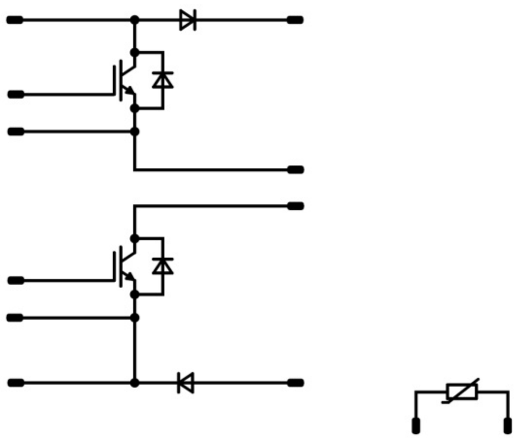
***flow* 1 12mm housing**



Target applications

- Solar Inverters

Schematic



Types

- 10-FY07NBA150S5-M506L98

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	104	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	145	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	101	A
Repetitive peak forward current	I_{FRM}			300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	127	W
Maximum Junction Temperature	T_{jmax}			175	°C
Boost Sw. Protection Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Repetitive peak forward current	I_{FRM}			60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	53	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
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				8,44	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	
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0015	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,43 1,52 1,55	1,75	V
Collector-emitter cut-off current	I_{CES}		0	650		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		9000		pF
Output capacitance	C_{oes}							260		
Reverse transfer capacitance	C_{res}							34		
Gate charge	Q_g		15	520	150	25		328		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,65		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	15/0	350	90	25 125 150		32 30 30		ns
Rise time	t_r					25 125 150		12 14 14		
Turn-off delay time	$t_{d(off)}$					25 125 150		154 179 185		
Fall time	t_f					25 125 150		14 21 29		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 3,7 µC Q_{rFWD} = 7,1 µC Q_{rFWD} = 8,1 µC				25 125 150		0,630 1,003 1,088		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,053 1,604 1,782		

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
Boost Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,56 1,50 1,48	1,92	V
Reverse leakage current	I_r			650		25			7,6	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,75		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 7886 A/µs di/dt = 6335 A/µs di/dt = 6414 A/µs	15/0	350	90	25 125 150		111 150 160		A
Reverse recovery time	t_{rr}					25 125 150		50 80 89		ns
Recovered charge	Q_r					25 125 150		3,730 7,100 8,077		µC
Reverse recovered energy	E_{rec}					25 125 150		0,950 1,844 2,103		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2916 2211 2185		A/µs
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				30	25 150		1,64 1,56	1,87	V
Reverse leakage current	I_r			650		25			0,36	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,80		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	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

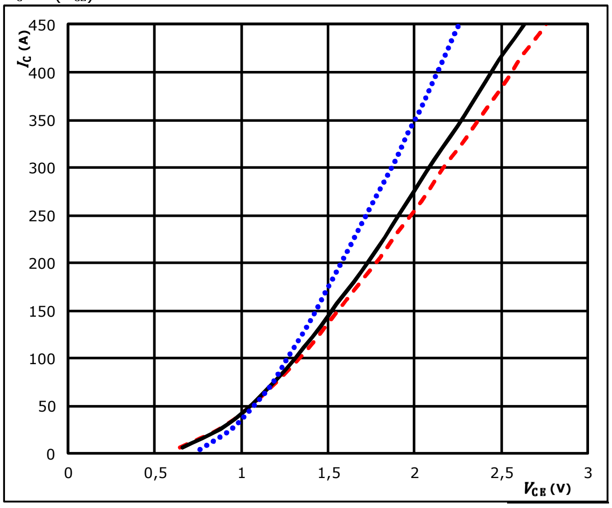
Vincotech

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

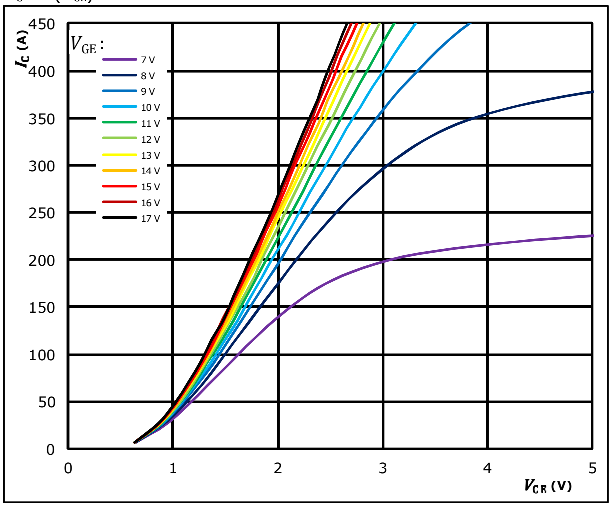


t_p =	250	μs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

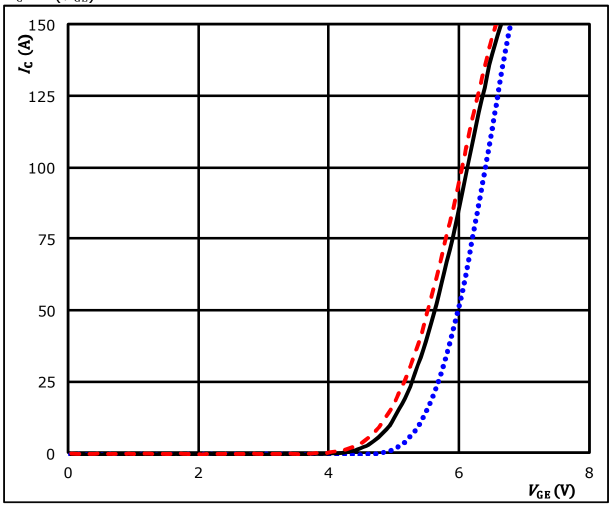


t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

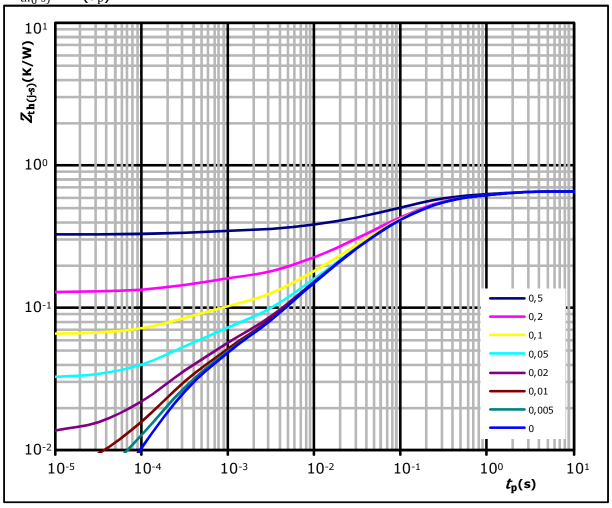


t_p =	100	μs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,65 K/W

IGBT thermal model values

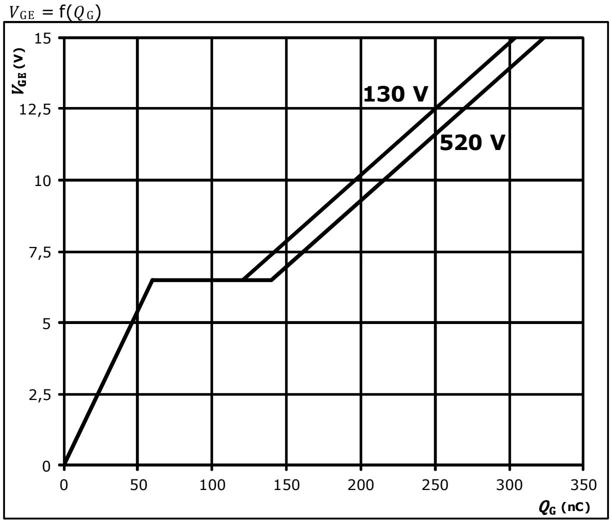
R (K/W)	τ (s)
1,13E-01	8,46E-01
2,91E-01	1,23E-01
1,38E-01	3,33E-02
6,68E-02	8,32E-03
1,32E-02	2,63E-03
3,21E-02	3,23E-04

Boost Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

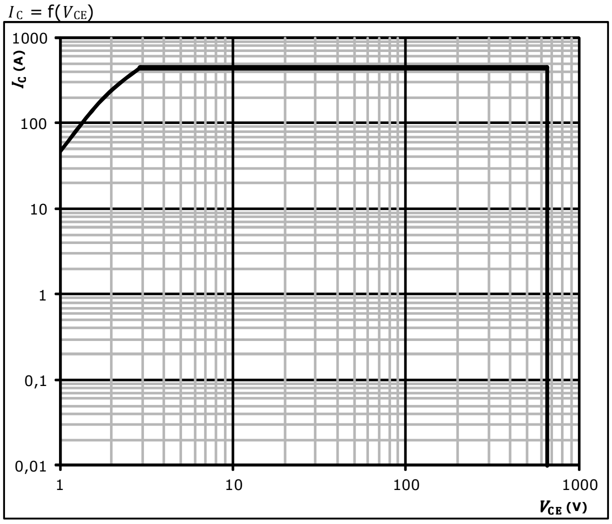


I_C= 150 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



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

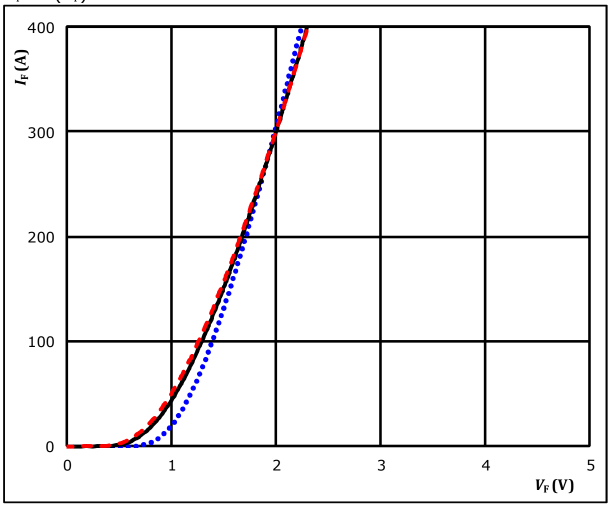
Vincotech

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

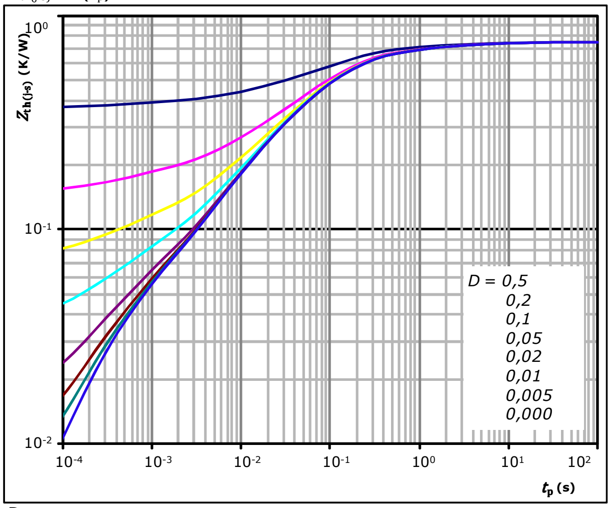


t_p =	250	μs		25	°C
			T_j:	125	°C
				150	°C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

FWD thermal model values

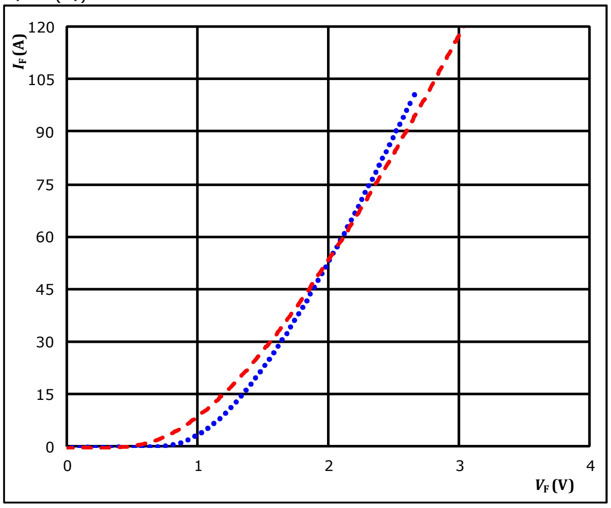
R (K/W)	τ (s)
2,8760E-02	7,4550E+00
7,0150E-02	1,2730E+00
1,9490E-01	2,0350E-01
2,6490E-01	6,3300E-02
1,2130E-01	1,2650E-02
3,3930E-02	3,0470E-03

Boost Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



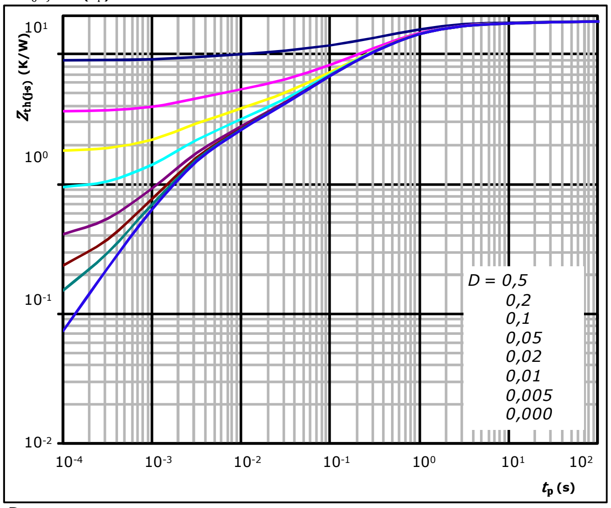
t_p = 250 µs

T_j: 25 °C (dotted) / 150 °C (dashed)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,80 K/W

FWD thermal model values

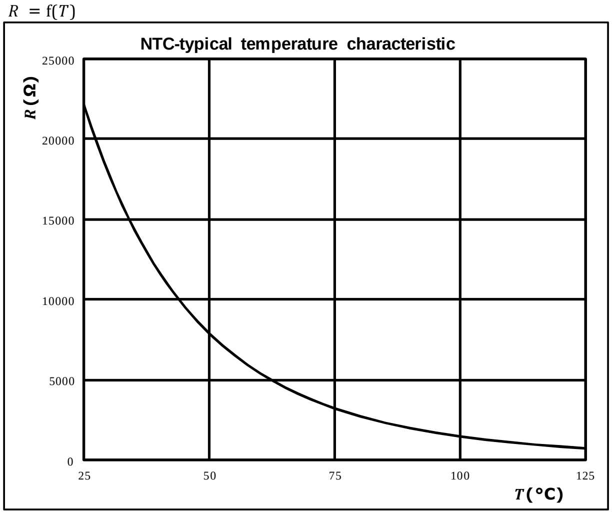
R (K/W)	τ (s)
5,88E-02	5,09E+00
1,26E-01	6,40E-01
5,91E-01	8,94E-02
5,13E-01	2,64E-02
2,57E-01	6,46E-03
1,01E-01	1,53E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

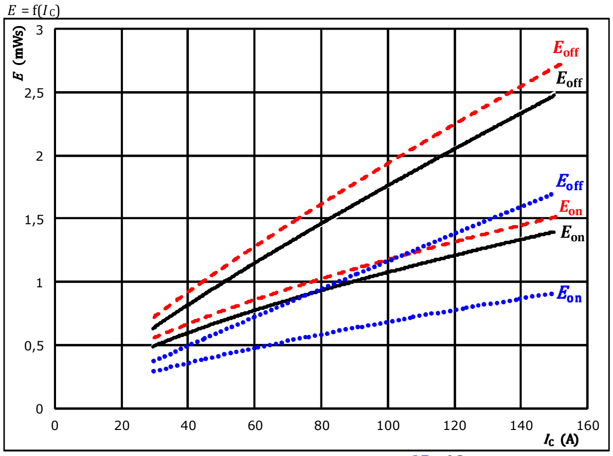


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



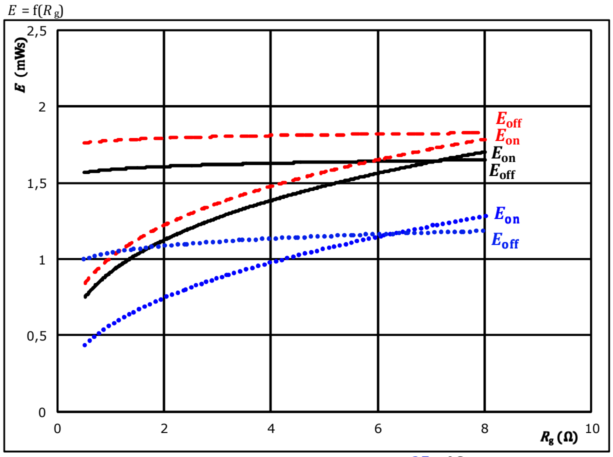
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed
R_{goff} =	2	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



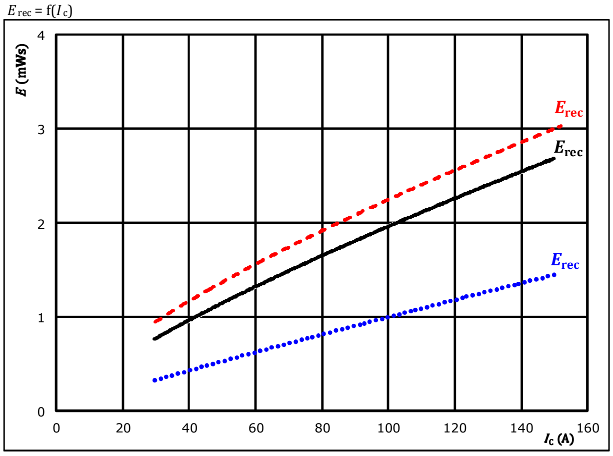
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	90	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



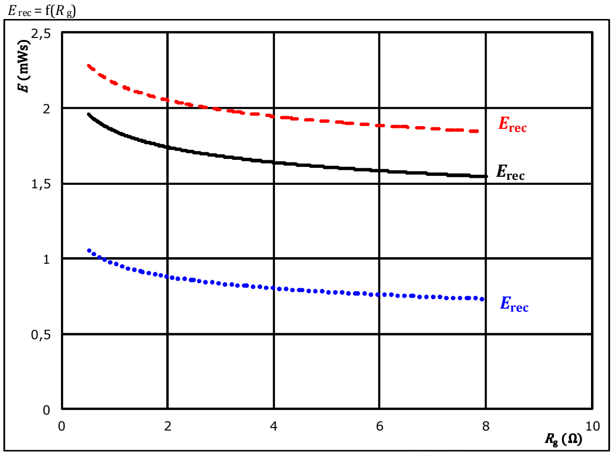
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

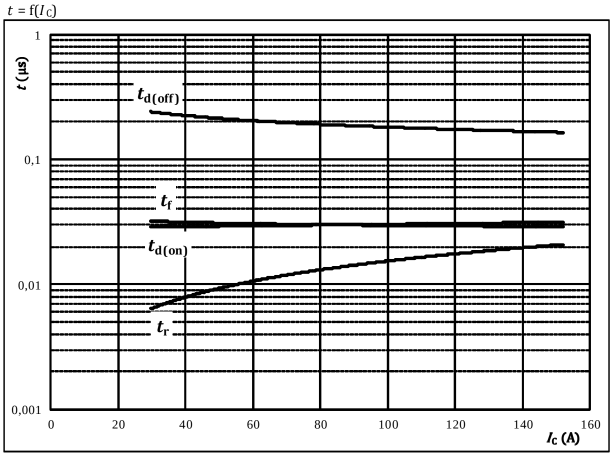
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	90	A		150 °C	dashed

Boost Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



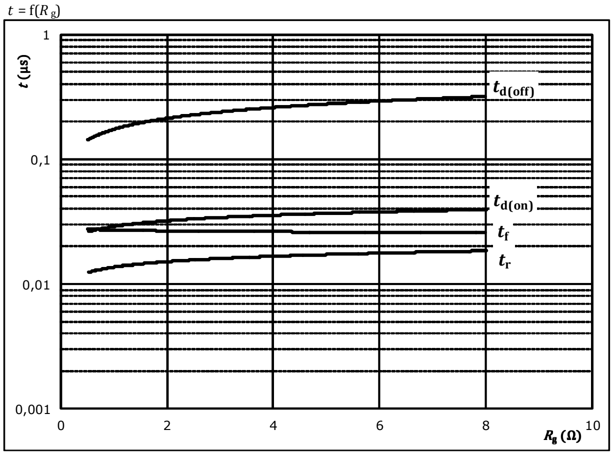
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	15/0	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



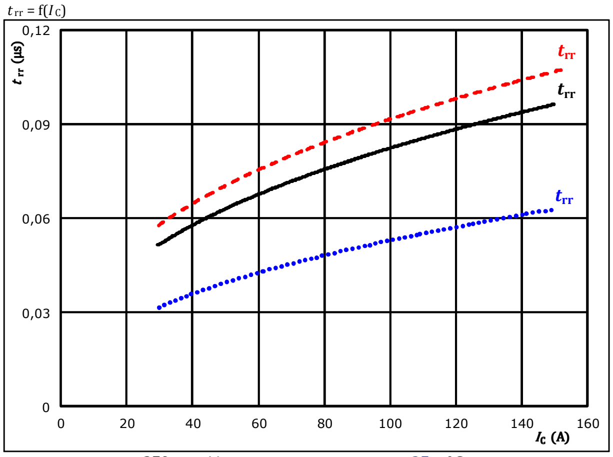
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	15/0	V
I_C =	90	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

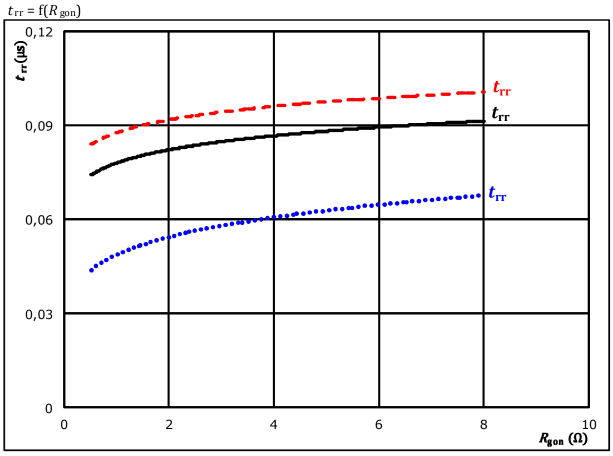


At					
V_{CE} =	350	V		25	°C
V_{GE} =	15/0	V	T_j:	125	°C
R_{gon} =	2	Ω		150	°C

figure 8. **FWD**

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

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



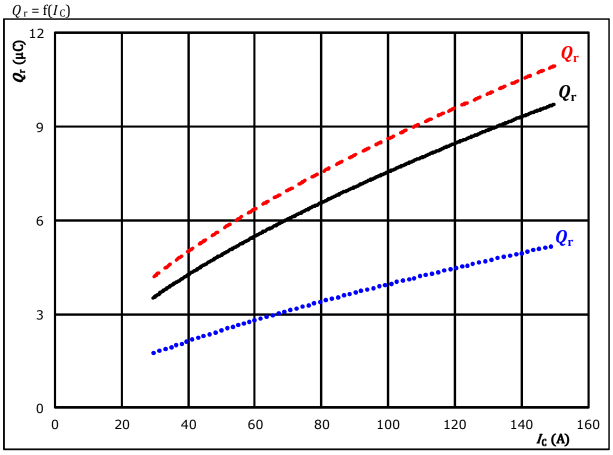
At					
V_{CE} =	350	V		25	°C
V_{GE} =	15/0	V	T_j:	125	°C
I_C =	90	A		150	°C

Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

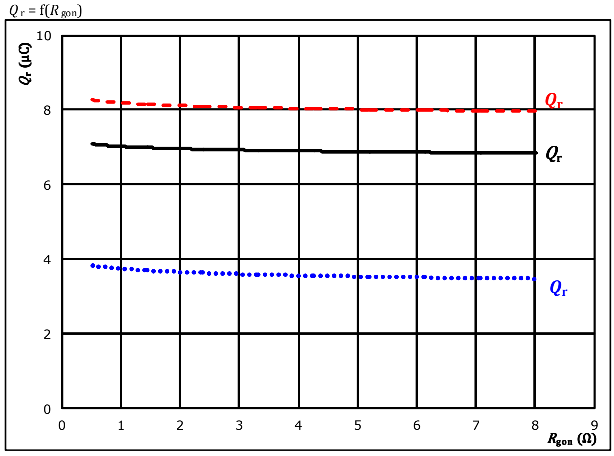


At	V_{CE} =	350	V	T_j:	25 °C	dotted
	V_{GE} =	15/0	V		125 °C	solid
	R_{gon} =	2	Ω		150 °C	dashed

figure 10. FWD

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

$Q_r = f(R_{gon})$

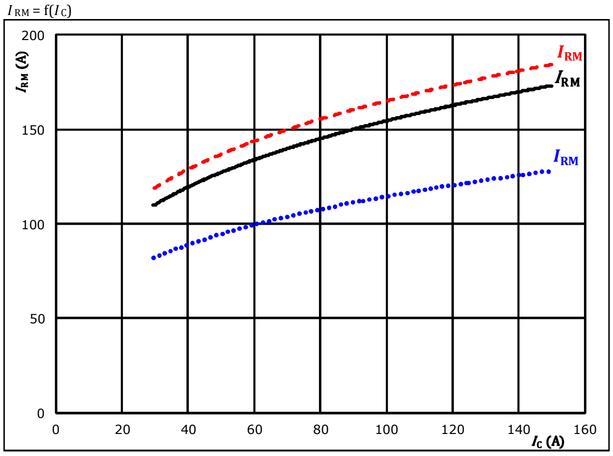


At	V_{CE}=	350	V	T_j:	25 °C	dotted
	V_{GE} =	15/0	V		125 °C	solid
	I_C=	90	A		150 °C	dashed

figure 11. FWD

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

$I_{RM} = f(I_C)$

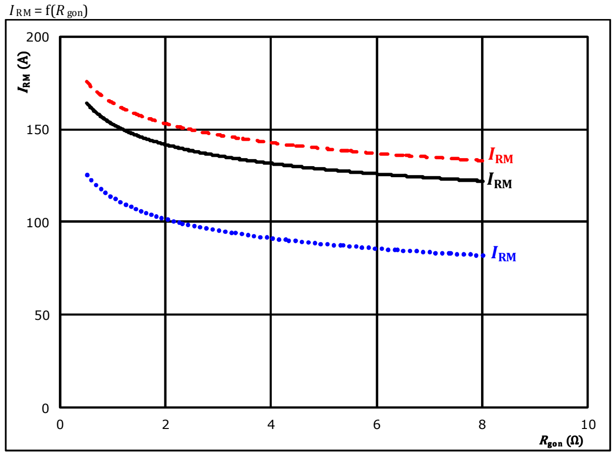


At	V_{CE}:	350	V	T_j:	25 °C	dotted
	V_{GE} =	15/0	V		125 °C	solid
	R_{gon} =	2	Ω		150 °C	dashed

figure 12. FWD

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

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



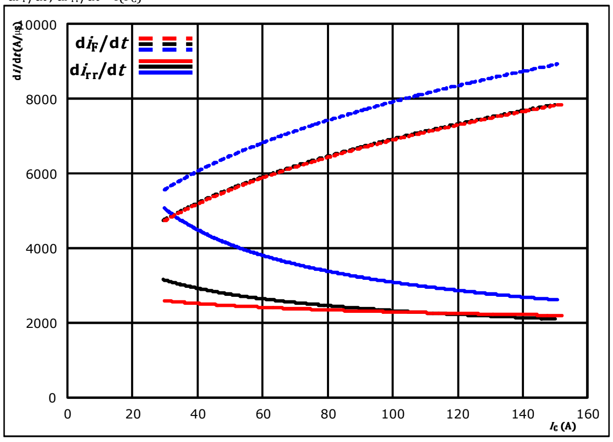
At	V_{CE} =	350	V	T_j:	25 °C	dotted
	V_{GE} =	15/0	V		125 °C	solid
	I_C =	90	A		150 °C	dashed

Boost 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)



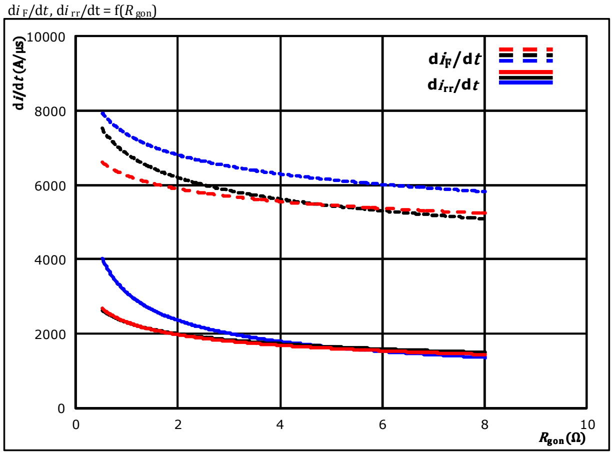
At

V_{CE} =	350	V	T_j:	25	°C	dotted
V_{GE} =	15/0	V		125	°C	solid
R_{gon} =	2	Ω		150	°C	dashed

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})



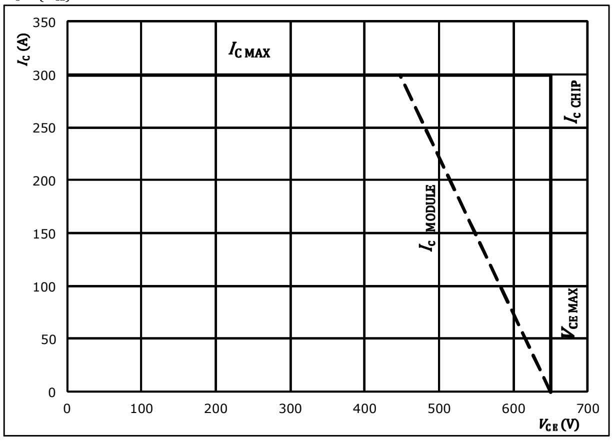
At

V_{CE} =	350	V	T_j:	25	°C	dotted
V_{GE} =	15/0	V		125	°C	solid
I_C =	90	A		150	°C	dashed

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

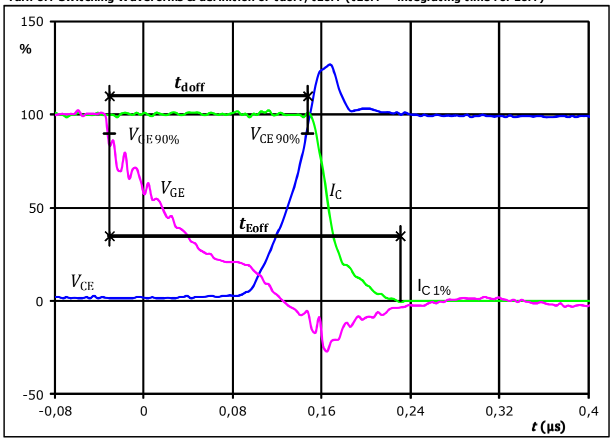
Boost Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. IGBT

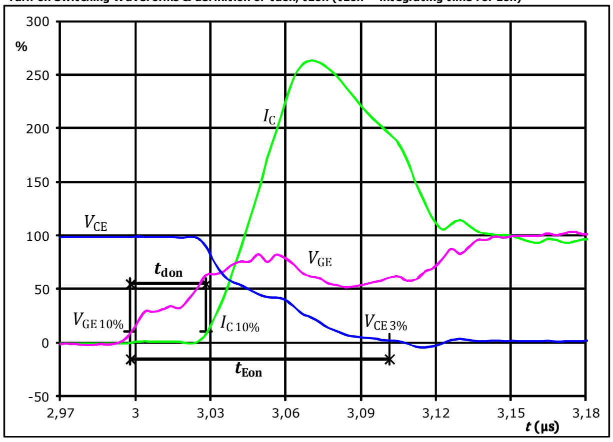
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	91	A
t_{doff} =	0,179	µs
t_{Eoff} =	0,262	µs

figure 2. IGBT

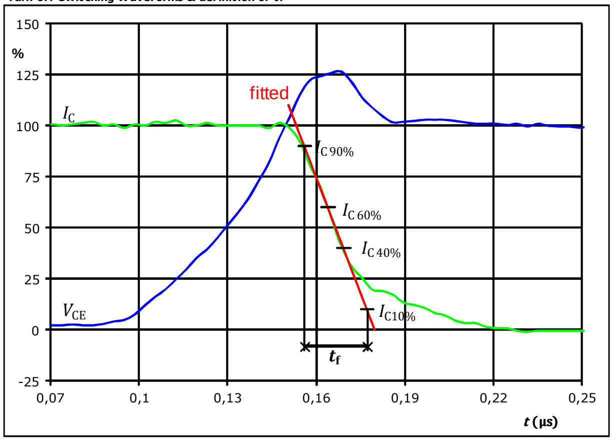
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	91	A
t_{don} =	0,030	µs
t_{Eon} =	0,103	µs

figure 3. IGBT

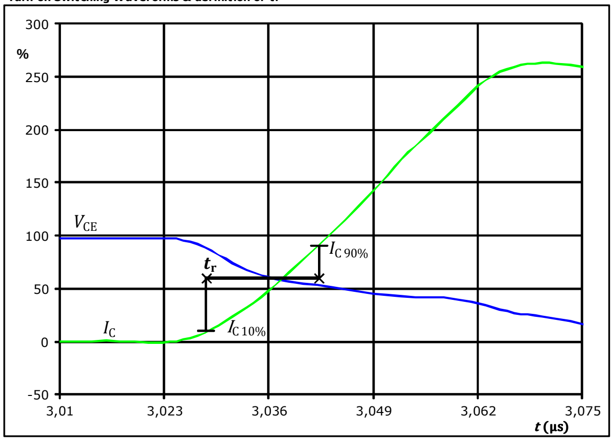
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	91	A
t_f =	0,021	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

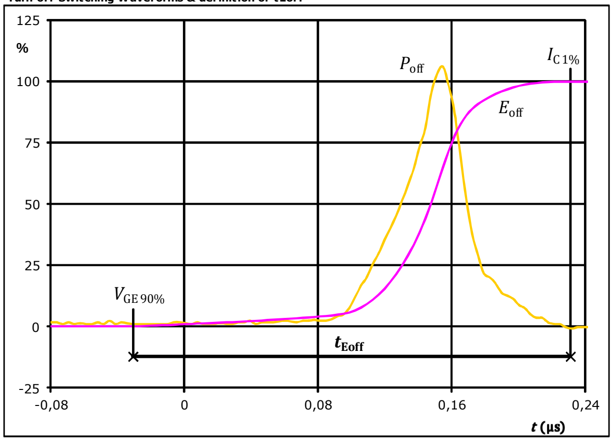


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	91	A
t_r =	0,014	µs

Boost Switching Characteristics

figure 5. **IGBT**

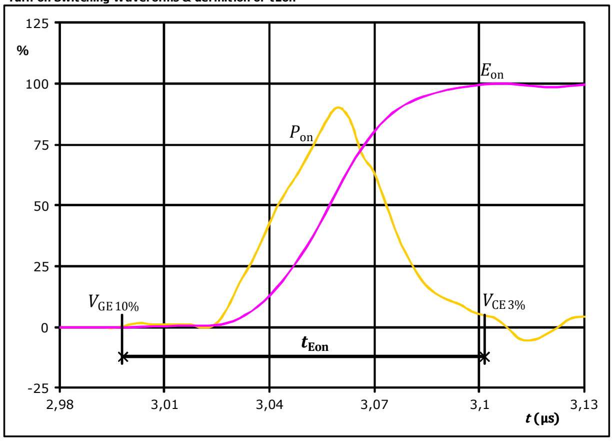
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	31,79	kW
E_{off} (100%) =	1,60	mJ
t_{Eoff} =	0,26	µs

figure 6. **IGBT**

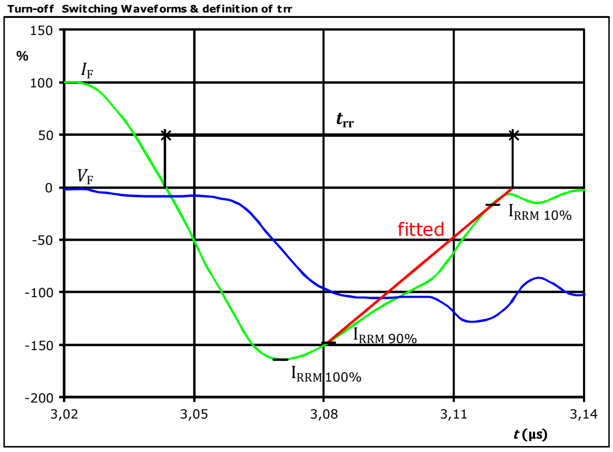
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	31,79	kW
E_{on} (100%) =	1,00	mJ
t_{Eon} =	0,10	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

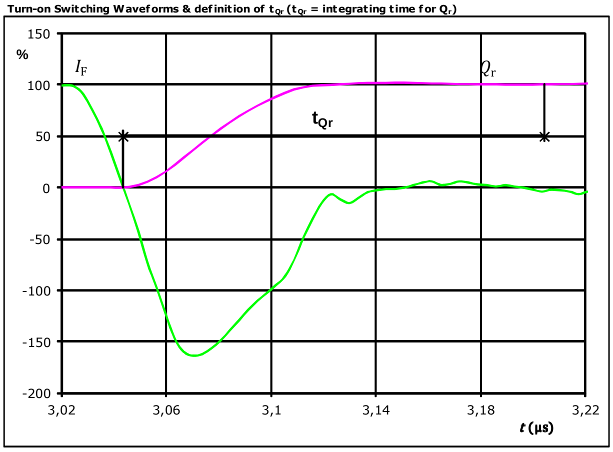


V_F (100%) =	350	V
I_F (100%) =	91	A
I_{RRM} (100%) =	-150	A
t_{rr} =	0,080	µs

Boost Switching Characteristics

figure 8.	FWD

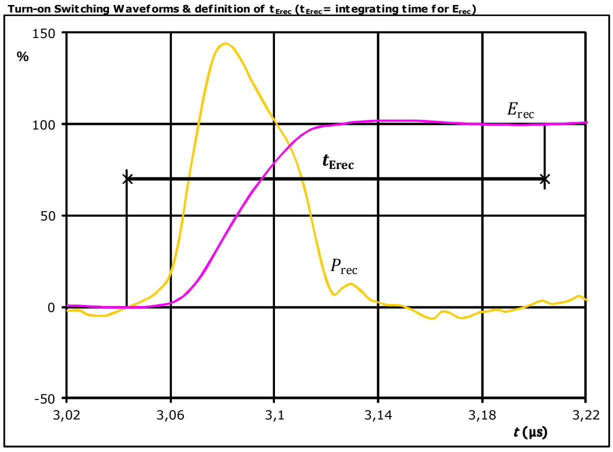
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	91	A
Q_r (100%) =	7,10	μC
t_{Qr} =	0,16	μs

figure 9.	FWD

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



P_{rec} (100%) =	31,79	kW
E_{rec} (100%) =	1,84	mJ
t_{Erec} =	0,16	μs

Vincotech

Ordering Code & Marking

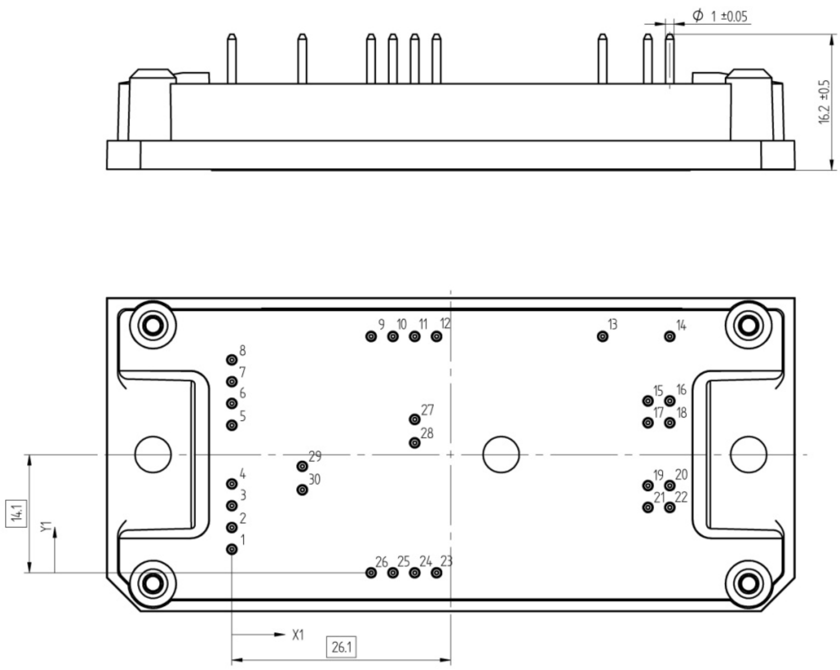
Version	Ordering Code
without thermal paste 12mm housing with solder pins	10-FY07NBA150S5-M506L98
with thermal paste 12mm housing with solder pins	10-FY07NBA150S5-M506L98-/3/

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

Outline

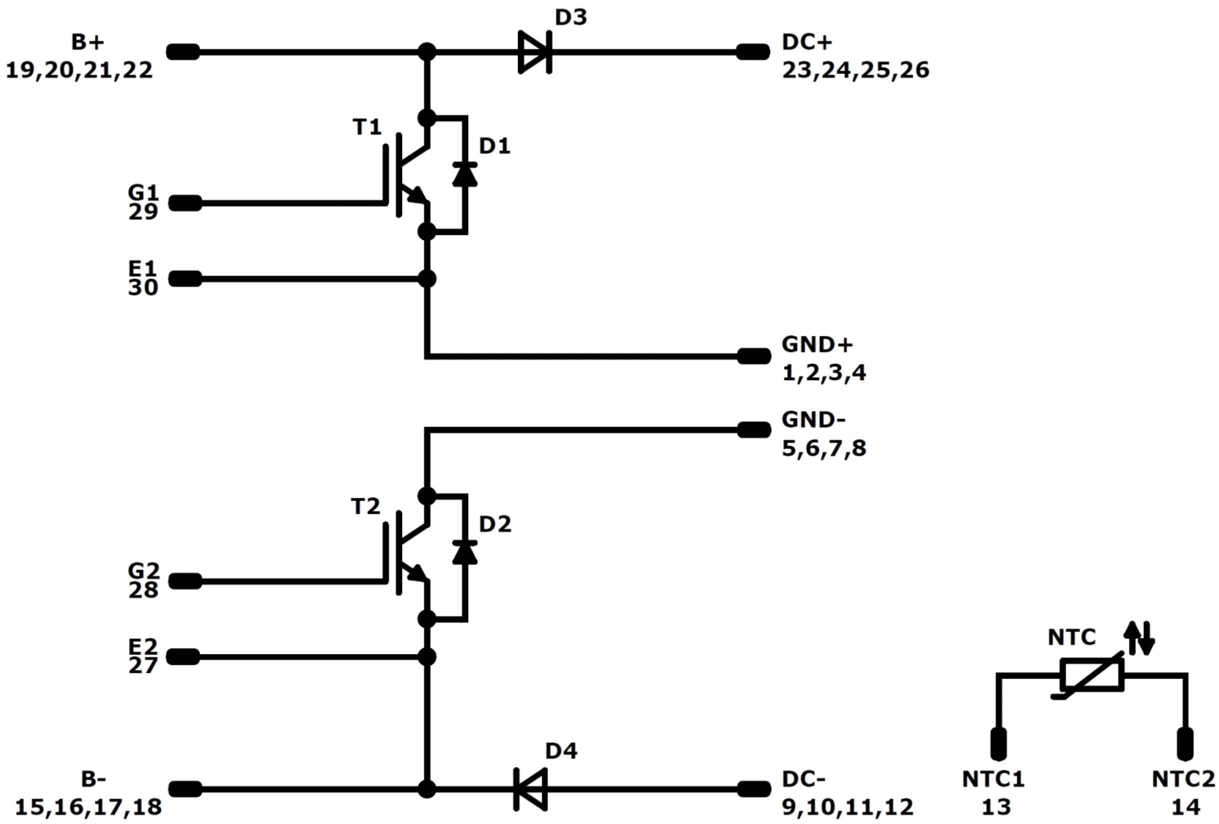
Pin table [mm]

Pin	X	Y	Function
1	0	2,8	GND+
2	0	5,4	GND+
3	0	8	GND+
4	0	10,6	GND+
5	0	17,6	GND-
6	0	20,2	GND-
7	0	22,8	GND-
8	0	25,4	GND-
9	16,6	28,2	DC-
10	19,2	28,2	DC-
11	21,8	28,2	DC-
12	24,4	28,2	DC-
13	44,2	28,2	NTC1
14	52,2	28,2	NTC2
15	49,6	20,5	B-
16	52,2	20,5	B-
17	49,6	17,9	B-
18	52,2	17,9	B-
19	49,6	10,4	B+
20	52,2	10,4	B+
21	49,6	7,8	B+
22	52,2	7,8	B+
23	24,4	0	DC+
24	21,8	0	DC+
25	19,2	0	DC+
26	16,6	0	DC+
27	21,8	18,3	E2
28	21,8	15,5	G2
29	8,4	12,7	G1
30	8,4	9,9	E1



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1 , T2	IGBT	650 V	150 A	Boost Switch	
D3 , D4	FWD	650 V	150 A	Boost Diode	
D1 , D2	FWD	650 V	30 A	Boost Sw. Protection Diode	
NTC	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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**
10-FY07NBA150S5-M506L98-D1-14	30 Jun. 2017		