Vincotech

10-FY07NBA100S5-M506L58
datasheet

flow BOOST1 symmetric — **650 V / 100 A**

Features

- High efficient and compact symmetric booster
- High switching frequency and low inductive design
- Low losses with TRENCHSTOP™ S5 IGBT
- Integrated temperature sensor

Target applications

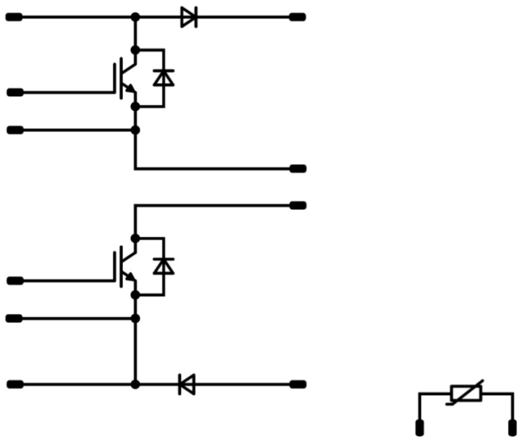
- Solar
- UPS
- Power Supply

Types

- 10-FY07NBA100S5-M506L58

flow 1 12 mm housing

Schematic



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	90	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	133	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	76	A
Repetitive peak forward current	I_{FRM}			200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	106	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	21	A
Repetitive peak forward current	I_{FRM}			30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	40	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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,001	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125 150		1,39 1,48 1,51	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		6200		pF
Output capacitance	C_{oes}							176		
Reverse transfer capacitance	C_{res}							24		
Gate charge	Q_{g}		15	520	100	25		240		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,72		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	15/0	400	102	25 125 150		30 30 30		ns
Rise time	t_{r}					25 125 150		10 11 11		
Turn-off delay time	$t_{d(off)}$					25 125 150		125 142 148		
Fall time	t_{f}					25 125 150		11 20 28		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 3,6 µC Q_{rFWD} = 6,7 µC Q_{rFWD} = 7,5 µC				25 125 150		1,139 1,538 1,568		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,855 1,410 1,564		

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				100	25 125 150		1,61 1,58 1,57	1,77	V
Reverse leakage current	I_r			650		25			5,3	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,90		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 9576 A/µs di/dt = 8438 A/µs di/dt = 7468 A/µs	15/0	400	102	25 125 150		124 161 168		A
Reverse recovery time	t_{rr}					25 125 150		46 72 81		ns
Recovered charge	Q_r					25 125 150		3,622 6,746 7,455		µC
Reverse recovered energy	E_{rec}					25 125 150		0,943 1,903 2,125		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2891 3415 3241		A/µs
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				15	25 125		1,79 1,67	1,87	V
Reverse leakage current	I_r			650		25			0,18	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,36		K/W

Characteristic Values

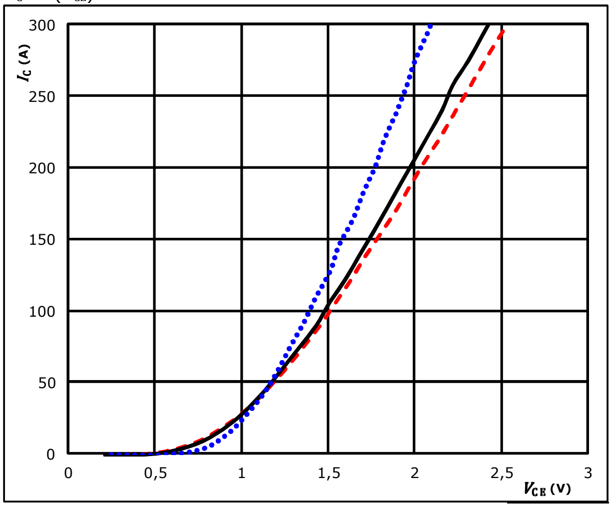
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
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	

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

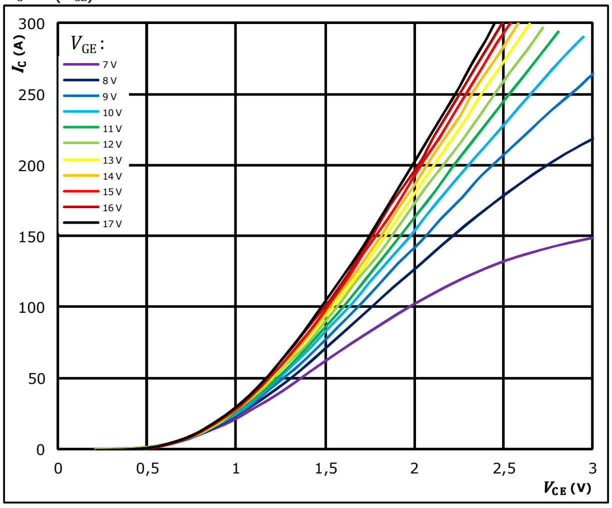


t_p =	250	µs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

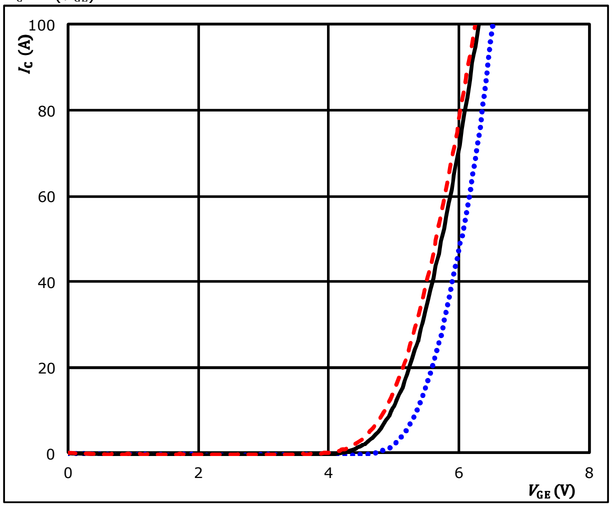
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

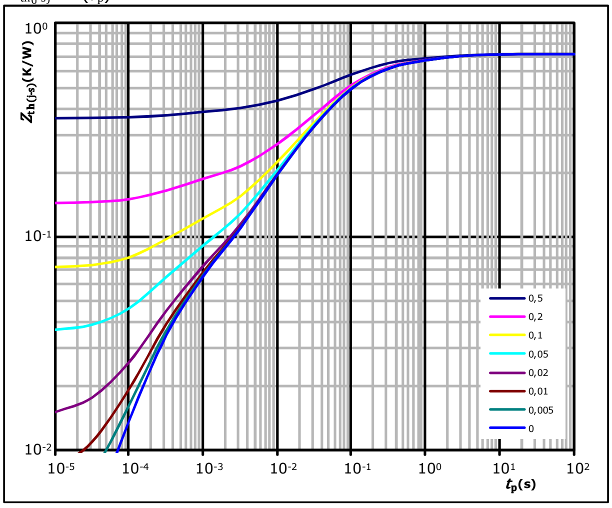


t_p =	100	µs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,72 K/W

IGBT thermal model values

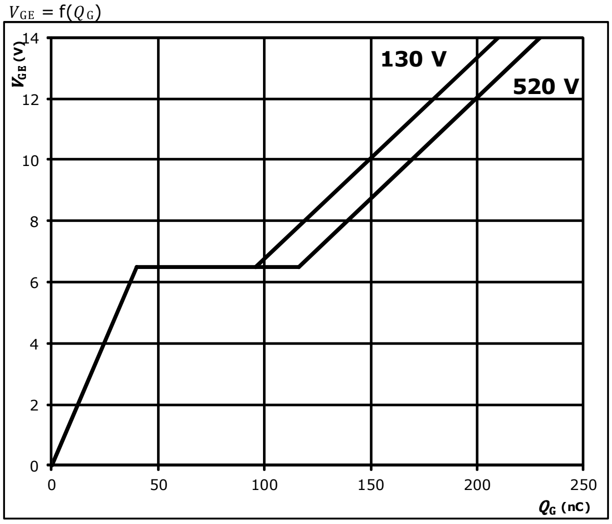
R (K/W)	τ (s)
7,52E-02	1,73E+00
1,31E-01	2,44E-01
3,01E-01	6,32E-02
1,21E-01	1,39E-02
4,30E-02	3,50E-03
4,35E-02	3,33E-04

Boost Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

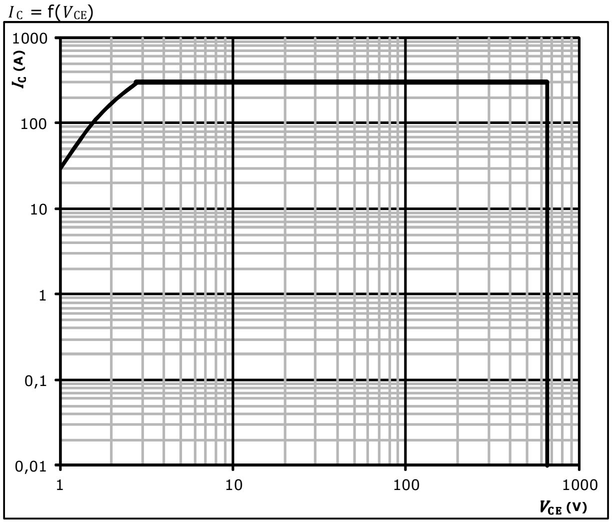


I_C= 100 A

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}	

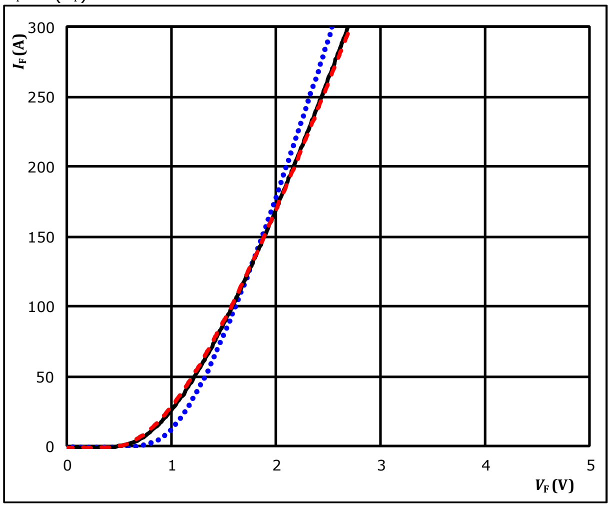
Vincotech

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

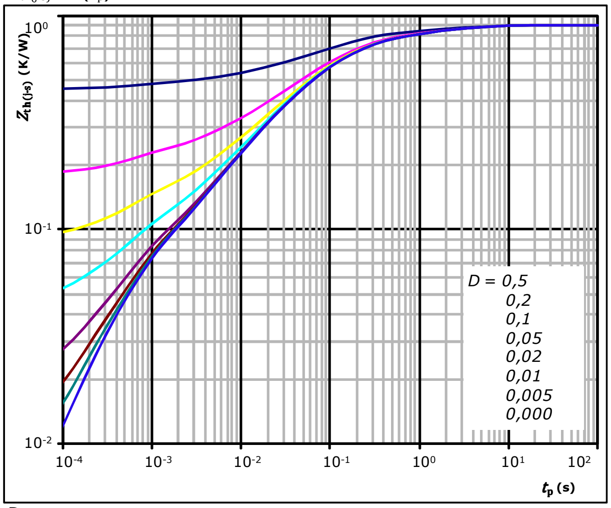


t_p =	250	μs	25 °C	············
		T_j:	125 °C	———
			150 °C	– – – –

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,90 K/W

FWD thermal model values

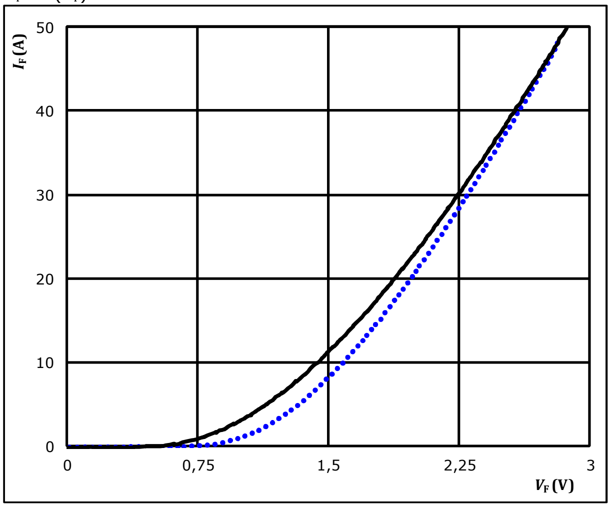
R (K/W)	τ (s)
7,42E-02	3,64E+00
1,41E-01	5,85E-01
3,41E-01	1,04E-01
1,94E-01	2,64E-02
9,09E-02	6,04E-03
5,85E-02	5,72E-04

Boost Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



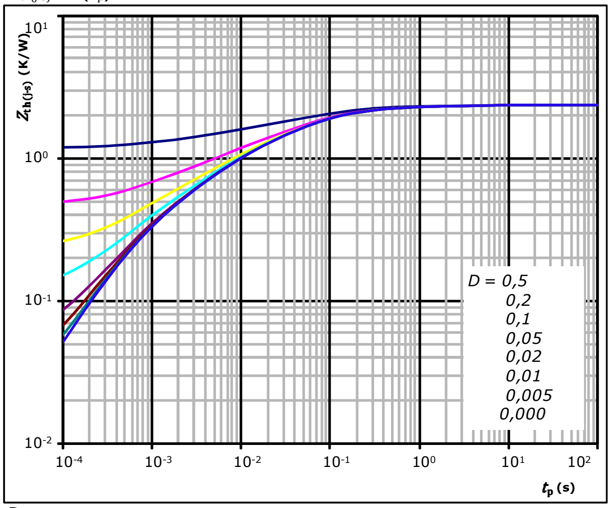
t_p = 250 μs

T_j: 25 °C / 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 2,36 K/W

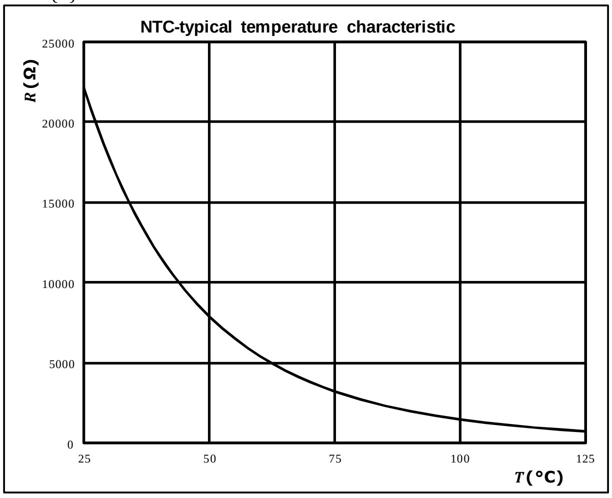
FWD thermal model values

R (K/W)	τ (s)
9,10E-02	3,90E+00
2,66E-01	3,08E-01
8,25E-01	6,57E-02
5,40E-01	1,54E-02
4,23E-01	3,41E-03
2,13E-01	5,87E-04

Thermistor Characteristics

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature
$R = f(T)$

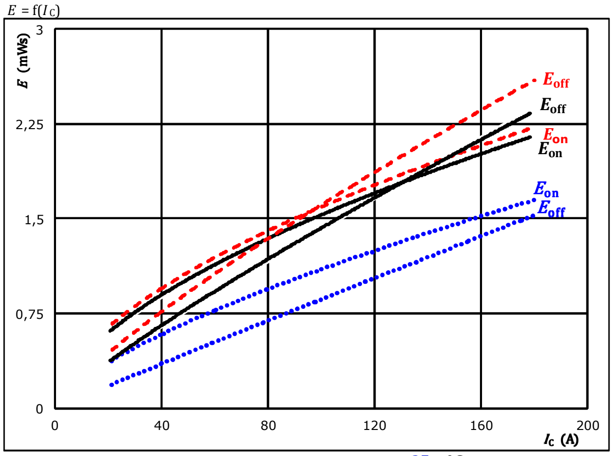


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



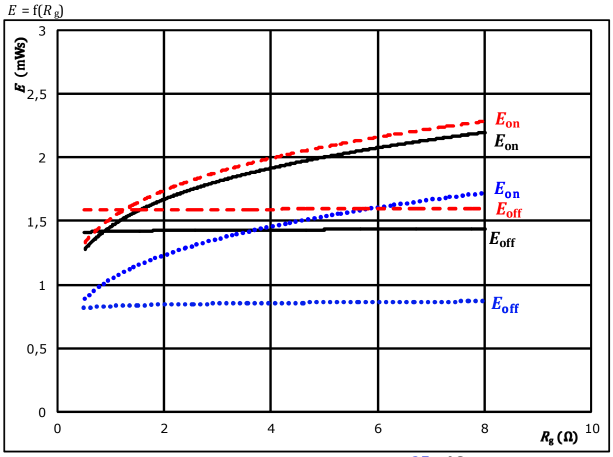
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



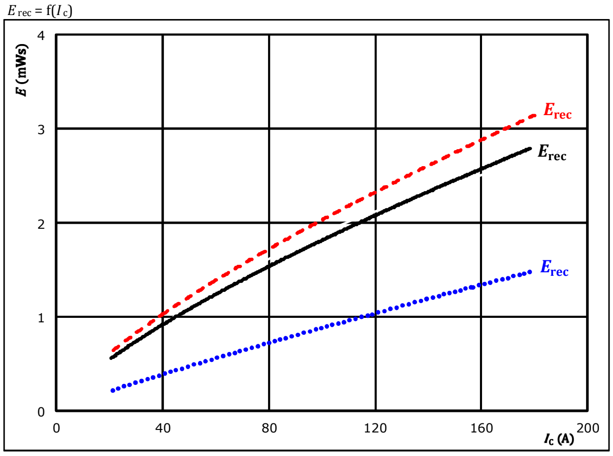
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
I_C =	102	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



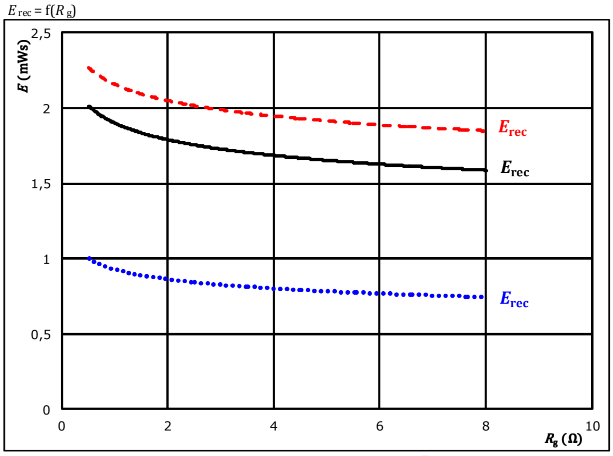
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
R_{gon} =	2	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

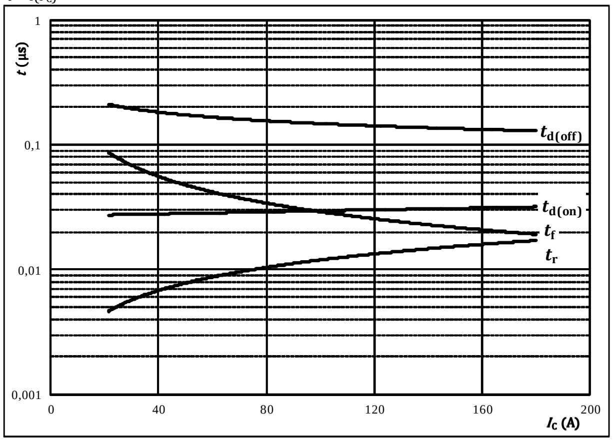
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
I_C =	102	A		150 °C

Boost Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



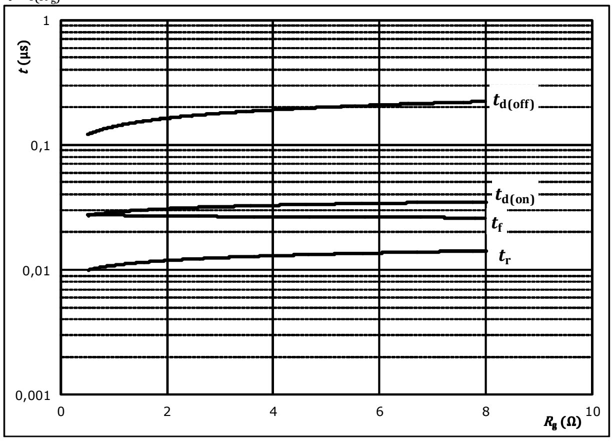
With an inductive load at

T_j =	150	°C
V_{CE} =	400	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

$t = f(R_g)$



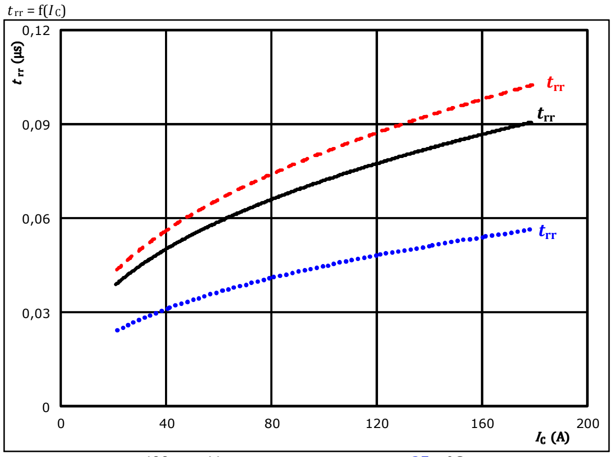
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	15/0	V
I_C =	102	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

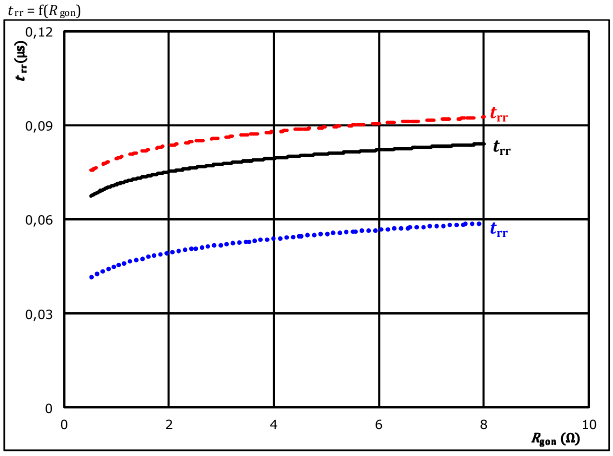


At						
V_{CE} =	400	V		25	°C	···········
V_{GE} =	15/0	V	T_j:	125	°C	———
R_{gon} =	2	Ω		150	°C	– – –

figure 8. **FWD**

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

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



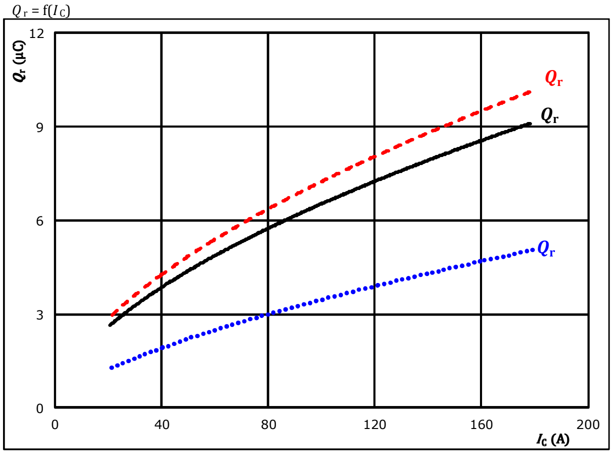
At						
V_{CE} =	400	V		25	°C	···········
V_{GE} =	15/0	V	T_j:	125	°C	———
I_C =	102	A		150	°C	– – –

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

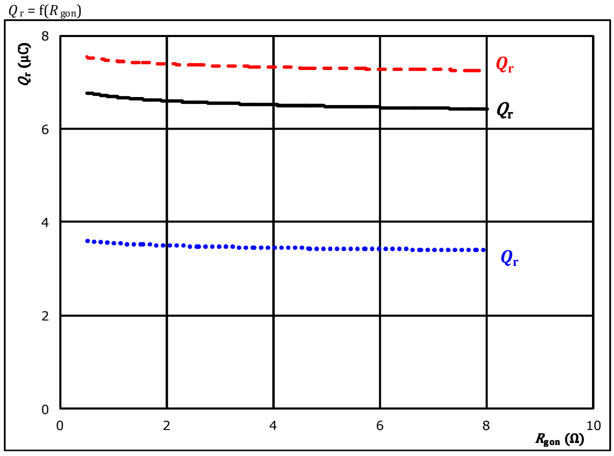


At							
	V_{CE} =	400	V		25	°C	············
	V_{GE} =	15/0	V	T_j:	125	°C	———
	R_{gon} =	2	Ω		150	°C	– – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

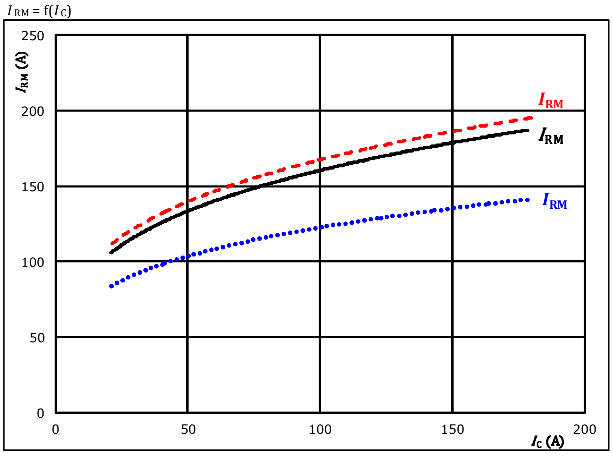


At							
	V_{CE}=	400	V		25	°C	············
	V_{GE} =	15/0	V	T_j:	125	°C	———
	I_C=	102	A		150	°C	– – –

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

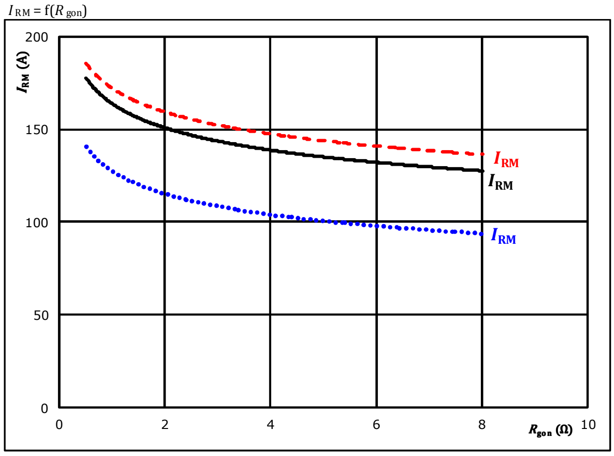


At							
	V_{CE} =	400	V		25	°C	············
	V_{GE} =	15/0	V	T_j:	125	°C	———
	R_{gon} =	2	Ω		150	°C	– – –

figure 12. **FWD**

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

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



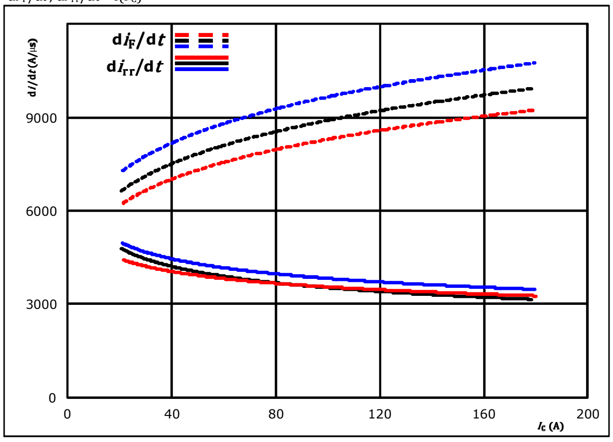
At							
	V_{CE} =	400	V		25	°C	············
	V_{GE} =	15/0	V	T_j:	125	°C	———
	I_C =	102	A		150	°C	– – –

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

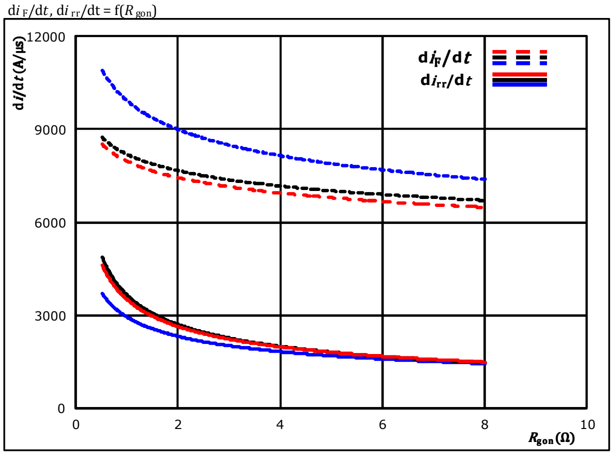


At						
V_{CE} =	400	V		25	°C	dotted
V_{GE} =	15/0	V	T_j:	125	°C	solid
R_{gon} =	2	Ω		150	°C	dashed

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

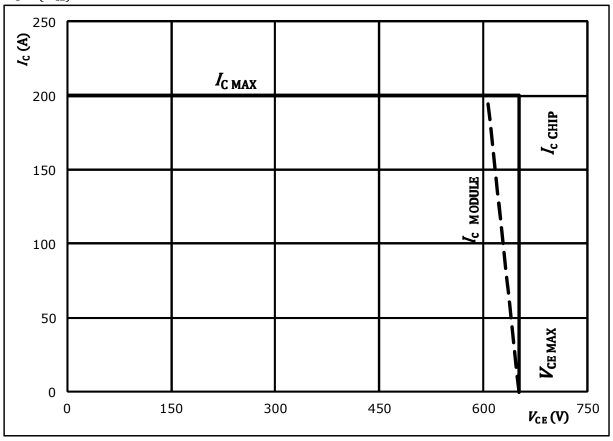


At						
V_{CE} =	400	V		25	°C	dotted
V_{GE} =	15/0	V	T_j:	125	°C	solid
I_C=	102	A		150	°C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

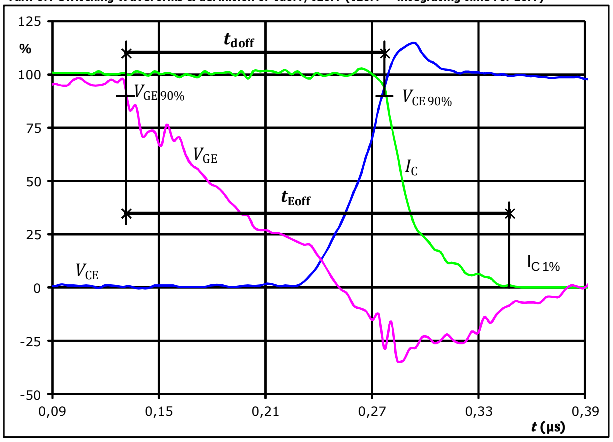
T_j =	175	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Boost Switching Definitions

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

figure 1. **IGBT**

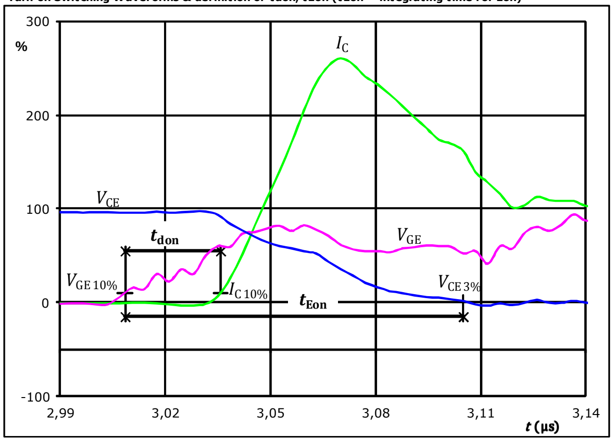
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	100	A
t_{doff} =	0,142	µs
t_{Eoff} =	0,216	µs

figure 2. **IGBT**

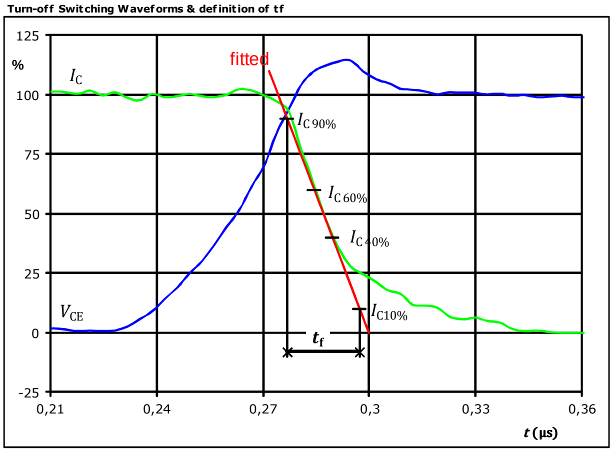
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	100	A
t_{don} =	0,030	µs
t_{Eon} =	0,096	µs

figure 3. **IGBT**

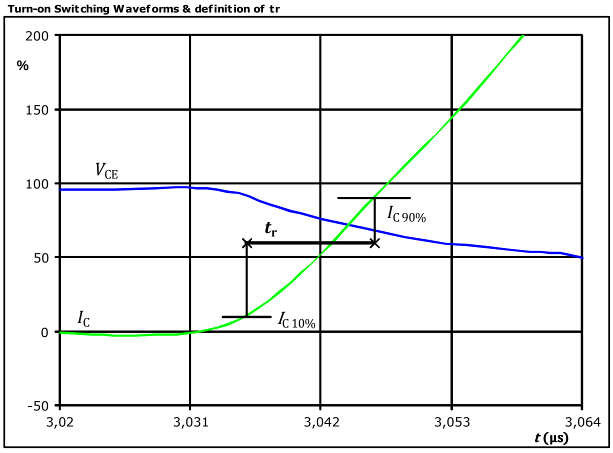
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	100	A
t_f =	0,020	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

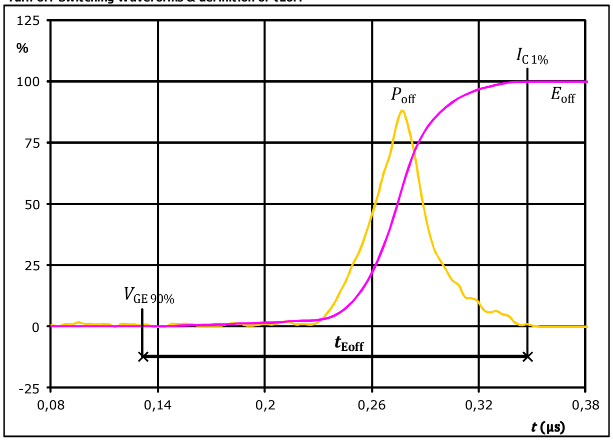


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	100	A
t_r =	0,011	µs

Boost Switching Characteristics

figure 5. IGBT

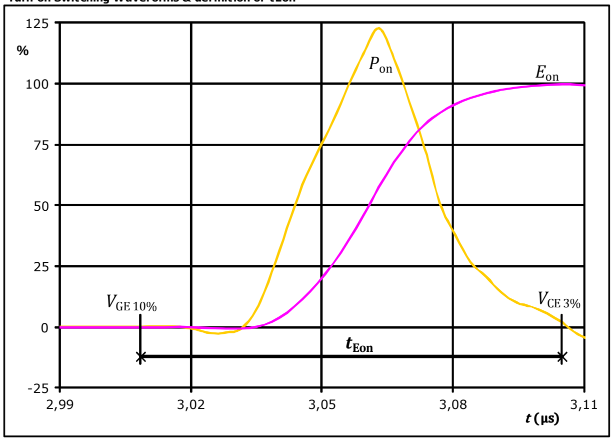
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	40,16	kW
E_{off} (100%) =	1,41	mJ
t_{Eoff} =	0,22	µs

figure 6. IGBT

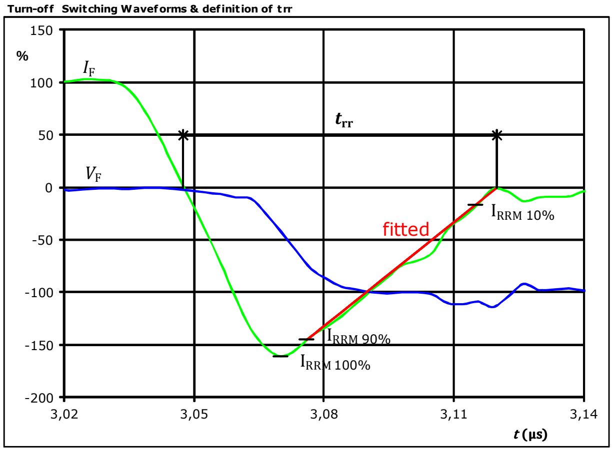
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	40,16	kW
E_{on} (100%) =	1,54	mJ
t_{Eon} =	0,10	µs

figure 7. FWD

Turn-off Switching Waveforms & definition of trr



V_F (100%) =	400	V
I_F (100%) =	100	A
I_{RRM} (100%) =	-161	A
t_{rr} =	0,072	µs

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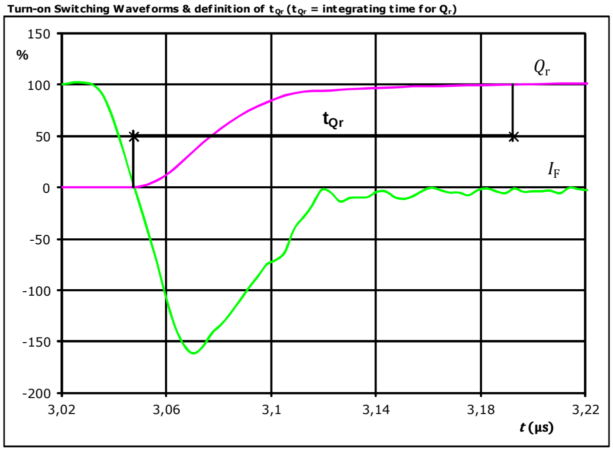
Boost Switching Characteristics

figure 8. **FWD**

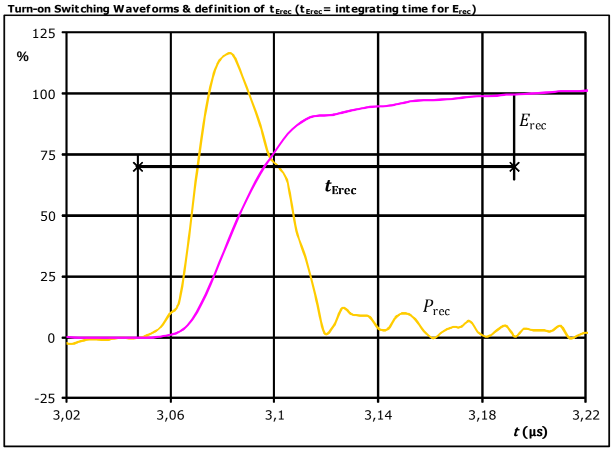
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	100	A
Q_r (100%) =	6,75	µC
t_{Qr} =	0,14	µs

figure 9. **FWD**

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



P_{rec} (100%) =	40,16	kW
E_{rec} (100%) =	1,90	mJ
t_{Erec} =	0,14	µs

Vincotech

10-FY07NBA100S5-M506L58
datasheet

Ordering Code & Marking

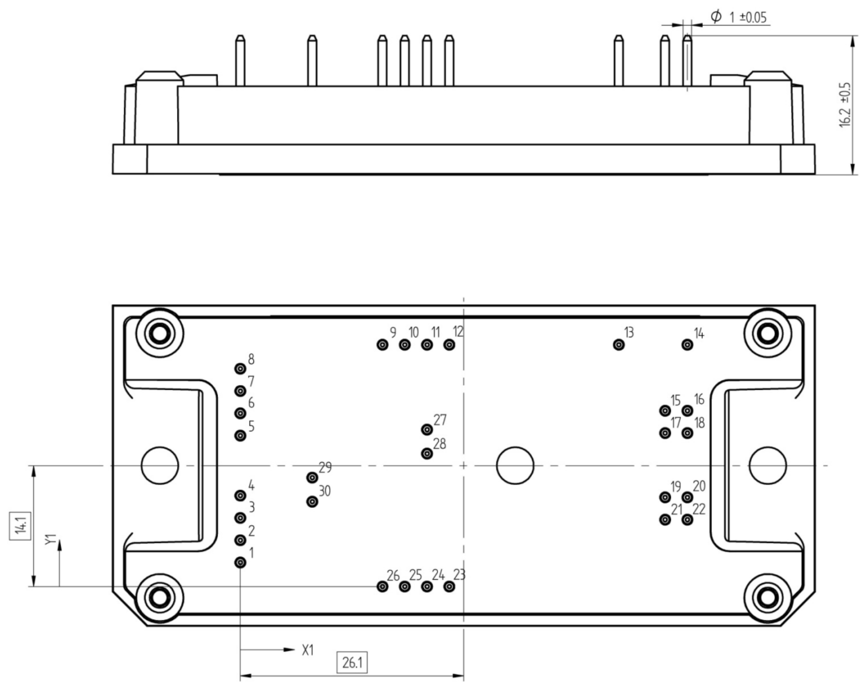
Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FY07NBA100S5-M506L58
with thermal paste 12 mm housing with solder pins	10-FY07NBA100S5-M506L58-/3/

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

Outline

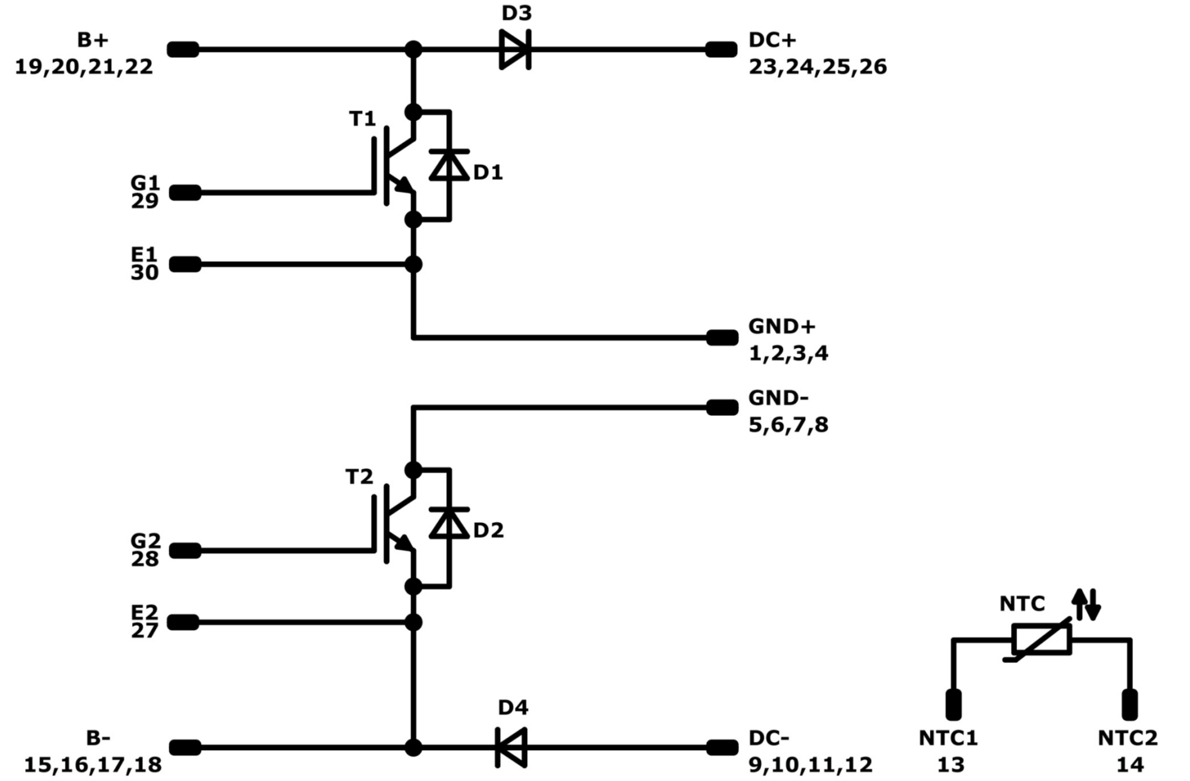
Pin	X	Y	Function
1	0	2,8	GND+
2	0	5,4	GND+
3	0	8	GND+
4	0	10,6	GND+
5	0	17,6	GND-
6	0	20,2	GND-
7	0	22,8	GND-
8	0	25,4	GND-
9	16,6	28,2	DC-
10	19,2	28,2	DC-
11	21,8	28,2	DC-
12	24,4	28,2	DC-
13	44,2	28,2	NTC1
14	52,2	28,2	NTC2
15	49,6	20,5	B-
16	52,2	20,5	B-
17	49,6	17,9	B-
18	52,2	17,9	B-
19	49,6	10,4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

Pin table



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	100 A	Boost Switch	
D4 , D3	FWD	650 V	100 A	Boost Diode	
D2 , D1	FWD	650 V	15 A	Boost Sw. Protection Diode	
NTC	NTC			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-FY07NBA100S5-M506L58-D1-14	10 Jul. 2017		